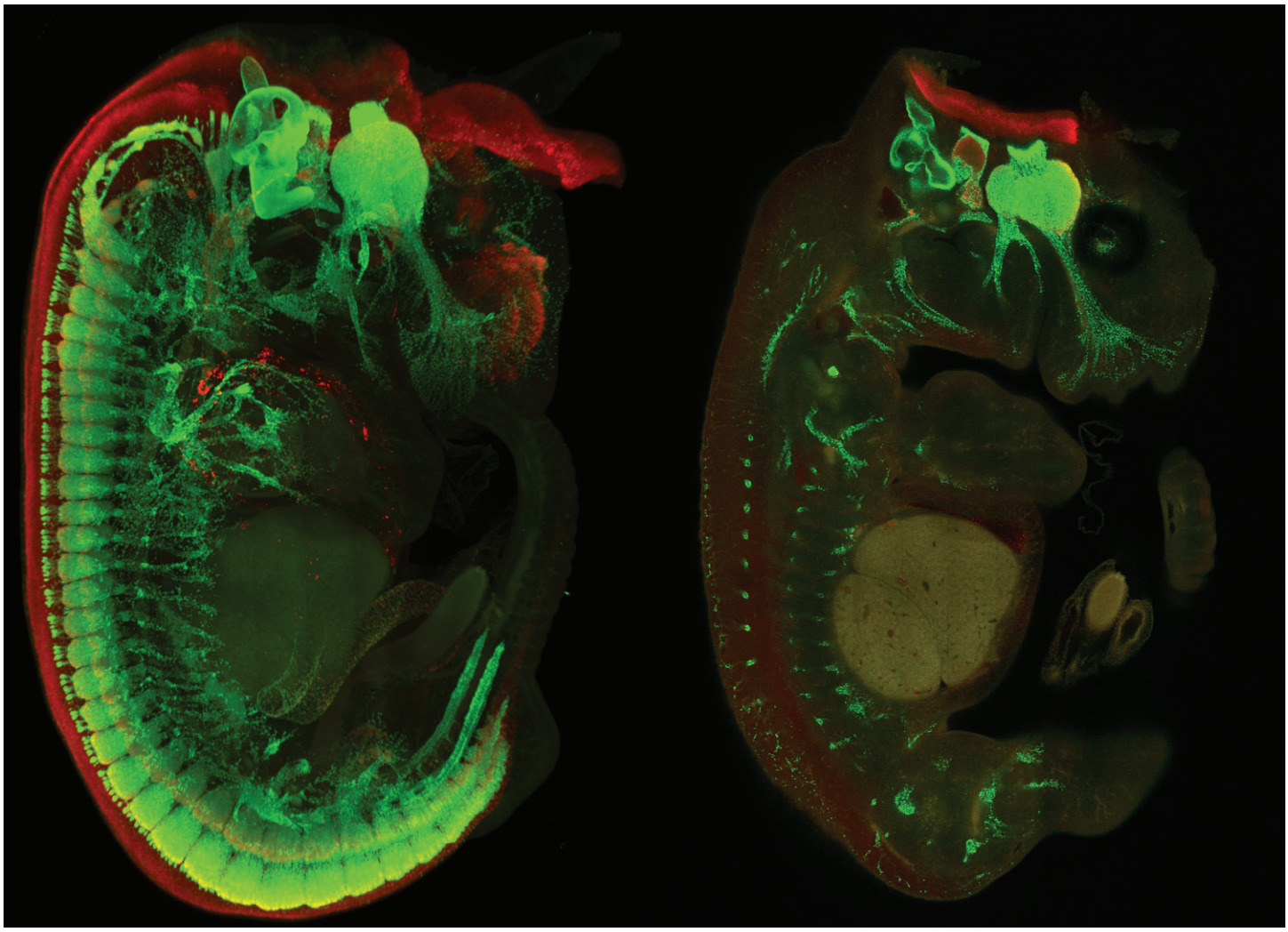
# UNIVERSITY OF PITTSBURGH SCHOOL OF MEDICINE

# CELL BIOLOGY



## FY19 ANNUAL REPORT AND FY20 BUSINESS PLAN

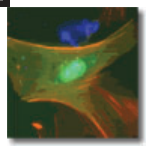
**Front Page**

**Cover figure by Alan Watson.** These images display Sox10 (green) and Hu C/D (Red) expression at subcellular resolution throughout a developing mouse embryo. On the left is a 3D reconstruction of the complete embryo, and on the right is a single high-resolution image which is a component of the 3D model on the left. The embryo was imaged with lateral resolution of 300 nanometers. These data were collected in collaboration with Dr. Michelle Southard-Smith at Vanderbilt University.

## Table of Contents of Cell Biology Annual Report







In the cell, life is governed by a multitude of molecular systems that shape and sustain the organellar system of the cell, maintain cellular homeostasis and respond to extracellular cues. These systems are dynamic, multicomponent macromolecular complexes. Maintaining and regulating the function of these complexes is essential for normal cell motility, growth, division, differentiation and programmed death. Dysregulation inevitably leads to an aberrant cell behavior and commonly disease. Understanding the structure, function and interactions of these macromolecular machineries and the underlying mechanisms by which they regulate organelles and other cellular compartments lie at the core of Cell Biology. The faculty in the Department of Cell Biology employs an interdisciplinary approach to address a broad-spectrum questions in cell biology from the roles of single molecules to through complex multicomponent cellular mechanisms to integrated studies at the organismal level in yeast, fly, fish and mouse. The research in the Department involves translation of the fundamental cell functions to understanding the disease mechanisms and development of therapeutics.

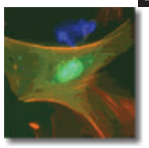
The Department of Cell Biology is one of eight basic science departments in the School of Medicine. Members of our Department benefit from close and collegial interactions with researchers in other Departments, and with basic scientists in other Schools of the University of Pittsburgh and Carnegie-Mellon University. The Department is comprised currently of eighteen primary faculty, seventeen of them with active research programs. Members of our faculty are active in both the medical and graduate school curricula, in curriculum development and student recruitment and mentoring. The graduate program in Cell Biology and Molecular Physiology is part of the Interdisciplinary Biomedical Graduate Program (IBGP) (http://www.gradbiomed.pitt.edu/) and led by our department faculty. We teach extensively in and direct (Dr. Hong) the Cell Biology Block, which comprises approximately one-third of the first year graduate course, Foundations of Biomedical Science. Our flagship course that departments offers, "Cell Biology of Normal and Disease States", is required of all students entering the program, and further information can be found at our departmental website (see: http://www.cbp.pitt.edu). The course has been recently revised to include exciting areas in modern cell biology as well as clinical conditions that arise from defects in these processes. Overall, the School of Medicine graduate program has more than 300 students currently working toward the PhD, and includes students in the newly-formed ISB (Integrated Systems Biology) program, also HHMI-funded Computational Biology program, Center for Neuroscience Program (CNUP), the Program in Integrative Molecular Biology, and the Structural Biology/Molecular Biophysics graduate program. Several of our faculty are active members of these programs. The Department is also actively participating in teaching in new Biomedical Master Program (BMP) that was launched in 2017.

The Department is housed in administrative and research space in the South Wing of the Biomedical Science Tower (SBST). We also have laboratories in BST3 and the Hillman Cancer Institute. Our modern facilities and support cores provide the faculty with space designed to optimize their research efforts.

**Faculty member featured in this Report: Alan Watson**

Dr. Watson is an assistant director of the Center for Biologic Imaging (CBI) where his research program is focused around the development of platforms for rapid high-resolution imaging of whole tissues and biologic systems. Such platforms are multi-technology dependent, requiring integration of techniques and infrastructure to collect, store and process tera- even peta-scale

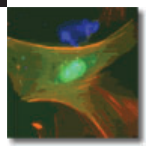




imaging data. The resources that have been compiled at the CBI are unique, enabling the collection and processing of truly massive volumetric datasets. Dr. Watson's efforts include the development of tissue staining and clearing approaches, the refinement of confocal imaging technologies to accelerate acquisition of volumetric data, the design and maintenance of high-performance computing systems for image processing and the implementation of novel data analysis pipelines within the CBI and Pittsburgh Supercomputing Center. Several images displayed herein were generated by Dr. Watson in collaboration with researchers at the University of Pittsburgh and institutions nationally. The subject matter is interdisciplinary, including neurobiology, developmental biology, virology, ophthalmology and immunology.







**Research foci**

Biomedical research in the Department of Cell Biology is directed at several major areas, as described below. The department is home of the School of Medicine's Center for Biological Imaging. The Department's major faculty groupings and research foci are summarized below.

***Membrane trafficking and organelle biogenesis***

Aridor
Butterworth
Devor
Ford
Hammond
Murray
Sorkin
Traub
Watkins

Scientists in this program are part of a larger "trafficking" community combining researchers from the School of Medicine, School of Arts and Sciences, and Carnegie Mellon University. The research is aimed at identifying the mechanisms underlying the organization of the cellular membrane compartment system, targeting of proteins and lipids to specific organelles and compartments, and at defining how these processes are disrupted in disease.

***Regulation of channels and transporters***

Butterworth
Devor
Sorkin
Watkins

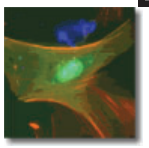
Studies in this group aim at elucidating the physiological mechanisms underlying regulation of several ion channel and transporter proteins. Our approaches include biochemical, molecular, electrophysiologic, imaging, cell biologic and transgenic techniques. Inherited mutations in ion channels are responsible for many genetic diseases, including cystic fibrosis (CF).

***Cellular organization and cell-cell communications***

Hong
Kwiatkowski
Murray
Shi
Stoltz
St. Croix
Traub
Watkins

This group uses various state-of-the-art cell imaging, biochemical and genetic approaches





to define the mechanisms involved in development and maintenance of epithelial cell polarity, regulation of all types of cellular junctions, mitochondria, nucleus, angiogenesis and vasculogenesis, and various routes of functional communication between dendritic cells.

***Regulation of intracellular signaling and gene expression***

Drain
Hammond
Leuba
Sorkin
St. Croix

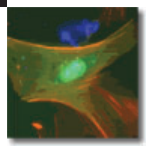
Scientists in this group are examining signaling processes mediated by receptors for growth factors and hormones, mechanisms of hormone secretion, processes involved in the regulation of cell cycle progression, ROS signaling and the mechanisms underlying virus replication. The particular focus is on the events leading to dysregulation of cellular signaling networks leading in the disease such as cancer.

***Mass-spectrometry and proteomics***

Shi
Yates

These laboratories are focused on developing new methodologies of quantitative mass-spectrometric analyses of proteins including new approaches to data acquisition, analysis and storage.





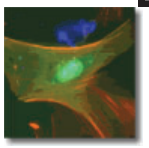
**Center for Biologic Imaging**

Over the last several years, microscopy as a scientific tool has reinvented itself. It has changed from a group of principally descriptive methodologies, to a wide range of primary tools and techniques to investigate the molecular organization of organs, tissues and cells. Advances in microscope and camera design, fluorescent dye technology and the development of fluorescent proteins as well as the advent of inexpensive, powerful computers have made the simultaneous resolution and quantitation of multiple concurrent molecular markers for both protein and DNA at a sub-micron resolution a reality. Furthermore, using these same systems, it is possible to probe living cells using a rapidly expanding repertoire of dyes sensitive to changes in cellular pH or the concentration of specific intracellular ions, and to optically section and rebuild images of cells in 3 dimensions using confocal microscopy. The development of nanometer sized particulate markers has been an essential extension of these techniques, allowing the distribution of proteins and mRNA to be studied within cells at a molecular resolution using electron microscopy.
The recognition of the potential utility of these techniques to the rapidly expanding research community here at the University of Pittsburgh School of Medicine led to the formation of a centralized microscope imaging center; the Center for Biologic Imaging (CBI), 25 years ago. Since then the CBI has become an essential resource for most of the research programs within the medical school and collaborates extensively with most of the active research programs within the school.

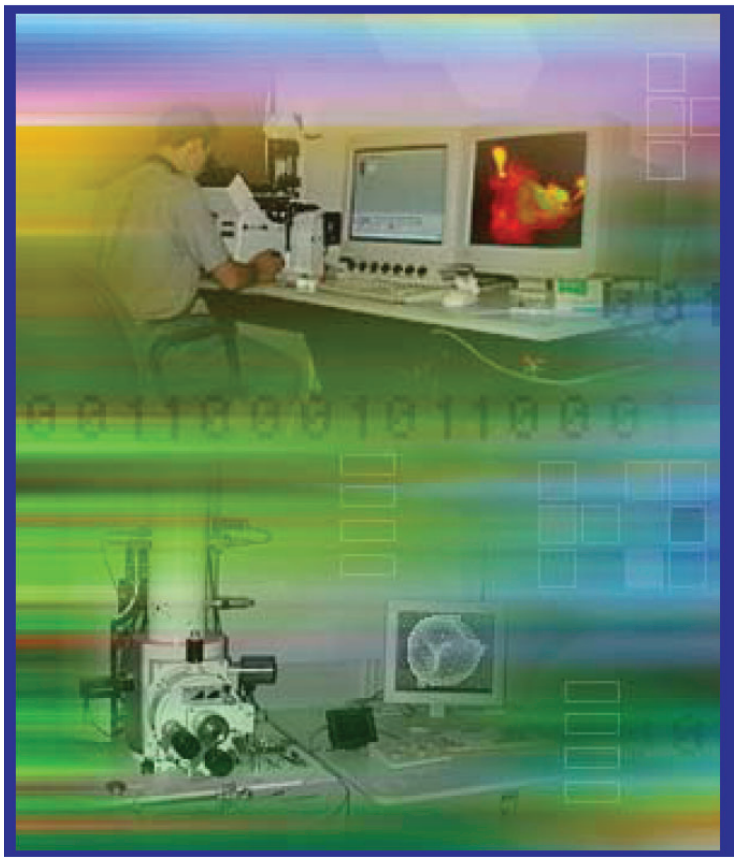
**Capacity of the Center:**
The capacity of the Center is limited only by instrumentation, by space, and by staff within the center. Over the last year, the Facility has continued to expand such that the base of imaging technologies has increased significantly, so that it now includes almost all cutting edge light microscopic, electron microscopic, and computer aided image analysis tools. In the last few years the CBI has successfully competed for new instrumentation for live cell (2 new systems), multicolor imaging, spectral confocal imaging (2 new systems), high speed confocal (3 systems) super resolutions systems (SIM, STORM, PALM, STED) electron microscopes and multiphoton microscopy through the NCRR. Furthermore, the Facility has supplemented its existing microscope and computer base with 2 new live cell imaging systems with microinjection capabilities. Currently the facility has 23 confocal microscopes of different types (point scanners, spinning disks, etc) 6 live cell systems (two with micro injection, 2 multiphoton systems, a SIM system a STORM system, 6 high end upright microscopes and 3 electron microscopes (SEM and TEM). We also have multiple (30) online image processing work stations equipped with Metamorph, Elements, Imaris and Photoshop. Real time storage is 1.7 petabytes at 10 gigabit speed Our current research themes are three fold. Very fast massive sample confocal imaging, Correlative Light and Electron Microscopy and probe development and application for reactive oxygen species imaging.

**The Director:**
Dr. Simon C. Watkins was recruited to the University of Pittsburgh from the Dana Farber Cancer Institute (DFCI) in Boston in 1991 to provide scientific leadership of the Center. He is a Distinguished Professor in the Department of Cell Biology and Professor of Immunology within the School of Medicine. His experience in microscopic methods covers most of the present





light and electron microscopic methodologies.



**The Associate Directors:**
Dr. Donna Beer-Stolz is an Associate Professor in Cell Biology. Her funded research interests are in liver regeneration and vasculogenesis. She was recruited specifically to facilitate interactions between the Cell and Tissue Imaging Core and its users. Dr. Beer-Stolz' primary role lies in the management and development of the electron microscopy component of the
center.

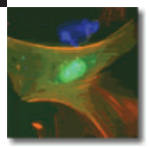
Dr. Claudette St. Croix is an Associate Professor in Cell Biology. Dr. St. Croix's funded research interests focus primarily on the pulmonary system and vascular biology. She is also heavily involved in the living system (both animal and cell) components of the Center.

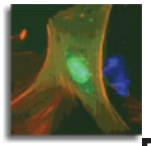
Dr. Alan Watson is an Assistant Professor in Cell Biology. Dr Watson's research program is directed towards the use and application of massive data methods including tissue clearing, very fast confocal and image analysis. His research focus is currently directed towards following rare events such as viral infectivity in entire tissues including brain, the ocular system, kidney, lung and bowel.

**Technical Specialists:** The technical bases of the Center are all trained microscopists; in total 19 technical specialists work in the center. Furthermore we have a staff of three research assistants who provide general lab maintenance and digital imaging services. These staff are responsible for the processing and experimental manipulation of materials for light and electron microscopy. They assist users directly in the application of microscopic techniques, though equally they perform complete procedures for users who are not sufficiently experienced to perform their own experiments. They are also responsible for the day-to-day running of the Center, including management of microscope usage, microscope maintenance, bookkeeping, solution preparation, etc.

**Administrative assistance:** The primary administrative responsibilities are in the preparation of grants, and the monthly billing of charge-back users, processing Center for Biologic Imaging purchase requisitions and other general administrative duties.









## Cell Biology Faculty Data

[Current as of June,2019]

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|---|---|---|---|---|---|
| Aridor, Meir | Associate Professor | S310 BST-South Wing | aridor@pitt.edu | 412-624-1970 | 412-648-8330 |
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| Devor, Daniel | Professor | S312 BST-South Wing | dd2@pitt.edu | 412-383-8755 | 412-648-8330 |
| Dong, Wei | Research Instructor | S333 BST-South Wing | wed16@pitt.edu | 412-648-2846 | 412-648-8330 |
| Drain, Peter | Associate Professor | S323 BST-South Wing | drain@pitt.edu | 412-648-9412 | 412-648-8792 |
| Duker, Georgia | Assistant Professor | 322 Scaife Hall | gduker1@pitt.edu | 412-648-9409 | 412-648-8330 |
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| Ford, Natalia | Res. Asst. Professor | S355 BST-South Wing | nw@pitt.edu | 412-383-9026 | 412-648-8330 |
| Hammond, Gerald | Assistant Professor | S327 BST-South Wing | ghammond@pitt.edu | 412-383-2215 | 412-648-8330 |
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| Shi, Yi | Assistant Professor | 9049 BST3 | yi.shi@pitt.edu | 412-383-3242 | 412-648-9009 |
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| Sorkin, Alexander | Professor and Chair | S368 BST-South Wing | sorkin@pitt.edu | 412-624-3116 | 412-648-8330 |
| Stolz, Donna Beer | Associate Professor | S221 BST-South Wing | dstolz@pitt.edu | 412-383-7283 | 412-648-8330 |
| Surve, Sachin | Research Instructor | S372 BST-South Wing | svs23@pitt.edu | 412-624-8147 | 412-648-8330 |
| Tan, Xiaojun (Jay) | Res. Asst. Professor | 550 Bridgeside Point Bldg. | xiaojun@pitt.edu | 412-383-4405 | 412-648-8330 |
| Traub, Linton | Professor | S325 BST-South Wing | traub@pitt.edu | 412-648-9711 | 412-648-8330 |
| Truschel, Steven | Assistant Professor | 322 Scaife Hall | stt39@pitt.edu | 412-648-9409 | 412-648-8330 |
| Watkins, Simon C. | Distinguished Professor | S225 BST-South Wing | swatkins@pitt.edu | 412-648-3051 | 412-383-8894 |
| Watson, Alan | Res. Asst. Professor | S220.5 BST-South Wing | alan.watson@pitt.edu | 412-648-9796 | 412-383-8894 |
| Yates, Nathan | Associate Professor | 9043B BST3 | yatesn@pitt.edu | 732-718-9739 | 412-648-9009 |

# CELL BIOLOGY
# FY18 ORGANIZATIONAL CHART

**Office of the Chairman**
**Alexander D. Sorkin, Ph.D.**
Richard Beatty Mellon Professor and
Chair of Cell Biology

**CBMP Graduate Program**
Michael Butterworth, Ph.D.
Director

**Cell Biology and Pharmacology Shops**

**Machine Shop**
Travis Wheeler, Manager

Matthew Greb

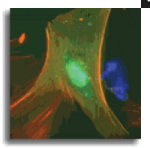
**Electronics Shop**
Dominick Caimano

**Center for Biologic Imaging**
Simon C. Watkins, Ph.D.
Director

**Tenured/Tenure Track Faculty**
Meir Aridor, Ph.D.
Michael B. Butterworth, Ph.D.
Daniel Devor, Ph.D.
Peter Drain, Ph.D.
Marijn Ford, Ph.D.
Gerald Hammond, Ph.D.
Yang Hong, Ph.D.
Adam Kwiatkowski, Ph.D.
Sanford Leuba, Ph.D.
Sandra Murray, Ph.D.
Yi Shi, Ph.D.
Claudette St. Croix, Ph.D.
Donna Beer Stolz, Ph.D.
Linton Traub, Ph.D.
Simon Watkins, Ph.D.

**Non-Tenure Track Faculty**

Wei Dong, Ph.D.
Natalia Ford, Ph.D.
Yang Li, Ph.D.
Itziar Pinilla Macua, Ph.D.
Sachin Surve, Ph.D.
Steven Truschel, Ph.D.
Xiaojun (Jay) Tan, Ph.D.
Alan Watson, Ph.D.
Nathan Yates, Ph.D.



**Cell Biology Seminar Series Schedule (Fiscal Year 2018 – 2019)**

September 14, 2018
Juan Bonafacino, PhD
NIH – NICHD Distinguished Investigator
"AP-4 Autophagy and Hereditary Spastic Paraplegia"

September 18, 2018
Tricia Serio, PhD
Professor, Dean of the College of Natural Sciences
University of Massachusetts, Amherst
"Prion Biology: at the intersection of Protein Folding and Its Cellular Environment"

October 2, 2018
Vladimir Gelfand, PhD
Professor, Cell & Molecular Biology
Northwestern University
"Unconventional functions of conventional kinesin in ococytes and neurons"

October 16, 2018
Ian Macara, PhD
Professor and Chair, Cell & Developmental Biology
Vanderbilt University
"Watching Polarity Protein Dynamics in the Living Cell"

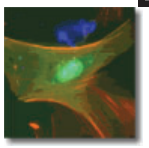
October 23, 2018
Scott Hansen, PhD
Assistant Professor, Chemistry & Biochemistry
University of Oregon
"Emergent properties and enzymology of membrane proximal signaling events"

December 4, 2018
Joshua S. Chappie, PhD
Assistant Professor, Molecular Medicine
Cornell University
"Structural characterization of nucleotide-powered molecular machines involved in bacterial defense and DNA repair"

March 19, 2019
Aashish Manglik, MD, PhD
Assistant Professor, Pharmaceutical Chemistry
University of California, San Francisco
"Molecular puzzles in transmembrane signaling"

April 2, 2019
Gerald Hammond, PhD
Assistant Professor, Cell Biology





University of Pittsburgh
"Lipid Signals in Physiology & Cancer"

April 9, 2019
Yi Shi, PhD
Assistant Professor, Cell Biology
University of Pittsburgh
"Diving into the Dichotomous Humoral Immunity"

April 16, 2019
Cara Gottardi, PhD
Associate Professor, Pulmonary & Critical Care
Northwestern University
"Cell-cell adhesion and signaling in health and disease"

April 23, 2019
Lan Huang, PhD
Professor, Physiology & Biophysics
University of California, Irvine
"Cross-linking Mass Spectrometry for Interactomics and Structural Biology"

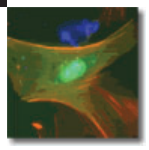
April 30, 2019
Suzanne Hoppins, PhD
Assistant Professor, Biochemistry
University of Washington
"Understanding the mitochondrial outer membrane fusion machine"

May 7, 2019
Julie Brill, PhD
Professor, Molecular Genetics & Director of Collaborative Program in Development Biology
University of Toronto
"Phosphoinositide signaling during sperm development: location, location, location"

May 14,2019
Marijn Ford, PhD
Assistant Professor, Cell Biology
University of Pittsburgh
"Structural insights into the SNX-BAR protein Mvp1"

May 21, 2019
Adam Kwiatkowski, PhD
Assistant Professor, Cell Biology
University of Pittsburgh
"Cardiomyocyte adhesion complexes and their linkage to the cytoskeleton"





**Faculty Research Interests**

**Meir Aridor, Ph.D.**
*Associate Professor*

The endoplasmic reticulum (ER) is the first compartment of the secretor pathway. Plasma membrane receptors, ion channels, hormones and secreted enzymes are few examples of proteins that are being processed and sorted for vesicular transport in the ER. The development of a variety of human diseases, ranging from hemochromatosis, cystic fibrosis or hereditary emphysema to Pelizaeus-Merzbacher or ALS and Alzheimer's neurodegeneration can be derived from mistakes in ER sorting. Viruses such as coxsackie, polio, cytomegalovirus, HIV-1 Epstein-Barr and others manipulate sorting to self propagate and/or to evade immune surveillance.

We take a multi disciplinary approach using a wide range of molecular, biochemical, biophysical and cellular techniques to unravel the molecular basis for protein and lipid sorting in the ER. Specifically, we use these approaches to address several related questions including the following: 1. What is the physical basis for membrane shaping and fission during ER exit? 2.What is the molecular basis for the assembly and organization of ER exit sites (ERES)? 3. How is the molecular machinery that organizes ERES regulated to couple ER sorting activities with physiological demands? 4. How are quality control activities in the ER coupled with cellular lipid homeostasis in normal and disease states?

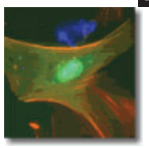
**Michael B. Butterworth, Ph.D.**
*Associate Professor*

Dr. Butterworth's research interest is in the regulation of epithelial ion transport, with a focus on the role of non-coding RNAs. Defective ion transport results in diseases such as hypertension and cystic fibrosis. To achieve plasma sodium homeostasis and modulate blood pressure, higher organisms rely on a complex signaling cascade which culminates in the release of steroid hormones that regulate sodium transport in kidney tubular epithelial cells. The role of non-coding RNAs in this regulation is being investigated by Dr. Butterworth. MicroRNAs (miRNAs) are small RNAs that pair to the mRNA of protein coding genes to direct their post-transcriptional repression. The regulation of miRNAs and other ncRNA species by steroid hormones and impact these changes have on ion channel function, sodium transport and blood pressure regulation is being studied.

**Daniel C. Devor, Ph.D.**
*Professor*

Intermediate (KCa3.1 or IK) and small (KCa2.3 or SK3) conductance, calcium-activated potassium channels play critical roles in a host of physiological processes, including the endothelial derived hyperpolarizing factor (EDHF) response which is critical to the maintenance of vascular tone and hence blood pressure regulation, the maintenance of a hyperpolarized membrane potential across the basolateral membrane of polarized epithelia required for transepithelial fluid secretion as well as being intimately involved in the afterhyperpolarization in nerves and a host of other processes. Thus, an





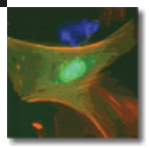
understanding of the physiological and pharmacological regulation of these channels as well as their assembly, trafficking and gating is crucial to the development of novel therapies based on targeting these channels. The long-term goals of my lab are to obtain a detailed molecular understanding of these channels in order to unravel the mechanisms involved in their assembly, trafficking, regulation and gating as well as to define the physiological role these channels play using *C. elegans* as a model system. In light of these goals, we have several ongoing projects designed to further our understanding of these channels.

First, Mark Bailey, a graduate student in the lab, is carrying out patch-clamp studies designed to elucidate the role of S6 in the gating of KCa3.1. In these studies, we are employing PCMBS to probe the cysteines in S6 and evaluate their role in gating. PCMBS has advantages over MTS reagents in both the site of the reactive moiety as well as the size of the molecule such that a larger perturbation in local molecular space is achieved. By using PCMBS in combination with a mutagenesis approach we have demonstrated that side chains pointing away from the pore, and toward S5, are critical to the coupling between $Ca^{2+}$ binding to the calmodulin binding domain and channel gating. In collaboration with Dr. Michael Grabe, of the Biological Sciences Department at the University of Pittsburgh, we are modeling the gating kinetics of KCa3.1 to extract the rate constants being affected by both PCMBs as well as mutations in this region of the channel. In the future, we plan to probe S5 by conducting a tryptophan scan of the region across from the cysteines in S6 to further our understanding of how S5-S6 interactions modulate the coupling between increasing $Ca^{2+}$ and channel gating. We have also identified critical amino acids in the S4-S5 linker region of both KCa3.1 and the related family member KCa2.3 which, when mutated to increase side-chain volume, result in a shift in apparent $Ca^{2+}$ affinity. These results suggest this region of the channel is similarly involved in the coupling between $Ca^{2+}$ binding to calmodulin in the cytoplasmic C-terminus and subsequent gating. A combination of patch-clamping, mutagenesis and modeling will be employed to definitively define the role of this region of the channel in the coupling between $Ca^{2+}$ and gating.

Second, as any physiological response is dictated by not only the likelihood that channels are in the open state ($P_o$), i.e., gating, but also the number of actively gating channels (N), it is critical to understand how the number of KCa3.1 and KCa2.3 channels at the plasma membrane is maintained and regulated. To this end, Yajuan Gao and Corina Balut, two post-doctoral associates in the lab, recently developed novel biotin ligase acceptor peptide (BLAP)-tagged KCa2.3 and KCa3.1 constructs which allow us to evaluate, in real time, the endocytic fate of these channels. Using these constructs, we have developed three separate projects. In one project, our recent data demonstrates that KCa2.3 is rapidly endocytosed and enters the recycling pathway back to the plasma membrane in a Rab35/EPI64C (RabGAP)- and RME1-dependent manner. Indeed, our evidence points to the role of a 12 amino acid domain in the N-terminus of KCa2.3 as being critical in this process via an association with RME1. Future studies along these lines will be designed to elucidate the role of ubiquitination/de-ubiquitination in the recycling of this channel to the plasma membrane in addition to determining the role of agonists in regulating this process. We have also recently identified the Rab5 pathway as being critical to the endocytosis of KCa2.3, whereas endocytosis and recycling are independent of the Arf6 pathway. These results point to this being a dynamin and clathrin-dependent endocytic process, although Rab5 has also been shown to be important in clathrin-independent endocytosis. The mechanism by which KCa2.3 is endocytosed will be defined using a combination of imaging, protein biochemical mutagenesis and cell biological techniques.

In a related project to the one above, we have recently demonstrated that KCa3.1 is targeted to the lysosome via the ESCRT machinery. We have recently begun to utilize tandem ubiquitin binding





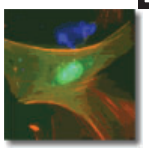
entities (TUBES) to define the role of ubiquitinylation in this process. By combining BLAP tagging and TUBES we are able to rapidly assess the ubiquitination of plasma membrane channels and correlate ubiquitinylation with endocytosis. In this regard, we have now shown that the endocytosis of KCa3.1 is directly correlated with poly-ubiquitinylation of the channel. By inhibiting ubiquitinylation we are able to block the channels endocytosis. This was first identified using a 96-well plate assay to identify modulators of channel endocytosis and formed the basis of our upcoming publication in *Future Medicinal Chemistry*, detailing this approach. Future studies will continue to explore the role of ubiquitin in the endocytosis of KCa3.1 as well as determine whether this is a regulated process. For example, is this a classic K63-dependent ubiquitinylation process, or are other ubiquitin-linked side-chains involved? Can the endocytosis of KCa3.1 be modified by second messengers generated in response to agonist stimulation? Of course, we are also attempting to identify the deubquitinylating enzymes (DUBs) involved in ubiquitin removal as this is critical for both the proper degradation of KCa3.1 as well as the recycling of KCa2.3. In this regard, we have begun a collaboration with Dr. Christian Loch at LifeSensors. We have now screened KCa3.1 prior to and following endocytosis using a DUB CHIP and have identified USP8 and USP2 as being DUBs critical in the endocytosis of this channel. As both KCa2.3 and KCa3.1 enter dynamic endosomal compartments, modulation of the rate-limiting steps in these events will allow for the regulation of the number of channels present at the plasma membrane such that the physiological response to agonists may be modified.

Given that KCa3.1 is targeted to the basolateral membrane in polarized epithelia, where it plays a critical role in the generation of the electromotive driving force required for $Ca^{2+}$-dependent agonists to stimulate $Cl^-$ and fluid secretion, an additional project, being undertaken in collaboration with Dr. Kirk Hamilton at the University of Otago in Dunedin, NZ, is designed to understand the mechanisms by which this channel is correctly targeted and endocytosed in various model systems, including FRT, MDCK and LLC-PK1 cells. In this regard, we have found that KCa3.1 is correctly targeted in each of these cell lines and that, similar to our studies on HEK cells and a microvascular endothelial cell line (HMEC-1), the channel is rapidly endocytosed. Further, we have generated chimeras between the C-terminal tail of KCa3.1 and the nerve growth factor receptor (NGFR, p75) and demonstrate that the C-terminus of KCa3.1 can redirect NGFR from its typical apical localization to the basolateral membrane in polarized epithelia. Future studies will be designed to elucidate the molecular motifs involved in the basolateral targeting of this channel as well as understanding the molecular mechanisms involved in the correct targeting of this channel to the basolateral membrane.

Fourth, in conjunction with our studies outlined above, we are using our BLAP-tagged channels to develop a 96-well plate assay to screen siRNA libraries to identify novel proteins involved in the endocytosis, recycling and lysosomal targeting of KCa2.3 and KCa3.1. By monitoring co-localization of these channels with a membrane marker over time we can determine whether knockdown of a specific protein influences the endocytic fate of these channels. Given the crucial role these channels play in a host of physiological processes it is anticipated that the identification of these novel proteins involved in maintaining plasma membrane localization will provide unique targets for therapeutic intervention.

While the majority of our studies are being carried out in HEK cells in order to facilitate an initial understanding of these processes which have not heretofore been studied in the context of KCa2.3 and KCa3.1, we similarly carry out crucial studies using the HMEC-1 microvascular endothelial cell line. One of our future aims is to develop a virus-based infection system, such that the trafficking of these channels can be studied in confluent endothelial monolayers. This will not only allow us to gain a greater understanding of these channels in endothelial cells, but also afford us the opportunity





to study the fate of these channels under more unique physiological situations, such as sheer stress.

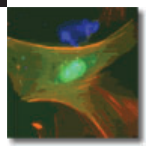
Given our interest in understanding these channels at a tissue/model system level, Cavita Chotoo, a graduate student in the lab, in collaboration with Drs. Cliff Luke and Gary Silverman at Children's Hospital of Pittsburgh, is further defining the physiological role of one of these channels using *C. elegans* as a model system. A single *C. elegans* SK channel homologue was targeted for deletion and this KO animal displays a developmental delay phenotype. The exact nature of this phenotype is currently being studied. Cavita has also generated transgenic *C. elegans* lines expressing GFP- and RFP-tagged channels to determine both an expression pattern profile as well as to determine the effect of overexpression of this gene product on physiological function. Our data demonstrate that the *C. elegans* SK channel is expressed in both the gut as well as in numerous nerves, including the nerve ring, ventral nerve chord and ganglia in the tail. Future studies will elucidate the role of this SK channel in this model physiological system. Cavita has also begun to culture cells from her transgenic line which will allow us to define cells expressing the transgene and characterize these *C. elegans* channels by patch-clamping. We can then determine whether mutations at conserved amino acids to those identified by us in mammalian channels will produce similar phenotypes, including increased $Ca^{2+}$ sensitivity; allowing us to evaluate the effect of a hyperactive phenotype on function at the level of an intact organism. Finally, we can utilize known endocytic/recycling phenotypes in *C. elegans* to probe the regulation of the number of channels (N) in a model system and determine how perturbations in N alter physiological function. These studies will tie together our efforts on heterologously expressed channels to our proposed studies on channels within the microvasculature; providing us with a clear picture of how KCa2.3 and KCa3.1 are regulated at the plasma membrane. Given the role of these channels in multiple disease processes, an understanding of how the number of channels is regulated at the plasma membrane is critical to understanding how these channels can be manipulated for therapeutic gain.

**Peter F. Drain, Ph.D.**
*Associate Professor*

Our laboratory studies regulatory mechanisms underlying secretory vesicle cell biology in health and disease. Currently, the experimental focus is on the cell biology of mutations and binding partners of vesicle proteins that cause monogenic forms of diabetes and Parkinson's disease:

(1) We are continuing our ongoing investigations into the structure-mechanism relations underlying the ATP-inhibited potassium (KATP) channel response to physiologically important ligands, ATP, ADP, and anti-diabetic sulfonylureas. In pancreatic beta cells, the KATP channel brings insulin secretion under the control of blood glucose levels. Our major goal is to establish the cellular mechanisms underlying how interactions of the KATP channel with its small molecular ligands and with its protein binding partners changes with high and low glucose metabolism, and consequent changes in insulin granule transport and exocytosis. Normally, the fraction of time the KATP channel spends in the inhibited state determines insulin secretory rates. When this regulation goes awry, serious complications at the whole-organism level lead to diabetes and other diseases. The research has fundamental importance to pharmaco-genetics, in which certain diabetic subjects with certain mutations can be transferred from insulin replacement therapy injected multiple times a day to an oral sulfonyluea pill once a day.
(2) Another key molecule in insulin secretion is insulin itself. Mutations in human proinsulin, the propeptide precursor to insulin, have been shown to cause clinical diabetes. In studying the associated cellular mechanisms underlying insulin biogenesis, trafficking, and secretion, we have





combined confocal fluorescence microscopy and a novel molecular strategy to visualize insulin secretion in live cells. The Ins-C-GFP reporter has exploded our ability to look inside live insulin-secreting cells to study glucose-stimulated insulin biogenesis, vesicle transport and exocytosis. Using this approach, we have localized KATP channels to the beta cell's large dense core vesicle (LDCV) where we have shown they mediate ATP- and glibenclamide-stimulated insulin secretion. In this way, the proteins whose mutation causes diabetes, the KATP channel and insulin, have a more intimate cell biological relationship and clinical pertinence than previous thought. Diabetic mutations in human insulin are used to study the beta cell biology of proinsulin trafficking, biogenesis, ER stress and protein degradation, and the consequences on insulin secretion. These investigations provide mechanistic details of the relationships between how KATP channels and insulin work together properly and fail to do so in diabetes.
(3) More recently we have found that alpha-synuclein is expressed in pancreatic beta cells, where it localizes to secretory vesicles, in addition to its well-established presence in dopaminergic and glutaminergic neurons of the brain. This has led to a new line of investigation studying the role of alpha-synuclein and how its interactions with other vesicle proteins changes under conditions of the stress leading to the hallmark degenerative cell biology that characterize these diseases.

Trainees in our laboratory have the opportunity to combine the techniques of molecular genetics and confocal live-cell fluorescence imaging, with transgenic techniques to integrate understanding at the level of the molecule, organelle, whole cell, organ, and organism.

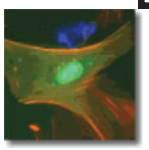
**Marijn Ford, Ph.D.**
*Assistant Professor*

Our laboratory has two broad objectives: to understanding the molecular mechanism of membrane remodeling by members of the Dynamin-Related Protein (DRP) family, and to study the signaling pathways yeast use to respond to stress, particularly starvation stress.

**The mechanism of membrane remodeling by the DRP family**
DRPs are believed to remodel membranes by self-assembly into helices that concomitantly remodel the underlying membrane. We are interested in how this self-assembly is coupled to membrane deformation and also in exploring the biology of some of the pathways where DRP function is required. To this end, we have been focusing on a poorly characterized fungal-specific DRP known as Vps1, that was initially identified in a screen for yeast mutants defective in sorting of carboxypeptidase Y to the vacuole. We chose Vps1 for two reasons: first, it is a better model for a typical DRP than dynamin and second, as it is a fungal protein, we could leverage the genetic and imaging tractability of *Saccharomyces cerevisiae* for our studies.

<u>Structural Studies:</u>
Using crystallographic approaches, we have obtained insight into Vps1 assembly and helix formation by solving two novel structures of the GTPase domain of Vps1, the first in complex with GDP and the second in complex with the non-hydrolyzable GTP analog GMPPCP. Strikingly, the structure of the GDP-bound GTPase forms a dimer interface of 2,722 $Å^2$ with the GDP "trapped" in a deep pocket between the dimer partners. The switch I and II regions of the GTPase domains are unusually well ordered for a GDP-bound GTPase, due to partial stabilization by a loop contacting the GDP *in trans* from the dimerization partner. The structure bound to GMPPCP includes the full "Bundle Signaling Element" in an extended conformation. Comparison of the two structures has





revealed new insight into the regulation of helix assembly by members of this family.

We have also determined the structure of a helical assembly of full-length Vps1 by cryo-electron microscopy, in collaboration with Frances Alvarez in the Zhang lab. The key enabling advance in this work was the ability to express and purify full length Vps1 for the first time. Extensive biochemical characterization resulted in optimized samples for cryo-preparation and data collection. The structure of the Vps1 helix, determined to ~13 Å resolution, demonstrates a novel lateral interface between the GTPase domains in the assembled helix that may regulate the kinetics of helix assembly and disassembly and consequently its function in the cell.

Cell Biology:
We have identified a novel function for Vps1 in autophagic processes as well as other stress response pathways. In all these cases, Vps1 concentrates into puncta (presumably assembling) at sites of close endosomal/vacuolar juxtaposition that are the site of membrane remodeling in various vacuolar uptake processes, including microautophagy and piecemeal microautophagy of the nucleus. We demonstrated that Ivy1, a marker for microautophagic invaginations, and Vps1 segregate during the autophagic process. We have made extensive use of the imaging facilities in the Center for Biologic Imaging for this work.

**Yeast Stress Response Pathways:**
TORC1 is a multiprotein complex that couples external cues such as nutrients and other environmental stimuli to the pathways regulating cell growth. TORC1 deregulation is associated with variety of human cancers and metabolic disorders and has consequently been the object of intense study. In yeast, the amino acid availability signal is relayed to TORC1 via the conserved Rag GTPases Gtr1 and Gtr2, both components of the vacuolar-membrane-associated EGO complex (EGOC).

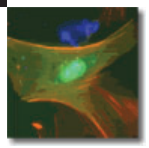
Cell Biology:
While studying the function of Vps1 in microautophagy, we identified the largely uncharacterized yeast protein Pib2 as an additional regulator of microautophagy and TORC1 signaling. Pib2 has a role in lysosomal membrane permeabilization and has two human homologues Phafin 1 and Phafin 2. Our work has demonstrated that Pib2, like the yeast EGO Complex, is required for TORC1 reactivation after exposure to the TORC1 inhibitor rapamycin.

Deletion of Pib2 phenocopies deletion of components of the EGO Complex in several assays: vacuolar morphology, TORC1 localization and activity, rapamycin sensitivity and inability to respond to amino acid supplementation after starvation.

The ΔPib2 phenotype can be rescued by active form of TOR1, but not by the constitutively active forms of GTRs. Pib2 is required for EGO Complex-mediated activation of TORC1 by glutamine and leucine as well as for redistribution of Tor1 on the vacuolar membrane.

High-throughput Genetics:
A synthetic dose lethality screen, where Pib2 is overexpressed in each individual knockout in the yeast deletion collection, demonstrated strong genetic interactions with components of the EGO Complex, TORC1 and downstream components of the Protein Phosphatase 2A branch of TORC1 signaling.





Together, we show that Pib2 and EGO Complex are reciprocally required for TORC1 activation and function within the same molecular pathway. Our observations therefore demonstrate that Pib2 is a novel relay in the cell's signaling pathway from amino acid perception to a TORC1 signaling response post-starvation.

**Gerald Hammond, Ph.D.**
*Assistant Professor*

Healthy cellular function demands the co-ordination of assorted signals, molecular traffic and cytoskeletal attachment at membranes. Although protein function is usually the focus of research into these processes, inositol-containing phospholipids are absolutely crucial to membrane function in eukaryotes. They act as substrates in signaling reactions, recruit adaptors for membrane traffic, activate components of the cytoskeleton, as well as many other functions including the control of ion flux. How are these lipids and their protein ligands normally organized and co-ordinated? What homeostatic mechanisms maintain a stable lipid and protein composition in the face of membrane turnover?

Answering these basic questions is crucial, because genetic diseases ranging from cancer to hereditary hearing loss are caused by disruption of membrane function resulting from mutations in inositol lipid metabolizing enzymes. Furthermore, many bacterial and viral pathogens re-model host cell membranes by actively disrupting inositol lipid distribution.

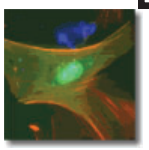
The overall aim of the lab is therefore to delineate the mechanisms of membrane organization and homeostasis, and how these mechanisms are altered in genetic and infectious disease. We use an array of state of the art methods, including live cell imaging, single molecule, super-resolution and chemical genetic approaches, supported by conventional molecular/cellular techniques, to probe the molecular scale organization of membranes. We interrogate specific protein-lipid complexes in both healthy cells and infectious or hereditary disease models.

**Yang Hong, Ph.D.**
*Associate Professor*

Research in my lab focuses on the molecular mechanisms regulating the cell polarity. Specifically, epithelial cells develop so-called apical-basal polarity by partitioning the cell surface into distinct apical and basolateral domains through polarized formation of cell junctions. Establishing and maintaining apical-basal polarity is crucial for the function and structure of epithelia, while disruption of such polarity often accompanies the malignant transformation or stress-induced damage of epithelial cells.

To date a dozen of so-called "polarity proteins" have been identified for their conserved and essential roles in regulating the cell polarity in both vertebrates and invertebrates. A key feature of these polarity proteins is that they must localize to specific apical or basolateral membrane domains to regulate cell polarity, and it is generally assumed that their membrane targeting is achieved by physical interactions with other polarity proteins or cytoskeleton etc. However, we recently discovered that plasma membrane targeting of polarity protein Lgl is in fact mediated by direct binding between its positively charged polybasic domain and negatively charged inositol phospholipids PIP2 and PI4P on the plasma membrane. Using both *Drosophila* and cultured mammalian cells as model systems, we are investigating how direct interactions between polarity





proteins and membrane lipids may act as a crucial molecular mechanism regulating the subcellular localization and functions of polarity proteins, such as:

1) Control of plasma membrane targeting of polarity proteins: direct binding to plasma membrane phospholipids likely targets proteins to all plasma membrane domains. We are identifying essential mechanisms that spatially restrict polarity proteins to specific membrane domains in polarized cells.

2) Role of phospholipids in regulating cell polarity: polybasic domain-mediated membrane targeting also highlights the critical role of inositol phospholipids such as PIP2 in establishing and maintaining cell polarity under cellular stress. Our discovery that hypoxia acutely and reversibly inhibits Lgl plasma membrane targeting through depleting membrane phospholipids suggests that phospholipid turn-over and homeostasis play significant role to conserve cell polarity and promote cell survival under cellular stress such as hypoxia/ischemia.

3) Regulation of membrane targeting of polarity proteins in tumorigenesis: many polarity proteins, such as Lgl, also function as tumor suppressors. Loss of Lgl membrane targeting is a hallmark in both *Drosophila* and human tumor cells. We are investigating the mechanism contribute to the compromised membrane targeting of polarity proteins and the progressive loss of cell polarity during tumorigenesis.

We have developed genomic engineering tools that allow efficient generation of knock-in alleles of *Drosophila* genes. We also developed comprehensive imaging tools for visualizing the dynamic subcellular localizations of polarity proteins under various physiological conditions including hypoxia.

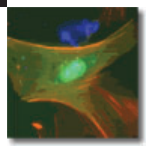
**Adam Kwiatkowski, Ph.D.**
*Assistant Professor*

The primary focus of work in the Kwiatkowski Lab is to gain a mechanistic understanding of cardiomyocyte adhesion and cytoskeletal organization. Our approach is to use to a combination of protein biochemistry, cell biology and microscopy to define mechanisms of cell-cell adhesion, and downstream regulation of actin and intermediate filament organization, by the cadherin-catenin adhesion complex. Our rationale is that understanding the molecular mechanisms of adherens junction adhesion in cardiomyocytes will provide fundamental insight into cardiomyocyte cell-cell adhesion and adherens junction biology.

**Sanford H. Leuba, Ph.D.**
*Associate Professor*

Since the discovery of the nucleosome in the early 1970's, scientists have sought to correlate chromatin structure and dynamics with biological function. More recently, we have learned that nucleosomes and chromatin play a critical role in the regulation of transcription, replication, recombination, and repair (Zlatanova and Leuba, 2004). Our laboratory uses an interdisciplinary approach combining the disciplines of molecular biology, biochemistry, engineering, and physics





to try to understand at the single nucleosome and single chromatin fiber level how chromatin structure and dynamics regulate biological processes that use DNA as a template. To this end, we are applying several single-molecule approaches such as atomic force microscopy (AFM), magnetic tweezers, optical tweezers and single-pair fluorescence resonance energy transfer (spFRET) to native or reconstituted chromatin fibers of different protein compositions with the latter three methods using homebuilt instrumentation. Single-molecule techniques provide the sensitivity to detect and to elucidate small, yet physiologically relevant, changes in chromatin structure and dynamics. Recent examples of what we have been able to discover include the following:

- We have been able to use AFM to detect conformational changes in chromatin fiber structure due to the presence of 24 methyl groups per nucleosome (Karymov et al., 2001) implying that the combined action of the DNA methylation and linker histone binding required to compact chromatin may affect the transcription of large chromatin domains.

- We also used AFM to investigate the role of histone variants in chromatin fiber structure (Tomschik et al., 2001). Eukaryl and archaeal organisms have similar fiber structure with differences likely related to the more complex needs of eukaryl organisms to regulate transcription.

- We have used optical tweezers to determine the piconewton forces necessary to unravel individual nucleosomes in a fiber context (Bennink et al., 2001) and found that the measured forces for individual nucleosome disruptions are in the same range of forces reported to be exerted by RNA- and DNA-polymerases.

- We have used magnetic tweezers to observe a dynamic equilibrium between force dependent nucleosomal assembly and disassembly on a single DNA molecule in real time (Leuba et al., 2003) as a model of what happens to nucleosomes when a transcribing polymerase passes through the region where they are located.

- We have used spFRET to demonstrate fast, long-range, reversible conformational fluctuations in nucleosomes between two states: fully folded (closed) with the DNA wrapped around the histone core, and open, with the DNA significantly unraveled from the histone octamer (Tomschik et al., 2005), implying that most of the DNA on the nucleosome can be sporadically accessible to regulatory proteins and proteins that track the DNA double helix.

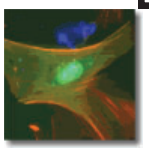
- We have used spFRET to demonstrate that PcrA DNA helicase displaces RecA from both ssDNA as well as dsDNA (Anand et al., 2007), as a model for regulation of homologous recombination.

- We have developed a method to isolate in one-step histones containing their native post-translational modifications (Rodriguez-Collazo et al., 2009). This method has also been patented and licensed.

- We have used spFRET to demonstrate the wrapping of DNA around the archaeal homohexameric MCM helicase from Sulfolobus solfataricus (Graham et al., NAR 2011), protecting the displaced single-stranded DNA tail and preventing reannealing.

- In collaboration with Li Lan, Satoshi Nakajima and Vesna Rapic-Otrin (Molecular Genetics and Biochemistry), we have studied the ability of an E3 ligase to ubiquitinate histone H2a and destabilize nucleosomes with UV-damaged DNA (Li et al., JBC 2012).





- We have used spFRET to demonstrate that PcrA DNA helicase displaces RecA but not RecA mutants (Fagerburg et al., NAR 2012) indicating that direct transduction of chemomechanical forces alone by translocating helicases, such as PcrA and Srs2, are insufficient to displace recombinases such as RecA and Rad51 that form large polymeric assemblies on ssDNA.

- We have used spFRET, single molecule protein induced fluorescence enhancement (PIFE), fluorescence anisotropy and modeling to demonstrate for the first time that allosteric inhibitors directly alter the mobility of HIV-1 reverse transcriptase on its DNA substrate by modulating its conformation, without changing the binding affinity of RT to DNA (Schauer et al., 2014).

Our future goals are to build combination single-molecule instruments to image and manipulate intramolecular nanometer movements in submillisecond real-time with piconewton force sensitivity (e.g., we want to observe directly what happens to the histones in a nucleosome in the path of a transcribing polymerase). We want to observe what changes in superhelicity occur upon nucleosome formation, nucleosome by nucleosome. We hope to resolve whether the positive supercoils generated by a transcribing polymerase are sufficient to displace histone octamers. In addition to chromatin, we are studying the mechanism of action of individual helicases unwinding DNA. We are also working on the capability to observe in real time single nucleosome dynamics in living cells.

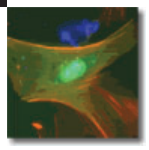
**Sandra A. Murray, Ph.D.**
*Professor*

In Dr. Murray's laboratory, integrated approaches are being used in studies to assess the role of gap junctions and cell-to-cell communication in endocrine cell proliferation, migration, differentiation, and hormone production and to elucidate the molecular machinery that regulates gap junction plaque endocytosis. Four different techniques (time-lapse video microscopy, immunocytochemistry, quantum dot immuno-electron microscopy, and western blot analysis) are being used to examine the role of clathrin and protein phosphorylation in gap junction protein (connexin) trafficking, including gap junction plaque assembly and subsequent internalization. The effect of over expression and inhibition of gap junctions on adrenal cell function, are being studied with cDNA antisense vectors, dominant-negative constructs, siRNA approaches, and antibody directed against gap junction genes products. Together these studies are designed to elucidate the role of cell-cell communication in tissue function with particular interest in how endocytosis and post-endocytic trafficking of gap junction proteins is regulated to control cellular function(s).

**Yi Shi, Ph.D.**
*Assistant Professor*

The extraordinarily emergent properties of living cells have evolved largely as a consequence of the intricately ordered interactions of their biomolecular components. These cellular building blocks interact with each other to form a hierarchy of dynamic macromolecular assemblies that drive a plethora of important biological processes. Unfortunately, despite their central role in cell biology, many protein complexes identified to date remain refractory to structure-functional characterization.





We are interested in the development of integrative proteomic technologies to elucidate the structure and function of large, native protein complexes. We are interested in developing new proteomic tools to investigate the spatiotemporal regulations of mitochondria, as well as their roles in aging and neurodegenerative diseases.

**Alexander D. Sorkin, Ph.D.**
*Richard B. Mellon Professor and Chairman*

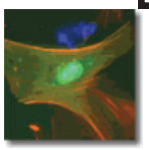
The focus of the research in the laboratory is currently split into two major directions which are distinct from each other with respect to the biological systems involved, their relation to the human disease, and experimental models used. However, the main idea underlying both directions is conceptually the same - to understand how endocytosis and post-endocytic trafficking regulate function(s) of the transmembrane proteins, such as receptors and transporters. One major project aims at elucidating the molecular mechanisms of endocytosis of growth factor receptors using a prototypic member of the family, epidermal growth factor (EGF) receptor, and analyzing the role of endocytosis in spatial and temporal regulation of signal transduction by the EGF receptor. Another major research direction is the study of the role of trafficking of the plasma membrane dopamine transporter (DAT) in the regulation of dopaminergic neurotransmission. In both these research areas we are using multidisciplinary methodological approach in *in vitro* and novel *in vivo* experimental models. Finally, we have recently engaged in a new collaborative project aimed at elucidating the mechanisms by which placenta-derived exosomes are internalized by target cells.

**Claudette St. Croix, Ph.D.**
*Associate Professor*
*Assistant Director of Center for Biologic Imaging*

My independent research program utilizes a combination of advanced optical imaging technologies to dissect molecular signaling pathways controlling vascular function in rodent and zebrafish model systems of disease. An important facet of this work is the *in vivo* application of novel fluorescent molecular reporters to study the biology of reactive oxygen and nitrogen species (ROS and RNS, respectively). These approaches are central to my multi-PI efforts with Drs. Marcel Bruchez and Alan Waggoner from Carnegie Mellon University. In addition, my expertise in the application of novel fluorescence-based probes and advanced *in vivo* imaging technologies have led to my appointment as an associate director of the Center of Biologic Imaging (CBI) at the University of Pittsburgh and invitations to present my work internationally and to take lead roles in well-respected courses such as Quantitative Fluorescence Microscopy (Mount Desert Island Biology Laboratory). In my leadership role at the CBI, I have well-established, active and productive collaborations with NIH funded investigators to study ROS based signaling, cell survival, and mitochondrial dynamics in living cells, tissue and animal models using an array of advanced, fluorescence based, optical imaging modalities. This is evidenced by my role as co-Investigator on federally funded projects, and as co-author on peer-reviewed manuscripts, including a recent Cell paper.

**Donna Beer Stolz, Ph.D.**
*Associate Professor*
*Assistant Director of Center for Biologic Imaging*





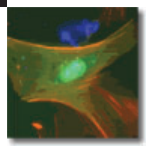
Overview: Angiogenesis is the process whereby new blood vessels sprout from existing vessels and requires that the specialized resident cells lining the vasculature, the endothelial cells (ECs), proliferate, migrate and differentiate spatially and temporally in response to specific signals. Vasculogenesis, on the other hand, has only recently emerged as an alternative mechanism of blood vessel growth in adult tissues and is the result of homing and engraftment of circulating EC precursors (ECPs) of bone marrow origin to sites of neovascularization. Both events are known to occur within tissue vasculature under very different conditions of growth, injury and repair, but the extent of each and the mechanisms by which they occur for each case is incompletely understood. We evaluate various signaling events that accompany blood vessel growth and repair during liver regeneration following partial hepatectomy, the result of cold ischemia/warm reperfusion injury following liver transplantation or warm ischemia/warm reperfusion following surgical resections for cancer. Comparative analysis of these systems will elucidate both similar and dissimilar mechanisms that control these events and potentially lead to optimization of therapies that will reflect the specific requirements for injury based neovascularization in the liver. Additional research concentrations include vascular and parenchymal changes in liver and kidney with normal aging and in mouse models of accelerated aging.

Dr. Stolz is Associate Director of the Center for Biologic Imaging and directs the electron microscopy facility of CBI. Her main role as Associate Director of CBI is to facilitate PI usage with the facility, as well as assist in design, execution and interpretation of experiments involving all types of imaging technologies in general. Additionally, she coordinates interactions of PIs and students with other arms of the CBI, including widefield and confocal microscopy as well as live cell imaging. Dr. Stolz's research specialties involve vascular biology, liver regeneration and liver and kidney aging.

**Linton M. Traub, Ph.D.**
*Professor*

Many molecules enter the cell interior within clathrin-coated vesicles, in process termed endocytosis. In the simplest sense, the clathrin-coated vesicle can be viewed as a nanomachine that temporally couples preferential retention of designated cargo with rapid vesicle assembly, invagination, and fission from the plasma membrane. In fact, this rapid process is critical to the way we move and think. At the tip of each axon, synaptic vesicles (packages of neurotransmitter) release their contents by fusing with the cell surface in response to stimulus-dependent calcium influx. Almost instantly, the membrane of the synaptic vesicle is then retrieved from the synapse within clathrin-coated vesicles. Clathrin-mediated endocytosis is thus tightly coupled to exocytosis, the stimulated release of neurotransmitter. Failure to recover synaptic-vesicle membrane results in both morphological disruption of the nerve terminal and defective neurotransmission. Clathrin-coated vesicles also play an important role in controlling plasma LDL-cholesetrol levels in humans and yolk protein accumulation in *Drosophila* and mosquitoes by promoting the rapid internalization of a family of related lipoprotein receptors. We study the mechanisms and molecules involved in clathrin-coat assembly. We are interested how this complex process, involving a network of more than 25 discrete protein components, is temporally coordinated to prevent chaotic seizures or run-away coat assembly. We have found recently that some of these protein components display unexpected cargo sorting properties that expand the overall sorting repertoire of the forming clathrin-coated vesicle. To understand how these complex structures, assemble within only a minute or two, we use biochemical, cell biological, structural and live-cell imaging approaches to unravel the protein–protein interactions that orchestrate the





formation of this elaborate protein-sorting machine.

**Steve T. Truschel, Ph.D.**
*Assistant Professor*

My contributions to the University Of Pittsburgh School of Medicine are primarily through teaching. Since joining the department of Cell Biology and Physiology last year, I contribute as a faculty member to separate courses throughout the first year of the medical students' education. My responsibilities include lectures, problem-based learning sessions, team-based learning, microscopy laboratories, workshops, and curriculum design. I also contribute original electron micrographs to course manuals used by 1st year medical students.

Within the Department of Cell Biology and Physiology, I am the course director for the Graduate Histology course. This course is taken by the majority of our students and is a broad survey of all the organ systems, focusing on structure/function at the cellular, tissue and organ levels. Upon successful completion of this course, students may then serve as Teaching Fellows for the Histology labs within the Medical School courses. One of my roles is coordinator of the Teaching Fellows, especially to oversee their training and preparation.

Lastly, this year I have become course director for Histology and Cell Function in Health and Disease within the Biomedical Master's program. In collaboration with the Laboratory of Educational Technology, I am transforming the course curriculum by creating a virtual microscopy slide collection that will be added to the medical education Navigator website. The virtual slides are high resolution digital images that can be manipulated on a computer screen in a similar way as can be done on a microscope. Importantly, these virtual slides will be incorporated into the curricula of both the Biomedical Master's program as well as the University of Pittsburgh School of Medicine.

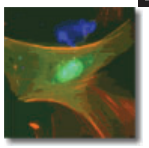
**Simon C. Watkins, Ph.D.**
*Distinguished Professor, Vice Chairman of Department*
*Director of Center for Biologic Imaging*

The application of advanced imaging tools to the field of cell biology is constantly revealing new facets of cellular and molecular behavior. The goals of my research program are two-fold. To develop novel quantitative fluorescent based assays using optical microscopy, and secondly to develop novel imaging platforms for use in health and disease. Recent accomplishments have been the development of multiple new high speed high resolution imaging platforms for multidimensional imaging of model systems as well as the development and implementation of imaging tools for new multiparametric imaging probes.

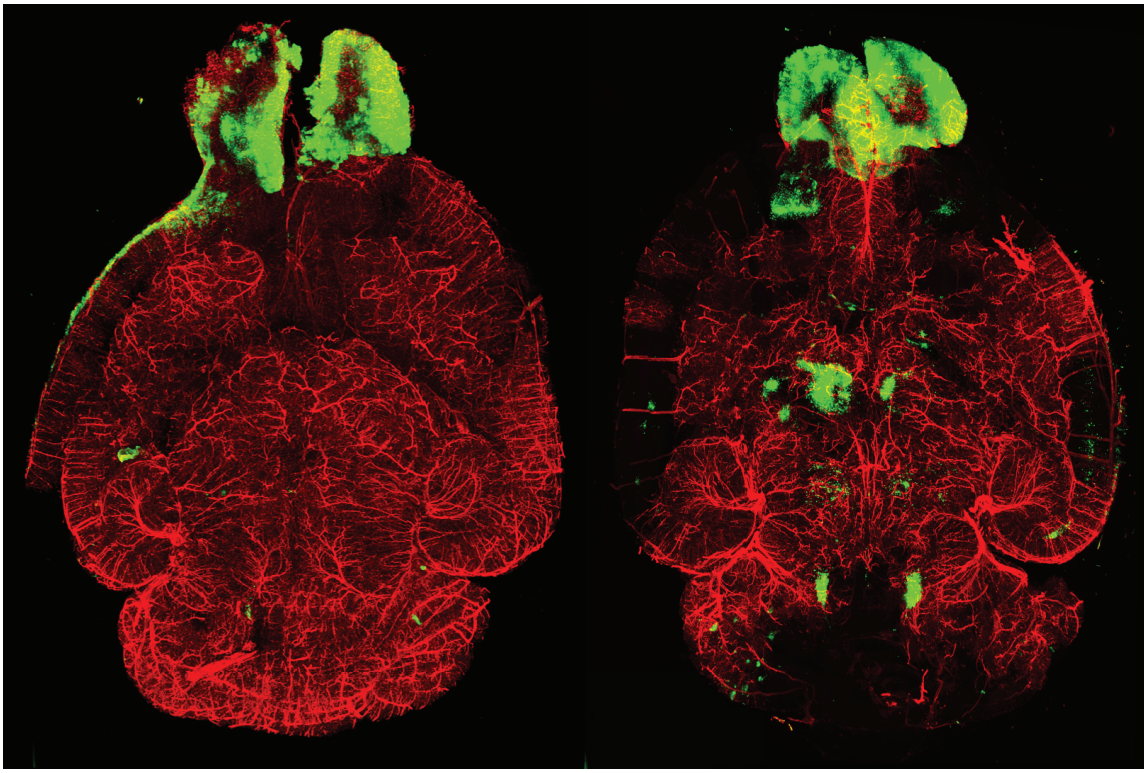
**Nathan Yates, Ph.D.**
*Associate Professor*

The systematic goal motivating our work is to develop and apply powerful mass spectrometry based tools that represent a new "microscope" for studying biology and advancing efforts to understand and treat disease. By integrating mass spectrometry, automation, and informatics, we are developing new analytical tools for the characterization and quantification of complex biological systems. These –omics tools provide exciting opportunities to probe biology with



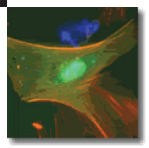


absolute molecular specificity, however, significant hurdles must be cleared before they tools have widespread impact in basic and clinical research. A specific aim of our research is to develop distributed informatics tools and mass spectrometry data analysis techniques. Prior to joining the University of Pittsburgh, Dr. Yates' work at Merck & Co. Inc. led to the invention and eventual the commercialization of Differential Mass Spectrometry; an unbiased quantitative proteomics method for comparing complex biological systems. The lab is also focused on the development of innovative technologies that are designed to improve the throughput and reliability of quantitative proteomics assays. In collaboration with several industry partners, the lab is developing "easy to use" assay platforms that will enable scientists in basic and clinical research.



**Dr. Alan Watson.** These images display brains from mice infected with Venezuelan Equine Encephalitis virus (green) via the aerosol route and perfused with microbeads (red) to display vasculature. Comparison of 72 (left) and 96 (right) hours post infection demonstrate the spread of virus from the olfactory bulbs and the breakdown of vascular flow within the brain. These data were collected in collaboration with Dr. William Klimstra from the Department of Immunology at the University of Pittsburgh.





**Study Sections (Fiscal Year 2018 - 2019)**

**Michael Butterworth, Ph.D.**
*Associate Professor*

2019 NIH (Ad Hoc)

**Adam Kwiatkowski, Ph.D.**
*Assistant Professor*

Ad hoc member, AHA Transformational Project Award Review Section

**Alexander D. Sorkin, Ph.D.**
*Richard B. Mellon Professor and Chairman*

ASIRC - Italian Association for Cancer Research; Standing Member
CSR Special Emphasis Panel ZRG1 CB-J (55) PAR-17-094: Maximizing Investigators' Research Award (R35) NIGMS

**Claudette St. Croix, Ph.D.**
*Associate Professor*

American Heart Association Innovative Program Award Basic Sciences 2 Review Panel
NIH CMT Standing Panel - Cellular and Molecular Technologies 2018/01 Temporary Member
American Cancer Society - Clinical Cancer Research and Epidemiology (CCE), Standing Member

**Donna B. Stolz, Ph.D.**
*Associate Professor*

NIDDK Training Grant Special Emphasis Panel, Member
NIH ZGM1-RCB-9 NIGMS INBRE/COBRE grant reviews

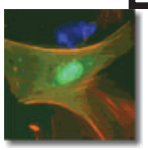
**Linton Traub, Ph.D.**
*Professor*

Ad hoc member of NIH ZRG, CSF and NRSA Study Sections

**Simon C. Watkins, Ph.D.**
*Distinguished Professor and Vice Chairman, Director of Center of Biologic Imaging*

Israeli Ministry of Science and Technology grant review Invited reviewer.





NIH Study Section ZRG1 BST-T(40)P Panelist
Science & Engineering Research Council (SERC) Singapore, Invited Reviewer
NSF study section Chemistry of Life Processes
NIH study section 2019/05 ZRG1 IMST-K (02) M Co-Chair
NIH Study section ZRG BST-T(40)

Cell Biology/Pharmacology Machine Shop

**Faculty Advisory Committee Memberships (Fiscal Year 2018 - 2019)**

**Meir Aridor, Ph.D.**
*Associate Professor*

University of Pittsburgh School of Medicine Interdisciplinary Biomedical Graduate Program-
Cell Biology and Molecular Physiology Program Committee
Local Traffic Symposium; Organizing Committee Member
Cell Biology Faculty Recruitment Committee
Integrated Systems Biology (ISB) Admission Committee
University of Pittsburgh, School of Medicine, Integrated Systems Biology (ISB)
Admission committee, PhD program.2014-2017
Biomedical Master Program (BMP) Admissions committee MSc program 2018-present
Biomedical Master Program (BMP) Academic advising. 2018-present.

**Michael Butterworth, Ph.D.**
*Associate Professor*

Cell Biology Space Committee
Integrated Systems Biology (ISB) Program Committee
Integrated Systems Biology (ISB) Course Director, Core Course (Imaging)
Cell Biology and Molecular Physiology Graduate Program, Director

**Daniel Devor, Ph.D.**
*Professor*

Cell Biology Departmental Tenure and Promotions Committee

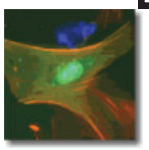
**Peter F. Drain, Ph.D.**
*Associate Professor*

University of Pittsburgh School of Medicine Interdisciplinary Biomedical Graduate Program-
Cell Biology and Molecular Physiology Program Committee
Cell Biology Representative, Graduate Student Recruitment Committee
Biomedical Masters Program Committee
UPSOM Curriculum Committee

**Marijn Ford, Ph.D.**
*Assistant Professor*

Organizer – Cell Biology Department Retreat
Organizing Committee, Pittsburgh "Local Traffic" symposium
Cell Biology Space Committee
Institutional Biosafety Committee





**Gerald Hammond, Ph.D.**
*Assistant Professor*

Organizer – Cell Biology Department Retreat
Organizing Committee, Pittsburgh "Local Traffic" symposium
Cell Biology Space Committee
Interdisciplinary Biomedical Graduate Program, Admissions Committee

**Yang Hong, Ph.D.**
*Associate Professor*

Cell Biology Space Committee
Cell Biology Faculty Recruitment Committee

**Adam Kwiatkowski, Ph.D.**
*Assistant Professor*

Cell Biology Space Committee
Local Traffic Symposium Organizing Committee, Chair
Associate Director, Cell Biology and Molecular Physiology Graduate Program
UPSOM Student Promotions Committee

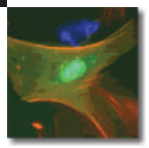
**Sanford Leuba, Ph.D.**
*Associate Professor*

University Molecular Biophysics and Structural Biology Graduate Program Chair of Admissions Committee & Curriculum Committee

**Sandra A. Murray, Ph.D.**
*Professor*

Graduate School of Public Health Research Advisory Committee – Center for Minority Health
Provost Advisory Committee for the Provost Development Fund Awards
Morehouse College of Medicine Advisory Board
Cell Biology Tenure and Promotions Committee
Cell Biology Faculty Recruitment Committee
Co-Chair of the Research Center of Excellence Committee, Graduate School of Public Health, University of Pittsburgh
Graduate School of Public Health Community Engagement Research Core
University Community Representative for Equipoise
Junior Faculty Advancement – Panel Member





**Yi Shi, Ph.D.**
*Assistant Professor*

Organizer – Cell Biology Department Retreat

**Alexander D. Sorkin, Ph.D.**
*Richard B. Mellon Professor and Chair*

Executive Committee – School of Medicine
University of Pittsburgh and Carnegie Mellon Medical Scientist Training Program Committee - MSTP
Center for Neuroscience University of Pittsburgh – CNUP
University of Pittsburgh Cell Biology and Molecular Physiology Program Committee
Cell Biology Tenure and Promotions Committee
Cell Biology Faculty Recruitment Committee
External Advisory Committee for Nevada's Cell Biology COBRE Grant, University of Nevada School of Medicine, Reno, NV
Dickson Prize Selection Committee – SOM
Integrated Systems Biology Executive Committee
Biomedical Masters Program Executive Committee

**Claudette St. Croix, Ph.D.**
*Associate Professor*

Cell Biology Faculty Recruitment Committee

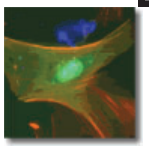
**Donna Beer Stolz, Ph.D.**
*Associate Professor*

University of Pittsburgh School of Medicine Interdisciplinary Biomedical Graduate Program-
Cell Biology and Molecular Physiology Program Admissions Committee
Assistant Director - Cell Biology and Molecular Physiology Program
School of Medicine Tenured Faculty Promotions and Appointments Committee

**Linton M. Traub, Ph.D.**
*Professor*

University of Pittsburgh School of Medicine Health Sciences Research Advisory Committee
Cell Biology Tenure and Promotions Committee
Cell Biology Faculty Recruitment Committee

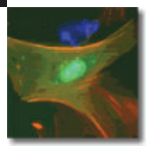


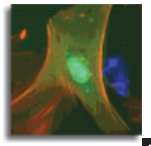


**Simon C. Watkins, Ph.D.**
*Distinguished Professor and Vice Chairman, Director of Center of Biologic Imaging*

Cell Biology Tenure and Promotions Committee
Cell Biology Student Advisory Committee
Cell Biology Space Committee
Cell Biology Faculty Recruitment Committee
Graduate Program, Curriculum Committee
University of Pittsburgh School of Medicine, Research Advisory Committee
University of Pittsburgh Cancer Institute Core Resources Committee
University of Pittsburgh Tenure and Promotions Committee
Chair UPCI Luminex advisory committee
Chair UPCI Proteomics advisory committee
Chair UPCI flow cytometry advisory committee
UPCI chemical biology advisory committee











## Cell Biology Sponsored Research Funding (FY19)

| Name | Agency Name | Title | Annual DC | Annual IDC |
|---|---|---|---|---|
| Michael Butterworth | National Institutes of Health | Role of MicroRNAs in kidney sodium regulation | 216,384 | 116,848 |
| Michael Butterworth | National Institutes of Health | Altered Biosynthesis and Function of ABCC6 in Systemix Mineralization Disorders | 14,138 | 7,970 |
| Marijn Ford | National Institutes of Health | The Roles of the Dynamin-Related Protein Vps1 and the ESCRT Complex in Microautophagy | 193,752 | 99,936 |
| Gerry Hammond | National Institutes of Health | Directing Membrane Function with Inositol Lipids in Health and Disease | 242,237 | 136,685 |
| Yang Hong | National Institutes of Health | Membrane Targeting and Retargeting of Polarity Proteins | 196,500 | 106,228 |
| Adam Kwiatkowski | National Institutes of Health | Alpha-Catenin Function in Cardiomyocyte Adhesion and Cytoskeletal Organization | 236,158 | 125,503 |
| Mads Larsen | National Institutes of Health | Cystic Fibrosis Foundation (Betrand) | 30,491 | - |
| Mads Larsen | National Institutes of Health | Selective Steps in Wild-Type and F508del CFTR Processing (PI - Frizzell) | 3,652 | 292 |
| Sanford Leuba | National Institutes of Health | NNRTI Induced Conformational Changes in HIV 1 RT (Sluis-Cremer) | 4,568 | 2,467 |
| Sanford Leuba | National Institutes of Health | Novel Mechanisms of HIV Resistance t0 RTIS (Sluis-Cremer) | 5,356 | 2,893 |
| Sanford Leuba | National Institutes of Health | Evolved DNA Contacts Required for Hexameric Helicase Unwinding. | 42,860 | 24,178 |
| Chelsea Merkel | National Institutes of Health | The Role of Vinculin in Cardiomyocyte Adhesion and Mechanical Continuity | 44,158 | - |
| Yi Shi | National Institutes of Health | Mechanisms of Signaling Protein Retention in the Primary Cilium | 3,867 | 2,185 |
| Alexander Sorkin | National Institutes of Health | Pathogenesis of Cancer | 63,898 | 36,102 |
| Alexander Sorkin | US Dept of Veterans Affairs | Investigating the Role of TMEM16A/AN01 in SCCHN | 5,801 | - |
| Alexander Sorkin | National Institutes of Health | Exosome Based Placental Maternal Communication | 46,059 | 25,831 |
| Alexander Sorkin | National Institutes of Health | Modeling Spatiotemporal Control of EGFR-ERK Signaling in Gene-Edited Cell Systems | 116,895 | 65,945 |
| Alexander Sorkin | National Institutes of Health | Signaling by them EGF Receptor from Endosomes | 208,139 | 117,477 |
| Alexander Sorkin | National Institutes of Health | Regulation of Dopamine Transporter by Trafficking | 260,438 | 132,744 |
| Claudette St. Croix | National Institutes of Health | In Vivo Localization and Mechanism of Regulatory B Cell Function in All immunity and Transplant Tolerance | 8,846 | 4,777 |
| Claudette St. Croix | National Institutes of Health | Pulmonary Arteriole Occlusion by Platelet Neutrohil micro emboli in acute chest syndrome | 25,414 | 2,529 |
| Claudette St. Croix | National Institutes of Health | Pathogenic Mechanisms of Gene-Environment Interactions in Parkinsons Disease | 2,917 | 1,575 |
| Claudette St. Croix | National Institutes of Health | Cardiolipin as a Novel Mediator of Acute Lung Injury | 5,314 | 2,870 |
| Claudette St. Croix | National Institutes of Health | Vascular Subphenotypes of Lung Disease - Preclinical Assessment Core | 68,013 | 38,428 |
| Claudette St. Croix | National Institutes of Health | Signaling Mechanisms by which Mitochondria Regulates Fibrosis in the Lung | 4,496 | 2,428 |
| Claudette St. Croix | National Institutes of Health | Reactive Oxygen Species in Vascular Disease | 8,236 | 4,448 |
| Claudette St. Croix | National Institutes of Health | Anti-Inflammatory Lipid Mediators in Asthma | 8,575 | 4,845 |
| Claudette St. Croix | National Institutes of Health | Vascular Smooth Muscle and Blood Pressure Regulation By cyb5R2 | 7,505 | 4,231 |
| Claudette St. Croix | National Institutes of Health | Novel Role of Smooth Muscle B5 Reductase in Sickle Cell Disease | 4,523 | 2,551 |
| Claudette St. Croix | National Institutes of Health | Aging of Mesenchymal Stem cells Missing Link in IPF | 6,984 | 3,771 |

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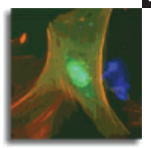
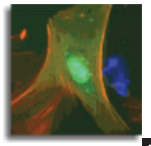
|---|---|---|---|---|
| Claudette St. Croix | National Institutes of Health | Regulation of Fuel Utilization by Lysine Acetylation in the Failing Heart | 3,625 | 2,043 |
| Claudette St. Croix | National Institutes of Health | Exploring and Exploiting Metabolic Plasticity in Regulatory T Cells | 8,925 | 5,031 |
| Claudette St. Croix | National Institutes of Health | The Anti-Aging Role of Klotho in Skeletal Muscle Regeneration | 27,601 | 9,932 |
| Claudette St. Croix | National Institutes of Health | Host Control Mechanisms Against K. Pneumoniae Infection in the Lungs | 25,943 | 14,610 |
| Claudette St. Croix | National Institutes of Health | Mechanisms of Myocardial-Infarction Induced Insulin Resistance | 12,166 | 6,846 |
| Claudette St. Croix | National Institutes of Health | Mechanisms and Promotion of Immune Regulation by CD4+ | 14,232 | 5,209 |
| Claudette St. Croix | National Institutes of Health | Mechanism-Directed Sequential Delivery of Radiation Mitigators Imaging Radiation Apathology Core | 5,255 | 2,838 |
| Claudette St. Croix | National Institutes of Health | Biological and Physical Mechanisms of Ultrasound/Microbubble-Mediated Therapeutic Gene Delivery Across the Endothelial Barrier | 22,358 | 8,395 |
| Claudette St. Croix | National Institutes of Health | Obesity-associated Mitophagy Resistance | 16,181 | 9,143 |
| Claudette St. Croix | National Institutes of Health | The Role of Telomerase in Valvular Calcification | 3,312 | 1,871 |
| Claudette St. Croix | American Heart Association | Reprogramming of the Vascular Matrisome and Matrix Cellularity as a Pathogenic Lynchpin for Pulmonary Hypertension | 3,331 | 334 |
| Claudette St. Croix | National Institutes of Health | The Function of EGFL6 in Ovarian Cancer Cell Biology, Tumor Initiation, and Therapy | 3,347 | 1,891 |
| Claudette St. Croix | Pitt Foundation | PET imaging of vaso-occlusion in sickle cell disease: from mice to humans | 5,666 | - |
| Claudette St. Croix | National Institutes of Health | Mechanisms of platelet exosome-mediated acute chest syndrome in sickle cell disease | 6,168 | 2,849 |
| Claudette St. Croix | National Institutes of Health | Epigenetic Control of Smooth Muscle Cell Phenotype during Microvascular Remodeling | 2,421 | 803 |
| Donna Beer Stolz | National Institutes of Health | Mechanisms of Arsenic-induced Muscle Morbidity and Reduced Regenerative Capacity (PI - Barchowsky) | 4,036 | 2,240 |
| Donna Beer Stolz | National Institutes of Health | Mechanisms of Trabecular Meshwork Regeneration by Stem Cell (PI - Du) | 10,040 | 3,884 |
| Donna Beer Stolz | National Institutes of Health | Critical Role for Fibroblast Growth Factor Receptors in Bladder Development (PI - Bates) | 6,638 | 3,585 |
| Donna Beer Stolz | National Institutes of Health | Dysfunctional Muscle remodeling and regeneration in environmental disease (PI - Ambrosio/Barchowsky) | 24,025 | 13,518 |
| Donna Beer Stolz | National Institutes of Health | Elucidating Mechanisms Involved in Lamin B1 Mediated Demyelination (PI - Padiath) | 4,405 | 2,380 |
| Donna Beer Stolz | National Institutes of Health | Endogenous Regulators of Inflammation in Liver Ischemia/Reperfusion (PI - Tsung) | 5,383 | 1,561 |
| Donna Beer Stolz | National Institutes of Health | Luminal Epithelial Junctions, Polarity and Permeability in BPH (PI - Wang) | 823 | 374 |
| Donna Beer Stolz | National Institutes of Health | Luminal Epithelial Junctions, Polarity and Permeability in BPH (PI - Wang) | 8,867 | 4,298 |
| Donna Beer Stolz | National Institutes of Health | Alpha Catenin Function in Cardiomyocyte adhesion and Cytoskeletal (PI - Kwiatkowski) | 8,264 | 4,463 |
| Donna Beer Stolz | National Institutes of Health | Characterization of Meiotic Crossover Surveillance System (PI - Yanowitz) | 7,243 | 4,092 |
| Donna Beer Stolz | National Institutes of Health | Core G: Signature-Directed, Sequential Delivery of Radiation Mitigators (PI - Greenberger) | 11,062 | 5,973 |
| Donna Beer Stolz | National Institutes of Health | Melatonin Biosynthesis in Neuronal Mitochondria - (PI - Friedlander) | 4,222 | 2,386 |









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|---|---|---|---|---|
| Donna Beer Stolz | National Institutes of Health | Fox01 in Beta-Cell Compensation (PI - Dong) | 3,483 | 1,968 |
| Donna Beer Stolz | National Institutes of Health | Biological and Physical Mechanisms of Ultrasound/Microbubble-Mediated Therapeutic Gene Delivery Across the Endothelial Barrier (PI - Villaneuva) | 2,007 | 1,134 |
| Donna Beer Stolz | National Institutes of Health | Correcting Pathogenic TGF beta Activity in the Airway | 4,053 | 1,982 |
| Donna Beer Stolz | National Institutes of Health | Progressive degenerative role of Nox and thrombospondin-1 in the aging vasculature | 2,126 | 1,201 |
| Linton Traub | National Institutes of Health | Clathrin-coated Vesicles and Endocytic Function | 23,098 | 8,433 |
| Steven Truschel | National Institutes of Health | Bladder Mucosal Dysfunction During Aging | 29,190 | 16,492 |
| Simon Watkins | National Institutes of Health | Cardiolipin as a Novel Mediator of Acute Lung Injury | 45,190 | 21,703 |
| Simon Watkins | National Institutes of Health | Biomimetric surface for neural implants | 5,447 | 2,941 |
| Simon Watkins | National Institutes of Health | Cancer Center Support Grant | 81,261 | 43,882 |
| Simon Watkins | National Institutes of Health | Inhibition of Neural Electrode-Mediated Inflammation and Neuronal Cell Death | 9,351 | 4,753 |
| Simon Watkins | National Institutes of Health | DNA Damage Recognition by Nucleotide Excision Repair Proteins | 9,315 | 5,103 |
| Simon Watkins | National Institutes of Health | Exosomes as paracrine signal mediators in cardiac allograft rejection | 17,157 | 7,511 |
| Simon Watkins | National Institutes of Health | Inhibition of the ALT Pathway by Interfering with Poly-ADP-Ribose Metabolism | 15,626 | 5,573 |
| Simon Watkins | National Institutes of Health | T Cell Memory in Organ Transplantation | 8,414 | 4,544 |
| Simon Watkins | National Institutes of Health | Pittsburgh Center for Kidney Research | 1,250 | 644 |
| Simon Watkins | National Institutes of Health | BMP10 in Cardiovascular Development and Hereditary Hemorrhagic Telangiectasia. | 10,207 | 3,705 |
| Simon Watkins | National Institutes of Health | Regulated Activation of latent-TGfB Determines Leukocyte Occupancy of the Epidermal Niche | 2,500 | - |
| Simon Watkins | National Institutes of Health | Mechanistic Elucidation and Targeted Therapy of Platelet Dysfunction After Trauma (Neal) | 12,262 | 6,917 |
| Simon Watkins | National Institutes of Health | B Cells in the Pathogenesis of Allograft Rejection (Chalasani) | 7,007 | 3,912 |
| Simon Watkins | National Institutes of Health | Improving cerebral aneurysm risk assessment through understanding wall vulnerability and failure models | 17,218 | 8,863 |
| Simon Watkins | National Institutes of Health | Blue Light Protects against Ischemia Induced Organ Injury (Rosengart) | 1,864 | 1,053 |
| Simon Watkins | National Institutes of Health | Genetics of Extracellular Matrix in Health and Disease (Urban) | 6,311 | 1,968 |
| Simon Watkins | National Institutes of Health | ROS driven mitochondrial-telomere dysfunction during environmental stress- | 43,833 | 24,427 |
| Simon Watkins | National Institutes of Health | Mechanisms of HMGB1 Release from Ischemic Muscle in Peripheral Arterial Disease (Hartman) | 13,337 | 7,514 |
| Simon Watkins | National Institutes of Health | Signaling by the EGF Receptor from Endosomes | 11,860 | 6,686 |
| Simon Watkins | National Institutes of Health | A Confocal fluorescence Microscopy Brain Data Archive | 33,333 | 18,884 |
| Simon Watkins | National Institutes of Health | Structure and Activation of Multiprotein Signaling Complex (PI Vignali) | 13,434 | 4,199 |
| Simon Watkins | National Institutes of Health | Benzodiazepine Treatment Induced Neuroplasticity | 7,008 | 3,922 |
| Simon Watkins | National Institutes of Health | Mechanisms of HMGB1 Release from Ischemic Muscle in Peripheral Arterial disease | 8,847 | 3,264 |
| Simon Watkins | National Institutes of Health | Surgery Triggered Immune Response and Liver Matastases | 5,853 | 3,278 |
| Simon Watkins | National Institutes of Health | Caspace-1 and Inflammasome Activation in Traumahemorrhagic Shock | 20,068 | 7,913 |

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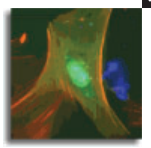
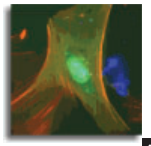
|---|---|---|---|---|
| Simon Watkins | National Institutes of Health | Illuminating Metabolic Pathways Enabled by Early T Cell Activation | 11,893 | 6,710 |
| Simon Watkins | National Institutes of Health | Lipid Imaging in Traumatic Brain Injury by High Resolution GCIB-Secondary Ion Mass Spectrom-etry | 9,999 | 5,649 |
| Simon Watkins | National Institutes of Health | Core G: signature-directed sequential delivery | 130,832 | 63,027 |
| Simon Watkins | National Institutes of Health | Pittsburgh Center for HIV Protein Interactions (PCHPI) Gronenborn- | 23,750 | 13,200 |
| Simon Watkins | National Institutes of Health | Mechanisms of Immune Dysfunction After Trauma and Surgical Sepsis | 20,240 | 9,726 |
| Simon Watkins | National Institutes of Health | HIV-Reservoir in Naïve CD+T Cells | 25,611 | 12,210 |
| Simon Watkins | National Institutes of Health | Damage Sensor role of UV-DDB during base excision repair | 9,778 | 5,524 |
| Simon Watkins | National Institutes of Health | Lipid Imaging in Traumatic Brain Injury by High Resolution GCIB-Secondary Ion Mass Spectrom-etry | 18,420 | 10,407 |
| Simon Watkins | National Institutes of Health | Project 1 for SSC Cort | 8,333 | 4,625 |
| Simon Watkins | National Institutes of Health | IFITM-Mediated Virus Restriction | 25,089 | 12,594 |
| Simon Watkins | National Institutes of Health | Pgh Center for Kidney research | 5,210 | 2,944 |
| Simon Watkins | National Institutes of Health | Exploring Antisense Oligonucleotides as potential therapy for autosomal dominant | 24,989 | 14,118 |
| Simon Watkins | National Institutes of Health | Molecular Mechanisms of Eastern Equic Encephalitis Virus Pathogenesis | 25,850 | 11,780 |
| Simon Watkins | National Institutes of Health | Engineering Biologic Topography into Vascular Grafts | 20,203 | 8,758 |
| Simon Watkins | National Institutes of Health | Role of the Snail1-Twist-p21 axis on cell cycle arrest and renal fibrosis development | 20,746 | 6,670 |
| Simon Watkins | National Institutes of Health | Role of RAN peptides in polyQ-Independent Toxicity in a new C. Elgans Model | 6,074 | 2,701 |
| Simon Watkins | National Institutes of Health | Structure, Function and Mechanistic Analysis of LAG3 | 22,009 | 6,785 |
| Simon Watkins | National Institutes of Health | Adult Stem Cell-Based Enhancement of Nerve Conduit for Peripheral Nerve Repair (McMann) | 800 | 432 |
| Simon Watkins | National Institutes of Health | Visualizing Synaptic Connection Between Distinct Cell types in Whole Mouse Brain (Bruchez) | 79,762 | 39,326 |
| Simon Watkins | National Institutes of Health | Targeting Host Responses to Prevent Virus Induced ARDS in the Nonhuman primate model | 10,966 | 6,131 |
| Simon Watkins | Cystic Fibrosis Foundation | Cell and Tissue Imaging Core C | 38,014 | - |
| Simon Watkins | American Cancer Society | Epstein-Barr Virus Oncogenesis in Nasopharyngeal Carcinoma | 11,256 | 2,251 |
| Simon Watkins | National Institutes of Health | Center for Biological Imaging - Biogen - Gutstein | 12,500 | - |
| Alan Watson | National Institutes of Health | Closed-Loop Neuroelectric Control of Meesis and Gastric Motility (supplement 1) | 20,165 | 1,971 |
| Alan Watson | National Institutes of Health | ENSMAP: Molecular and Functional Mapping of the Enteric Nervous System (Southard-Smith PI) | 17,290 | 9,773 |
| Nathan Yates | National Institutes of Health | Plasticity of Auditory Cortical Circuits in Schizophrenia | 8,790 | 4,747 |
| Nathan Yates | National Institutes of Health | Regulation of Fuel Utilization by Lysine Acetylation in the Falling Heart | 17,744 | 9,998 |
| Nathan Yates | National Institutes of Health | Alzheimer's Disease Research center-funding | 11,772 | 6,356 |
| Nathan Yates | National Institutes of Health | Novel Approaches to Enhance Tumor Cell Cytotoxicity of Alkylating Agents | 33,957 | 10,690 |
| Nathan Yates | National Institutes of Health | The Metabolic Evolution of Staphylococcus Aureus | 11,860 | 6,685 |
| Nathan Yates | American Heart Association | Defining the Systems Biology of the Vascular Matrix in Pulmonary Hypertension | 2,237 | 224 |









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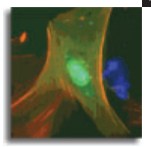
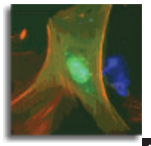
|---|---|---|---|---|
| Nathan Yates | National Institutes of Health | Mechanisms by Which Cyanotriazoles Activate Latent HIV | 11,886 | 6,694 |
| Nathan Yates | Department of Defense | Physiological Biomarkers of Resilience and Musculoskeletal Readiness | 52,412 | 12,663 |
| Nathan Yates | National Institutes of Health | Chemokine CXCL 12/CXCR4 System and Synthetic Cathinones | 20,833 | 11,771 |
| Nathan Yates | National Institutes of Health | Synaptic Resilience to Psychosis in Alzheimer Disease | 4,908 | 2,773 |
| Nathan Yates | National Institutes of Health | Liver-enriched Transcription Factors as Prognostic markers and Therapeutic Targets in Alcoholic Hepatitis | 5,948 | 3,361 |
| Nathan Yates | NARSAD | A New Map to Recovery in Schizophrenia | 15,940 | 1,275 |
| Nathan Yates | UPMC ITTC | Discovering the Protein Signature of Synapse Loss and Cognitive Decline During Aging | 33,330 | - |
| | | | 3,645,019 | 1,765,204 |

## Cell Biology Sponsored Research Funding (FY20)

| Name | Agency Name | Title | Annual DC | Annual IDC |
|---|---|---|---|---|
| Michael Butterworth | National Institutes of Health | Role of MicroRNAs in kidney sodium regulation | 179,404 | 96,878 |
| Michael Butterworth | National Institutes of Health | Altered Biosynthesis and Function of ABCC6 in Systemix Mineralization Disorders | 8,139 | 4,600 |
| Marijn Ford | National Institutes of Health | The Roles of the Dynamin-Related Protein Vps1 and the ESCRT Complex in Microautophagy | 193,752 | 99,936 |
| Gerry Hammond | National Institutes of Health | Directing Membrane Function with Inositol Lipids in Health and Disease | 249,404 | 140,914 |
| Yang Hong | National Institutes of Health | Membrane Targeting and Retargeting of Polarity Proteins | 196,500 | 106,582 |
| Adam Kwiatkowski | National Institutes of Health | Alpha-Catenin Function in Cardiomyocyte Adhesion and Cytoskeletal Organization | 233,866 | 124,235 |
| Sanford Leuba | National Institutes of Health | Evolved DNA Contacts Required for Hexameric Helicase Unwinding. | 42,141 | 23,810 |
| Chelsea Merkel | National Institutes of Health | The Role of Vinculin in Cardiomyocyte Adhesion and Mechanical Continuity | 8,181 | - |
| Yi Shi | National Institutes of Health | Mechanisms of Signaling Protein Retention in the Primary Cilium | 15,586 | 8,055 |
| Yi Shi | UPMC | Novel Tools to Study Mitochondria and Postsynaptic Densities in Aging | 20,000 | - |
| Yi Shi | MJFF | Gaining Access to the Brain: Robust Integrative Proteomics to Produce Novel, Highly Potent Blood-Brain Barrier (BBB) | 293,856 | 29,386 |
| Alexander Sorkin | National Institutes of Health | Pathogenesis of Cancer | 211,672 | 111,823 |
| Alexander Sorkin | National Institutes of Health | Exosome Based Placental Maternal Communication | 45,626 | 25,779 |
| Alexander Sorkin | National Institutes of Health | Modeling Spatiotemporal Control of EGFR-ERK Signaling in Gene-Edited Cell Systems | 116,400 | 65,767 |
| Alexander Sorkin | National Institutes of Health | Signaling by them EGF Receptor from Endosomes | 207,967 | 117,378 |
| Alexander Sorkin | National Institutes of Health | Regulation of Dopamine Transporter by Trafficking | 234,912 | 118,782 |
| Claudette St. Croix | National Institutes of Health | In Vivo Localization and Mechanism of Regulatory B Cell Function in All immunity and Transplant Tolerance | 4,483 | 2,421 |
| Claudette St. Croix | National Institutes of Health | Pulmonary Arteriole Occlusion by Platelet Neutrohil micro emboli in acute chest syndrome | 23,867 | 1,912 |
| Claudette St. Croix | National Institutes of Health | Vascular Subphenotypes of Lung Disease - Preclinical Assessment Core | 68,014 | 38,428 |
| Claudette St. Croix | National Institutes of Health | Signaling Mechanisms by which Mitochondria Regulates Fibrosis in the Lung | 4,623 | 2,496 |
| Claudette St. Croix | National Institutes of Health | Anti-Inflammatory Lipid Mediators in Asthma | 8,855 | 5,003 |
| Claudette St. Croix | National Institutes of Health | Vascular Smooth Muscle and Blood Pressure Regulation By cyb5R2 | 7,632 | 4,312 |
| Claudette St. Croix | National Institutes of Health | Novel Role of Smooth Muscle B5 Reductase in Sickle Cell Disease | 4,517 | 2,552 |
| Claudette St. Croix | National Institutes of Health | Regulation of Fuel Utilization by Lysine Acetylation in the Failing Heart | 3,707 | 2,094 |
| Claudette St. Croix | National Institutes of Health | Exploring and Exploiting Metabolic Plasticity in Regulatory T Cells | 9,194 | 5,195 |
| Claudette St. Croix | National Institutes of Health | The Anti-Aging Role of Klotho in Skeletal Muscle Regeneration | 27,998 | 10,170 |
| Claudette St. Croix | National Institutes of Health | Host Control Mechanisms Against K. Pneumoniae Infection in the Lungs | 25,920 | 14,645 |
| Claudette St. Croix | National Institutes of Health | Mechanisms of Myocardial-Infarction Induced Insulin Resistance | 12,075 | 6,823 |
| Claudette St. Croix | National Institutes of Health | Mechanisms and Promotion of Immune Regulation by CD4+ | 14,241 | 5,220 |
| Claudette St. Croix | National Institutes of Health | Mechanism-Directed Sequential Delivery of Radiation Mitigators Imaging Radiation Apathology Core | 6,429 | 3,472 |





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|---|---|---|---|---|
| Claudette St. Croix | National Institutes of Health | Biological and Physical Mechanisms of Ultrasound/Microbubble-Mediated Therapeutic Gene Delivery Across the Endothelial Barrier | 29,830 | 11,768 |
| Claudette St. Croix | National Institutes of Health | Obesity-associated Mitophagy Resistance | 15,060 | 8,509 |
| Claudette St. Croix | National Institutes of Health | The Role of Telomerase in Valvular Calcification | 3,792 | 2,143 |
| Claudette St. Croix | American Heart Association | Reprogramming of the Vascular Matrisome and Matrix Cellularity as a Pathogenic Lynchpin for Pulmonary Hypertension | 3,334 | 334 |
| Claudette St. Croix | National Institutes of Health | The Function of EGFL6 in Ovarian Cancer Cell Biology, Tumor Initiation, and Therapy | 5,856 | 3,299 |
| Claudette St. Croix | Pitt Foundation | PET imaging of vaso-occlusion in sickle cell disease: from mice to humans | 11,672 | - |
| Claudette St. Croix | National Institutes of Health | Mechanisms of platelet exosome-mediated acute chest syndrome in sickle cell disease | 24,753 | 11,443 |
| Claudette St. Croix | National Institutes of Health | Epigenetic Control of Smooth Muscle Cell Phenotype during Microvascular Remodeling | 9,713 | 3,228 |
| Claudette St. Croix | National Institutes of Health | Cardiolipin as a Novel Mediator of Acute Lune Injury | 74,824 | 39,451 |
| Claudette St. Croix | National Institutes of Health | Role of Necroptosis in Colorectal Cancer Therapy | 11,392 | 6,436 |
| Claudette St. Croix | National Institutes of Health | Tead1 and Cardiac Adaptation | 10,000 | 3,390 |
| Claudette St. Croix | Department of Defense | Neomorphic cell-cell adhesive reprogramming facilitates metastasis of ESR1 mutant breast cancer | 8,333 | 4,708 |
| Claudette St. Croix | National Institutes of Health | Endothelial Reprogramming in Pulmonary Hypertension | 9,955 | 3,930 |
| Claudette St. Croix | National Institutes of Health | Role of extracellular matrix in age-related declines of muscle regeneration | 25,969 | 10,151 |
| Claudette St. Croix | National Institutes of Health | Inhibition of DNA double strand break repair in TNBC by nitro-fatty acids | 7,697 | 4,348 |
| Donna Beer Stolz | National Institutes of Health | Mechanisms of Trabecular Meshwork Regeneration by Stem Cell (PI - Du) | 10,049 | 3,898 |
| Donna Beer Stolz | National Institutes of Health | Dysfunctional Muscle remodeling and regeneration in environmental disease (PI - Ambrosio/Barchowsky) | 24,786 | 13,744 |
| Donna Beer Stolz | National Institutes of Health | Elucidating Mechanisms Involved in Lamin B1 Mediated Demyelination (PI - Padiath) | 5,149 | 2,780 |
| Donna Beer Stolz | National Institutes of Health | Luminal Epithelial Junctions, Polarity and Permeability in BPH (PI - Wang) | 9,584 | 4,777 |
| Donna Beer Stolz | National Institutes of Health | Alpha Catenin Function in Cardiomyocyte adhesion and Cytoskeletal (PI - Kwiatkowski) | 8,523 | 4,602 |
| Donna Beer Stolz | National Institutes of Health | Characterization of Meiotic Crossover Surveillance System (PI - Yanowitz) | 8,952 | 5,058 |
| Donna Beer Stolz | National Institutes of Health | Core G: Signature-Directed, Sequential Delivery of Radiation Mitigators (PI - Greenberger) | 13,531 | 7,307 |
| Donna Beer Stolz | National Institutes of Health | Melatonin Biosynthesis in Neuronal Mitochondria - (PI - Friedlander) | 5,222 | 2,950 |
| Donna Beer Stolz | National Institutes of Health | Fox01 in Beta-Cell Compensation (PI - Dong) | 697 | 394 |
| Donna Beer Stolz | National Institutes of Health | Biological and Physical Mechanisms of Ultrasound/Microbubble-Mediated Therapeutic Gene Delivery Across the Endothelial Barrier (PI - Villaneuva) | 2,971 | 1,682 |
| Donna Beer Stolz | National Institutes of Health | Correcting Pathogenic TGF beta Activity in the Airway (PI - Swiatecka Urban) | 9,872 | 4,831 |
| Donna Beer Stolz | National Institutes of Health | Progressive degenerative role of Nox and thrombospondin-1 in the aging vasculature (PI - Pagano) | 8,581 | 4,848 |
| Donna Beer Stolz | National Institutes of Health | Cardiolipin as a Novel Mediator of Acute Lune Injury (PI- Mallampalli) | 23,885 | 13,495 |
| Donna Beer Stolz | National Institutes of Health | Mechanisms of hypersensitivity to sound-induced cochlear damage (Rubio) | 9,419 | 4,418 |
| Donna Beer Stolz | National Institutes of Health | Advanced Imaging Core (Core A) | 94,797 | 45,085 |

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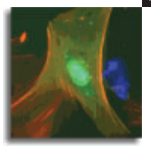
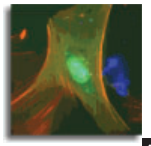
|---|---|---|---|---|
| Donna Beer Stolz | National Institutes of Health | Beta-catenin-driven hepatobiliary reprogramming as a therapeutic modality for cholangiopathies | 5,716 | 3,229 |
| Linton Traub | National Institutes of Health | Protein Mechanics Regulating Endocytic Clathrin Coat | 167,795 | 85,825 |
| Steven Truschel | National Institutes of Health | Bladder Mucosal Dysfunction During Aging | 37,516 | 21,197 |
| Simon Watkins | National Institutes of Health | Cancer Center Support Grant | 82,665 | 43,946 |
| Simon Watkins | National Institutes of Health | Inhibition of Neural Electrode-Mediated Inflammation and Neuronal Cell Death | 9,840 | 4,331 |
| Simon Watkins | National Institutes of Health | DNA Damage Recognition by Nucleotide Excision Repair Proteins | 9,173 | 5,160 |
| Simon Watkins | National Institutes of Health | Exosomes as paracrine signal mediators in cardiac allograft rejection | 9,505 | 4,503 |
| Simon Watkins | National Institutes of Health | Inhibition of the ALT Pathway by Interfering with Poly-ADP-Ribose Metabolism | 15,720 | 5,624 |
| Simon Watkins | National Institutes of Health | BMP10 in Cardiovascular Development and Hereditary Hemorrhagic Telangiectasia. | 10,318 | 3,852 |
| Simon Watkins | National Institutes of Health | Regulated Activation of latent-TGfB Determines Leukocyte Occupancy of the Epidermal Niche | 2,500 | - |
| Simon Watkins | National Institutes of Health | Mechanistic Elucidation and Targeted Therapy of Platelet Dysfunction After Trauma (Neal) | 12,262 | 6,917 |
| Simon Watkins | National Institutes of Health | B Cells in the Pathogenesis of Allograft Rejection (Chalasani) | 7,138 | 4,033 |
| Simon Watkins | National Institutes of Health | Improving cerebral aneurysm risk assessment through understanding wall vulnerability and failure models | 22,236 | 12,563 |
| Simon Watkins | National Institutes of Health | ROS driven mitochondrial-telomere dysfunction during environmental stress- | 44,578 | 25,187 |
| Simon Watkins | National Institutes of Health | Mechanisms of HMGB1 Release from Ischemic Muscle in Peripheral Arterial Disease (Hartman) | 13,322 | 7,527 |
| Simon Watkins | National Institutes of Health | Signaling by the EGF Receptor from Endosomes | 12,071 | 6,819 |
| Simon Watkins | National Institutes of Health | A Confocal fluorescence Microscopy Brain Data Archive | 40,000 | 22,660 |
| Simon Watkins | National Institutes of Health | Structure and Activation of Multiprotein Signaling Complex (PI Vignali) | 13,398 | 4,304 |
| Simon Watkins | National Institutes of Health | Mechanisms of HMGB1 Release from Ischemic Muscle in Peripheral Arterial disease | 8,942 | 3,360 |
| Simon Watkins | National Institutes of Health | Caspace-1 and Inflammasome Activation in Traumahemorrhagic Shock | 18,159 | 6,869 |
| Simon Watkins | National Institutes of Health | Mechanisms of Immune Dysfunction After Trauma and Surgical Sepsis | 21,307 | 10,344 |
| Simon Watkins | National Institutes of Health | Illuminating Metabolic Pathways Enabled by Early T Cell Activation | 11,893 | 6,711 |
| Simon Watkins | National Institutes of Health | Damage Sensor role of UV-DDB during base excision repair | 12,486 | 7,054 |
| Simon Watkins | National Institutes of Health | Lipid Imaging in Traumatic Brain Injury by High Resolution GCIB-Secondary Ion Mass Spectrometry | 17,776 | 10,043 |
| Simon Watkins | National Institutes of Health | HIV-Reservoir in Naive CD4 + T Cells (PI - Sluis -Cremer) | 2,134 | 1,018 |
| Simon Watkins | National Institutes of Health | IFITM-Mediated Virus Restriction | 26,688 | 11,152 |
| Simon Watkins | National Institutes of Health | Pgh Center for Kidney research | 5,237 | 2,959 |
| Simon Watkins | National Institutes of Health | Exploring Antisense Oligonucleotides as potential therapy for autosomal dominant | 4,867 | 2,750 |
| Simon Watkins | National Institutes of Health | Visualization of Influenza Viral RNA Assembly (PI - Lakdowala) | 10,187 | 4,344 |
| Simon Watkins | National Institutes of Health | Engineering Biologic Topography into Vascular Grafts | 24,244 | 10,510 |
| Simon Watkins | National Institutes of Health | Molecular Mechanisms of Eastern Equic Encephalitis Virus Pathogenesis | 26,173 | 11,962 |
| Simon Watkins | National Institutes of Health | Project 1 for SSC Cort | 10,000 | 5,566 |









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|---|---|---|---|---|
| Simon Watkins | National Institutes of Health | Role of the Snail1-Twist-p21 axis on cell cycle arrest and renal fibrosis development | 34,576 | 11,116 |
| Simon Watkins | National Institutes of Health | Benzodiazepine Treatment Induced Neuroplasticity (PI - Jacob) | 7,152 | 4,042 |
| Simon Watkins | National Institutes of Health | Role of RAN peptides in polyQ-Independent Toxicity in a new C. Elgans Model | 14,578 | 6,483 |
| Simon Watkins | National Institutes of Health | Structure, Function and Mechanistic Analysis of LAG3 | 44,018 | 13,570 |
| Simon Watkins | National Institutes of Health | Excision Repair of environmental Telomere Damage | 34,880 | 19,707 |
| Simon Watkins | National Institutes of Health | NitriteTherapy to Improve Mitochondrial Energetics | 15,138 | 4,553 |
| Simon Watkins | National Institutes of Health | Administrative Supplement to Bladder Mucosal Dysfunction during Aging (PI Birder) | 18,460 | 10,430 |
| Simon Watkins | National Institutes of Health | Immunity to Live Mosquito Probing and Flavivirus Infection in Human Skin (Barratt Boyes - PI) | 2,387 | 1,349 |
| Simon Watkins | National Institutes of Health | Pittsburgh Center for HIV Protein Interactions (PCHPI) Gronenborn- | 23,750 | 13,201 |
| Simon Watkins | National Institutes of Health | Core G: signature-directed sequential delivery | 103,757 | 48,468 |
| Simon Watkins | National Institutes of Health | Visualizing Synaptic Connection Between Distinct Cell types in Whole Mouse Brain (Bruchez - CMU subcontract) | 81,198 | 40,228 |
| Simon Watkins | National Institutes of Health | Targeting Host Responses to Prevent Virus-Induced ARDS in the Nonhuman primate model | 11,023 | 6,228 |
| Simon Watkins | National Institutes of Health | Seal r01 renewal | 10,000 | 4,803 |
| Simon Watkins | National Institutes of Health | Placental Extracellular vesicles ... | 10,000 | 4,803 |
| Simon Watkins | National Institutes of Health | DNA Damage Signaling … | 49,977 | 28,287 |
| Simon Watkins | National Institutes of Health | Understanding & Countering Mechanisms Underlying IL-33_driven support of Graf vs host disease | 14,678 | 3,208 |
| Simon Watkins | National Institutes of Health | R0S Mechanisms in BAV Aortopathy | 7,101 | 2,529 |
| Simon Watkins | National Institutes of Health | Targeting the Chemokine System to Sensitize Tumors to Immunotherapy | 50,249 | 28,391 |
| Alan Watson | National Institutes of Health | Closed-Loop Neuroelectric Control of Meesis and Gastric Motility (supplement 1) | 20,000 | - |
| Alan Watson | National Institutes of Health | U54 Pilot Project - A comprehensive Approach to Imaging Benign rostatic Hyperplasia (BPH) (Wang PI) | 70,000 | 28,251 |
| Alan Watson | National Institutes of Health | ENSMAP: Molecular and Functional Mapping of the Enteric Nervous System (Southard-Smith PI) | 24,205 | 13,677 |
| Alan Watson | National Institutes of Health | Atlas of Autonomic and Neuormodulatory Lineages in the Developing Lower Urinary Tract | 29,952 | 16,923 |
| Alan Watson | National Institutes of Health | Contribution of Sympathetic Nerves to Herpes Stromal Keratitis | 21,842 | 12,340 |
| Alan Watson | National Institutes of Health | Understanding Functional Connectivity of Sensory and Motor Pathways to Specific Regions of the Lower Urinary Tract | 62,137 | 35,107 |
| Nathan Yates | National Institutes of Health | Regulation of Fuel Utilization by Lysine Acetylation in the Falling Heart | 17,592 | 9,938 |
| Nathan Yates | National Institutes of Health | Alzheimer's Disease Research center-funding | 8,945 | 4,830 |
| Nathan Yates | National Institutes of Health | Novel Approaches to Enhance Tumor Cell Cytotoxicity of Alkylating Agents | 13,819 | 7,807 |
| Nathan Yates | National Institutes of Health | The Metabolic Evolution of Staphylococcus Aureus | 11,897 | 6,722 |
| Nathan Yates | National Institutes of Health | Mechanisms by Which Cyanotriazoles Activate Latent HIV | 8,945 | 5,054 |
| Nathan Yates | Department of Defense | Physiological Biomarkers of Resilience and Musculoskeletal Readiness | 40,411 | 17,183 |

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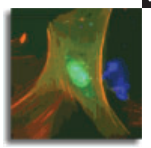
|---|---|---|---|---|
| Nathan Yates | National Institutes of Health | Synaptic Resilience to Psychosis in Alzheimer Disease | 50,861 | 28,736 |
| Nathan Yates | National Institutes of Health | Liver-enriched Transcription Factors as Prognostic markers and Therapeutic Targets in Alcoholic Hepatitis | 7,205 | 4,071 |
| Nathan Yates | National Institutes of Health | Omega-3, Isoflavones & Amyloid Deposition in Cognitively | 20,000 | 11,300 |
| Nathan Yates | National Institutes of Health | ER and post-ER quality control of integral membrane proteins | 397 | 224 |
| Nathan Yates | UPMC | Discovering the Protein Signature of Synapse Loss and Cognitive Decline During Aging | 50,995 | - |
| | | | 4,675,130 | 2,227,553 |



**Faculty Editorships (Fiscal Year 2018 - 2019)**

**Michael B. Butterworth, Ph.D.**
*Associate Professor*

American Journal of Physiology – Renal Physiology
Frontiers in Renal and Epithelial Physiology
PLoS ONE
Physiological Genomics
American Journal of Physiology – Cell Physiology

**Adam Kwiatkowski, Ph.D.**
*Assistant Professor*

Associate Editor, BMC Cell Biology

**Alexander D. Sorkin, Ph.D.**
*Richard B. Mellon Professor and Chair*

Traffic, Associate Editor
Scientific Reports (Nature) Editorial Board

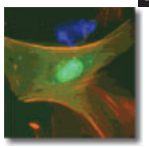
**Linton Traub, Ph.D.**
*Professor*

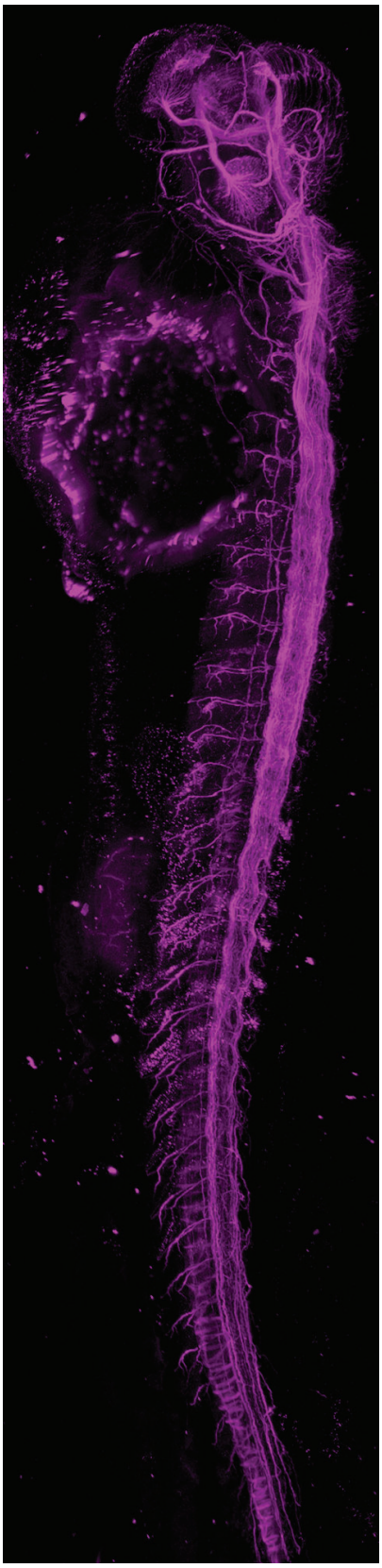
Member of editorial board of Traffic
Member of editorial board of Cellular Logistics
Member of editorial board of Scientific Reports
Member of editorial board of The Journal of Biological Chemistry
Member of board of reviewing editors, Molecular Biology of the Cell

**Simon C. Watkins, Ph.D.**
*Distinguished Professor and Vice Chairman, Director of Center of Biologic Imaging*

Member, Editorial Board, PittMed
Associate Editor, Experimental Biology and Medicine
Editor, Current Protocols in Cytometry
Editor, Experimental Science and Medicine
Editor, Microscopy Today

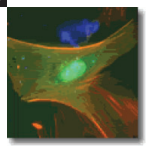


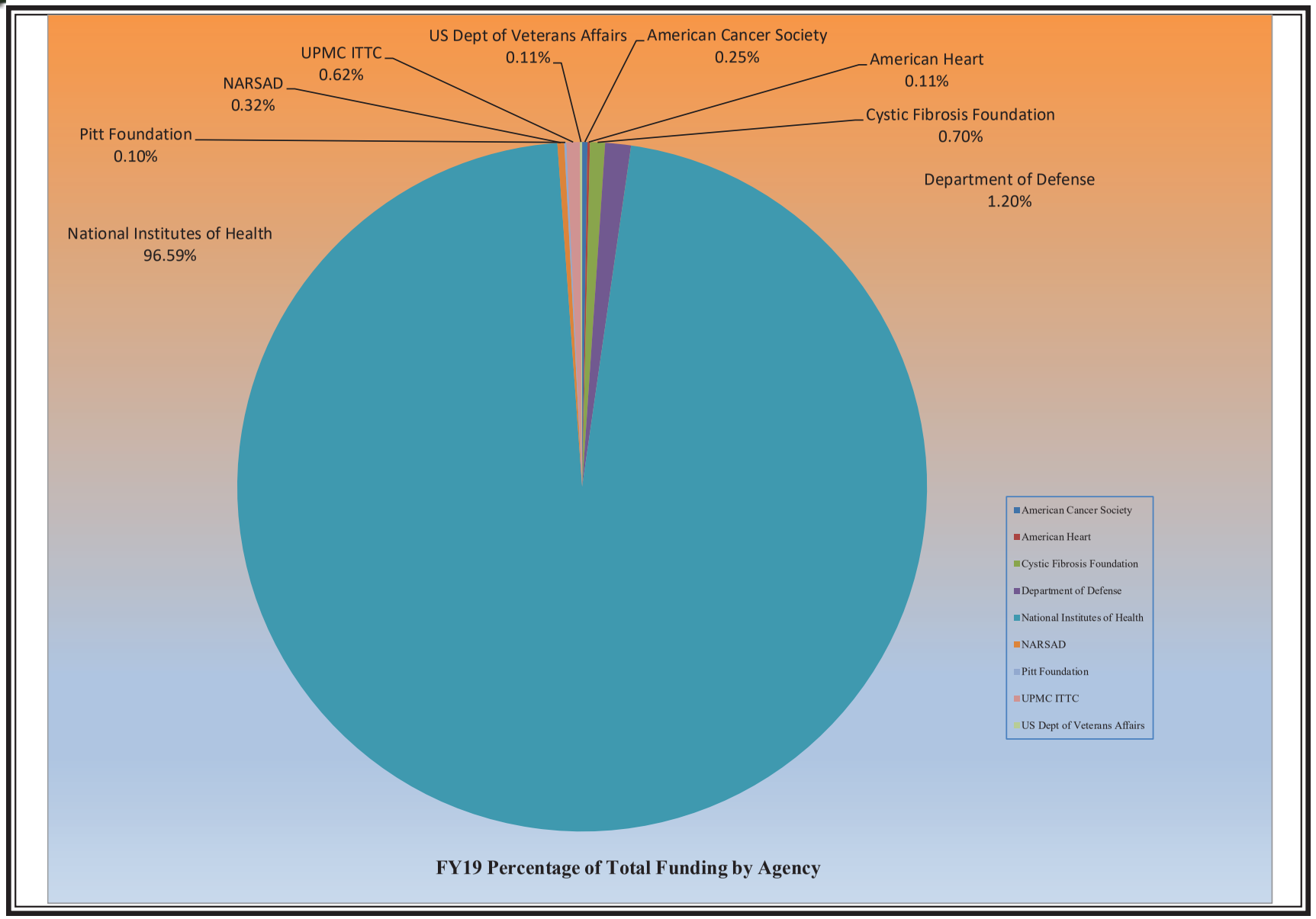


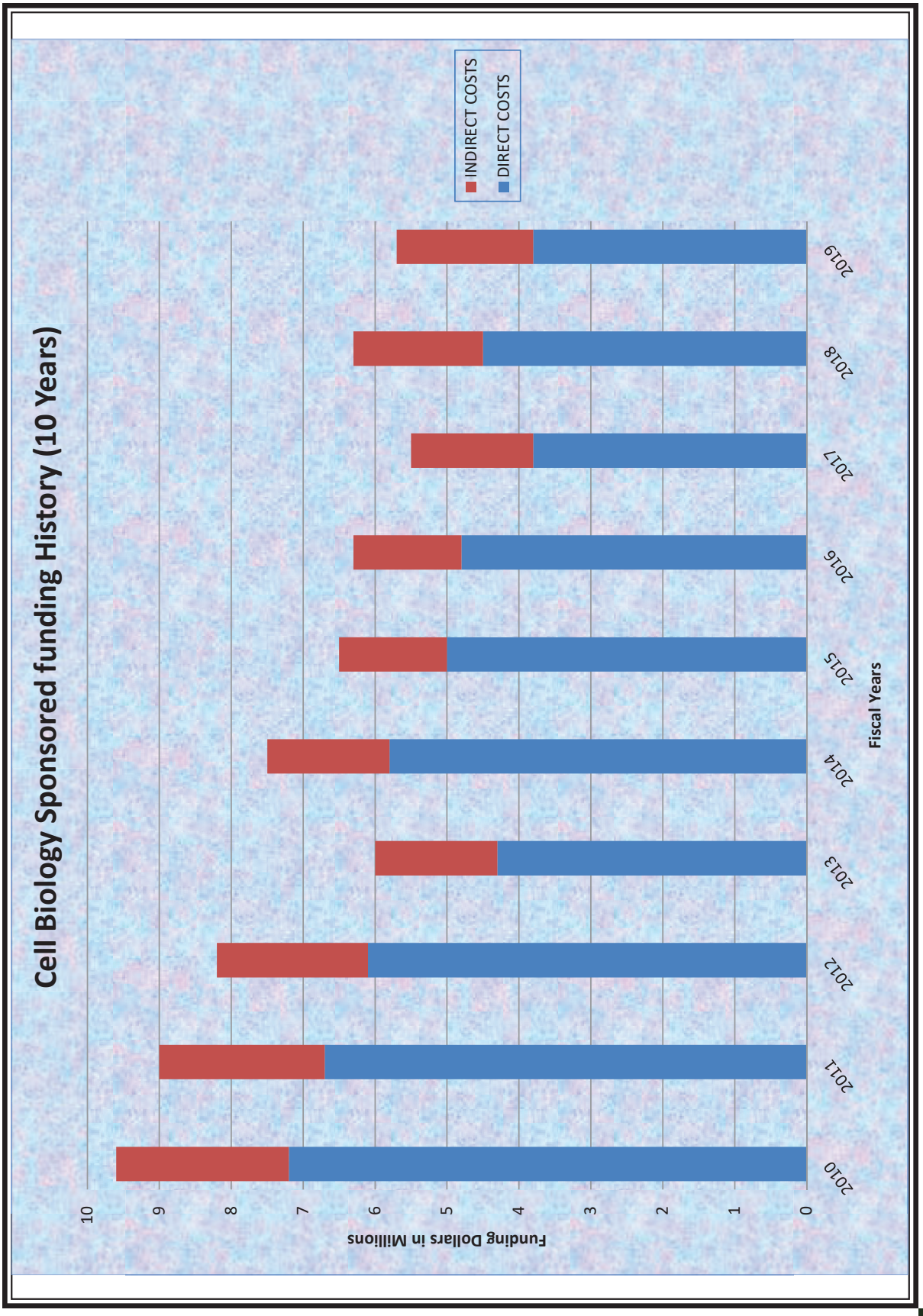


**Dr. Alan Watson.** Super resolution (~150 nanometer) reconstruction of neurofilament staining across the complete neuronal system of a 5 days post fertilization zebrafish embryo. Super resolution imagery was achieved by using novel tissue expansion techniques developed by Dr. Yongxin (Leon) Zhao at Carnegie Mellon University and imagery was captured using ribbon scanning confocal microscopy. Dr. Ed Burton from the Department of Neurology at the University of Pittsburgh provided the zebrafish embryo.

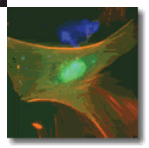


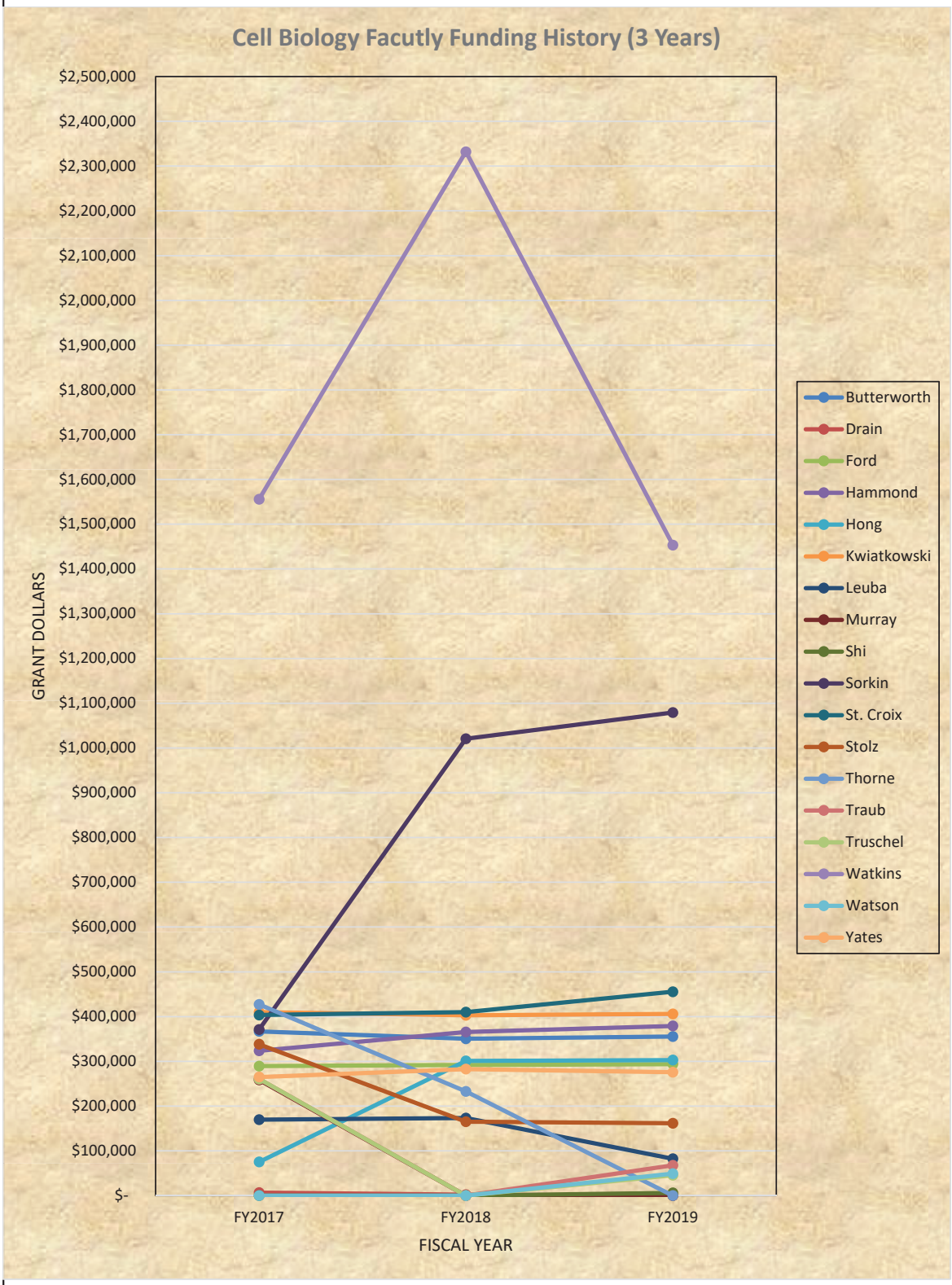



US Dept of Veterans Affairs
0.11%
American Cancer Society
0.25%
UPMC ITTC
0.62%
American Heart
0.11%
NARSAD
0.32%
Cystic Fibrosis Foundation
0.70%
Pitt Foundation
0.10%
Department of Defense
1.20%
National Institutes of Health
96.59%
American Cancer Society
American Heart
Cystic Fibrosis Foundation
Department of Defense
National Institutes of Health
NARSAD
Pitt Foundation
UPMC ITTC
US Dept of Veterans Affairs
FY19 Percentage of Total Funding by Agency

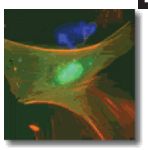

Cell Biology Sponsored funding History (10 Years)
INDIRECT COSTS
DIRECT COSTS
Funding Dollars in Millions
0
1
2
3
4
5
6
7
8
9
10
Fiscal Years
2010
2011
2012
2013
2014
2015
2016
2017
2018
2019






Cell Biology Facutly Funding History (3 Years)
GRANT DOLLARS
$2,500,000
$2,400,000
$2,300,000
$2,200,000
$2,100,000
$2,000,000
$1,900,000
$1,800,000
$1,700,000
$1,600,000
$1,500,000
$1,400,000
$1,300,000
$1,200,000
$1,100,000
$1,000,000
$900,000
$800,000
$700,000
$600,000
$500,000
$400,000
$300,000
$200,000
$100,000
$-
FY2017
FY2018
FY2019
FISCAL YEAR
Butterworth
Drain
Ford
Hammond
Hong
Kwiatkowski
Leuba
Murray
Shi
Sorkin
St. Croix
Stolz
Thorne
Traub
Truschel
Watkins
Watson
Yates



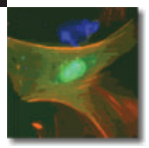


**CELL BIOLOGY FACULTY ROSTER**
**(Effective June, 2019)**

| Faculty Member | Salary Support on Grants | Rank | Status |
|---|---|---|---|
| Dong, Wei | 100% | Research Instructor | Non-tenure Track |
| Li, Yang | 100% | Research Instructor | Non-tenure Track |
| Pinilla Macua, Itziar | 100% | Research Instructor | Non-tenure Track |
| Surve, Sachin | 100% | Research Instructor | Non-tenure Track |
| Tan, Xiaojun | 100% | Res. Assistant Professor | Non-tenure Track |
| Watson, Alan | 100% | Res. Assistant Professor | Non-tenure Track |
| Watkins, Simon* | 80.63% | Professor | Tenured |
| St. Croix, Claudette | 80.21% | Associate Professor | Tenured |
| Sorkin, Alexander* | 74.57% | Professor | Tenured |
| Yates, Nathan* | 61.14% | Associate Professor | Non-tenure Track |
| Hammond, Gerald | 51.0% | Associate Professor | Tenured |
| Kwiatkowski, Adam | 50.0% | Assistant Professor | Tenure Track |
| Butterworth, Michael | 49.33% | Associate Professor | Tenured |
| Stolz, Donna | 46.55% | Associate Professor | Tenured |
| Ford, Natalia | 45.0% | Res. Assistant Professor | Non-tenure Track |
| Ford, Marijn | 40.0% | Assistant Professor | Tenure Track |
| Hong, Yang | 33.0% | Associate Professor | Tenured |
| Shi, Yi | 20.0% | Assistant Professor | Tenure Track |
| Truschel, Steven | 18.96% | Assistant Professor | Non-tenure Track |
| Murray, Sandra | 16.7% | Professor | Tenured |
| Leuba, Sanford | 15.4% | Associate Professor | Tenured |
| Traub, Linton | 7.35% | Professor | Tenured |
| Drain, Peter | 3.0% | Associate Professor | Tenured |
| Aridor, Meir | .21% | Associate Professor | Tenured |
| Devor, Daniel | 0.02% | Associate Professor | Tenured |

*Calculated using year appropriate NIH salary cap as upper limit for each grant



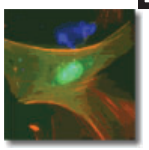


**STUDENTS INVOLVED IN RESEARCH IN CELL BIOLOGY FACULTY LABS**
**Snapshot as of June, 2019**

**GRADUATE STUDENTS ENROLLED IN CBMP PROGRAM**

| STUDENT | LAB | SUPPORT |
|---|---|---|
| Sarel Urso | Todd Lamitina, Ph.D.<br>Dept. Pediatrics | Todd Lamitina, Ph.D.<br>Cell Biology & Teaching Fellowship |
| Rachel Wills | Gerald Hammond, Ph.D.<br>Cell Biology | Gerald Hammond, Ph.D.<br>Cell Biology & Teaching Fellowship |
| Jonathan Heier | Adam Kwiatkowski, Ph.D.<br>Cell Biology | Adam Kwiatkowski, Ph.D.<br>Cell Biology & Teaching Fellowship |
| Amity Eaton | Gerard Apodaca, Ph.D.<br>Renal-Electrolyte Division | Gerard Apodaca, Ph.D.<br>Cell Biology &Teaching Fellowship 25%<br>National Research Service Award (NRSA)<br>NIH Trainee |
| Paige Rudich | Todd Lamitina, Ph.D.<br>Dept. Pediatrics | Todd Lamitina, Ph.D.<br>Children's Hospital Predoctoral Grant (RAC) |
| Chelsea Merkel | Adam Kwiatkowski, Ph.D.<br>Cell Biology | Adam Kwiatkowski, Ph.D.<br>National Research Service Award (NRSA)<br>NIH Trainee |





**FY19 Projects**

Kwiatkowski lab: *The Role of Vinculin in Cardiomyocyte Adhesion and Mechanical Continuity* (National Institutes of Health)

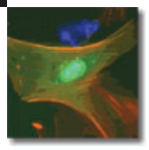
The combined funding for this post-doctoral fellowship grants is $44,158 in FY19 (Total costs, annualized).

**FY20 Projects**

Kwiatkowski lab: *The Role of Vinculin in Cardiomyocyte Adhesion and Mechanical Continuity* (National Institutes of Health)

The combined funding for this post-doctoral fellowship grants is $44,650 in FY20 (Total costs, annualized).





**Cell Biology Program Grants (Fiscal Year 2018-19)**

The Department of Cell Biology is funded by eight Program Grants and 4 by the National Institutes of Health, as follows:

The CBI is funded to a large degree through multiple programmatic PHS grants, in which the CBI is listed as a core resource for the grant. There are 2 currently funded program grants including

Cancer Center support Grant (PI Charleen Chu P30CA047904)

University of Pittsburgh Center for HIV Protein interactions (PCHPI, PI Gronenborn A 5P50GM082251)

Cardiolipin as a Novel Mediator of Acute Lung Injury (Mallampalli R. P01HL114453)

Vascular Subphenotypes of Lung Disease (PI Gladwin M. 5P01HL103455-09)

Pittsburgh Center for Kidney Research (PI Gerard Apodaca P30DK079307-09)

Mechanism-Directed Sequential Delivery of Radiation Mitigators Imaging Radiation Apathology Core (PI Joel Greenberger U19AI068021)

Alzheimer's Disease Research Center (PI Matthew MacDonald P30AG05133)

Project 1 for SSc Cort Novel Pathways in Systemic Sclerosis (PI Robert Lafyatis 2P50AR06078006)

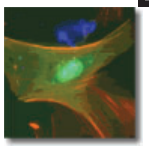
Luminal Epithelial Junctions, Polarity and Permeabiility in BPH Pathogenesis (PI-Zhau Wang U54DK112079)

Pittsburgh Liver Research Center (PI - Satdarshan Singh Monga P30DK120531)

Mechanisms and Promotion of Immune Regulation by CD4 Regulatory T Cells within allografts (PI: Camirand U01AI132758)

Liver-enriched Transcription Factors as Prognostic markers and Therapeutic Targets in Alcoholic Hepatitis (PI: Bataller U01AA026972)

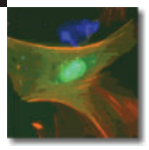




## New Cell Biology Research Recruits in FY19

| Name | Rank | |
|---|---|---|
| **Faculty Level** | | |
| Xiaojun (Jay) Tan | Research Assstant Professor | |
| **Name** | **Rank** | **Lab Association** |
| **Post Doctoral Level** | | |
| James Boslett | Post Doctoral Fellow | Dr. Nathan Yates |





**Graduate Program in Cell Biology and Molecular Physiology**

The program in Cell Biology and Molecular Physiology has a strong track-record of scientific training and discovery. Graduates of the Ph.D. program undertake a range of careers in both academic and scientifically related fields. The department brings together basic and clinical research faculty who are dedicated to their research programs and to the training of graduate students. Among the medical school departments, this faculty is uniquely focused on integrative biology; that is, using the tools of genetics, cellular and molecular biology, imaging and systems biology to understand the integrated functions of cells, tissues, organs, organisms and humans.

The educational component of the program offers students the opportunity to interact with multiple, well-supported faculty with international reputations. Students in the program enjoy a rich experience going beyond formal classroom training, including numerous journal clubs, "work in progress" interactions with student peers, research conferences and the opportunity to attend national and international meetings.

CBMP students can develop their teaching and mentoring skills by participating as instructors for the histology laboratory sections taught to first and second year medical students. Student instructors assist the medical students by using virtual microscopy slides and presentations to identify tissues and cells and to understand the functions of the tissues and cells that they are observing. Teaching responsibilities require approximately 5 to 10 hours per month of preparation and teaching time. Prior to becoming instructors, the CMBP students are required to take the graduate level course in Histology (MSCBMP2870), which prepares them for their teaching responsibilities. Beyond the teaching experience, these fellowships also provide students with funding that covers much of their stipend and tuition for two years.

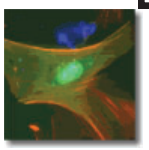
**Courses**

The CBMP program has 2 required courses and several electives available to students. Before entering the CBMP program, students successfully complete all the required first year IBGP courses including the foundations course, grant writing, scientific ethics and responsible research conduct, biostatistics and data analysis. After matriculating into the CBMP program all students are required to enroll in "Cell Biology of Normal and Disease States" (MSCBMP 2880) in the spring, and one of the imaging courses offered, either "Imaging Cell Biology in Living Systems" (MSCBMP 2885) in the spring or "Mutliparametric Microscopic Imaging" (MSCBMP 2860) in the summer. Students are encouraged to take the histology course (MSCBMP 2870) to be eligible to TA medical students. Ongoing classes include the work-in-progress class "Experiments and Logic in Cell Biology" (MSCBMP 2875) and a journal club that meets throughout the year.

**Faculty**

Faculty have a common interest in understanding the cellular basis of life and disease. As most human diseases arise from failures on a cellular level, our faculty investigate the cellular underpinnings of kidney, heart, lung and brain diseases, cancer, diabetes and inherited diseases of development and reproduction. Their research can be divided into the following broad categories:





*Membrane Traffic of Proteins and Lipids*
Many of our faculty study how cells assemble the molecular machinery to coordinate membrane and organelle transport. Studies investigate how errors in cellular trafficking result in disease.

Apodaca, Aridor, Brodsky, Butterworth, Ford, Goetzman, Hammond, Hong, Hughey, Liu, Murray, Sorkin, Swiatecka-Urban, Traub, Weisz.

*Cell Communication, Signaling and Ion Channel Biology*
Studies aim to understand how cells receive, decode and transmit signals to establish complex signaling networks in the body. A breakdown in cellular communication leads to diseases like diabetes, neurodegenerative disease, cystic fibrosis, hypertension, heart disease and others, all under investigation by faculty.

Brodsky, Butterworth, Carattino, Devor, Du, Dutta, Hammond, Hughey, Kashlan, Kleyman, Kwiatkowski, Lamitina, Liu, Murray, Nicotra, Roy, Salama, Sims-Lucas, St. Croix, Stolz, Subramanya, Swiatecka-Urban, Thibodeau, Watkins, Weisz, Zhu.

*Cellular Injury, Wound Healing, Aging and Tissue Regeneration*
Researchers are investigating responses to stress, cell or tissue damage to understand the cellular mechanisms that mediate repair and maintenance. This includes acute injury, chronic aging and new tissue growth.

Du, Dutta, Funderburgh, Ghazi, Kwiatkowski, Lamitina, Murray, Stolz, Swamynathan, Yanowitz, Zhu

*DNA Damage/Repair, Cell-Cycle Control and Gene Expression, Cancer*
An undamaged genome is essential to prevent cancer. Our faculty strive to identify defects associated with the cellular response to DNA damage/repair and cancer.

Ghazi, Lamitina, Leuba, Swamynathan, Walker, Yanowitz.

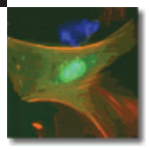
*Genomics, Proteomics and Metabolomics*
Faculty that aim to describe cellular function as a product of their genomic, proteomic or small molecule interactomes.

Brodsky, Butterworth, Devor, Drain, Goetzman, Hong, Kwiatkowski, Lamitina, Liu, Shi, Sims-Lucas, Sorkin, Swiatecka-Urban, Thibodeau, Weisz, Whitcomb, Zhu

*Reproductive Biology*
Faculty specialize in the unique cellular processes associated with reproduction, and defects linked to reproductive disease and disorder.

Ghazi, Schatten, Walker, Yanowitz.





**Courses in the Cell Biology and Molecular Physiology Graduate Program**

**Courses in FY-19**

**Title: MS Thesis Research**
*Course Number: 2800*
Course Director: Michael Butterworth
When: Fall Term, Spring Term, Summer Term
Prerequisites: INTBP 2000 Foundations of Biomedical Sciences
INTBP 2005 Conference

Description: A directed research project that results in a thesis for a Master's Degree.

**Title: Regulation of Membrane Traffic**
*Course Number: 2840*
Course Director: Gerard Apodaca and Ora Weisz
When: Summer Term
Prerequisites: INTBP 2000 Foundations of Biomedical Sciences
INTBP 2005 Conference
Core Course for: students in the Program in Cell Biology and Molecular Physiology with research focus in cellular biology

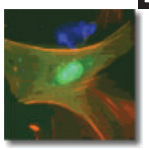
Description: The focus of this course is to analyze membrane/protein traffic along both the biosynthetic and endocytic pathways. The general goal is to teach students how to read and interpret the literature. In particular, we emphasize the conclusions of the assigned papers, examine the experimental basis of these conclusions, and discuss their validity. The course is updated each year to include topics in which new and interesting developments have occurred. Emphasis is placed on how membrane traffic is regulated and how it is disrupted or subverted during disease processes. The course is of general interest to students, fellows, and faculty interested in cell biology, immunology, neurobiology, pharmacology, and virology.

**Title: Research Seminar in Cellular Biological Membrane Trafficking**
*Course Number: 2852*
Course Director: Gerard Apodaca
When: Fall Term, Spring Term
Prerequisites: INTBP 2000 Foundations of Biomedical Sciences
INTBP 2005 Conference
Core Course for: students in the Program in Cell Biology and Molecular Physiology with research focus in cellular biology

Description: Advanced research seminar with journal club format specializing in current aspects of membrane traffic.

**Title: Research Seminar in Reproductive Physiology**
*Course Number: 2853*
Course Director: William Walker
When: Fall Term, Spring Term





Prerequisites: INTBP 2000 Foundations of Biomedical Sciences
INTBP 2005 Conference

Description: Advanced research seminar with journal club format specializing in current aspects of reproductive physiology.

**Title: Research Seminar in Molecular Physiology**
*Course Number: 2855*
Course Director: Thomas Kleyman
When: Fall Term, Spring Term
Prerequisites: INTBP 2000 Foundations of Biomedical Sciences
INTBP 2005 Conference

Description: Advanced Research Seminar with Journal Club format specializing in current aspects of molecular and cellular physiology.

**Title: Multiparametric Microscopic Imaging**
*Course Number: 2860*
Course Director: Claudette St. Croix and Donna Beer Stolz
When: Summer Term
Prerequisites: INTBP 2000 Foundations of Biomedical Sciences
INTBP 2005 Conference

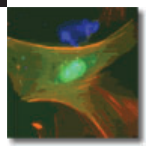
Description: a lecture/lab course that immerses students in the theory and practical aspects of modern microscopic imaging. The fields will cover the theory and implementation of all types of light and electron microscopy and computer aided imaging. Students will be expected to reach a functional capability in a selected technology.

**Title: Histology**
*Course Number: 2870*
Course Director: Steven Truschel
When: Spring Term
Prerequisites: INTBP 2000 Foundations of Biomedical Sciences
INTBP 2005 Conference

Description: The objective of this lecture/lab course is to comprehend the relationship between structure and function at the cell, organ and organ system levels. Focus is placed on the integration of cell biology, classical histology and basic physiology of each of the organ systems, with the exclusion of the central nervous system. This knowledge is applied by building skills in the interpretation of light and electron micrographic images of cells and organs. This course is a requirement for those graduate students wishing to serve as teaching fellows in Histology for the Medical School.

**Title: Experiments and Logic in Cell Biology**
*Course Number: 2875*
Course Director: Michael Butterworth and Donna Beer Stolz
When: Spring and Fall Term





Prerequisites: INTBP 2000 Foundations of Biomedical Sciences
INTBP 2005 Conference

Description: The purpose of Experiments and Logic in Cell Biology (ELCB) is to engage the students of the Cell Biology and Molecular Physiology graduate program in a self-directed seminar structured to stimulate the students ability to think scientifically and critically as future scientists. The iterative, collaborative and collegial process of ELCB is the same used by teams of collaborating scientists to develop and solve biomedical projects.

**Title: Cellular Biology of Normal and Disease States**
*Course Number: 2880*
Course Director: Daniel Devor
When: Spring Term
Prerequisites: INTBP 2000 Foundations of Biomedical Sciences
INTBP 2005 Conference
Core Course for: Cell Biology and Molecular Physiology Program

Description: This course will extend basic knowledge of cell and molecular biology obtained in Foundations of Biomedical science. The lectures will focus on four or five intensely active research areas of cell biology. Basic principles will be reinforced by considering disease states in which these processes are defective. Examples: cell growth and cancer, cell polarity and protein targeting, diseases of ion channels, cell biology of diabetes. Lectures and discussion groups.

**Title: Imaging Cell Biology in Living Systems**
*Course Number: 2885*
Course Director: Simon Watkins
When: Spring Term
Prerequisites: None

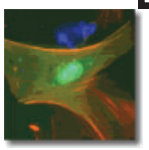
Description: The focus of this course is to study relevant problems in Cell Biology, Immunology, Developmental Biology and Neurobiology and how they have been solved using imaging approaches. The course will follow a Lecture/Demo/Journal Club format. Lectures will be interspersed with a journal club discussion of a relevant paper on each technology.

**Title: Directed Study**
*Course Number: 2890*
Course Director: Michael Butterworth
When: Fall Term, Spring Term, Summer Term, and Fall Term
Prerequisites: INTBP 2000 Foundations of Biomedical Sciences
INTBP 2005 Conference

Description: This course provides the student an opportunity to carry out a specific laboratory project in any area of interest in Cell Biology or Physiology.

**Title: Ph.D. Dissertation Research**
*Course Number: 3800*
Course Director: Michael Butterworth
When: Fall Term, Spring Term, Summer Term





Prerequisites: Successful completion of the Comprehensive Examination
INTBP 2000 Foundations of Biomedical Sciences
INTBP 2005 Conference

Description: After advancement to candidacy for the Ph.D. degree, students enroll in this course to pursue original experimental laboratory research. The results of which will provide the substance of their doctoral dissertation. A minimum of forty credits of this course are required for the Ph.D. degree in the School of Medicine.

**Title: DNA Repair Journal**
*Course Number: 3835*
Course Director: Bennett Van Houten
When: Fall Term, Spring Term
Prerequisites: INTBP 2000 Foundations of Biomedical Sciences
INTBP 2005 Conference

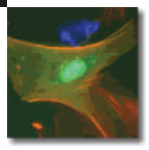
Description: The course is a journal club on current topics in DNA Repair as it relates to human disease, DNA damage processing, genome stability, telomere biology, cancer and aging. Primarily designed for students in the second year of their graduate program and beyond. Presentations will be held twice per month during the fall and spring semester. In order to receive credit for the course, students must attend a minimum of 80% of the sessions, present once per semester, participate in class discussion and complete anonymous peer-evaluations for each presenter. One week prior to presentation, presenters will identify a recent publication in the field and distribute it to their classmates. Presenters must define the hypothesis of the paper, provide background and significance, describe experimental methods used, interpret the data, conclude whether the data support the author's conclusions and propose future experiments. Grades will be determined by attendance (10%), class participation (20%) and quality of presentation (70%).

**Title: Reproductive Development from Model Organisms to Humans**
*Course Number: 3840*
Course Directors: Judith Yanowitz
When: Fall Term
Prerequisites: None

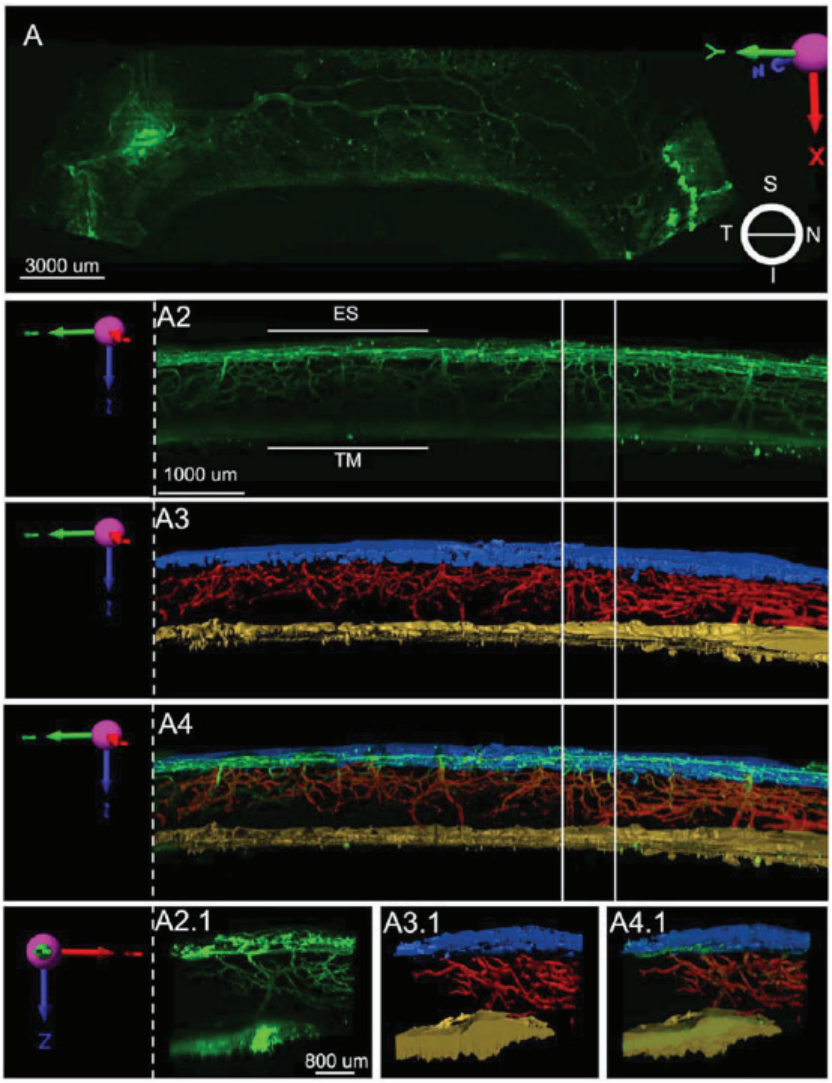
Description: This course focuses on the molecular aspects of the transition from gamete to a reproductive organism. The course progresses through the building of germ cells, fertilization and stem cell participation to sex determination, gonad morphogenesis, puberty, menopause and pregnancy. This course highlights both human and model organisms to bring together diverse aspects of the cell and developmental biology of reproductive tissues and their impact on disease pathology.

**Title: Graduate Student Writing Seminar**
*Course Number: INTBP 3240*
Course Director: Daniel Devor
When: Fall Term
Prerequisites: None



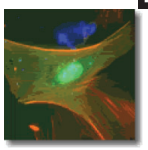


Description: This Course teaches fundamental grantmanship skills using actual NIH training grant submissions. Students construct a competitive research training grant and are instructed on methods to identify funding sources. This course consists of introductory lectures followed by a series of workshops staffed by the IBGP training faculty. Workshops cover peer scientific review and study section operation, avoidance of common pitfalls in grant writing, grant writing ethics and scientific community service.




**Dr. Alan Watson.** Volumetric reconstruction of porcine limbal drainage system visualized as maximum intensity projections (MIPs) of the superior (A) limbus as seen from the anterior. A2 shows fine elements of the aqueous humor outflow tract distal to the trabecular meshwork (TM) as seen from the anterior chamber angle, viewed through the cornea and facing the z-plane. A3 shows the surface reconstruction and labeling of morphology with TM in yellow, collector channels in red, and scleral vascular plexus in blue. A4 shows a merged image with corresponding surfaces set to 50% transparency. Vertical, solid white lines demarcate boundaries within which representative sagittal subregions (A2.1, A3.1, A4.1) are segmented and positioned with the Z plane facing inward. These data were collected in collaboration with Dr. Nils Loewen from the from Department of Ophthalmology at the University of Pittsburgh. Adapted from: Susannah Waxman, Ralitsa T. Loewen, Yalong Dang, Simon C. Watkins, Alan M. Watson, Nils A. Loewen; High-Resolution, Three-Dimensional Reconstruction of the Outflow Tract Demonstrates Segmental Differences in Cleared Eyes. Invest. Ophthalmol. Vis. Sci. 2018;59(6):2371-2380. doi: 10.1167/iovs.17-23075.



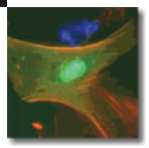


**Faculty Teaching Honors (Fiscal Year 2018-2019)**

None





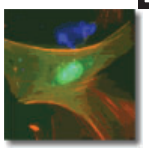


**University of Pittsburgh School of Medicine**
**Educational Credit Units (2017-2018)**
**Department of Cell Biology**
**Summary of Faculty ECU's**

| Faculty Name / Activity | ECURV | Units | ECUs |
|---|---|---|---|
| Aridor, Meir | | | |
| GS - Journal Club/Seminar Series Program Director | 25.0 | 1.0 | 25.0 |
| GS - Lecture | 2.0 | 9.0 | 18.0 |
| GS - Small group (e.g., PBL, conference, workshop) | 2.0 | 10.0 | 20.0 |
| | | Total ECUs: | 63.0 |
| Butterworth, Michael | | | |
| GS - Course Director | 50.0 | 2.0 | 100.0 |
| GS - GS Academic Advisor | 2.0 | 3.0 | 6.0 |
| GS - Journal Club/Seminar Series Program Director | 25.0 | 2.0 | 50.0 |
| GS - Laboratory supervision (e.g., MSTP, Ph.D. & M.Sc.) | 1.0 | 12.0 | 12.0 |
| GS - Lecture | 2.0 | 4.0 | 8.0 |
| GS - Member: Comprehensive, Dissertation, Thesis, Preliminary or Reprint | 5.0 | 2.0 | 10.0 |
| GS - Member: Curriculum, Recruiting, Program, or other SOM Committee | 2.0 | 3.0 | 6.0 |
| GS - Member: Program Steering Committee | 40.0 | 1.0 | 40.0 |
| GS - Small group (e.g., PBL, conference, workshop) | 2.0 | 18.8 | 37.5 |
| | | Total ECUs: | 269.5 |
| Devor, Daniel | | | |
| MS-1, MS-2 - Small group (e.g., PBL, conference, workshop) | 2.0 | 20.8 | 41.5 |
| GS - Chair: Comprehensive, Dissertation, Thesis, Preliminary or Reprint Committee | 5.0 | 1.0 | 5.0 |
| GS - Course Director | 50.0 | 2.0 | 100.0 |
| GS - Lecture | 2.0 | 10.0 | 20.0 |
| GS - Small group (e.g., PBL, conference, workshop) | 2.0 | 12.0 | 24.0 |
| | | Total ECUs: | 190.5 |
| Drain, Peter | | | |
| MS-1, MS-2 - Block Director | 10.0 | 1.0 | 10.0 |
| MS-1, MS-2 - Course Director | 200.0 | 2.0 | 400.0 |
| MS-1, MS-2 - Lecture | 2.0 | 7.8 | 15.5 |
| MS-1, MS-2 - Small group (e.g., PBL, conference, workshop) | 2.0 | 11.3 | 22.5 |
| MS - Applicant Interviewer | 1.0 | 16.0 | 16.0 |
| MS - Member, Admissions Committee | 75.0 | 1.0 | 75.0 |
| MS - Member, Curriculum Committee | 20.0 | 1.0 | 20.0 |
| MS - Member, Promotions Committee | 5.0 | 1.0 | 5.0 |
| MS - Member, Task Force/Work Group/Subcommittee/or other SOM Committee | 5.0 | 1.0 | 5.0 |
| | | Total ECUs: | 569.0 |
| Duker, Georgia | | | |





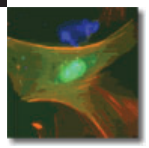


**University of Pittsburgh School of Medicine**
**Educational Credit Units (2017-2018)**
**Department of Cell Biology**
**Summary of Faculty ECU's**

| Faculty Name / Activity | ECURV | Units | ECUs |
|---|---|---|---|
| MS-1, MS-2 - Course Director | 200.0 | 1.0 | 200.0 |
| MS-1, MS-2 - Laboratory | 2.0 | 14.1 | 28.2 |
| MS-1, MS-2 - Lecture | 2.0 | 19.6 | 39.2 |
| MS-1, MS-2 - Other | 2.0 | 8.0 | 16.0 |
| MS-1, MS-2 - Small group (e.g., PBL, conference, workshop) | 2.0 | 27.1 | 54.2 |
| MS - Course Design Group Member | 5.0 | 1.0 | 5.0 |
| MS - Member, Promotions Committee | 5.0 | 1.0 | 5.0 |
| GS - Course Director | 50.0 | 1.0 | 50.0 |
| GS - Lecture | 2.0 | 27.0 | 54.0 |
| GS - Other | 2.0 | 6.0 | 12.0 |
| GS - Small group (e.g., PBL, conference, workshop) | 2.0 | 46.0 | 92.0 |
| | Total ECUs: | | 555.5 |
| Ford, Marijn | | | |
| GS - Chair: Comprehensive, Dissertation, Thesis, Preliminary or Reprint Committee | 5.0 | 1.0 | 5.0 |
| GS - Lecture | 2.0 | 9.5 | 19.0 |
| GS - Member: Comprehensive, Dissertation, Thesis, Preliminary or Reprint | 5.0 | 3.0 | 15.0 |
| GS - Small group (e.g., PBL, conference, workshop) | 2.0 | 4.5 | 9.0 |
| | Total ECUs: | | 48.0 |
| Hammond, Gerald | | | |
| MS-1, MS-2 - Small group (e.g., PBL, conference, workshop) | 2.0 | 11.3 | 22.5 |
| GS - Chair: Comprehensive, Dissertation, Thesis, Preliminary or Reprint Committee | 5.0 | 1.0 | 5.0 |
| GS - Laboratory supervision (e.g., MSTP, Ph.D. & M.Sc.) | 1.0 | 12.0 | 12.0 |
| GS - Lecture | 2.0 | 11.5 | 23.0 |
| GS - Member: Admissions Committee | 75.0 | 1.0 | 75.0 |
| GS - Member: Comprehensive, Dissertation, Thesis, Preliminary or Reprint | 5.0 | 3.0 | 15.0 |
| GS - Ph.D. or M.Sc. Mentor | 50.0 | 1.0 | 50.0 |
| GS - Small group (e.g., PBL, conference, workshop) | 2.0 | 4.5 | 9.0 |
| | Total ECUs: | | 211.5 |
| Hong, Yang | | | |
| GS - Course Director | 50.0 | 1.0 | 50.0 |
| GS - Lecture | 2.0 | 10.0 | 20.0 |
| GS - Member: Comprehensive, Dissertation, Thesis, Preliminary or Reprint | 5.0 | 2.0 | 10.0 |
| GS - Small group (e.g., PBL, conference, workshop) | 2.0 | 2.0 | 4.0 |
| | Total ECUs: | | 84.0 |
| Kwiatkowski, Adam | | | |
| MS-1, MS-2 - Laboratory | 2.0 | 7.0 | 14.0 |





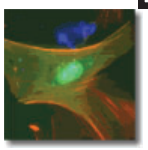


**University of Pittsburgh School of Medicine**
**Educational Credit Units (2017-2018)**
**Department of Cell Biology**
**Summary of Faculty ECU's**

| Faculty Name / Activity | ECURV | Units | ECUs |
|---|---|---|---|
| MS-1, MS-2 - Lecture | 2.0 | 2.3 | 4.7 |
| MS-1, MS-2 - Small group (e.g., PBL, conference, workshop) | 2.0 | 5.6 | 11.2 |
| MS - Course Design Group Member | 5.0 | 1.0 | 5.0 |
| GS - Lecture | 2.0 | 8.0 | 16.0 |
| GS - Member: Comprehensive, Dissertation, Thesis, Preliminary or Reprint | 5.0 | 6.0 | 30.0 |
| GS - Ph.D. or M.Sc. Mentor | 50.0 | 2.0 | 100.0 |
| GS - Small group (e.g., PBL, conference, workshop) | 2.0 | 3.0 | 6.0 |
| | Total ECUs: | | 186.8 |
| Leuba, Sanford | | | |
| GS - Course Director | 50.0 | 1.0 | 50.0 |
| GS - Lecture | 2.0 | 11.0 | 22.0 |
| GS - Member: Curriculum, Recruiting, Program, or other SOM Committee | 2.0 | 1.0 | 2.0 |
| GS - Member: Program Steering Committee | 40.0 | 1.0 | 40.0 |
| GS - Small group (e.g., PBL, conference, workshop) | 2.0 | 10.0 | 20.0 |
| | Total ECUs: | | 134.0 |
| Murray, Sandra | | | |
| MS-1, MS-2 - Laboratory | 2.0 | 31.8 | 63.5 |
| MS-1, MS-2 - Lecture | 2.0 | 4.0 | 8.0 |
| MS-1, MS-2 - Other | 2.0 | 21.0 | 42.0 |
| MS - Course Design Group Member | 5.0 | 2.0 | 10.0 |
| MS - Member, Promotions Committee | 5.0 | 1.0 | 5.0 |
| MS - Member, Task Force/Work Group/Subcommittee/or other SOM Committee | 5.0 | 2.0 | 10.0 |
| GS - Lecture | 2.0 | 1.0 | 2.0 |
| | Total ECUs: | | 140.5 |
| Shi, Yi | | | |
| GS - Lecture | 2.0 | 5.0 | 10.0 |
| GS - Member: Comprehensive, Dissertation, Thesis, Preliminary or Reprint | 5.0 | 1.0 | 5.0 |
| | Total ECUs: | | 15.0 |
| Sorkin, Alexander | | | |
| GS - Lecture | 2.0 | 6.0 | 12.0 |
| GS - Member: Comprehensive, Dissertation, Thesis, Preliminary or Reprint | 5.0 | 3.0 | 15.0 |
| GS - Ph.D. or M.Sc. Mentor | 50.0 | 1.0 | 50.0 |
| GS - Small group (e.g., PBL, conference, workshop) | 2.0 | 2.0 | 4.0 |
| | Total ECUs: | | 81.0 |
| St Croix, Claudette | | | |
| MS-1, MS-2 - Small group (e.g., PBL, conference, workshop) | 2.0 | 9.5 | 19.0 |



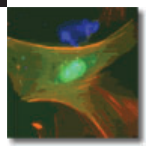




**University of Pittsburgh School of Medicine**
**Educational Credit Units (2017-2018)**
**Department of Cell Biology**
**Summary of Faculty ECU's**

| Faculty Name | Activity | ECURV | Units | ECUs |
|---|---|---|---|---|
| | GS - Course Director | 50.0 | 1.0 | 50.0 |
| | GS - Lecture | 2.0 | 11.0 | 22.0 |
| | GS - Member: Comprehensive, Dissertation, Thesis, Preliminary or Reprint | 5.0 | 2.0 | 10.0 |
| | | | Total ECUs: | 101.0 |
| Stolz, Donna | | | | |
| | MS-1, MS-2 - Laboratory | 2.0 | 8.7 | 17.3 |
| | MS-1, MS-2 - Lecture | 2.0 | 0.8 | 1.7 |
| | MS-1, MS-2 - Small group (e.g., PBL, conference, workshop) | 2.0 | 5.6 | 11.2 |
| | MS - Course Design Group Member | 5.0 | 1.0 | 5.0 |
| | GS - Associate Director | 75.0 | 1.0 | 75.0 |
| | GS - Chair: Comprehensive, Dissertation, Thesis, Preliminary or Reprint Committee | 5.0 | 5.0 | 25.0 |
| | GS - Course Director | 50.0 | 1.0 | 50.0 |
| | GS - Journal Club/Seminar Series Program Director | 25.0 | 2.0 | 50.0 |
| | GS - Lecture | 2.0 | 6.5 | 13.0 |
| | GS - Member: Comprehensive, Dissertation, Thesis, Preliminary or Reprint | 5.0 | 9.0 | 45.0 |
| | GS - Small group (e.g., PBL, conference, workshop) | 2.0 | 17.5 | 35.0 |
| | | | Total ECUs: | 328.2 |
| Thorne, Stephen | | | | |
| | GS - Lecture | 2.0 | 1.5 | 3.0 |
| | | | Total ECUs: | 3.0 |
| Traub, Linton | | | | |
| | GS - Member: Comprehensive, Dissertation, Thesis, Preliminary or Reprint | 5.0 | 1.0 | 5.0 |
| | | | Total ECUs: | 5.0 |
| Watkins, Simon | | | | |
| | MS - Member, Task Force/Work Group/Subcommittee/or other SOM Committee | 5.0 | 1.0 | 5.0 |
| | GS - Chair: Comprehensive, Dissertation, Thesis, Preliminary or Reprint Committee | 5.0 | 2.0 | 10.0 |
| | GS - Course Director | 50.0 | 1.0 | 50.0 |
| | GS - Lecture | 2.0 | 9.5 | 19.0 |
| | GS - Member: Comprehensive, Dissertation, Thesis, Preliminary or Reprint | 5.0 | 5.0 | 25.0 |
| | GS - Small group (e.g., PBL, conference, workshop) | 2.0 | 8.0 | 16.0 |
| | | | Total ECUs: | 125.0 |
| Yates, Nathan | | | | |
| | GS - Lecture | 2.0 | 3.0 | 6.0 |
| | | | Total ECUs: | 6.0 |
| | | | **Subtotal:** | **3116.5** |





**University of Pittsburgh School of Medicine**
**Educational Credit Units (2017-2018)**
**Department of Cell Biology**
**Summary of Faculty ECU's**

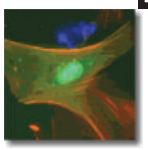
| Faculty Name | Activity | ECURV | Units | ECUs |
|---|---|---|---|---|

**Total Faculty Reporting: 19**

**Total ECU's for Cell Biology: 3116.5**

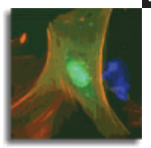






**Post Doctoral Personnel Data**
[Current as of June, 2019]

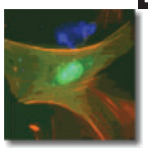
| Name | Title | Office Address | Email Address | Office Phone | Fax | Research Focus |
|---|---|---|---|---|---|---|
| Bagalkot, Tarique | Post Doctoral Associate | S372 BSTWR | tariqueb@pitt.edu | 412-624-8147 | 412-648-8330 | Sorkin Lab |
| Boslett, James | Post Doctoral Associate | BST3-9th Fl | jjb179@pitt.edu | 412-648-3261 | 412-641-2458 | Yates Lab |
| Lu, Juan | Post Doctoral Associate | S333 BSTWR | jul105@pitt.edu | 412-648-2846 | 412-648-8330 | Hong Lab |
| Pacheco, Jonathan | Post Doctoral Associate | S332 BSTWR | jep160@pitt.edu | 412-383-1783 | 412-648-8330 | Hammond Lab |
| Perez Verdaguer, Mireia | Post Doctoral Associate | S372 BSTWR | mip85@pitt.edu | 412-624-8147 | 412-648-8330 | Sorkin Lab |
| Sun, Dapeng | Post Doctoral Associate | S355 BSTWR | das306@pitt.edu | 412-383-9026 | 412-648-8330 | Ford Lab |



**Current Cell Biology and Molecular Physiology Graduate Program Students as of June 30, 2019**

| Student | Mentor | Year |
|---|---|---|
| Chelsea Merkel | Dr. Adam Kwiatkowski | 5th |
| Paige Rudich | Dr. Todd Lamitina | 4th |
| Amity Eaton | Dr. Gerard Apodaca | 4th |
| Jonathan Heier | Dr. Adam Kwiatkowski | 3rd |
| Rachel Wills | Dr. Gerald Hammond | 3rd |
| Sarel Urso | Dr. Lamitina | 2nd |





**Prior Graduates of the Cell Biology and Molecular Physiology Program as of June 2019**
**(Past five years)**

**Chelsea DeAnn Merkel**
Defended: 6/21/19
Industry

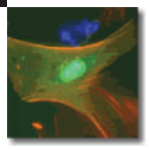
**Paige Davison Rudich**
Defended: 5/15/19
Post-Doc Canada

**George Michael Preston, Ph.D.**
Defended: April 13, 2017
Research Specialist
Spark Therapeutics, Inc., Malvern, PA

**Christine Klemens, Ph.D.**
Defended April 11, 2017
Post-Doc Fellow, Medical College of Wisconsin

**Kathryn Wack, Ph.D.**
Defended July 23, 2014
Vice President of Development, Western Oncolytics, Ltd.





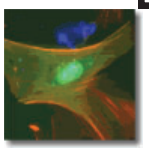
**Student Ratings of CBMP Faculty Teaching FY2019**

| Name | Course | Type | Date | Rating | Ave |
|---|---|---|---|---|---|
| Devor | Investigation and Discovery | SGCS | Fall-18 | 4.40 | 4.40 |
| Butterworth | Tissues in Health and Disease | LAB | Spring-19 | 5.00 | 5.00 |
| Drain | Investigation and Discovery | SGCS | Fall-18 | 4.20 | 4.20 |
| Kwiatkowski | Tissues in Health and Disease | LEC | Spring-19 | 4.30 | |
| Kwiatkowski | Tissues in Health and Disease | LAB | Spring-19 | 5.00 | 4.65 |
| Murray | Medical Anatomy | LEC | Fall-18 | 4.00 | |
| Murray | Medical Anatomy | LAB | Fall-18 | 4.70 | 4.35 |
| Stolz | Tissues in Health and Disease | LEC | Spring-19 | 4.10 | |
| Stolz | Tissues in Health and Disease | LAB | Spring-19 | 4.90 | 4.50 |
| | **Overall Teaching Average** | | | **4.50** | |

**Type codes:**

| | |
|---|---|
| LEC | Lecture |
| PBL | Practice Based Learning |
| WKSP | Workshop |
| SGCS | Small Group Conference Session |
| AP | Applications Staff |
| LAB | Laboratory |

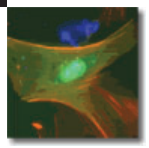




**CELL BIOLOGY FACULTY ROSTER**
**(Effective June, 2019)**

| Last Name | First | Rank | Status |
|---|---|---|---|
| Sorkin | Alexander | Professor & Chair | Tenured |
| Devor | Daniel | Professor | Tenured |
| Murray | Sandra | Professor | Tenured |
| Traub | Linton | Professor | Tenured |
| Watkins | Simon | Professor | Tenured |
| Aridor | Meir | Associate Professor | Tenured |
| Butterworth | Michael | Associate Professor | Tenured |
| Drain | Peter | Associate Professor | Tenured |
| Hong | Yang | Associate Professor | Tenured |
| Leuba | Sanford | Associate Professor | Tenured |
| St. Croix | Claudette | Associate Professor | Tenured |
| Stolz | Donna | Associate Professor | Tenured |
| Yates | Nathan | Associate Professor | Non-tenure Track |
| Ford | Marijn | Assistant Professor | Tenure Track |
| Hammond | Gerald | Assistant Professor | Tenure Track |
| Kwiatkowski | Adam | Assistant Professor | Tenure Track |
| Shi | Yi | Assistant Professor | Tenure Track |
| Truschel | Steven | Assistant Professor | Non-tenure Track |
| Ford | Natalia | Res. Assistant Professor | Non-tenure Track |
| Tan | Xiaojun (Jay) | Res. Assistant Professor | Non-tenure Track |

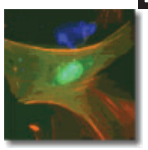




## New Cell Biology Faculty in FY19

| Name | Prior Institution /Rank | Current Rank |
|---|---|---|
| Jay (Xiaojun) Tan | UT Southwestern Medical Center<br>Department of Molecular Biology<br>Dallas, TX 75390<br>Postdoc | Res. Assstant Professor |





**Faculty Honors, Recognition and Professional Affiliations (Fiscal Year 2018 – 2019)**

**Michael Butterworth, Ph.D.**
*Associate Professor*

Member, American Physiological Society
Member, Salt and Water Club
American Society of Nephrology
American Heart Association

**Daniel C. Devor, Ph.D.**
*Professor*

Member, American Physiological Society
Member, Biophysical Society
Member, Mount Desert Island Biological Laboratory

**Peter F. Drain, Ph.D.**
*Associate Professor*

Member, Biophysical Society
Member, American Association for the Advancement of Science
Member, Society of General Physiologists
Member, American Diabetes Association

**Marijn Ford, Ph.D.**
*Assistant Professor*

Member, The Biochemical Society
Member, American Society of Cell Biology

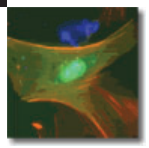
**Gerry Hammond, Ph.D.**
*Assistant Professor*

Member, Biochemical Society
Member, American Association for the Advancement of Science
Member, American Society of Cell Biology
American Society for Biochemistry & Molecular Biology

**Yang Hong, Ph.D.**
*Associate Professor*

Member of Faculty 1000





**Adam Kwiatkowski, Ph.D.**
*Assistant Professor*

Member, American Society for Cell Biology
American Society for Biochemistry and Molecular Biology
American Heart Association

**Sanford Leuba, Ph.D.**
*Associate Professor*

Member, Biophysical Society
Member, Spectroscopy Society of Pittsburgh

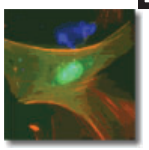
**Yang Li, Ph.D.**
*Research Instructor*

Member, American Heart Association
Member, American Society for Cell Biology

**Sandra A. Murray, Ph.D.**
*Professor*

American Society for Cell Biology Lifetime Fellow Recognition for Distinguished Contributions to the Advancement of Cell Biology
Member, American Society for Cell Biology – Council, Minority Affairs
Member, Society for In Vitro Biology
Member, The Pittsburgh Cancer Institute
Member, Corporation of the Marine Biological Laboratory
Member, Cell Transplant Society
Member, Endocrine Society
Member, American Physiological Society
Member, International Society for Preventive Oncology
University of Pittsburgh Helen Faison Council of Elders
School of Medicine Summer "Minority" Work-Study Program
Member, Medical Student Promotions Committee
Member, Training Faculty Immunology Graduate Training Program
NIH - Biomedical Faces of Science Mentors
Co-Chair of the Research Center of Excellence Committee Graduate School of Public Health, University of Pittsburgh
Graduate School of Public Health Community Engagement Research Cor
Graduate School of Public Health Research Advisory Committee- Center for Minority Health
Provost Special Advisory Committee
Provost Selection Committee for the Provost Development Fund Awards





University Community Representative for Equipoise
Junior Faculty Advancement – Panel Member

**Itziar Pinilla-Macua, Ph.D.**
*Research Instructor*

Spanish Society of Biochemistry and Molecular Biology

**Yi Shi, Ph.D.**
*Assistant Professor*

Member, American Society for Mass Spectrometry
Member, New York Academy of Sciences

**Alexander D. Sorkin, Ph.D.**
*Richard B. Mellon Professor and Chairman*

Member, American Society for Cell Biology
Society for Neuroscience

**Donna B. Stolz, Ph.D.**
*Associate Professor*

Member, American Society for Cell Biology
Member, Microscopy Society of America

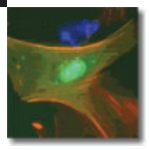
**Jay Tan, Ph.D.**
*Research Assistant Professor*

Member, American Heart Association
Member, American Society of Cell Biology
Member, American Association for the Advancement of Science

**Linton M. Traub, Ph.D.**
*Professor*

Member, American Society for Cell Biology
American Association for the Advancement of Science
American Society for Biochemistry and Molecular Biology

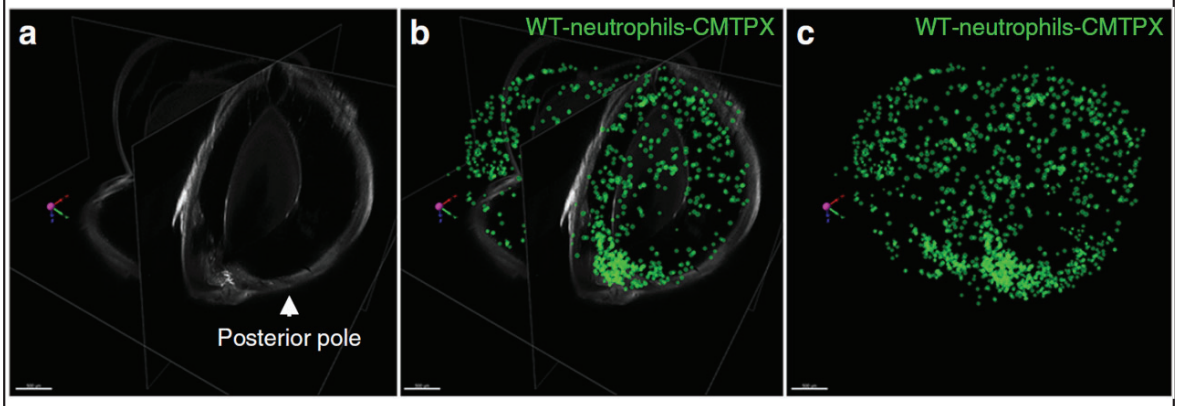




**Simon C. Watkins, Ph.D.**
*Distinguished Professor and Vice Chairman, Director of Center of Biologic Imaging*

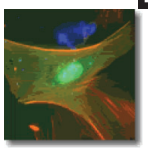
Member, The Pittsburgh Cancer Institute

**Nathan Yates, Ph.D.**
*Associate Professor*
American Chemical Society
American Society for Mass Spectrometry




**Dr. Alan Watson.** Interferon lambda (IFNλ) is responsible for neutrophil sequestration into the eye. (a) Orthogonal projections from all three dimensions of a whole eye from a mouse injected with CMTPX-labeled WT neutrophils +IFNλ. Cells within the retina and Schlemm's canal are depicted as green spheres (b) with and (c) without the orthogonal projection. These data were collected in collaboration with Dr. Debasish Sinha from Department of Ophthalmology at the University of Pittsburgh. Adapted from article in press. https://doi.org/10.1038/s42003-019-0588-y





**Faculty Presentations (Fiscal Year 2018 - 2019)**

**Marijn Ford, Ph.D.**
***Assistant Professor***

Department of Biological Sciences, Vanderbilt University, Nashville, Tennessee "Not all dynamin-related proteins are alike: the unique architecture of Vps1"

Midwest Yeast Meeting, Northwestern University "Ivy1 is a negative regulator of Gtr-dependent TORC1 activation"

**Gerald Hammond, Ph.D.**
***Assistant Professor***

"SAC1 Degrades its Lipid Substrate PtdIns4P in the Endoplasmic Reticulum to Maintain a Steep Chemical Gradient with Donor Membranes" at Keystone Symposium: "Phosphoinositide Biology: New Therapeutic Targets Beyond Class I PI3K"

"SAC1 Degrades its Lipid Substrate PtdIns4P in the Endoplasmic Reticulum to Maintain a Steep Chemical Gradient with Donor Membranes" in "Molecular Basis of Signaling" symposium, American Society of Biochemistry and Molecular Biology 2018 Annual meeting, San Diego, CA.

"Reverse Engineering Lipid Signaling in Living Cells". Invited seminar, The Francis Crick Institute, London, UK.

"Dissecting the unique cellular functions driven by $PI(3,4)P_2$". FASEB conference "Phospholipids: Dynamic Lipid Signaling in Health and Disease". Steamboat Springs, CO.

"Reverse Engineering Lipid Signaling in Living Cells". Invited seminar, Department of Biological Sciences, University of Pittsburgh

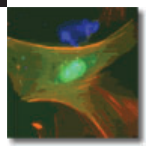
"Reverse Engineering Lipid Signaling in Living Cells". Invited seminar, Department of Physiology, University of Texas Southwestern Medical Center, Dallas, TX.

"Reverse Engineering Lipid Signaling in Living Cells". Invited seminar, Department of Physiology, Albany Medical College, Albany, NY.

**Yang Hong, Ph.D.**
***Associate Professor***

The 9th Jin Ling Conference of Development Biology, Nanjing, Jiangsu, China Gene Targeting 2011, Vienna, Austria.





**Adam Kwiatkowski, Ph.D.**
***Assistant Professor***

World Congress of Biomechanics, Dublin, Ireland.

Molecular Medicine Research Seminar, Children's Hospital of Pittsburgh of UPMC, Pittsburgh, PA.

Department of Regenerative Medicine and Cell Biology, Medical University of South Carolina, Charleston, SC.

Cell and Developmental Biology Center, National Heart, Lung, and Blood Institute, Bethesda, MD.

Mechanobiology Institute, National University of Singapore, Singapore

**Sanford Leuba, Ph.D.**
***Associate Professor***

Department of Chemistry and Biochemistry, Baylor University

**Yi Shi, Ph.D.**
***Assistant Professor***

CPSA USA, Philadelphia

Science 2018, Pittsburgh

Shanghai Tech University, Shanghai, China

CHUPO, Guangzhou, China

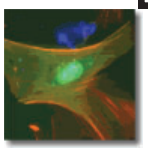
**Alexander D. Sorkin, Ph.D.**
***Richard B. Mellon Professor and Chairman***

University of Arkansas Medical School, Little Rock, AK
McGill University Health Center, Montreal, Canada

**Claudette St. Croix, Ph.D.**
***Associate Professor***

Symposium Speaker, 19th International Microscopy Congress, Sydney, Australia
Invited Speaker: IDEX Corporation, National Sales Meeting, Las Vegas, NV





**Simon C. Watkins, Ph.D.**
***Distinguished Professor and Vice Chairman***
***Director of Center of Biologic Imaging***

Imaging Fast, Imaging Deep University of Melbourne, Invited seminar speaker

Exchange of Experience, Building, running and managing a truly large imaging center. Sydney Australia. Invited speaker

Imaging Futures: IDEX global meeting, Keynote speaker, Las Vegas NV

Imaging Fast Imaging Deep HUB-MAP annual meeting, Invited speaker

**Alan Watson, Ph.D.**
***Research Assistant Professor***

How to Find a Single Neuron in the Brain: Technology for High-Speed High-Resolution Imaging of Whole Biologic Systems. Central Michigan University. Mt. Pleasant, MI.

Ribbon Scanning Confocal for High-Speed High-Resolution Imaging of Massive Volumes. University of Colorado Denver, Anschutz Medical Center. Aurora, CO.

Ribbon Scanning Confocal for High-Speed High-Resolution Imaging of Massive Volumes. University of Colorado Boulder. Boulder, CO.

Technologies for High-Speed High-Resolution Imaging of Whole Biologic Systems. Scripts. San Diego, CA.

Technologies for High-Speed High-Resolution Imaging of Whole Biologic Systems. Salk Institute. San Diego, CA

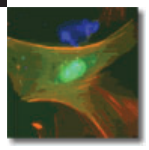
Technologies for High-Speed High-Resolution Imaging of Large Biologic Systems. GUDMAP Annual Meeting. Washington, DC.

Applying Technologies for High-Resolution Volumetric Imaging of Large Tissues to the Characterization of Benign Prostatic Hyperplasia. O'Brien Benign Urology Research Center Symposium. University of Pittsburgh, Pittsburgh, PA.

**Nathan Yates, Ph.D.**
***Associate Professor***

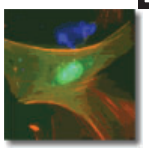
"AD BioMarkers- Mass Spectrometry from Basic Research to the Clinic" GERO Talk, Santiago, Chile





"Mass Spec. Technology, Protein Biomarkers and Protein Target" AAPS PharmSci 360 Conference, Washington DC





**Peer Reviewed Publications (Fiscal Year 2017 - 2019)**

**Meir Aridor, Ph.D.**
*Associate Professor*

Gang Yu; Yinan Liu; Shiyong Liu; **Meir Aridor;** Yuan Huang; Yushuang Hu; Longfeii Wang; Sisi Li; Hongbo Xiong; Bo Tang; Xia Li; Chen Cheng; Susmita Chakrabarti; Fan Wang; Qingyu Wu; Sadashiva Karnik; Chengqi Xu; Qiuyun Chen; Qing Wang (2018) Small GTPases SAR1A and SAR1B regulate the trafficking of the cardiac sodium channel Nav1.5. Biochim Biophys Acta Mol Basis Dis. 2018 Nov;1864(11):3672-3684. doi: 10.1016/j.bbadis.2018.09.003. Epub 2018 Sep

**Michael Butterworth, Ph.D.**
*Assistant Professor*

Mukherjee, A., Wang, Z., Kinlough, C.L., Poland, P.A., Marciszyn, A.L., Montalbetti, N., Carattino, M.D., Butterworth, M.B., Kleyman, T.R. and Hughey, R.P. (2017). Specific palmitoyltransferases associate with and activate the Epithelial Sodium Channel. Journal of Biological Chemistry. 292(10):4152-4163. PMID: 28154191

Klemens, C.A., Edinger, R.S, Kightlinger, L. Liu, X. and Butterworth, M.B. (2017). Ankyrin G expression regulates apical delivery of the epithelial sodium channel (ENaC). Journal of Biological Chemistry. 292(1):375-85. PMID: 27895120

Liu, X., Edinger, R.S., Klemens, C.A. Phua, Y.L., Bodnar, A.J., LaFramboise, W.A., Ho, J. and Butterworth, M.B. (2017). A microRNA cluster miR23~24~27 is upregulated in the distal kidney ephron where it alters sodium transport. Journal of Cellular Physiology. 232: 1306–1317. PMID: 27636893

Espiritu E.B., Crunk A.E., Bais A., Hochbaum D., Cervino A.S., Phua Y.L., Butterworth M.B., Goto T., Ho J., Hukriede N.A., Cirio M.C. (2018). The Lhx1-Ldb1 complex interacts with Furry to regulate microRNA expression during pronephric kidney development. Sci Rep. 8(1):16029. PMID: 30375416.

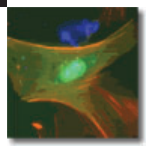
Phua Y.L., Chen K.H., Hemker S.L., Marrone A.K., Bodnar A.J., Liu X., Clugston A., Kostka D., Butterworth M.B., Ho J. (2019). Loss of miR-17~92 results in dysregulation of *Cftr* in nephron progenitors. Am J Physiol Renal Physiol. 316(5):F993-F1005. PMID: 30838872

**Daniel Devor, Ph.D.**
*Professor*

Lee, S.L., D.C. Devor and K.L. Hamilton. Modulation of retrograde trafficking of KCa3.1 in polarized epithelium. Frontiers of Physiology, DOI: 10.3389/fphys.2017.00489, 2017.

Bertuccio, C.A., T. Wang, S.B. Condliffe and D.C. Devor. Plasma membrane insertion of KCa2.3 (SK3) is dependent upon the SNARE proteins, Syntaxin 4 and SNAP23. PLoS One.





13(5):e0196717. doi: 10.1371/journal.pone.0196717, 2018.

**Peter F. Drain, Ph.D.**
*Associate Professor*

D. Brüning, K. Reckers, P. Drain, and I. Rustenbeck. 2017. Glucose Diminishes and KCl Increases Insulin Granule Turnover in the Submembrane Space of Primary Beta-Cells. J Mol Endocrinol Oct:59(3):311-324. PMID: 28765259.

Luppi, P., and P. Drain. 2017. Autocrine C-Peptide Mechanism Underlying INS1 Beta Cell Adaptation to Free Fatty Acid-Induced Oxidative Stress. In preparation.

Li Ma, Vytautas P. Bindokas, Christine Labno, Jie Wang, Andrey Kuznetsov, Manani Hara, Xuehui Geng, Peter Drain, Christopher J. Rhodes, Donald F. Steiner, and Louis H Philipson. 2017. Non-Crystallized Cargo Protein Shifts Insulin LDCV Exocytosis From Full to Transient Fusion, in revision

**Marijn Ford, Ph.D.**
*Assistant Professor*

Varlakhanova NV, Mihalevic MJ, Bernstein KA, **Ford MGJ**. Pib2 and the EGO complex are both required for activation of TORC1. J Cell Sci. 2017 Nov 15; 130(22):3878-3890. DOI: 10.1242/jcs.207910 PMID: 28993463. PMCID: PMC5702048.

Varlakhanova NV, Tornabene BA, **Ford MGJ**. Feedback regulation of TORC1 by its downstream effectors Npr1 and Par32. 2018. Mol. Biol. Cell. DOI: 10.1091/mbc.E18-03-0158. PMID: 30156471.

Varlakhanova NV, Tornabene BA, **Ford MGJ**. Ivy1 is a negative regulator of Gtr-dependent TORC1 activation. 2018. J. Cell Sci. DOI: 10.1242/jcs.218305. PMID: 30097557.

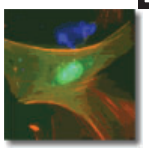
Varlakhanova NV, Alvarez FJ, Brady TM, Tornabene BA, Hosford CJ, Chappie JS, Zhang P, **Ford MGJ**. Structures of the fungal dynamin related protein Vps1 reveal a unique, open helical architecture. J. Cell Biol. 2018. DOI: 10.1083/jcb.201712021. PMID: 30087125.

**Natalia Varlakhanova Ford, Ph.D.**
*Research Assistant Professor*

Varlakhanova NV, Mihalevic MJ, Bernstein KA, **Ford MGJ**. Pib2 and the EGO complex are both required for activation of TORC1. J Cell Sci. 2017 Nov 15; 130(22):3878-3890. DOI: 10.1242/jcs.207910 PMID: 28993463. PMCID: PMC5702048.

Varlakhanova NV, Tornabene BA, **Ford MGJ**. Feedback regulation of TORC1 by its downstream effectors Npr1 and Par32. 2018. Mol. Biol. Cell. DOI: 10.1091/mbc.E18-03-0158. PMID: 30156471.





Varlakhanova NV, Tornabene BA, **Ford MGJ**. Ivy1 is a negative regulator of Gtr-dependent TORC1 activation. 2018. J. Cell Sci. DOI: 10.1242/jcs.218305. PMID: 30097557.

Varlakhanova NV, Alvarez FJ, Brady TM, Tornabene BA, Hosford CJ, Chappie JS, Zhang P, **Ford MGJ**. Structures of the fungal dynamin related protein Vps1 reveal a unique, open helical architecture. J. Cell Biol. 2018. DOI: 10.1083/jcb.201712021. PMID: 30087125.

**Gerald Hammond, Ph.D.**
*Assistant Professor*

Levin R, Hammond GRV, Balla T, DeCamillli P, Fairn, GD, Grinstein S. 2017. Multiphasic dynamics of phosphatidylinositol 4-phosphate during phagocytosis. Mol Biol Cell 28, 128-140.

Willett, R., Martina, J.A., Zewe, J.P., Wills, R., Hammond, G.R.V., and Puertollano, R. 2017. TFEB regulates lysosomal positioning by modulating TMEM55B expression and JIP4 recruitment to lysosomes. Nature Communications. doi:10.1038/s41467-017-01871-z. 8:1580.

Sohn, M., Korzeniowski, M., Zewe, J.P., Wills, R. C., Hammond, G., Humpolickova, J., et al. PI(4,5)P2 controls plasma membrane PI4P and PS levels via ORP5/8 recruitment to ER–PM contact sites. J Cell Biol. 2018;jcb.201710095.

Zewe J. P., Wills, C, Sangappa, Goulden, B. D., Hammond, G. R. V. SAC1 degrades its lipid substrate PtdIns4P in the endoplasmic reticulum to maintain a steep chemical gradient with donor membranes. eLife. 2018;7:e35588.

Chintaluri K., Goulden B.D., Celmenza C., Saffi G., Miraglia E., Hammond G.R., Botelho R.J. The PH domain from the Toxoplasma gondii PH-containing protein-1 (TgPH1) serves as an ectopic reporter of phosphatidylinositol 3-phosphate in mammalian cells. PLoS ONE. 2018;13(6):e0198454.

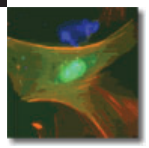
Goulden B, Pacheco J, Dull A, Zewe J, Deiters A, Hammond G. A High Avidity Biosensor Reveals PI(3,4)P2 is Predominantly a Class I PI3K Signaling Product. J Cell Biol. 2019;218(3): 1066-1079. Doi: 10.1083/jcb.201809026

**Yang Hong, Ph.D.**
*Associate Professor*

Cao H, Xu R, Shi Q, Zhang D, Huang J and Hong Y. (2017) FERM Domain Phosphorylation and Endogenous 3'UTR are not Essential for Regulating the Function and Subcellular Localization of Polarity Protein Crumbs. J Genetics & Genomics 44(8):409-412. PMID: 28844685

Chen Y-J, Huang J, Huang L, Austin E and Hong Y. (2017) Phosphorylation Potential of Drosophila E-Cadherin Intracellular Domain is Essential for Development and Regulating Adherens Junction Biosynthetic Dynamics. Development 144(7):1242-1248. PMID: 28219947





Hong Y. (2018) aPKC: the Kinase that Phosphorylates Cell Polarity. *F1000Research* 2018, 7(F1000 Faculty Rev):903 (doi: 10.12688/f1000research.14427.1)

Raza Q, Choi JY, Li Y, O'Dowd RM, Watkins SC, Hong Y, Clark NL and Kwiatkowski AV. (2019) Evolutionary rate covariation identifies the GTPase activating protein Raskol as a signaling component of the cadherin adhesion network in *Drosophila*. *Plos Genetics* 15(2): e1007720. PMID: 30763317

**Adam Kwiatkowski, Ph.D.**
*Assistant Professor*

Kang H, Bang I, Jin KS, Lee B, Lee J, Shao X, Heier JA, Kwiatkowski AV, Nelson WJ, Hardin J, Weis WI, Choi HJ. Structural and Functional Characterization of Caenorhabditis elegans α-Catenin Reveals Constitutive Binding to β-catenin and F-actin. 2017 March 15 Epub. PMID: 28298447

Heier JA, Dickinson DJ, **Kwiatkowski AV**. Measuring Protein Binding to F-actin by Co-sedimentation. J. Vis. Exp. 2017 May 18;(123). PMID: 28570520

Hager NA, Krasowski CJ, Mackie TD, Kolb AR, Needham PG, Augustine AA, Dempsey A, Szent-Gyorgyi C, Bruchez MP, Bain DJ, Kwiatkowski AV, O'Donnell AF, Brodsky JL. Select α-arrestins control cell-surface abundance of the mammalian Kir2.1 potassium channel in a yeast model. J Biol Chem. 2018 Jul 13;293(28):11006-11021. PMID: 29784874

Li Y, Merkel CD, Zeng X, Heier JA, Cantrell PS, Sun M, Stolz DB, Watkins SC, Yates NA, Kwiatkowski AV†. The N-cadherin interactome in cardiomyocytes as defined by quantitative proximity proteomics. J Cell Sci. 2019 Feb 11;132(3). PMID: 30630894
†Corresponding author; *a JCS Research Highlight and accompanied by JCS First Person interview with the first authors Yang Li and Chelsea Merkel*

Pang SM, Le S, **Kwiatkowski AV**, Yan J. Mechanical stability of αT-catenin and its activation by force for vinculin binding. Mol Biol Cell. 2019 Jul 22;30(16). PMID: 31318313

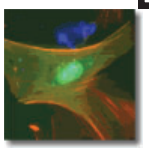
Raza Q, Choi JY, Li Y, O'Dowd RM, Watkins SC, Hong Y, Clark NL and Kwiatkowski AV. (2019) Evolutionary rate covariation identifies the GTPase activating protein Raskol as a signaling component of the cadherin adhesion network in *Drosophila*. *Plos Genetics* 15(2): e1007720. PMID: 30763317

**Sanford Leuba, Ph.D.**
*Associate Professor*

Carney SM, Gomathinayagam S, Leuba SH, Trakselis MA. (2017) Bacterial DnaB helicase interacts with the excluded strand to regulate unwinding. J Biol Chem. Sep 22. pii: jbc.M117.814178. doi: 10.1074/jbc.M117.814178. [Epub ahead of print] PMID: 28939774

Chirico G*, Gansen A, Leuba SH*, Olins AL, Olins DE, Smith JC, Tóth K*. (2018) Jörg Langowski: his scientific legacy and the future it promises. BMC Biophysics (in press).





*Corresponding authors.

**Yang Li, Ph.D.**
*Research Instructor*

Liu, J., Li, Y., Lin, B., Sheng, Y., and L. Yang: HBL1 Is a Human Long Noncoding RNA that Modulates Cardiomyocyte Development from Pluripotent Stem Cells by Counteracting MIR1. Dev. Cell, 42(4):333-48, 2017.

**Li Y**, Merkel CD, Zeng X, Heier JA, Cantrell PS, Sun M, Stolz DB, Watkins SC, Yates NA, Kwiatkowski AV. The N-cadherin interactome in primary cardiomyocytes as defined using quantitative proximity proteomics. J Cell Sci. 132(3), 2019.

Raza Q, Choi JY, **Li Y**, O'Dowd RM, Watkins SC, Chikina M, Hong Y, Clark NL, Kwiatkowski AV. Evolutionary rate covariation analysis of E-cadherin identifies Raskol as a regulator of cell adhesion and actin dynamics in Drosophila. PLoS Genet. 15(2):e1007720, 2019.

**Sandra A. Murray, Ph.D.**
*Professor*

Bell, C.L., Shakespeare, T.I. Smith, A. and **Murray, S.A**., Visualization of Annular Gap Junction Vesicle Processing: The Interplay Between Annular Gap Junctions and Mitochondria, International Journal of Molecular Sciences 20(1):44, 2018 doi: 10.3390/ijms20010044

**Itziar Pinilla Macua, Ph.D.**
*Research Instructor*

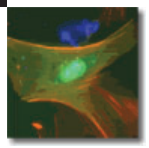
Pinilla-Macua I, Grassart A, DuvvuriU, Watkins Simon C., Sorkin A, EGF receptor signaling, phosphorylation, ubiquitylation and endocytosis in tumors in vivo. Elife 2017; 6. piie31993

**Yi Shi, Ph.D.**
*Assistant Professor*

Kim, S.J.*, Fernandez-Martinez, J.*, Nudelman, I.*, Shi, Y.*, Zhang, W., Raveh, B., Herricks, T., Slaughter, B.D., Hogan, J., Paula, U., Chemmama, I., Pallerin, R., Echeverria, I., Shivaraju, M., Chaudhury, A.S., Wang, J.J., Williams, R., Unruh, J.R., Greenberg, C.H., Jacobs, E.Y., Yu, Z., De la Cruz, M.J., Mironska, R., Strokes, D.L., Aitchison, J.D., Jarrold, M.F., Gerton, J.L., Ludtke, S.J., Akey, C.W., Chait, B.T., Sali, A., and Rout, M.P. Integrative Structure and Functional Anatomy of the Nuclear Pore Complex. (2018). *Nature* 555, 475-482 (* equal contribution)

Teng Y, Yadav T, Duan M, Tan J, Xiang Y, Gao B, Xu J, Liang Z, Liu Y, Nakajima S, Shi Y, Levine AS, Zou L, Lan L (2018) ROS-induced R loops trigger a transcription-coupled but BRCA1/2-independent homologous recombination pathway through CSB. *Nature communications* 9: 4115





Jishage, M., Yu, X., Shi, Y., Ganesan, S.J., Chen, W.Y., Sali, A., Chait, B.T., Asturias, F.J., and Roeder, R.G. (2018). Architecture of Pol II(G) and molecular mechanism of transcription regulation by Gdown1. *Nat Struct Mol Biol* 25, 859-867.

Iacobucci, C., Piotrowski, C., Aebersold, R., Amaral, B.C., Andrews, P., Bernfur, K., Borchers, C., Brodie, N.I., Bruce, J.E., Cao, Y., Shi, Y., et al. (2019). First Community-Wide, Comparative Cross-Linking Mass Spectrometry Study. Analytical Chemistry 91, 6953-6961

**Alexander D. Sorkin, Ph.D.**
*Richard B. Mellon Professor and Chair*

Martínez-Mármol, R., Styrczewska, K., Pérez-Verdaguer, M., Vallejo-Gracia, A., Comes, N., Sorkin, Felipe, A. Ubiquitination mediates Kv1.3 endocytosis as a mechanism for protein kinase C-dependent modulation. *Sci. Reports (Nature)* (2017) *Sci. Reports* 7:42395. doi: 10.1038/srep42395.

Ma, S., Cheng, M. H., Guthrie, D.A., Newman, A. H., Bahar, I., and Sorkin, A. Targeting of dopamine transporter to filopodia requires an outward-facing conformation of the transporter. (2017) *Sci. Reports* 7(1):5399. doi: 10.1038/s41598-017-05637

Pinilla-Macua, I., Grassart, A., Duvvuri, U., Watkins, S. C., and **Sorkin, A.** EGF receptor signaling, phosphorylation, ubiquitylation and endocytosis in tumors in vivo. (2017) *eLife*. 2017;6:e31993. DOI: https://doi.org/10.7554/eLife.31993

Kaya, C., Cheng, M. H., Block, E., Bartol, T., Sejnowski, T., **Sorkin**, A., Faeder, J., and Bahar, I. Heterogeneities in Axonal Structure and Transporter Distribution Lower Dopamine Reuptake Efficiency.(2018) *eNeuro*.

Sorkina, T., Ma, S., Larsen, M. B., Watkins, S. C., and **Sorkin A.** Small molecule induced oligomerization, clustering and clathrin-independent endocytosis of the dopamine transporter (2018) *eLife*. https://doi.org/10.7554/eLife.32293.001

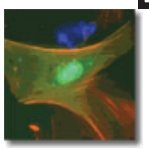
Ma, S. and Sorkin, A. (2018). Striatal Synaptosomes Preparation from Mouse Brain. Bio-protocol Bio101: e2996. DOI: 10.21769/BioProtoc.2996.

Surve, S., Myers, P. J., Clayton, S. A., Watkins, S. A., Lazzara, M. J., **Sorkin, A.** Localization dynamics of endogenous fluorescently-labeled Raf1 in EGF-stimulated cells (2018). *Mol. Biol. Cell.* 26 Dec 2018 https://doi.org/10.1091/mbc.E18-08-0512.

Larsen, M. B., Perez Verdaguer, M., Schmidt, B. F., Bruchez, M. P., Watkins, S. C., and **Sorkin, A.** Generation of endogenous pH-sensitive EGF receptor and its application in high-throughput screening for proteins involved in clathrin-mediated endocytosis. (2019) *eLife* 2019;8:e46135 DOI: 10.7554/eLife.46135

Cheng, M. H., Ponzonia, L., Sorkina, T., Young, J., Zhang, L. S., **Sorkin, A.**, Bahar, I. Trimerization of dopamine transporter triggered by AIM-100 binding: Molecular mechanism





and effect of mutations. *Neuropharmacology*. 2019. In press. https://doi.org/10.1016/j.neuropharm.2019.107676

**Claudette St. Croix, Ph.D.**
*Associate Professor*

Wang Y, Ballou B, Schmidt BF, Andreko S, St Croix CM, Watkins SC, Bruchez MP. Affibody-targeted fluorogen activating protein for in vivo tumor imaging. Chem Commun (Camb). 2017 Feb 7;53(12):2001-2004. doi: 10.1039/c6cc09137g. PubMed PMID:28120951; PubMed Central PMCID: PMC5340305.

Chakraborty K, Raundhal M, Chen BB, Morse C, Tyurina YY, Khare A, Oriss TB, Huff R, Lee JS, St Croix CM, Watkins S, Mallampalli RK, Kagan VE, Ray A, Ray P. The mito-DAMP cardiolipin blocks IL-10 production causing persistent inflammation during bacterial pneumonia. Nat Commun. 2017 Jan 11;8:13944. doi:10.1038/ncomms13944. PubMed PMID: 28074841; PubMed Central PMCID: PMC5241690.

Zhao J, Fuhrmann-Stroissnigg H, Gurkar AU, Flores RR, Dorronsoro A, Stolz DB, St Croix CM, Niedernhofer LJ, Robbins PD. Quantitative Analysis of Cellular Senescence in Culture and In Vivo. Curr Protoc Cytom. 2017 Jan 5;79:9.51.1-9.51.25. doi: 10.1002/cpcy.16. PubMed PMID: 28055114.

Wesolowski J, Weber MM, Nawrotek A, Dooley CA, Calderon M, St Croix CM, Hackstadt T, Cherfils J, Paumet F. Chlamydia Hijacks ARF GTPases To Coordinate Microtubule Posttranslational Modifications and Golgi Complex Positioning. MBio. 2017 May 2;8(3). pii: e02280-16. doi: 10.1128/mBio.02280-16. PubMed PMID:28465429; PubMed Central PMCID: PMC5414008.

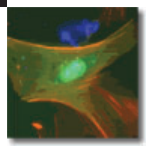
Wang Y, Ballou B, Schmidt BF, Andreko S, St Croix CM, Watkins SC, Bruchez MP. Affibody-targeted fluorogen activating protein for in vivo tumor imaging. Chem Commun (Camb). 2017 Feb 7;53(12):2001-2004. doi: 10.1039/c6cc09137g. PubMed PMID: 28120951; PubMed Central PMCID: PMC5340305.

Kagan VE, Mao G, Qu F, Angeli JP, Doll S, St Croix C, Dar HH, Liu B, Tyurin VA, Ritov VB, Kapralov AA, Amoscato AA, Jiang J, Anthonymuthu T, Mohammadyani D, Yang Q, Proneth B, Klein-Seetharaman J, Watkins S, Bahar I, Greenberger J, Mallampalli RK, Stockwell BR, Tyurina YY, Conrad M, Bayır H. Oxidized arachidonic and adrenic PEs navigate cells to ferroptosis. Nat Chem Biol. 2017 Jan;13(1):81-90. doi: 10.1038/nchembio.2238. Epub 2016 Nov 14. PubMed PMID: 27842066.

Watson AM, Rose AH, Gibson GA, Gardner CL, Sun C, Reed DS, Lam LKM, St Croix, CM, Strick PL, Klimstra WB, Watkins SC. Ribbon scanning confocal for high-speed high-resolution volume imaging of brain. PLoS One. 2017 Jul 7;12(7):e0180486. doi: 10.1371/journal.pone.0180486. eCollection 2017. PubMed PMID: 28686653; PubMed Central PMCID: PMC5501561.







Billaud M, Phillippi JA, Kotlarczyk MP, Hill JC, Ellis BW, St Croix CM, Cantu-Medéllin N, Kelley EE, Gleason TG. Elevated oxidative stress in the aortic media of patients with bicuspid aortic valve. J Thorac Cardiovasc Surg. 2017 May 25. pii: S0022-5223(17)31118-2. doi: 10.1016/j.jtcvs.2017.05.065. [Epub ahead of print] PubMed PMID: 28651938.

Watson AM, Rose AH, Gibson GA, Gardner CL, Sun C, Reed DS, Lam LKM, **St Croix, CM**, Strick PL, Klimstra WB, Watkins SC. Ribbon scanning confocal for high-speed high-resolution volume imaging of brain. PLoS One. 2017 Jul 7;12(7):e0180486. doi: 10.1371/journal.pone.0180486. eCollection 2017. PubMed PMID: 28686653; PubMed Central PMCID: PMC5501561.

Zarakowska E, Czerwinska J, Tupalska A, Yousefzadeh MJ, Gregg SQ, **St Croix CM**, Niedernhofer LJ, Foksinski M, Gackowski D, Szpila A, Starczak M, Tudek B, Olinski R. Oxidation Products of 5-Methyl Cytosine are Decreased in Senescent Cells and Tissues of Progeroid Mice. J Gerontol A Biol Sci Med Sci. 2018 Feb 3. Doi: 10.1093/gerona/gly012. [Epub ahead of print] PubMed PMID: 29415265.

Bueno M, Brands J, Voltz L, Fiedler K, Mays B, **St Croix C**, Sembrat J Mallampalli RK, Rojas M, Mora AL. ATF3 represses PINK1 gene transcription in lung epithelial cells to control mitochondrial homeostasis. Aging Cell. 2018 Jan 24.doi: 10.1111/acel.12720. [Epub ahead of print] PubMed PMID: 29363258.

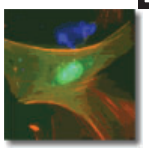
Li L, Poloyac SM, Waltkins SC, **St Croix CM**, Alexander H, Gibson GA, Loughran PA, Kirisci L, Clark RS, Kochanek PM, Vazquez AL, Manole MD. Cerebral microcirculatory alterations and the no-reflow phenomenon in vivo after experimental pediatric cardiac arrest. J Cereb Blood Flow Metab. 2017 Jan 1:271678X17744717. doi: 10.1177/0271678X17744717. [Epub ahead of print] PubMed PMID: 29192562.

Wenzel SE, Tyurina YY, Zhao J, **St Croix CM**, Dar HH, Mao G, Tyurin VA, Anthonymuthu TS, Kapralov AA, Amoscato AA, Mikulska-Ruminska K, Shrivastava IH,Kenny EM, Yang Q, Rosenbaum JC, Sparvero LJ, Emlet DR, Wen X, Minami Y, Qu F,Watkins SC, Holman TR, VanDemark AP, Kellum JA, Bahar I, Bayır H, Kagan VE. PEBP1 Wardens Ferroptosis by Enabling Lipoxygenase Generation of Lipid Death Signals. Cell. 2017 Oct 19;171(3):628-641. e26. doi: 10.1016/j.cell.2017.09.044. PubMedPMID: 29053969; PubMed Central PMCID: PMC5683852.

Begum G, Song S, Wang S, Zhao H, Bhuiyan MIH, Li E, Nepomuceno R, Ye Q, Sun M,Calderon MJ, Stolz DB, **St Croix C**, Watkins SC, Chen Y, He P, Shull GE, Sun D.Selective knockout of astrocytic Na(+) /H(+) exchanger isoform 1 reduces astrogliosis, BBB damage, infarction, and improves neurological function after ischemic stroke. Glia. 2018 Jan;66(1):126-144. doi: 10.1002/glia.23232. Epub 2017 Sep 19. PubMed PMID: 28925083; PubMed Central PMCID: PMC5705024.

Watkins SC, **St Croix CM**. Light sheet imaging comes of age. J Cell Biol. 2018 May 7;217(5):1567-1569. doi: 10.1083/jcb.201804016. Epub 2018 Apr 13. PubMed PMID: 29653995; PubMed Central PMCID: PMC5940317.





Robinson AR, Yousefzadeh MJ, Rozgaja TA, Wang J, Li X, Tilstra JS, Feldman CH,Gregg SQ, Johnson CH, Skoda EM, Frantz MC, Bell-Temin H, Pope-Varsalona H, Gurkar AU, Nasto LA, Robinson RAS, Fuhrmann-Stroissnigg H, Czerwinska J, McGowan SJ,Cantu-Medellin N, Harris JB, Maniar S, Ross MA, Trussoni CE, LaRusso NF,Cifuentes-Pagano E, Pagano PJ, Tudek B, Vo NV, Rigatti LH, Opresko PL, Stolz DB, Watkins SC, Burd CE, **St Croix C**, Siuzdak G, Yates NA, Robbins PD, Wang Y, Wipf P, Kelley EE, Niedernhofer LJ. Spontaneous DNA damage to the nuclear genome promotes senescence, redox imbalance and aging. Redox Biol. 2018 Jul;17:259-273. doi:10.1016/j.redox.2018.04.007. Epub 2018 Apr 13. PubMed PMID: 29747066.

Zarakowska E, Czerwinska J, Tupalska A, Yousefzadeh MJ, Gregg SQ, St Croix CM, Niedernhofer LJ, Foksinski M, Gackowski D, Szpila A, Starczak M, Tudek B, Olinski R. Oxidation Products of 5-Methylcytosine are Decreased in Senescent Cells and Tissues of Progeroid Mice. J Gerontol A Biol Sci Med Sci. 2018 Jul 9;73(8):1003-1009. doi: 10.1093/gerona/gly012. PubMed PMID: 29415265.

Van Laar VS, Arnold B, Howlett EH, Calderon MJ, St Croix CM, Greenamyre JT, Sanders LH, Berman SB. Evidence for Compartmentalized Axonal Mitochondrial Biogenesis: Mitochondrial DNA Replication Increases in Distal Axons As an Early Response to Parkinson's Disease-Relevant Stress. J Neurosci. 2018 Aug 22;38(34):7505-7515. doi: 10.1523/JNEUROSCI.0541-18.2018. Epub 2018 Jul 20. PubMed PMID: 30030401; PubMed Central PMCID: PMC6104298.

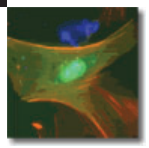
Gurkar AU, Robinson AR, Cui Y, Li X, Allani SK, Webster A, Muravia M, Fallahi M, Weissbach H, Robbins PD, Wang Y, Kelley EE, St Croix CM, Niedernhofer LJ, Gill MS. Dysregulation of DAF-16/FOXO3A-mediated stress responses accelerates oxidative DNA damage induced aging. Redox Biol. 2018 Sep;18:191-199. doi: 10.1016/j.redox.2018.06.005. Epub 2018 Jun 19. PubMed PMID: 30031267; PubMed Central PMCID: PMC6076207.

Dar HH, Tyurina YY, Mikulska-Ruminska K, Shrivastava I, Ting HC, Tyurin VA, Krieger J, St Croix CM, Watkins S, Bayir E, Mao G, Armbruster CR, Kapralov A, Wang H, Parsek MR, Anthonymuthu TS, Ogunsola AF, Flitter BA, Freedman CJ, Gaston JR, Holman TR, Pilewski JM, Greenberger JS, Mallampalli RK, Doi Y, Lee JS, Bahar I, Bomberger JM, Bayır H, Kagan VE.Pseudomonas aeruginosa utilizes host polyunsaturated phosphatidylethanolamines to trigger theft-ferroptosis in bronchial epithelium. J Clin Invest. 2018 Oct 1;128(10):4639-4653. doi: 10.1172/JCI99490. Epub 2018 Sep 10. PubMed PMID: 30198910; PubMed Central PMCID: PMC6159971.

Hartman R, Patil P, Tisherman R, St Croix C, Niedernhofer LJ, Robbins PD, Ambrosio F, Van Houten B, Sowa G, Vo N. Age-dependent changes in intervertebral disc cell mitochondria and bioenergetics. Eur Cell Mater. 2018 Oct 18;36:171-183. doi: 10.22203/eCM.v036a13. PubMed PMID: 30334244.

Sahu A, Mamiya H, Shinde SN, Cheikhi A, Winter LL, Vo NV, Stolz D, Roginskaya V, Tang WY, St Croix C, Sanders LH, Franti M, Van Houten B, Rando TA, Barchowsky A, Ambrosio F. Age-related declines in α-Klotho drive progenitor cell mitochondrial dysfunction and impaired muscle regeneration. Nat Commun. 2018 Nov 19;9(1):4859. doi: 10.1038/s41467-018-07253-3. PubMed PMID: 30451844; PubMed Central PMCID: PMC6242898.





Chandra D, Londino J, Alexander S, Bednash JS, Zhang Y, Friedlander RM, Daskivich G, Carlisle DL, Lariviere WR, Nakassa ACI, Ross M, St Croix C, Nyunoya T, Sciurba F, Chen B, Mallampalli RK. The SCFFBXO3 ubiquitin E3 ligase regulates inflammation in atherosclerosis. J Mol Cell Cardiol. 2019 Jan;126:50-59. doi: 10.1016/j.yjmcc.2018.11.006. Epub 2018 Nov 16. PubMed PMID: 30448480; NIHMSID:NIHMS1011360.

Cheikhi A, Wallace C, St Croix C, Cohen C, Tang WY, Wipf P, Benos PV, Ambrosio F, Barchowsky A. Mitochondria are a substrate of cellular memory. Free Radic Biol Med. 2019 Jan;130:528-541. doi: 10.1016/j.freeradbiomed.2018.11.028. Epub 2018 Nov 22. PubMed PMID: 30472365.

Sehrawat A, Samanta SK, Hahm ER, St Croix C, Watkins S, Singh SV. Withaferin A-mediated apoptosis in breast cancer cells is associated with alterations in mitochondrial dynamics. Mitochondrion. 2019 Jan 24;. doi: 10.1016/j.mito.2019.01.003. [Epub ahead of print] PubMed PMID: 30685490; NIHMSID:NIHMS1520465.

Bain W, Olonisakin T, Yu M, Qu Y, Hulver M, Xiong Z, Li H, Pilewski J, Mallampalli RK, Nouraie M, Ray A, Ray P, Cheng Z, Shanks RMQ, St Croix C, Silverstein RL, Lee JS. Platelets inhibit apoptotic lung epithelial cell death and protect mice against infection-induced lung injury. Blood Adv. 2019 Feb 12;3(3):432-445. doi: 10.1182/bloodadvances.2018026286. PubMed PMID: 30733303; PubMed Central PMCID: PMC6373758.

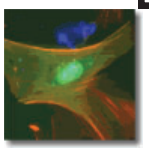
Novelli EM, Little-Ihrig L, Knupp HE, Rogers NM, Yao M, Baust JJ, Meijles D, St Croix CM, Ross MA, Pagano PJ, DeVallance ER, Miles G, Potoka KP, Isenberg JS, Gladwin MT. Vascular TSP1-CD47 Signaling Promotes Sickle Cell-Associated Arterial Vasculopathy and Pulmonary Hypertension in Mice. Am J Physiol Lung Cell Mol Physiol. 2019 Mar 20;. doi: 10.1152/ajplung.00302.2018. [Epub ahead of print] PubMed PMID: 30892078.

Li Y, Cifuentes-Pagano E, DeVallance ER, de Jesus DS, Sahoo S, Meijles DN, Koes D, Camacho CJ, Ross M, St Croix C, Pagano PJ. NADPH oxidase 2 inhibitors CPP11G and CPP11H attenuate endothelial cell inflammation & vessel dysfunction and restore mouse hind-limb flow. Redox Biol. 2019 Apr;22:101143. doi: 10.1016/j.redox.2019.101143. Epub 2019 Feb 15. PubMed PMID: 30897521; PubMed Central PMCID: PMC6435978.

Falabella M, Kolesar JE, Wallace C, de Jesus D, Sun L, Taguchi YV, Wang C, Wang T, Xiang IM, Alder JK, Maheshan R, Horne W, Turek-Herman J, Pagano PJ, St Croix CM, Sondheimer N, Yatsunyk LA, Johnson FB, Kaufman BA. G-quadruplex dynamics contribute to regulation of mitochondrial gene expression. Sci Rep. 2019 Apr 3;9(1):5605. doi: 10.1038/s41598-019-41464-y. PubMed PMID: 30944353; PubMed Central PMCID: PMC6447596.

Li L, Poloyac SM, Watkins SC, St Croix CM, Alexander H, Gibson GA, Loughran PA, Kirisci L, Clark RS, Kochanek PM, Vazquez AL, Manole MD. Cerebral microcirculatory alterations and the no-reflow phenomenon in vivo after experimental pediatric cardiac arrest. J Cereb Blood Flow Metab. 2019 May;39(5):913-925. doi: 10.1177/0271678X17744717. Epub 2017 Dec 1. PubMed PMID: 29192562; PubMed Central PMCID: PMC6501505.





Braganza A, Quesnelle K, Bickta J, Reyes C, Wang Y, Jessup M, St Croix C, Arlotti J, Singh SV, Shiva S. Myoglobin induces mitochondrial fusion, thereby inhibiting breast cancer cell proliferation. J Biol Chem. 2019 May 3;294(18):7269-7282. doi: 10.1074/jbc.RA118.006673. Epub 2019 Mar 14. PubMed PMID: 30872402; PubMed Central PMCID: PMC6509513.

Tyurina YY, St Croix CM, Watkins SC, Watson AM, Epperly MW, Anthonymuthu TS, Kisin ER, Vlasova II, Krysko O, Krysko DV, Kapralov AA, Dar HH, Tyurin VA, Amoscato AA, Popova EN, Bolevich SB, Timashev PS, Kellum JA, Wenzel SE, Mallampalli RK, Greenberger JS, Bayir H, Shvedova AA, Kagan VE. Redox (phospho)lipidomics of signaling in inflammation and programmed cell death. J Leukoc Biol. 2019 May 9;. doi: 10.1002/JLB.3MIR0119-004RR. [Epub ahead of print] Review. PubMed PMID: 31071242.

Patil P, Falabella M, Saeed A, Lee D, Kaufman B, Shiva S, St Croix C, Van Houten B, Niedernhofer LJ, Robbins PD, Lee J, Gwendolyn S, Vo NV. Oxidative stress-induced senescence markedly increases disc cell bioenergetics. Mech Ageing Dev.2019 Jun;180:97-106. doi: 10.1016/j.mad.2019.04.006. Epub 2019 Apr 17. PubMed PMID: 31002926.

Wang Y, Palmfeldt J, Gregersen N, Makhov AM, Conway JF, Wang M, McCalley SP, Basu S, Alharbi H, St Croix C, Calderon MJ, Watkins S, Vockley J. Mitochondrial fatty acid oxidation and the electron transport chain comprise a multifunctional mitochondrial protein complex. J Biol Chem. 2019 Jun 24;. doi: 10.1074/jbc.RA119.008680. [Epub ahead of print] PubMed PMID: 31235473.

**Donna B. Stolz, Ph.D.**
*Associate Professor*

Khan Z, S Yokota, Y Ono, AW Bell, DB Stolz, GK Michalopoulos. Bile duct ligation induces ATZ globule clearance in a mouse model of Alpha-1 Antitrypsin Deficiency. Gene Expr. 2017; 17(2);115-127. PMID: 27543967 PMCID: PMC5296240

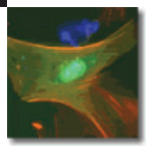
Fu H, Y Tian, L Zhou, D Zhou, RJ Tan, DB Stolz, Y Liu. Tenacin-C is a major component of the fibrogenic niche in kidney fibrosis. J Am Soc Nephrol 2017; 28(3):785-801. PMID: 27612995 PMCID: PMC4977215

Li HS, DB Stolz, G Romero. Characterization of endocytic vesicles using magnetic microbeads coated with signaling ligands. Traffic 17(10):1150 PMID: 27624842

Xiao X, G Jones, WA Sevilla, DB Stolz, KE Magee, M Haughney, A Mukherjee, Y Wang, ME Lowe. A carboxyl ester lipase (CEL) mutant causes chronic pancreatitis by forming intracellular aggregates that activate apoptosis. J Biol Chem. 2017; 292(19):7744 pii: jbc:M116.734384. PMID: 28500240 PMCID PMC5427256

Wang H, Lu J, Edmunds LR, Kulkarni S, Dolezal J, Tao J, Ranganathan S, Jackson L, Fromherz M, Beer-Stolz D, Uppala R, Bharathi S, Monga SP, Goetzman ES, Prochownik EV. Coordinated activities of multiple Myc-dependent and Myc-independent pathways in hepatoblastoma. J Biol Chem 291(51):26241-26251. PMID: 27738108.2016





Uppala R, B Dudiak, ME Beck, SS Bharathi, Y Zhang, DB Stolz, ES Goetzman. Aspirin increases mitochondrial fatty acid oxidation. Biochem Biophys Res Comm. 482(2):346-351. 2017. PMID: 27856258 PMCID: PMC195905

Blair, HC, QC Larrouture, Y Li, H Lin, D Beer Stolz, L Liu, R Tuan, LJ Robinson, PH Schlesinger, DJ Nelson. Tissue Eng Part B Reviews 2017. 23(3):268-280. PMID: 27846781 PMCID: PMC5467150

Clark AM, SE Wheeler, CL Young, L Stockdale, L Shepard Neiman, W Zhao, DB Stolz, R Venkataramanan, D Lauffenburger, L Griffith, A Wells. A liver microphysiological system of tumor cell dormancy and inflammatory responsiveness is affected by scaffold properties. Lab Chip. 17(1): 156-168. 2016 PMID: 27910972

Li G, AT Larregina, RT Domsic, DB Stolz, TA Medsger Jr, R Lafyatiz, P Fuschiotti. Skin-resident effector memory CD8+CD28- T-cells exhibit a pro-fibrotic phenotype in patients with systemic sclerosis. J Invest Derm 2017; 137(5):1042-1050. PMID: 28012718

Soltys KA, Setoyama K, Tafaleng EN, Soto Gutiérrez A, Fong J, Fukumitsu K, Nishikawa T, Nagaya M, Sada R, Haberman K, Gramignoli R, Dorko K, Tahan V, Dreyzin A, Baskin K, Crowley JJ, Quader MA, Deutsch M, Ashokkumar C, Shneider BL, Squires RH, Ranganathan S, Reyes-Mugica M, Dobrowolski SF, Mazariegos G, Elango R, Stolz DB, Strom SC, Vockley G, Roy-Chowdhury J, Cascalho M, Guha C, Sindhi R, Platt JL, Fox IJ. Host conditioning and rejection monitoring in hepatocyte transplantation in humans. J Hepatol 2017; 66(5):987-1000 PMID: 28027971 PMCID: PMC5395353

Zhao J, Fuhrmann-Stroissnigg H, Gurkar AU, Flores RR, Dorronsoro A, Stolz DB, St Croix CM, Niedernhofer LJ, Robbins PD. Quantitative analysis of Cellular Senescence in culture and in vivo. Curr Protoc Cytom 2017 79:9.51.1-9.51.25. PMID: 28055114.

Khan Z, Venkat VL, Soltys KA, Stolz DB, Ragananathan S. A challenging case of severe infantile cholestasis in Alpha-1 Antitrypsin Deficiency. Ped and Dev Path. 2017; 20(2):176-181. PMID: 28326955. PMCID: PMC4977215

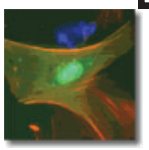
Franks J, Wallace CT, Shibata M, Suga M, Erdman N, Stolz DB, Watkins, SC. Correlative fluorescence and electron microscopy in a 3D-scanning electron microscope perspective. Current Protocols in Cytology. 2017; 80:12.45.1-12.45.15. PMID: 28369763

Schmitt DM, R Barnes, T Rogerson, A Haught, LK Mazzella, M Ford, T Gilson, JW Birch, A Sjostedt,DS Reed, JM Franks, DB Stolz, J Denvir, J Fan, S Rekulapally, DA Primerano, Horzempa, J. The role and mechanism of erythrocyte invasion by Francisella tularensis. Frontiers in Cellular and Infection Microbiology. 2017. 7:173. PMID: 28536678. PMCID: PMC5423315.

Lothet EH, KM Shaw, H Lu, J Zhou, YT Wang, S Gu, DB Stolz, ED Jansen, CC Horn, HJ CHeil, MW Jenkins. Selective inhibition of small-diameter axons using infrared light. Scientific Reports 2017: 7(1):3275. PMID: 28607402/

Efimova N, F Korobova, MC Stankewich, AH Moberly, DB Stolz, A Kashina, M Ma, T Svitkina.





BIII spectrin is necessary for formation of the constricted neck of dendritic spines and regulation of synaptic activity in neurons. J Neuroscience. 2017; 37(27):6442-6459. PMID: 28576936.

Buijs N, JE Oosterink, M Jessup, H Schierbeek, DB Stolz, AP Houdijk, DA Geller, PA van Leeuwen. A new key player in VEGF-dependent angiogenesis in human hepatocellular carcinoma: dimethylarginine dimethylaminohydrolase 1. Angiogenesis 2017 July 24 doi: 10.1017/s10456-017-9567-4. PMID: 28741166.

Ono Y, Perez-Gutierrez A, Nakao T, Dai H, Camirand G, Yoshida O, Yokota S, Stolz DB, Ross MA, Morelli AE, Geller DA, Thomson AW. Graft-infiltrating PD-L1$^{hi}$ cross-dressed dendritic cells regulate antidonor T cell responses in mouse liver transplant tolerance. Hepatology. 2018 67(4):1499-1515. PMID: 28921638 PMCID PMC5856603

Suofu Y, Li W, Jean-Alphonse FG, Jia J, Khattar NK, Li J, Baranov SV, Leronni D, Mihalik AC, He Y, Cecon E, Wehbi VL, Kim J, Heath BE, Baranova OV, Wang X, Gable MJ, Kretz ES, Di Benedetto G, Lezon TR, Ferrando LM, Larkin TM, Sullivan M, Yablonska S, Wang J, Minnigh MB, Guillaumet G, Suzenet F, Richardson RM, Poloyac SM, Stolz DB, Jockers R, Witt-Enderby PA, Carlisle DL, Vilardaga JP, Friedlander RM. Dual role of mitochondria in producing melatonin and driving GPCR signaling to block cytochrome c release. PNAS. 2017; 114(38):E7997-E8006. PMID: 28874589, PMCID: PMC5617277

Yazdani HO, Chen HW, Tohme S, Tai S, van der Windt DJ, Loughran P, Rosborough BR, Sud V, Beer-Stolz D, Turnquist HR, Tsung A, Huang H. IL-33 exacerbates liver sterile inflammation by amplifying neutrophil extracellular trap formation. Journal of Hepatology. 2017; PMID: 28943296

Pradhan-Sundd T, Zhou L, Vats R, Jiang A, Molina L, Singh S, Poddar M, Russell JM, Stolz DB, Oertel M, Apte U, Watkins S, Ranganathan S, Nejak-Bowen KN, Sundd P, Monga SP. Dual catenin loss in murine liver causes tight junctional deregulation and progressive intrahepatic cholestasis. Hepatology. 2018 67(6):2320-2337 PMID: 29023813

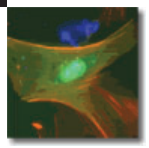
Buijs N, Oosterink JE, Jessup M, Schierbeek H, Stolz DB, Houdijk AP, Geller DA, van Leeuwen PA. A new key player in VEGF-dependent angiogenesis in human hepatocellular carcinoma: dimethylarginine dimethylaminohydrolase 1. Angiogenesis. 2017; 20(4):557-565. PMID: 28741166, PMCID: PMC5660142

Begum G, Song S, Wang S, Zhao H, Bhuiyan MIH, Li E, Nepomuceno R, Ye Q, Sun M, Calderon MJ, Stolz DB, St Croix C, Watkins SC, Chen Y, He P, Shull GE, Sun D. Selective knockout of astrocytic Na+ /H+ exchanger isoform 1 reduces astrogliosis, BBB damage, infarction, and improves neurological function after ischemic stroke. Glia. 2018; 66(1):126-144. NIHMSID: NIHMS921245 PMID: 28925083, PMCID: PMC5705024

Yang MQ, Du Q, Varley PR, Goswami J, Liang Z, Wang R, Li H, Stolz DB, Geller DA. Interferon regulatory factor 1 priming of tumour-derived exosomes enhances the antitumour immune response. British Journal of Cancer. 2018; 118(1):62-71. PMID: 29112686, PMCID: PMC5765230







Beckwitt CH, Clark AM, Wheeler S, Taylor DL, Stolz DB, Griffith L, Wells A. Liver 'organ on a chip'. Experimental Cell Research. 2018; 363(1):15-25. PMID: 29291400

Boyd-Shiwarski CR, Shiwarski DJ, Roy A, Namboodiri HN, Nkashama LJ, Xie J, McClain KL, Marciszyn A, Kleyman TR, Tan RJ, Stolz DB, Puthenveedu MA, Huang CL, Subramanya AR. Potassium-regulated distal tubule WNK bodies are kidney-specific WNK1 dependent. Molecular Biology of the Cell. 2018; 29(4):499-509.PMID: 29237822

Yang MQ, Du Q, Goswami J, Varley PR, Chen B, Wang RH, Morelli AE, Stolz DB, Billiar TR, Li J, Geller DA. Interferon regulatory factor 1-Rab27a regulated extracellular vesicles promote liver ischemia/reperfusion injury. Hepatology. 2018; 67(3):1056-1070. NIHMSID: NIHMS915188 PMID: 29059701, PMCID: PMC5826835

Clark AM, MP Kumar, SE Wheeler, CL Young, R Venkataramanan, DB Stolz, LG Griffith, DA Lauffenburger, A Wells. A Model of Dormant-Emergent Metastatic Breast Cancer Progression Enabling Exploration of Biomarker Signatures. Molecular and Cellular Proteomics: MCP, 2018 17(4):619-630. PMID: 29353230, PMCID: PMC5880110

Chen D, J Tong, L Yang, L Wei, DB Stolz, J Yu, J Zhang, L Zhang. PUMA amplifies necroptosis signaling by activating cytosolic DNA sensors. PNAS 2018 115(15):3930-3935. PMID: 29581256 PMCID: PMC5899441

Waltz PK, B Kautza, J Luciano, M Dyer, DB Stolz, P Loughran, MD Neal, JL Sperry, MR Rosengart, BS Zuckerbraun. Heme Oxygenase-2 localizes to mitochondria and regulates hypoxic responses in hepatocytes. Oxidative Medicine and Cellular Longevity. 2018. 2018:2021645. PMID: 29849867 PMCID: PMC5925001

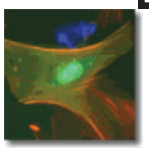
Xing B, LE Brink, K Maers, ML Sullivan, RJ Bodnar, DB Stolz, F Cambi. Conditional depletion of GSK3b protects oligodendrocytes from apoptosis and lessens demyelination in the acute cuprizone model. Glia 2018 in press. PMID: 29761559

Mukherjee A, T Hidvegi, P Araya, M Ewing, DB Stolz, DH Perlmutter. NF-kB Mitigates the pathological effects of misfolded a1-antittrypsin by activating autophagy and an integrated program of proteostasis mechanisms. Cell Death and Differentiation. 2018 in press. PMID: 29795336

Guo C, J Zou, Y Wen, W Fang, DB Stolz, M Sun, X Wei. Apical cell-cell adhesions reconcile symmetry in zebrafish neurulation. iScience 2018; 3:63-85. NIHMSID: NIHMS972543 PMID: 29901027 PMCID: PMC5994761

Robinson AR, Yousefzadeh MJ, Rozgaja TA, Wang J, Li X, Tilstra JS, Feldman CH, Gregg SQ, Johnson CH, Skoda EM, Frantz MC, Bell-Temin H, Pope-Varsalona H, Gurkar AU, Nasto LA, Robinson RAS, Fuhrmann-Stroissnigg H, Czerwinska J, McGowan SJ, Cantu-Medellin N, Harris JB, Maniar S, Ross MA, Trussoni CE, LaRusso NF, Cifuentes-Pagano E, Pagano PJ, Tudek B, Vo NV, Rigatti LH, Opresko PL, Stolz DB, Watkins SC, Burd CE, Croix CMS, Siuzdak G, Yates NA, Robbins PD, Wang Y, Wipf P, Kelley EE, Niedernhofer LJ. Spontaneous DNA dammaghe to the nuclear genome promotes senescence, redox imbalance and aging. Redox Biology. 2018;





17:259-273. PMID: 29747066 PMCID: PMC6006678

Liu A, Li S, Donnenberg V, Gollin SM, Ma H, Lu C, **Stolz DB**, Mapara MY, Monaghan SA, Lentzsch S. Immunomodulatory drugs downregulate IKZF1 leading to expansion of hematopoietic progenitors with concomitant block of megakaryocytic maturation. Haematologica. 2018 In press pii: haematol.2018.188227. doi: 10.3324/haematol.2018.188227. PMID: 29954930

Patel A, Xue Y, Hartley R, Sant V, Eles JR, Cui XT, **Stolz DB**, Sant S. Hierarchically aligned fibrous hydrogel films through microfluidic self-assembly of graphene and polysaccharides. Biotechnol Bioeng. 2018 in press 2018 Jul 16. doi: 10.1002/bit.26801. PMID: 30011077

Garbacz WG, Uppal H, Yan J, Xu M, Ren S, **Stolz DB,** Huang M, Xie W. Chronic activation of liver X receptor sensitizes mice to high cholesterol diet induced gut toxicity. Mol Pharmacol, 2018 94(4):1145-1154. doi: 10.1124/mol.118.112672

Sannino, S, Guerriero CJ, Sabnis AJ, **Stolz DB**, Wallace CT, Wipf P, Watkins SC, Bivona TG, Brodsky JL. Compensatory increases of select proteastasis networks after Hsp70 inhibition in cancer cells. J Cell Sci. 2018 Sep 5;131(17). pii: jcs217760. doi: 10.1242/jcs.217760. PMID:30131440

Saydmohammed M, Yagi, H, Calderon M, Clark MJ, Feinstein T, Sun M, **Stolz DB**, Watkins SC, Amack JD, Lo CW Tsang M. Vertebrate myosin 1d regulates left-right organizer morphogenesis and laterality. Nat Commun. 2018 Aug 23;9(1):3381. doi: 10.1038/s41467-018-05866-2. PMID: 30139971

Blair HC, Larrouture QC, Tourtova IL, Liu L, Bian JH, **Stolz DB**, Nelson DJ, Schlesinger PH. Support of bone mineral deposition by regulation of pH. Am J Physiol. Cell Physiol. 2018; 315(4):C587-C597. PMID: 30044661

Chakraborty S, Jiang C, Gau D, Oddo M, Ding Z, Vollmer L, Joy M, Schiemann W, **Stolz DB**, Vogt A, Ghosh S, Roy P. Profilin-1 deficiency leads to SMAD3 upregulation and impared 3D outgrowth of breast cancer cells. Br J Cancer 2018 119(9):1106-1117. PMID: 30318519

Rush BM, Small SA, **Stolz DB**, Tan RJ. An efficient sieving method to isolate intact glomeruli from adult rat kidney. JoVE 2018 (141). Doi: 10.3791/58162

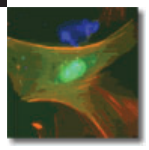
Yun H, Wang Y, Zhou Y, Wang K, Sun M, **Stolz DB**, Xia X, Ethier CR, Du Y. Human stem cells home to and repair laser-damaged trabecular meshwork in a mouse model. Commun Biol 2018 1:216 eCollection 2018. PMID: 30534608.

Li Y, Merkel CD, Zeng X, Heier JA, Cantrell PS, Sun M, **Stolz DB**, Watkins SC, Yates NA, Kwiatkowski AV. The N-cadherin interactome in primary cardiomyocytes as defined using quantitative proximity proteomics. J Cell Sci 2019 132(3). PMID 30630894

Nmezi B, Xu J, Fu R, Armiger TJ, Rodriguez-Bey G, Powell JS, Ma H, Sullivan M, Tu Y, Chen NY,Young SG, **Stolz DB**, Dahl KN, Liu Y, Padiath QS. Concentric organization of A- and B-type lamins predicts their distinct roles in the spatial organization and stability of the nuclear lamina.







PNAS 2019 In press PMID: 30765529

Mukherjee A, Hidvegi T, Araya P, Ewing M, **Stolz DB**, Perlmutter DH. NFkB mitigates pathological effects of misfolded a1-antitrypsin by activating autophagy and an integrated program of proteostasis mechanisms. Cell Death Differ 2019; 26(3):455-469. PMID: 29795336 PMCID: PMC6370812

Watson AR, Dai H, Zheng Y, Nakano R, Giannou AD, Menk AV, Stolz DB, Delgoffe GM, Thomson AW. mTORC2 Deficiency Alters the Metabolic Profile of Conventional Dendritic Cells. Front Immunol. 2019;10:1451. doi: 10.3389/fimmu.2019.01451. eCollection 2019. PubMed PMID: 31338091; PubMed Central PMCID: PMC6626913.

Shojaati G, Khandaker I, Funderburgh ML, Mann MM, Basu R, **Stolz DB**, Geary ML, Dos Santos A, Deng SX, Funderburgh JL.Mesenchymal Stem Cells Reduce Corneal Fibrosis and Inflammation Via Extracellular Vesicle-Mediated Delivery of miRNA.Stem Cells Transl Med. 2019 Jul 10;. doi: 10.1002/sctm.18-0297. [Epub ahead of print] PubMed PMID: 31290598.

Espiritu EB, Jiang H, Moreau-Marquis S, Sullivan M, Yan K, **Beer Stolz D**, Sampson MG, Hukriede NA, Swiatecka-Urban A. The human nephrin $Y^{1139}$RSL motif is essential for podocyte foot process organization and slit diaphragm formation during glomerular development. J Biol Chem. 2019 Jul 12;294(28):10773-10788. doi: 10.1074/jbc.RA119.008235. Epub 2019 May 31. PubMed PMID: 31152064; PubMed Central PMCID: PMC6635437.

Li F, Pascal LE, **Stolz DB,** Wang K, Zhou Y, Chen W, Xu Y, Chen Y, Dhir R, Parwani AV, Nelson JB, DeFranco DB, Yoshimura N, Balasubramani GK, Gingrich JR, Maranchie JK, Jacobs BL, Davies BJ, Hrebinko RL, Bigley JD, McBride D, Guo P, He D, Wang Z. E-cadherin is downregulated in benign prostatic hyperplasia and required for tight junction formation and permeability barrier in the prostatic epithelial cell monolayer. Prostate. 2019 Aug;79(11):1226-1237. doi: 10.1002/pros.23806. Epub 2019 Jun 18. PubMed PMID: 31212363; PubMed Central PMCID: PMC6599563.

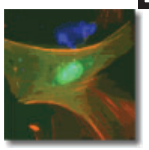
Liu C, Chikina M. Deshpande R, Menk AV, Wang T, Tabib T, Brunazzi EA, Viganli KM, Sun M, **Stolz DB**, Lafyatis RA, Chen W, Delgoffe GM, Workman CJ, Wendell SG, Vinali DAA. Treg cells promote SREBP1-dependent metabolic fitness of tumor-promoting macrophages repression of $CD8^+$ T cell derived interferon-λ. Immunity. 2019 Jul 13. pii: S1074-7613(19)30287-0. doi: 10.1016/j.immuni.2019.06.017. [Epub ahead of print] PMID: 31350177

**Sachin Surve, Ph.D.**
*Research Instructor*

**Sachin V. Surve**, Bryan C. Jensen, Meredith Heestand, Muriel Mazet, Terry K. Smith, Frédéric Bringaud, Marilyn Parsons, Achim Schnaufer. NADH dehydrogenase of Trypanosoma brucei is important for efficient acetate production in bloodstream forms. Molecular and Biochemical Parasitology, Jan 2017(211):57–61

Surve SV, Myers PJ, Clayton SA, Watkins SC, Lazzara MJ, Sorkin A Localization dynamics





of endogenous fluorescently labeled RAF1 in EGF-stimulated cells.. *Mol Biol Cell.* 2019 Feb 15;30(4):506-523

**Jay Tan, Ph.D.**
*Research Assistant Professor*

Gui X, Yang H, Li T, Tan X, Shi P, Du F, Chen ZJ. Autophagy Induction through STING Vesicle Trafficking Is a Primordial Function of the cGAS Pathway. Nature. 2019;567(7747):262-266.

Tan X, Sun L, Chen J, Chen ZJ. Detection of microbial infections through innate immune sensing of nucleic acids. Annual Review of Microbiology. 2018. 72:447-78. Review.

**Linton M. Traub, Ph.D.**
*Professor*

Muenzner, J., L.M. Traub, B.T. Kelly, and S.C. Graham. Cellular and viral peptides bind multiple sites on the N-terminal domain of clathrin. *Traffic*: ***18*:** 44–57, 2017.

Traub LM. A nanobody-based molecular toolkit provides new mechanistic insight into clathrin-coat initiation. Elife. 2019 Apr 30;8. Pii: e41768. doi: 10.7554/eLife.41768.

**Steven Truschel, Ph.D.**
*Assistant Professor*

Truschel, ST, Clayton, DR, Beckel, JM, Yabes, JG, Yao, Y, Wolf-Johnston, A, Birder, L, Apodaca, GA. Age-related endolysosomes dysfunction in the rat urothelium. PLoS One. 2018 Jun 8;13(6):e0198817. PMID 29883476.

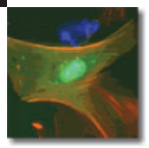
Kullman, AF, Truschel ST, Wolf-Johnston AS, McHonnell BM, Lynn AM, Kanai AJ, Kessler TM, Apodaca G, Birder LA. Acute spinal cord injury is associated with mitochondrial dysfunction in mouse urothelium. Neurourol Urodyn. 2019 Aug; 38(6) Epub 2019 May 18. PMID 31102563.

Lui, C, Tate, T, Batourina, E, Truschel, ST, Potter, S, Adam, M, Xiang, TW, Picard, M, Reiley, M, Schneider, K, Tamargo, M, Lu, C Chen, X, He, J, Kim, H, Mendelsohn, C. Pparg promotes differentiation and regulates mitochondrial gene expression in bladder epithelial cells. Manuscript accepted for publication. Nat. Commun. 2019.

**Simon C. Watkins, Ph.D.**
*Distinguished Professor and Vice Chairman, Director of Center for Biologic Imaging*

Wang Y, Ballou B, Schmidt BF, Andreko S, St Croix CM, Watkins SC, Bruchez MP. Affibody-targeted fluorogen activating protein for in vivo tumor imaging. Chem Commun (Camb). 2017 Jan 25. doi: 10.1039/c6cc09137g. [Epub ahead of print] PubMed PMID: 28120951





Yilmaz E, Watkins SC, Gold MS. Paclitaxel-induced increase in mitochondrial volume mediates dysregulation of intracellular Ca(2+) in putative nociceptive glabrous skin neurons from the rat. Cell Calcium. 2017 Jan 16. pii: S0143-4160(16)30135-X. doi: 10.1016/j.ceca.2017.01.005. [Epub ahead of print] PubMed PMID: 28109678.

Chakraborty K, Raundhal M, Chen BB, Morse C, Tyurina YY, Khare A, Oriss TB, Huff R, Lee JS, St Croix CM, Watkins S, Mallampalli RK, Kagan VE, Ray A, Ray P.The mito-DAMP cardiolipin blocks IL-10 production causing persistent inflammation during bacterial pneumonia. Nat Commun. 2017 Jan 11;8:13944. doi:10.1038/ncomms13944. PubMed PMID: 28074841; PubMed Central PMCID: PMC5241690.

Csányi G, Feck DM, Ghoshal P, Singla B, Lin H, Nagarajan S, Meijles DN, Al Ghouleh I, Cantu-Medellin N, Kelley EE, Mateuszuk L, Isenberg JS, Watkins S, Pagano PJ. CD47 and Nox1 Mediate Dynamic Fluid-Phase Macropinocytosis of Native LDL. Antioxid Redox Signal. 2017 Jan 31. doi: 10.1089/ars.2016.6834. [Epub ahead of print] PubMed PMID: 27958762.

Montecalvo A, Watkins SC, Orange J, Kane LP. Inducible turnover of optineurin regulates T cell activation. Mol Immunol. 2017 Feb 10;85:9-17. doi:10.1016/j.molimm.2017.01.027. [Epub ahead of print] PubMed PMID: 28192730.

Franks J, Wallace CT, Shibata M, Suga M, Erdman N, Stolz DB, Watkins SC. Correlative Fluorescence and Electron Microscopy in 3D-Scanning Electron Microscope Perspective. Curr Protoc Cytom. 2017 Apr 3;80:12.45.1-12.45.15. doi: 10.1002/cpcy.18. PubMed PMID: 28369763.

Yilmaz E, Watkins SC, Gold MS. Paclitaxel-induced increase in mitochondrial volume mediates dysregulation of intracellular Ca(2+) in putative nociceptive glabrous skin neurons from the rat. Cell Calcium. 2017 Mar;62:16-28. doi: 10.1016/j.ceca.2017.01.005. Epub 2017 Jan 16. PubMed PMID: 28109678; PubMed Central PMCID: PMC5365154.

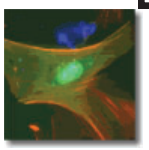
Wang Y, Ballou B, Schmidt BF, Andreko S, St Croix CM, Watkins SC, Bruchez MP. Affibody-targeted fluorogen activating protein for in vivo tumor imaging. Chem Commun (Camb). 2017 Feb 7;53(12):2001-2004. doi: 10.1039/c6cc09137g. PubMed PMID 28120951; PubMed Central PMCID: PMC5340305.

Muthuswamy R, Okada NJ, Jenkins FJ, McGuire K, McAuliffe PF, Zeh HJ, Bartlett DL, Wallace C, Watkins S, Henning JD, Bovbjerg DH, Kalinski P. Epinephrine promotes COX-2-dependent mmune suppression in myeloid cells and cancer tissues. Brain Behav Immun. 2017 May;62:78-86. Doi 10.1016/j.bbi.2017.02.008. Epub 2017 Feb 16. PubMed PMID: 28212885.

Watson AM, Rose AH, Gibson GA, Gardner CL, Sun C, Reed DS, Lam LKM, St Croix CM, Strick PL, Klimstra WB, Watkins SC. Ribbon scanning confocal for high-speed high-resolution volume imaging of brain. PLoS One. 2017 Jul 7;12(7):e0180486.doi: 10.1371/journal.pone.0180486. eCollection 2017. PubMed PMID: 28686653.

Weinstein AM, Chen L, Brzana EA, Patil PR, Taylor JL, Fabian KL, Wallace CT, Jones SD,





Watkins SC, Lu B, Stroncek DF, Denning TL, Fu YX, Cohen PA, Storkus WJ. Tbet and IL-36γ cooperate in therapeutic DC-mediated promotion of ectopic lymphoid organogenesis in the tumor microenvironment. Oncoimmunology. 2017 Apr 28;6(6):e1322238. doi: 10.1080/2162402X.2017.1322238. eCollection 2017. PubMedbvPMID: 28680760; PubMed Central PMCID: PMC5486180.

Kinner-Bibeau LB, Sedlacek AL, Messmer MN, Watkins SC, Binder RJ. HSPs drive dichotomous T-cell immune responses via DNA methylome remodelling in antigen presenting cells. Nat Commun. 2017 May 31;8:15648. doi: 10.1038/ncomms15648. PubMed PMID: 28561043; PubMed Central PMCID: PMC5460028.

Vujanovic L, Stahl EC, Pardee AD, Geller DA, Tsung A, Watkins SC, Gibson GA, Storkus WJ, Butterfield LH. Tumor-Derived α-Fetoprotein Directly Drives Human Natural Killer-Cell Activation and Subsequent Cell Death. Cancer Immunol Res. 2017 Jun;5(6):493-502. doi: 10.1158/2326-6066.CIR-16-0216. Epub 2017 May 3. PubMed PMID: 28468916.

Franks J, Wallace CT, Shibata M, Suga M, Erdman N, Stolz DB, Watkins SC. Correlative Fluorescence and Electron Microscopy in 3D-Scanning Electron Microscope Perspective. Curr Protoc Cytom. 2017 Apr 3;80:12.45.1-12.45.15. doi: 10.1002/cpcy.18. PubMed PMID: 28369763.

Begum G, Song S, Wang S, Zhao H, Bhuiyan MIH, Li E, Nepomuceno R, Ye Q, Sun M,Calderon MJ, Stolz DB, St Croix C, **Watkins SC**, Chen Y, He P, Shull GE, Sun D.Selective knockout of astrocytic Na(+) /H(+) exchanger isoform 1 reducesastrogliosis, BBB damage, infarction, and improves neurological function afterischemic stroke. Glia. 2017 Sep 19. doi: 10.1002/glia.23232. [Epub ahead ofprint] PubMed PMID: 28925083.

Muller L, Simms P, Hong CS, Nishimura MI, Jackson EK, **Watkins SC**, WhitesidenTL. Human tumor-derived exosomes (TEX) regulate Treg functions via cell surfacen signaling rather than uptake mechanisms. Oncoimmunology. 2017 Jul 19;6(8):e1261243. Doi 10.1080/2162402X.2016.1261243. eCollection 2017. PubMed PMID: 28919985; PubMed Central PMCID: PMC5593709.

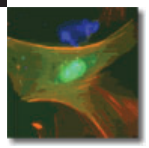
Fantus D, Dai H, Ono Y, Watson A, Yokota S, Mohib K, Yoshida O, Ross MA, **Watkins SC,** Ramaswami B, Valusjkikh A, Rothstein DM, Thomson AW. Influence of the Novel ATP-Competitive Dual mTORC1/2 Inhibitor AZD2014 on Immune Cell Populations and Heart Allograft Rejection. Transplantation. 2017 Sep 6. doi:10.1097/TP.0000000000001933. [Epub ahead of print] PubMed PMID: 28885497.

Helfield BL, Chen X, Qin B, **Watkins SC**, Villanueva FS. Mechanistic Insight into Sonoporation with Ultrasound-Stimulated Polymer Microbubbles. Ultrasound MedBiol. 2017 Nov;43(11):2678-2689. doi: 10.1016/j.ultrasmedbio.2017.07.017. Epubn2017 Aug 25. PubMed PMID: 28847500

Liu X, Yagi H, Saeed S, Bais AS, Gabriel GC, Chen Z, Peterson KA, Li Y, Schwartz MC, Reynolds WT, Saydmohammed M, Gibbs B, Wu Y, Devine W, Chatterjee B, Klena NT, Kostka D, de Mesy Bentley KL, Ganapathiraju MK, Dexheimer P, Leatherbury L, Khalifa O, Bhagat A,







Zahid M, Pu W, **Watkins S**, Grossfeld P, Murray SA, Porter GA Jr, Tsang M, Martin LJ, Benson DW, Aronow BJ, Lo CW. The complex genetics of hypoplastic left heart syndrome. Nat Genet. 2017 Jul;49(7):1152-1159.doi: 10.1038/ng.3870. Epub 2017 May 22. PubMed PMID: 28530678

Wenzel SE, Tyurina YY, Zhao J, St Croix CM, Dar HH, Mao G, Tyurin VA, Anthonymuthu TS, Kapralov AA, Amoscato AA, Mikulska-Ruminska K, Shrivastava IH,Kenny EM, Yang Q, Rosenbaum JC, Sparvero LJ, Emlet DR, Wen X, Minami Y, Qu F,**Watkins SC**, Holman TR, VanDemark AP, Kellum JA, Bahar I, Bayır H, Kagan VE. PEBP1 Wardens Ferroptosis by Enabling Lipoxygenase Generation of Lipid Death Signals. Cell. 2017 Oct 19;171(3):628-641. e26. doi: 10.1016/j.cell.2017.09.044. PubMedPMID: 29053969.

Cheng F, Birder LA, Kullmann FA, Hornsby J, Watton PN, **Watkins S**, Thompson M, Robertson AM. Layer-dependent role of collagen recruitment during loading of the rat bladder wall. Biomech Model Mechanobiol. 2017 Oct 16. doi:10.1007/s10237-017-0968-5. [Epub ahead of print] PubMed PMID: 29039043.

Rudich P, Snoznik C, **Watkins SC**, Monaghan J, Bhan Pandey U, Lamitina T. Nuclear localized C9orf72 associated arginine containing dipeptides exhibit age-dependent toxicity in C. elegans. Hum Mol Genet. 2017 Sep 27. doi:10.1093/hmg/ddx372. [Epub ahead of print] PubMed PMID: 29036691.

Lorenz-Guertin JM, Wilcox MR, Zhang M, Larsen MB, Pilli J, Schmidt BF, Bruchez MP, Johnson JW, Waggoner AS, **Watkins SC**, Jacob TC. A versatile optical tool for studying synaptic GABA(A) receptor trafficking. J Cell Sci. 2017 Oct 12. pii:jcs.205286. doi: 10.1242/jcs.205286. [Epub ahead of print] PubMed PMID: 29025969.

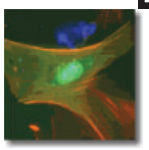
Pradhan-Sundd T, Zhou L, Vats R, Jiang A, Molina L, Singh S, Poddar M, Russell JM, Stolz DB, Oertel M, Apte U, **Watkins S**, Ranganathan S, Nejak-Bowen KN, Sundd P, Pal Monga S. Dual catenin loss in murine liver causes tight junctional deregulation and progressive intrahepatic cholestasis. Hepatology. 2017 Oct 10. doi: 10.1002/hep.29585. [Epub ahead of print] PubMed PMID: 29023813.

Begum G, Song S, Wang S, Zhao H, Bhuiyan MIH, Li E, Nepomuceno R, Ye Q, Sun M, Calderon MJ, Stolz DB, St Croix C, **Watkins SC**, Chen Y, He P, Shull GE, Sun D Selective knockout of astrocytic Na(+) /H(+) exchanger isoform 1 reduces astrogliosis, BBB damage, infarction, and improves neurological function after ischemic stroke. Glia. 2017 Sep 19. doi: 10.1002/glia.23232. [Epub ahead of print] PubMed PMID: 28925083.

Tyurina YY, Shrivastava I, Tyurin VA, Mao G, Dar HH, **Watkins S**, Epperly M, Bahar I, Shvedova AA, Pitt B, Wenzel SE, Mallampalli RK, Sadovsky Y, Gabrilovich D, Greenberger JS, Bayır H, Kagan VE. "Only a Life Lived for Others Is Worth Living": Redox Signaling by Oxygenated Phospholipids in Cell Fate Decisions. Antioxid Redox Signal. 2017 Oct 16. doi: 10.1089/ars.2017.7124. [Epub ahead of print] PubMed PMID: 28835115.

Akiyama H, Ramirez NP, Gibson G, Kline C, **Watkins S,** Ambrose Z, Gummuluru S. Interferon-Inducible CD169/Siglec1 Attenuates Anti-HIV-1 Effects of Alpha Interferon. J Virol. 2017 Oct 13;91(21). pii: e00972-17. doi:10.1128/JVI.00972-17. Print 2017 Nov 1. PubMed PMID: 28794041; PubMed Central PMCID: PMC5640826.





Li P, Wang L, Zhou Y, Gan Y, Zhu W, Xia Y, Jiang X, **Watkins S**, Vazquez A, Thomson AW, Chen J, Yu W, Hu X. C-C Chemokine Receptor Type 5 (CCR5)-Mediated Docking of Transferred Tregs Protects Against Early Blood-Brain Barrier Disruption After Stroke. J Am Heart Assoc. 2017 Aug 2;6(8). pii: e006387. doi: 10.1161/JAHA.117.006387. PubMed PMID: 28768648; PubMed Central PMCID: PMC5586468.

Geskin LJ, Akilov OE, Kwon S, Schowalter M, Watkins S, Whiteside TL, Butterfield LH, Falo LD Jr. Therapeutic reduction of cell-mediated immunosuppression in mycosis fungoides and Sézary syndrome. Cancer Immunol Immunother. 2017 Dec 4. doi: 10.1007/s00262-017-2090-z. [Epub ahead of print] PubMed PMID: 29204699.

Pinilla-Macua I, Grassart A, Duvvuri U, Watkins SC, Sorkin A. EGF receptor signaling, phosphorylation, ubiquitylation and endocytosis in tumors in vivo. Elife. 2017 Dec 21;6. pii: e31993. doi: 10.7554/eLife.31993. PubMed PMID: 29268862.

Cascio S, Medsger TA Jr, Hawse WF, Watkins SC, Milcarek C, Moreland LW, Lafyatis RA, Fuschiotti P. 14-3-3z sequesters cytosolic T-bet, upregulating IL-13 levels in T(C)2 and CD8(+) lymphocytes from patients with scleroderma. J Allergy Clin Immunol. 2017 Nov 15. pii: S0091-6749(17)31760-8. doi:10.1016/j.jaci.2017.10.029. [Epub ahead of print] PubMed PMID: 29155097.

Liu L, Kong M, Gassman NR, Freudenthal BD, Prasad R, Zhen S, Watkins SC, Wilson SH, Van Houten B. PARP1 changes from three-dimensional DNA damage searching to one-dimensional diffusion after auto-PARylation or in the presence of APE1. Nucleic Acids Res. 2017 Dec 15;45(22):12834-12847. doi: 10.1093/nar/gkx1047. PubMed PMID: 29121337; PubMed Central PMCID: PMC5728402.

Duangkhae P, Erdos G, Ryman KD, Watkins SC, Falo LD Jr, Marques ETA Jr, Barratt-Boyes SM. Interplay between Keratinocytes and Myeloid Cells Drives Dengue Virus Spread in Human Skin. J Invest Dermatol. 2017 Oct 26. pii: S0022-202X(17)33090-7. doi: 10.1016/j.jid.2017.10.018. [Epub ahead of print] PubMed PMID: 29106931

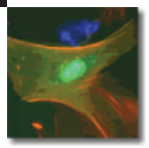
Washington MA, Balmert SC, Fedorchak MV, Little SR, Watkins SC, Meyer TY. Monomer sequence in PLGA microparticles: Effects on acidic microclimates and in vivo inflammatory response. Acta Biomater. 2018 Jan;65:259-271. doi: 10.1016/j.actbio.2017.10.043. Epub 2017 Oct 31. PubMed PMID: 29101019.

Waxman S, Loewen RT, Dang Y, Watkins SC, Watson AM, Loewen NA.High-Resolution, Three-Dimensional Reconstruction of the Outflow Tract Demonstrates Segmental Differences in Cleared Eyes. Invest Ophthalmol Vis Sci. 2018 May 1;59(6):2371-2380. doi: 10.1167/iovs.17-23075. PubMed PMID: 29847643; PubMed Central PMCID: PMC5939687

Robinson AR, Yousefzadeh MJ, Rozgaja TA, Wang J, Li X, Tilstra JS, Feldman CH, Gregg SQ, Johnson CH, Skoda EM, Frantz MC, Bell-Temin H, Pope-Varsalona H, Gurkar AU, Nasto LA, Robinson RAS, Fuhrmann-Stroissnigg H, Czerwinska J, McGowan SJ, Cantu-Medellin N, Harris JB, Maniar S, Ross MA, Trussoni CE, LaRusso NF, Cifuentes-Pagano E, Pagano PJ, Tudek B, Vo







NV, Rigatti LH, Opresko PL, Stolz DB, Watkins SC, Burd CE, Croix CMS, Siuzdak G, Yates NA, Robbins PD, Wang Y, Wipf P, Kelley EE, Niedernhofer LJ. Spontaneous DNA damage to the nuclear genome promotes senescence, redox imbalance and aging. Redox Biol. 2018 Apr 13;17:259-273. doi: 10.1016/j.redox.2018.04.007. [Epub ahead of print] PubMed PMID: 29747066.

Choy CH, Saffi G, Gray MA, Wallace C, Dayam RM, Ou ZA, Lenk G, Puertollano R, Watkins SC, Botelho RJ. Lysosome enlargement during inhibition of the lipid kinase PIKfyve proceeds through lysosome coalescence. J Cell Sci. 2018 May 21;131(10). pii: jcs213587. doi: 10.1242/jcs.213587. PubMed PMID: 29661845.

Watkins SC, St Croix CM. Light sheet imaging comes of age. J Cell Biol. 2018 May 7;217(5):1567-1569. doi: 10.1083/jcb.201804016. Epub 2018 Apr 13. PubMed PMID: 29653995; PubMed Central PMCID: PMC5940317.

Ning J, Zhong Z, Fischer DK, Harris G, Watkins SC, Ambrose Z, Zhang P. Truncated CPSF6 forms higher order complexes that bind and disrupt HIV-1 capsid. J Virol. 2018 Apr 11. pii: JVI.00368-18. doi: 10.1128/JVI.00368-18. [Epub ahead of print] PubMed PMID: 29643241.

Sorkina T, Ma S, Larsen MB, Watkins SC, Sorkin A. Small molecule induced oligomerization, clustering and clathrin-independent endocytosis of the dopamine transporter. Elife. 2018 Apr 9;7. pii: e32293. doi: 10.7554/eLife.32293. PubMed PMID: 29630493; PubMed Central PMCID: PMC5896956.

Wen X, Cui L, Morrisroe S, Maberry D, Emlet DR, Watkins SC, Hukriede NA, Kellum JA. A zebrafish model of infection-associated acute kidney injury. Am J Physiol Renal Physiol. 2018 Mar 14. doi: 10.1152/ajprenal.00328.2017. [Epub ahead of print] PubMed PMID: 29537312.

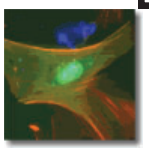
Menk AV, Scharping NE, Rivadeneira DB, Calderon MJ, Watson MJ, Dunstane D, Watkins SC, Delgoffe GM. 4-1BB costimulation induces T cell mitochondrial function and biogenesis enabling cancer immunotherapeutic responses. J Exp Med. 2018 Apr 2;215(4):1091-1100. doi: 10.1084/jem.20171068. Epub 2018 Mar 6. PubMed PMID: 29511066; PubMed Central PMCID: PMC5881463.

Perkins LA, Yan Q, Schmidt BF, Kolodieznyi D, Saurabh S, Larsen MB, Watkins SC, Kremer L, Bruchez MP. Genetically Targeted Ratiometric and Activated pH Indicator Complexes (TRApHIC) for Receptor Trafficking. Biochemistry. 2018 Feb 6;57(5):861-871. doi: 10.1021/acs.biochem.7b01135. Epub 2018 Jan 16. PubMed PMID: 29283245.

Zhang J, Tian XJ, Chen YJ, Wang W, Watkins S, Xing J. Pathway crosstalkenables cells to interpret TGF-β duration. NPJ Syst Biol Appl. 2018 May 28;4:18. doi: 10.1038/s41540-018-0060-5. eCollection 2018. PubMed PMID: 29872541; PubMed Central PMCID: PMC5972147.

Saydmohammed M, Yagi H, Calderon M, Clark MJ, Feinstein T, Sun M, Stolz DB, Watkins SC, Amack JD, Lo CW, Tsang M. Vertebrate myosin 1d regulates left-right organizer morphogenesis and laterality. Nat Commun. 2018 Aug 23;9(1):3381. doi:10.1038/s41467-018-05866-2. PubMed PMID: 30139971.





Sannino S, Guerriero CJ, Sabnis AJ, Stolz DB, Wallace CT, Wipf P, Watkins SC, Bivona TG, Brodsky JL. Compensation of select proteostasis networks after Hsp70 inhibition in cancer. J Cell Sci. 2018 Aug 21. pii: jcs.217760. doi:10.1242/jcs.217760. [Epub ahead of print] PubMed PMID: 30131440.

Caves EA, Cook SA, Lee N, Stoltz D, Watkins S, Shair KHY. Air-Liquid Interface Method To Study Epstein-Barr Virus Pathogenesis in Nasopharyngeal Epithelial Cells. mSphere. 2018 Jul 18;3(4). pii: e00152-18. doi: 10.1128/mSphere.00152-18. PubMed PMID: 30021875; PubMed Central PMCID: PMC6052337.

Saydmohammed M, Vollmer LL, Onuoha EO, Maskrey TS, Gibson G, Watkins SC, Wipf P, Vogt A, Tsang M. A High-Content Screen Reveals New Small-Molecule Enhancers of Ras/Mapk Signaling as Probes for Zebrafish Heart Development. Molecules. 2018 Jul 11;23(7). pii: E1691. doi: 10.3390/molecules23071691. PubMed PMID: 29997348.

Pradhan-Sundd T, Vats R, Russell JM, Singh S, Michael AA, Molina L, Kakar S, Cornuet P, Poddar M, Watkins SC, Nejak-Bowen KN, Monga SP, Sundd P. Dysregulated bile transporters and impaired tight junctions during chronic liver injury inmice. Gastroenterology. 2018 Jun 28. pii: S0016-5085(18)34690-0. doi:10.1053/j.gastro.2018.06.048. [Epub ahead of print] PubMed PMID: 29964040.

Zhao J, Zhang L, Mu X, Doebelin C, Nguyen W, Wallace C, Reay DP, McGowan SJ, Corbo L, Clemens PR, Wilson GM, Watkins SC, Solt LA, Cameron MD, Huard J, Niedernhofer LJ, Kamenecka TM, Robbins PD. Development of novel NEMO-binding domain mimetics for inhibiting IKK/NF-κB activation. PLoS Biol. 2018 Jun 11;16(6):e2004663. doi: 10.1371/journal.pbio.2004663. eCollection 2018 Jun.PubMed PMID: 29889904; PubMed Central PMCID: PMC6013238.

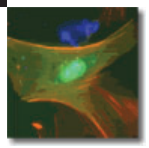
Krainz T, Lamade AM, Du L, Maskrey TS, Calderon MJ, Watkins SC, Epperly MW,Greenberger JS, Bayır H, Wipf P, Clark RSB. Synthesis and Evaluation of a Mitochondria-Targeting Poly(ADP-ribose) Polymerase-1 Inhibitor. ACS Chem Biol.2018 Sep 14. doi: 10.1021/acschembio.8b00423. [Epub ahead of print] PubMed PMID: 30184433.

Tyurina YY, Shrivastava I, Tyurin VA, Mao G, Dar HH, Watkins S, Epperly M, Bahar I, Shvedova AA, Pitt B, Wenzel SE, Mallampalli RK, Sadovsky Y, Gabrilovich D, Greenberger JS, Bayır H, Kagan VE. "Only a Life Lived for Others Is Worth Living": Redox Signaling by Oxygenated Phospholipids in Cell Fate Decisions. Antioxidants & redox signaling. 2018; 29(13):1333-1358. PubMed [journal] PMID: 28835115, PMCID: PMC6157439

Dar HH, Tyurina YY, Mikulska-Ruminska K, Shrivastava I, Ting HC, Tyurin VA, Krieger J, St Croix CM, Watkins S, Bayir E, Mao G, Armbruster CR, Kapralov A, Wang H, Parsek MR, Anthonymuthu TS, Ogunsola AF, Flitter BA, Freedman CJ, Gaston JR, Holman TR, Pilewski JM, Greenberger JS, Mallampalli RK, Doi Y, Lee JS, Bahar I, Bomberger JM, Bayır H, Kagan VE. Pseudomonas aeruginosa utilizes host polyunsaturated phosphatidylethanolamines to trigger theft-ferroptosis in bronchial epithelium. The Journal of clinical investigation. 2018; 128(10):4639-4653. PubMed [journal] PMID: 30198910, PMCID: PMC6159971







Skvarca LB, Han HI, Espiritu EB, Missinato MA, Rochon ER, McDaniels MD, Bais AS, Roman BL, Waxman JS, Watkins SC, Davidson AJ, Tsang M, Hukriede NA. Enhancing acute kidney injury regeneration by promoting cellular dedifferentiation in zebrafish. Dis Model Mech. 2019 Mar 19. pii: dmm.037390. doi: 10.1242/dmm.037390. [Epub ahead of print] PubMed PMID: 30890583.

Tao J, Bulgari D, Berkhoudt DA, Calderon MJ, Watkins SC, Fonseca H, Sabeva N, Deitcher DL, Levitan ES. Ptp4E regulates vesicular packaging for monoamine-neuropeptide co-transmission. J Cell Sci. 2019 Mar 5. pii: jcs.224568. doi: 10.1242/jcs.224568. [Epub ahead of print] PubMed PMID: 30837287.

Fischer DK, Saito A, Kline C, Cohen R, Watkins SC, Yamashita M, Ambrose Z. CA Mutation N57A Has Distinct Strain-Specific HIV-1 Capsid Uncoating and Infectivity Phenotypes. J Virol. 2019 Feb 27. pii: JVI.00214-19. doi: 10.1128/JVI.00214-19. [Epub ahead of print] PubMed PMID: 30814280.

Raza Q, Choi JY, Li Y, O'Dowd RM, Watkins SC, Chikina M, Hong Y, Clark NL, Kwiatkowski AV. Evolutionary rate covariation analysis of E-cadherin identifies Raskol as a regulator of cell adhesion and actin dynamics in Drosophila. PLoS Genet. 2019 Feb 14;15(2):e1007720. doi: 10.1371/journal.pgen.1007720. eCollection 2019 Feb. PubMed PMID: 30763317; PubMed Central PMCID: PMC6375579.

Tian H, Sparvero LJ, Blenkinsopp P, Amoscato AA, Watkins SC, Bayır H, Kagan VE, Winograd N. Secondary-Ion Mass Spectrometry Images Cardiolipins and Phosphatidylethanolamines at the Subcellular Level. Angew Chem Int Ed Engl. 2019 Mar 4;58(10):3156-3161. doi: 10.1002/anie.201814256. Epub 2019 Feb 14. PubMed PMID: 30680861.

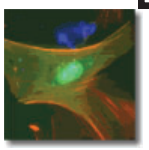
Li Y, Merkel CD, Zeng X, Heier JA, Cantrell PS, Sun M, Stolz DB, Watkins SC, Yates NA, Kwiatkowski AV. The N-cadherin interactome in primary cardiomyocytes as defined using quantitative proximity proteomics. J Cell Sci. 2019 Feb 11;132(3). pii: jcs221606. doi: 10.1242/jcs.221606. PubMed PMID: 30630894; PubMed Central PMCID: PMC6382013.

Surve SV, Myers PJ, Clayton SA, Watkins SC, Lazzara MJ, Sorkin A. Localization dynamics of endogenous fluorescently labeled RAF1 in EGF-stimulated cells. Mol Biol Cell. 2019 Feb 15;30(4):506-523. doi: 10.1091/mbc.E18-08-0512. Epub 2018 Dec 26. PubMed PMID: 30586319

Oh H, Piantadosi SC, Rocco BR, Lewis DA, Watkins SC, Sibille E. The Role of Dendritic Brain-Derived Neurotrophic Factor Transcripts on Altered Inhibitory Circuitry in Depression. Biol Psychiatry. 2019 Mar 15;85(6):517-526. doi: 10.1016/j.biopsych.2018.09.026. Epub 2018 Oct 9. PubMed PMID: 30449530; PubMed Central PMCID: PMC6380918.

Krainz T, Lamade AM, Du L, Maskrey TS, Calderon MJ, Watkins SC, Epperly MW, Greenberger JS, Bayır H, Wipf P, Clark RSB. Synthesis and Evaluation of a Mitochondria-Targeting Poly (ADP-ribose) Polymerase-1 Inhibitor. ACS Chem Biol. 2018 Oct





19;13(10):2868-2879. doi: 10.1021/acschembio.8b00423. Epub 2018 Sep 14 PubMed PMID: 30184433; PubMed Central PMCID: PMC6402482.

Moiseeva TN, Yin Y, Calderon MJ, Qian C, Schamus-Haynes S, Sugitani N, Osmanbeyoglu HU, Rothenberg E, Watkins SC, Bakkenist CJ. An ATR and CHK1 kinase signaling mechanism that limits origin firing during unperturbed DNA replication. Proc Natl Acad Sci U S A. 2019 Jun 17. pii: 201903418. doi: 10.1073/pnas.1903418116. [Epub ahead of print] PubMed PMID: 31209037

Piccirillo AR, Hyzny EJ, Beppu LY, Menk AV, Wallace CT, Hawse WF, Buechel HM, Wong BH, Foo JC, Cazenave-Gassiot A, Wenk MR, Delgoffe GM, Watkins SC, Silver DL, D'Cruz LM. The Lysophosphatidylcholine Transporter MFSD2A Is Essential for CD8(+) Memory T Cell Maintenance and Secondary Response to Infection. J Immunol. 2019 Jul 1;203(1):117-126. doi: 10.4049/jimmunol.1801585. Epub 2019 May 24. PubMed PMID: 31127034; PubMed Central PMCID: PMC6581627.

Fouquerel E, Barnes RP, Uttam S, Watkins SC, Bruchez MP, Opresko PL. Targeted and Persistent 8-Oxoguanine Base Damage at Telomeres Promotes Telomere Loss and Crisis. Mol Cell. 2019 May 10. pii: S1097-2765(19)30316-8. doi:10.1016/ j. molcel 2019.04.024. [Epub ahead of print] PubMed PMID: 31101499.

Watson AM, Watkins SC. Massive volumetric imaging of cleared tissue: The necessary tools to be successful. Int J Biochem Cell Biol. 2019 Jul; 112:76-78. doi: 10.1016/j.biocel.2019.05.007. Epub 2019 May 11. PubMed PMID: 31085331.

Tyurina YY, St Croix CM, Watkins SC, Watson AM, Epperly MW, Anthonymuthu TS,Kisin ER, Vlasova II, Krysko O, Krysko DV, Kapralov AA, Dar HH, Tyurin VA, Amoscato AA, Popova EN, Bolevich SB, Timashev PS, Kellum JA, Wenzel SE, Mallampalli RK, Greenberger JS, Bayir H, Shvedova AA, Kagan VE. Redox (phospho)lipidomics of signaling in inflammation and programmed cell death. J Leukoc Biol. 2019 May 9. doi: 10.1002/JLB.3MIR0119-004RR. [Epub ahead of print] Review. PubMed PMID: 31071242.

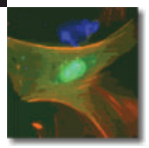
Larsen MB, Perez Verdaguer M, Schmidt BF, Bruchez MP, Watkins SC, Sorkin A. Generation of endogenous pH-sensitive EGF receptor and its application in high-throughput screening for proteins involved in clathrin-mediated endocytosis. Elife. 2019 May 8;8. pii: e46135. doi: 10.7554/eLife.46135. PubMed PMID: 31066673; PubMed Central PMCID: PMC6533059.

Wang W, Taft DA, Chen YJ, Zhang J, Wallace CT, Xu M, Watkins SC, Xing J. Learn to segment single cells with deep distance estimator and deep cell detector. Comput Biol Med. 2019 May; 108:133-141. doi: 10.1016/j.compbiomed.2019.04.006. Epub 2019 Apr 8. PubMed PMID: 31005005.

Singh M, Tian XJ, Donnenberg VS, Watson AM, Zhang J, Stabile LP, Watkins SC, Xing J, Sant S. Targeting the Temporal Dynamics of Hypoxia-Induced Tumor-Secreted Factors Halts Tumor Migration. Cancer Res. 2019 Jun 1;79(11):2962-2977. doi: 10.1158/0008-5472.CAN-18-3151. Epub 2019 Apr 5. PubMed PMID: 30952634; PubMed Central PMCID: PMC6548579







Brilli Skvarca L, Han HI, Espiritu EB, Missinato MA, Rochon ER, McDaniels MD, Bais AS, Roman BL, Waxman JS, Watkins SC, Davidson AJ, Tsang M, Hukriede NA. Enhancing regeneration after acute kidney injury by promoting cellular dedifferentiation in zebrafish. Dis Model Mech. 2019 Apr 5;12(4). pii: dmm037390. doi: 10.1242/dmm.037390. PubMed PMID: 30890583; PubMed Central PMCID: PMC6505474.

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*Research Assistant Professor*

Watson AM, Rose AH, Gibson GA, Gardner CL, Sun C, Reed DS, Lam LKM, Croix CMS, Strick PL, Klimstra WB, Watkins SC. Ribbon scanning confocal for high-speed high-resolution volume imaging of brain. PLOS ONE. 2017 Jul 7;12(7) e0180486.

Muntifering M, Castranova D, Gibson GA, Meyer E, Kofron M, Watson AM. Clearing for Deep Tissue Imaging. Curr Protoc Cytom. 2018 Jul 13; 38.

Waxman S, Loewen RT, Dang Y, Watkins SC, Watson AM, Loewen NA. High-Resolution, Three-Dimensional Reconstruction of the Outflow Tract Demonstrates Segmental Differences in Cleared Eyes. Investigative ophthalmology & visual science. 2018; 59(6):2371-2380.

Lane WC, Dunn MD, Gardner CL, Lam LKM, Watson AM, Hartman AL, Ryman KD, Klimstra WB. The Efficacy of the Interferon Alpha/Beta Response versus Arboviruses Is Temperature Dependent. mBio. 2018; 9(2).

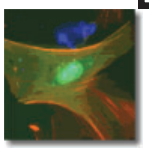
Lam LKM, Watson AM, Ryman KD, Klimstra WB. Gamma-interferon exerts a critical early restriction on replication and dissemination of yellow fever virus vaccine strain 17D-204. npj Vaccines. 2018 Jan 23; Muntifering M, Castranova D, Gibson GA, Meyer E, Kofron M, Watson AM. Clearing for Deep Tissue Imaging. Curr Protoc Cytom. 2018 Jul 13; e38.

Sanders, Steven M., Zhiwei Ma, Julia M. Hughes, Brooke M. Riscoe, Gregory A. Gibson, Alan M. Watson, Hakima Flici, et al. "CRISPR/Cas9-Mediated Gene Knockin in the Hydroid Hydractinia Symbiolongicarpus." *BMC Genomics* 19, no. 1 (September 3, 2018): 649. https://doi.org/10.1186/s12864-018-5032-z.

Williams JJ, Watson AM, Vazquez AL, Schwartz AB. Viral-Mediated Optogenetic Stimulation of Peripheral Motor Nerves in Non-human Primates. Front Neurosci. 2019 13:759. doi: 10.3389/fnins.2019.00759. eCollection 2019. PubMed PMID: 31417342; PubMed Central PMCID: PMC6684788.

Tyurina YY, St Croix CM, Watkins SC, Watson AM, Epperly MW, Anthonymuthu TS, Kisin ER, Vlasova II, Krysko O, Krysko DV, Kapralov AA, Dar HH, Tyurin VA, Amoscato AA, Popova EN, Bolevich SB, Timashev PS, Kellum JA, Wenzel SE, Mallampalli RK, Greenberger JS, Bayir H, Shvedova AA, Kagan VE. Redox (phospho)lipidomics of signaling in inflammation and programmed cell death. J Leukoc Biol. 2019 Jul;106(1):57-81. doi: 10.1002/JLB.3MIR0119-004RR. Epub 2019 May 9. Review. PubMed PMID: 31071242; PubMed Central PMCID: PMC6626990.





Singh M, Tian XJ, Donnenberg VS, Watson AM, Zhang J, Stabile LP, Watkins SC, Xing J, Sant S. Targeting the Temporal Dynamics of Hypoxia-Induced Tumor-Secreted Factors Halts Tumor Migration. Cancer Res. 2019 Jun 1;79(11):2962-2977. doi: 10.1158/0008-5472.CAN-18-3151. Epub 2019 Apr 5. PubMed PMID: 30952634; PubMed Central PMCID: PMC6548579.

Watson AM, Watkins SC. Massive Volumetric Imaging of Cleared Tissue: The Necessary Tools to be Successful. Int J Biochem Cell Biol. 2019 May 11, doi: 10.1016/j.biocel.2019.05.007. [Epub ahead of print] PubMed PMID: 31085331.

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*Associate Professor*

Braganza A, Li J, Zeng X, Yates NA, Dey NB, Andrews J, Clark J, Zamani L, Wang X, St. Croix C, O'Sullivan R, Garcia-Exposito L, Brodsky JL, Sobol RW. UBE3B is a calmodulin-regulated, mitochondria-associated E3 ubiquitin ligase. J Biol Chem. 2017 Feb 10;292(6):2470-2484. doi: 10.1074/jbc.M116.766824. Epub 2016 Dec 21. PubMed PMID: 28003368; PubMed Central PMCID: PMC5313114.

Tan R, Nakajima S, Wang Q, Sun H, Xue J, Wu J, Hellwig S, Zeng X, Yates NA, Smithgall TE, Lei M, Jiang Y, Levine AS, Su B, Lan L. Nek7 Protects Telomeres from Oxidative DNA Damage by Phosphorylation and Stabilization of TRF1. Mol Cell. 2017 Mar 2; 65(5):818-831.e5. doi 10.1016/j.molcel.2017.01.015. Epub 2017 Feb 16. PubMed PMID:28216227

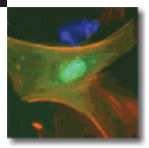
Khetarpal SA, Zeng X, Millar JS, Vitali C, Somasundara AVH, Zanoni P, Landro JA, Barucci N, Zavadoski WJ, Sun Z, de Haard H, Toth IV, Peloso GM, Natarajan P, Cuchel M, Lund-Katz S, Phillips MC, Tall AR, Kathiresan S, DaSilva-Jardine P, Yates NA, Rader DJ. A human APOC3 missense variant and monoclonal antibody accelerate apoC-III clearance and lower triglyceride-rich lipoprotein levels. Nat Med. 2017 Aug 21. doi: 10.1038/nm.4390.

Robinson AR, Yousefzadeh MJ, Rozgaja TA, Wang J, Li X, Tilstra JS, Feldman CH, Gregg SQ, Johnson CH, Skoda EM, Frantz MC, Bell-Temin H, Pope-Varsalona H, Gurkar AU, Nasto LA, Robinson RAS, Fuhrmann-Stroissnigg H, Czerwinska J, McGowan SJ, Cantu-Medellin N, Harris JB, Maniar S, Ross MA, Trussoni CE, LaRusso NF, Cifuentes-Pagano E, Pagano PJ, Tudek B, Vo NV, Rigatti LH, Opresko PL, Stolz DB, Watkins SC, Burd CE, Croix CMS, Siuzdak G, Yates NA, Robbins PD, Wang Y, Wipf P, Kelley EE, Niedernhofer LJ. Spontaneous DNA damage to the nuclear genome promotes senescence, redox imbalance and aging. Redox Biol., 17:259-273, 2018.

Krivinko JM, Erickson SL, Ding Y, Sun Z, Penzes P, MacDonald ML, **Yates NA**, Ikonomovic MD, Lopez OL, Sweet RA, Kofler J. Synaptic proteome compensation and resilience to psychosis in Alzheimer's Disease. Am J Psychiatry. 175(10): 999-1009, 2018.

Li Y, Merkel CD, Zeng X, Heier JA, Cantrell PS, Sun M, Stolz DB, Watkins SC, **Yates NA**, Kwiatkowski AV. The N-cadherin interactome in primary cardiomyocytes as defined by quantitative proximity proteomics. J Cell Sci. Feb 11; 132(3), 2019.

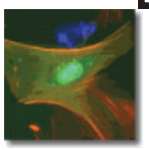




Bell-Temin H, Yousefzadeh MJ, Bondarenko A, Quarles E, Jones-Laughner J, Robbins PD, Ladiges W, Niedernhofer LJ, **Yates NA**. Measuring biological age in mice using differential mass spectrometry. Aging (Albany NY). Feb 11; 11(3):1045-1061, 2019.

Bakkenist CJ, Czambel RK, Lin Y, **Yates NA**, Zeng X, Shogan J, Schmitz JC. Quantitative analysis of ATM phosphorylation in lymphocytes. DNA Repair (Amst). June 4; 80:1-7, 2019.





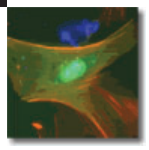
**Executive Summary for the Cell Biology FY2020 Business Plan**

The department has developed a diverse group of well funded investigators who contribute on many levels to the research and educational programs of the School of Medicine. During last nine years significant changes in the Department took place with ten members of the primary faculty leaving the Department and eight new members joining the faculty. Achievement of the balanced distribution of the junior and senior faculty and strong integration of all activities of the faculty remains the important goal of our FY2020 plan. To this end, we hope that one Assistant Professor will be promoted, and we will recruit one more tenure-track faculty in the Department in FY20. We plan to recruit a scientist who studies fundamental aspects of cell biology, in particular, in the area of protein folding and protein conformational diseases, and who can interface with our faculty, researchers in other departments in the School of Medicine and the entire Pittsburgh scientific community.

The outlook for the future of the Department is optimistic. New research themes and resources are integrated into the Department, which should lead to the overall increase in the research productivity and funding, new scientific interactions and development of new joint funding opportunities. There is also a strong confidence in continuing excellence of the established programs in the Department.

The Department's operating budget for fiscal year 2020 has been approved and is appended at the end of this analysis.





**Strengths**

*Research*

The Department of Cell Biology has a strong research program aimed at addressing fundamental questions of cell biology, including mechanisms controlling membrane trafficking, cell polarity, actin cytoskeleton, signal transduction, intercellular interactions, and membrane channel and transport regulation. The Faculty in the Department have made important contributions to these various areas of cell biology, and established themselves as leaders in their respective research fields. This is evident from recent publications in high-impact journals such as eLife (Sorkin, Traub), Journal of Cell Biology (Hammond), Molecular Biology of the Cell Journal of Cell Science (Ford, Kwiatkowsky), and others.

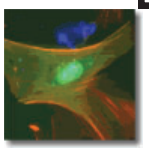
Membrane trafficking is a particular strength of the Department with the research covering the entire spectrum of traffic-related issues from general mechanisms of protein and lipid trafficking, endocytosis and membrane organelle biogenesis, to cargo-specific mechanisms of anterograde and endocytic trafficking of receptors, transporters and channels. Studies of the mechanisms of cell polarity, cell motility, and intracellular signaling have also been growing in the department. Our faculty continue to present their research at international and national meetings, participate in NIH and other grant review panels and other organizational and service activities, all reflecting their influence in the respective research areas.

The majority of the Cell Biology faculty maintains active, funded research programs. We have been especially successful in obtaining extramural research funding in multiple collaborative grants (Watkins, St. Croix, Stolz, Yates, Shi). All tenure-stream Assistant Professors, except Yi Shi who started two and a half ago, are currently funded by NIH. Submission of new grant applications remains to be at a high rate which ensures relative fiscal stability of the Department.

The Center for Biologic Imaging (CBI) associated with the Department is one of the largest imaging facilities in the country and provides state-of-the-art equipment and indispensable expertise in all types of cellular imaging to the faculty of the Department and the entire School of Medicine and University of Pittsburgh. In the last year, CBI obtained a new lattice light sheet microscope system which is essential to the continued expansion of the CBI capabilities and departmental infrastructure. Dr. Yates, Director of the Biomedical Mass Spectrometry Center, SOM and U. Pitt, is also enhancing an infrastructure to implement modern methods of quantitative mass-spectrometric analyses.

Our faculty also participated in NIH funded program projects (Center for HIV Protein Interactions; Molecular Biology of Hemorrhagic Shock, and several others) and are involved in multiple collaborations with basic science faculty and various divisions of the Departments of Medicine and Pediatrics, as well as with the researchers at Carnegie Mellon University. Individual CB faculty hold major roles in organization of the annual "Local Traffic" and "Ubiquitin" symposiums, running the Membrane Trafficking journal club and participate in various School committees.





*Teaching*

*Medical Curriculum:* The department contributes extensively to the teaching of medical and graduate students in the School of Medicine. Our faculty has been actively participating in the remodeling of the first-year curriculum, particularly in the area of biochemistry and cell biology, involving formal lectures in these areas and contributing to small group PBLs. With the retirement of Dr. Duker, a new faculty member, Dr. Truschel replaced her in teaching extensively in the medical school.

*Graduate Curriculum:* We now have 6 students in the graduate Ph.D. program in Cell Biology and Molecular Physiology. Two students graduated in 2019; one is planning to graduate later in the year, and three new students joined the program. In addition, CB faculty participate in other graduate programs under umbrella of the Medical School Interdisciplinary Biomedical Graduate Program, as well as in the Departments of Bioengineering, Biological Sciences, ISB, CNUP among others. The major development this year has been the submission of the first application for the T32 training grant in cell biology which has been a joint effort of faculty in Cell Biology, School of Arts and CMU.

*Biomedical Master's Program (BMP).* Faculty in the Department together with the Department of Pharmacology launched a new BMP program in September 2017. Three faculty are teaching didactic courses, Dr. Peter Drain serves as the Director of Academic Affairs, and Dr. Sorkin is a member of the Executive Committee.

**Administration:**

The administrative staff, headed by Susan Conway, has done an excellent job in providing various levels of support to the research, teaching and service activities. There have been additional and substantial loads placed on the administration due to large flood in the Department that occurred in January 2019. The fact that all post-flooding issues, such as dealing with cleaning and repair, supply an dequipment replacement and others, were successfully accomplished in a timely and efficient manner demonstrates the experience and strength of our administrative staff.

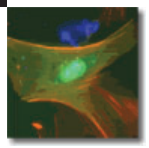
**Weaknesses**

Limited and poorly designed research space has become a weakness of the program, especially during our faculty recruitment efforts. We will commit major efforts to rearrange the space in BST South to allow for the growth of the research programs of new and current faculty located in this area.
One of the CBP faculty Dr. Leuba is located in the Hillman Cancer Center. There is clear separation from the rest of the Department leading to a lesser engagement of his laboratory in the main activities of the Department.

**Opportunities**

The vision of the chair and the leadership of the School, is to focus our research





program towards basic cell biology and build a premier Department of Cell Biology. The key to accomplishing this task is the recruitment of new dynamic and creative faculty, and continue to support productive mid-career and senior faculty. We hope to continue recruiting faculty whose research programs focus on fundamental questions of cell biology. The importance of the successful recruitment of a strong faculty is to shape the future of the department, while achieving a healthy balance of junior and senior faculty members, and this is difficult to overemphasize.

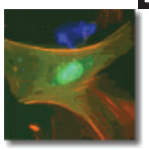
Cohesiveness of the faculty research expertise in the Department creates exceptional opportunities for collaborative research, which should open doors to building new program projects and centers. The Department is now in the position to lead the assembly of new interdisciplinary research programs that would be competitive in obtaining the extramural funding.

**Threats**

The steady decrease in federal and private funding opportunities to support basic cell biology research will continue to be the most significant threat during next several years. Several senior faculty are currently struggling with sustaining funding necessary to support their research programs. Yet, in order for the Department to become one of the elite cell biology departments, total funding of the Department must increase 2-fold above the current level.

Another difficult challenge we face is to strengthen the Cell Biology and Molecular Physiology Graduate Program through the recruitment of top-tier students and provision of the best possible training environment in the laboratories of the Department.



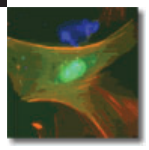


**Cell Biology FY2019 Fiscal Issues**

The main budgetary issue that faced the Department in the FY19 budget was maintaining the extramural funding of the faculty at the level necessary to support their research program and as required by the SOM Policies. Our goal for FY20 is to increase the funding level of previous years. Main efforts will be devoted to ensuring that the departmental infrastructure necessary for advancing research programs of the faculty continues to improve.



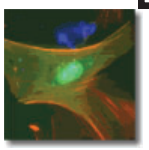


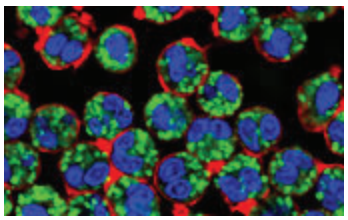


***University of Pittsburgh School of Medicine***
***University of Pittsburgh Physicians***
***Department of Cell Biology***
***Schedule of Revenue and Expenses Fiscal Year 2020 Budget***

| | University | UPP and Other | Total Budget FY 2019 |
|---|---|---|---|
| ***Revenue*** | | | |
| Patient Care | $ - | $ - | $ - |
| Grant: | | | |
| Directs | 4,354,101 | - | 4,354,101 |
| Indirects | 1,943,880 | - | 1,943,880 |
| Hospital Contract | - | - | - |
| School of Medicine | 3,486,424 | | 3,486,424 |
| VAMC | | - | - |
| Other | 411,097 | - | 411,097 |
| ***Total Revenue*** | $ 10,195,502 | $ - | $ 10,195,502 |
| | | | |
| ***Expenses*** | | | |
| Salaries and Fringe Benefits: | | | |
| Faculty | $ 3,634,200 | $ - | $ 3,634,200 |
| Non-Faculty | 2,270,286 | - | 2,270,286 |
| Malpractice Insurance | | - | - |
| Space Rental | 86,355 | - | 86,355 |
| UPP Overhead | | - | - |
| University Overhead | 2,627,953 | | 2,627,953 |
| Other Operating Expenses | 1,576,708 | - | 1,506,355 |
| ***Total Operating Expenses*** | $ 10,195,502 | $ - | $ 10,195,502 |
| | | | |
| ***Excess Revenue over Expenses*** | $ - | $ - | $ - |
| | | | |
| ***Capital Equipment/Improvements*** | $ - | $ - | $ - |
| | | | |
| ***Fund Balances*** | | | |
| University Restricted Accounts as of 6/30/19 | $ 2,566,380 | $ - | $ 2,566,380 |
| University Endowments as of 6/30/19 | 403,036 | | 403,036 |
| UPP Fund Balance as of 6/30/19 | | - | - |
| UPMC Endowments as of 6/30/19 | | - | - |
| UPMC SPF Accounts as of 6/30/19 | | - | - |
| ***Total Fund Balances*** | $ 2,969,416 | $ - | $ 2,969,416 |







Thank you for your kind attention.