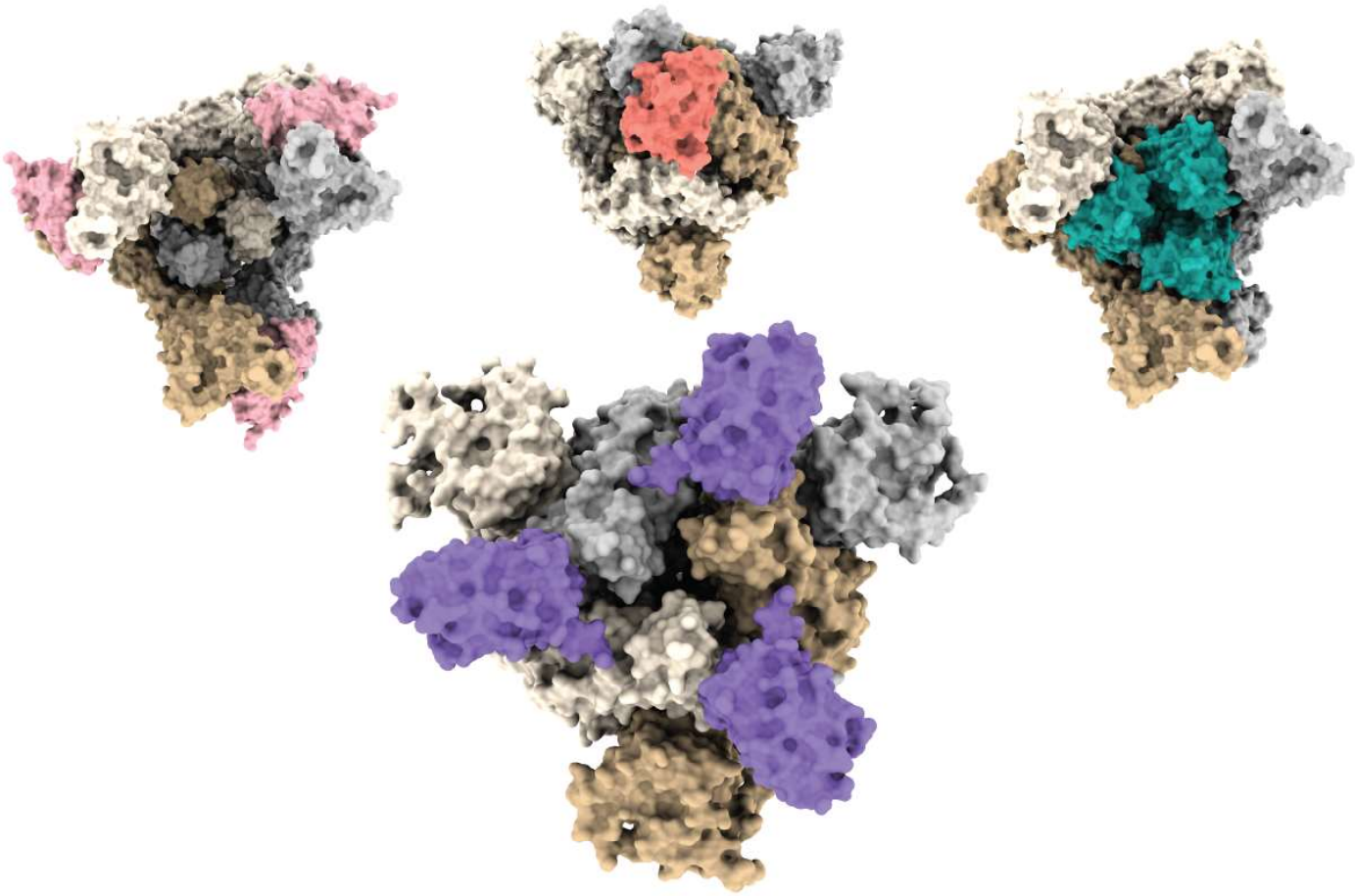
UNIVERSITY OF PITTSBURGH SCHOOL OF MEDICINE

CELL BIOLOGY



FY20 ANNUAL REPORT AND FY21 BUSINESS PLAN

Front Page

Cover figure by Yi Shi. Structural proteomics and integrative modeling reveals multiple distinct and non-overlapping epitopes and indicated an array of potential neutralization mechanisms. Spike trimer conformation (wheat, plum, and light blue colors)

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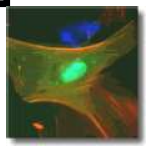
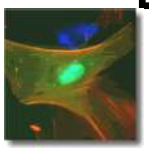


In the cell, life is governed by a multitude of molecular systems that shape and sustain the organellar system of the cell, maintain cellular homeostasis and respond to extracellular cues. These systems are dynamic, multicomponent macromolecular complexes. Maintaining and regulating the function of these 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 nineteen primary faculty, eighteen 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.



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.

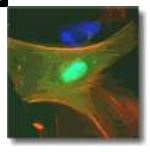
Regulation of channels and transporters

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
Watson



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

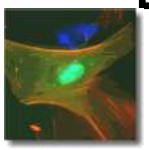
Drain
Hammond
Leuba
Sorkin
St. Croix

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.

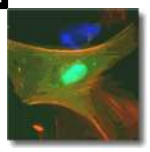


Center for Biologic Imaging

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.

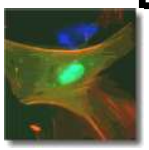
The Associate Directors:
Dr. Donna Beer-Stolz is an Associate Professor in Cell Biology. Her funded research interests are in liver regeneration and vasculogenesis. She was recruited specifically to facilitate interactions between the Cell and Tissue Imaging Core and its users. Dr. Beer-Stolz' primary 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,2020]

Name	Rank	Office Address	Email Address	Phone	Fax
Aridor, Meir	Associate Professor	S310 BST-South Wing	aridor@pitt.edu	412-624-1970	412-648-8330
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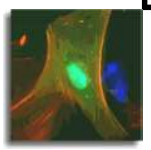
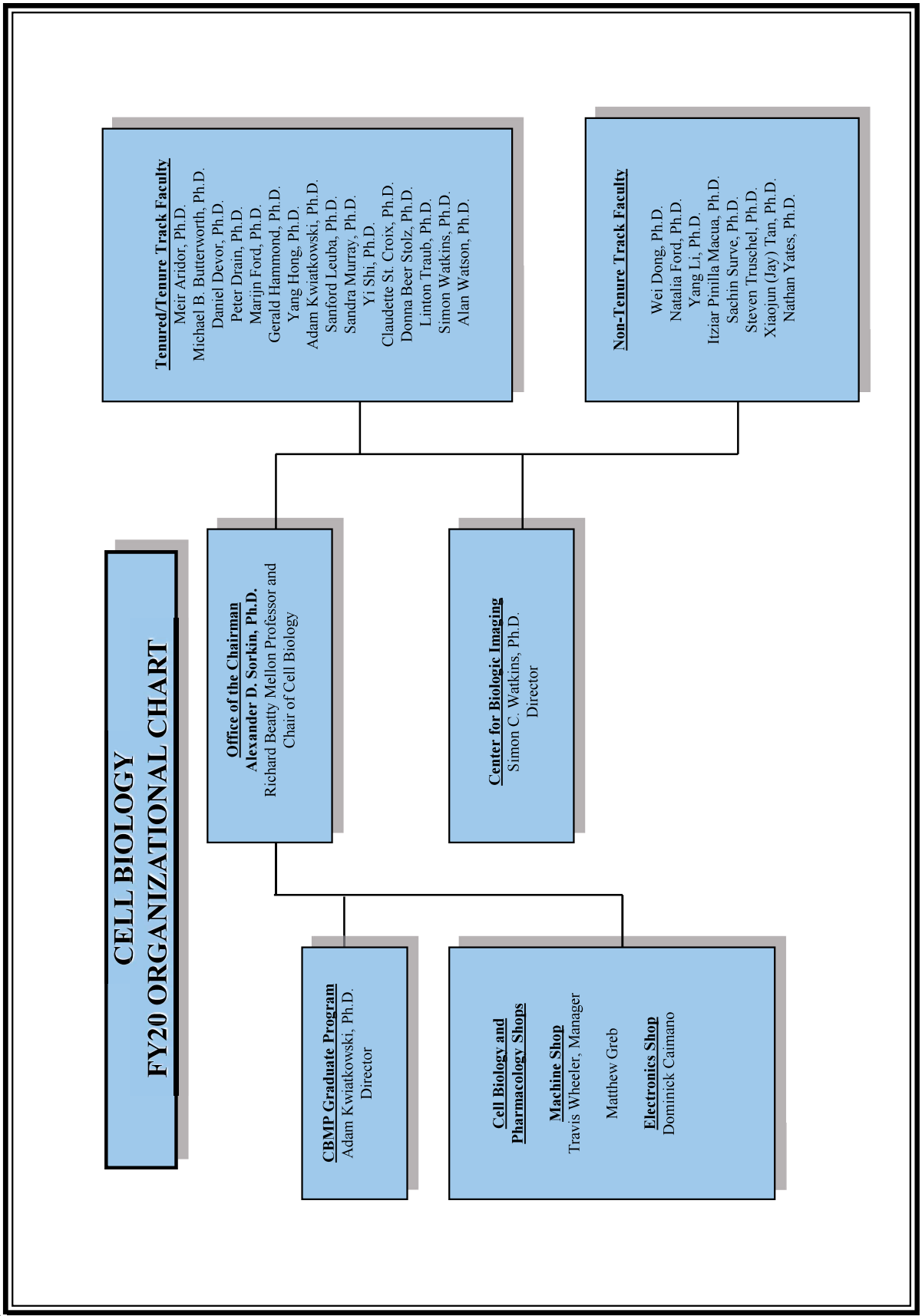
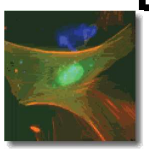
Watson, Alan	Res. Asst. Professor	S220.5 BST-South Wing	alan.watson@pitt.edu	412-648-9796	412-383-8894
Yates, Nathan	Associate Professor	9043B BST3	yatesn@pitt.edu	732-718-9739	412-648-9009




CELL BIOLOGY
FY20 ORGANIZATIONAL CHART
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.
Alan Watson, 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.
Nathan Yates, Ph.D.
Office of the Chairman
Alexander D. Sorkin, Ph.D.
Richard Beatty Mellon Professor and Chair of Cell Biology
Center for Biologic Imaging
Simon C. Watkins, Ph.D.
Director
CBMP Graduate Program
Adam Kwiatkowski, Ph.D.
Director
Cell Biology and Pharmacology Shops
Machine Shop
Travis Wheeler, Manager
Matthew Greb
Electronics Shop
Dominick Caimano



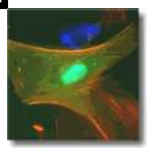
Cell Biology Seminar Series Schedule (Fiscal Year 2019 – 2020)

September 13, 2019
Phyllis Hanson, PhD
Professor and Chair, Biological Chemistry
University of Michigan Medical School
"ESCRT function in membrane repair"

October 8, 2019
Terence Dermody, MD
Vira I. Heinz Professor and Chair of Pediatrics
UPMC Children's Hospital of Pittsburgh
"Form and function of Reovirus Replication Organelles"

October 29, 2019
David Bilder, PhD
Professor, Department of Molecular & Cell Biology
University of California, Berkeley
"Cold-blooded cancer: tumor-host interactions in Drosophila"

November 12, 2019
Richard A. Anderson, PhD
Professor of Medicine
University of Wisconsin
"Phosphoinositide signaling controls everything – EVEN p53"



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.

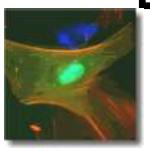
We take a multi disciplinary approach using a wide range of molecular, biochemical, biophysical and cellular techniques to unravel the molecular basis for protein and lipid sorting in the ER. Specifically, we use these approaches to address several related questions including the following: 1. What is 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

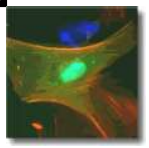


assembly, trafficking and gating is crucial to the development of novel therapies based on targeting these channels. The long-term goals of my lab are to obtain a detailed molecular understanding of these channels in order to unravel the mechanisms involved in their assembly, trafficking, regulation 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

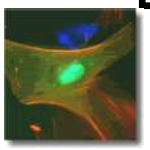


and TUBES we are able to rapidly assess the ubiquitination of plasma membrane channels and correlate ubiquitinylation with endocytosis. In this regard, we have now shown that the endocytosis of KCa3.1 is directly correlated with poly-ubiquitinylation of the channel. By inhibiting ubiquitinylation we 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.

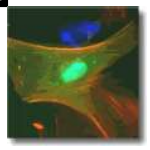


Given our interest in understanding these channels at a tissue/model system level, Cavita Chotoo, a graduate student in the lab, in collaboration with Drs. Cliff Luke and Gary Silverman at Children's Hospital of Pittsburgh, is further defining the physiological role of one of these channels using *C. 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.

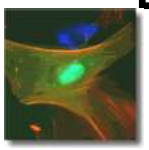
Trainees in our laboratory have the opportunity to combine the techniques of molecular genetics and confocal live-cell fluorescence imaging, with transgenic techniques to integrate understanding at the level of the molecule, organelle, whole cell, organ, and organism.

Marijn Ford, Ph.D.
Associate 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.

Structural Studies:
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.

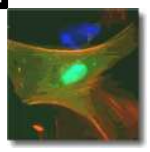
Yeast Stress Response Pathways:
TORC1 is a multiprotein complex that couples external cues such as nutrients and other environmental stimuli to the pathways regulating cell growth. TORC1 deregulation is associated with variety of human cancers and metabolic disorders and has consequently been the object 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?

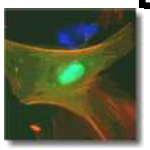
Answering these basic questions is crucial, because genetic diseases ranging from cancer to hereditary hearing loss are caused by disruption of membrane function resulting from mutations in inositol lipid metabolizing enzymes. Furthermore, many bacterial and viral pathogens re-model host cell membranes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

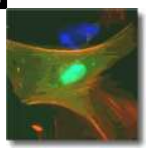
We have developed genomic engineering tools that allow efficient generation of knock-in alleles of *Drosophila* genes. We also developed comprehensive imaging tools for visualizing the dynamic subcellular localizations of polarity proteins under various physiological conditions including hypoxia.

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.

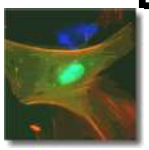
- We have used magnetic tweezers to observe a dynamic equilibrium between force dependent nucleosomal assembly and disassembly on a single DNA molecule in real time (Leuba et al., 2003) as a model of what happens to nucleosomes when a transcribing polymerase passes through the region where they are located.

- 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).

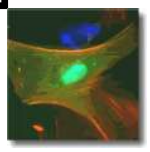
Our future goals are to build combination single-molecule instruments to image and manipulate intramolecular nanometer movements in submillisecond real-time with piconewton force sensitivity (e.g., we want to observe directly what happens to the histones in a nucleosome in the path of a transcribing 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

My research is interested in the development of cutting-edge mass spectrometry-based proteomics technologies for the analysis of biomolecules and macromolecular assemblies. Recently, fascinated by the exciting biomedical potentials of camelid single-chain antibodies (or nanobodies), we have begun to develop methods and informatics to revolutionize the discovery and characterizations of



nanobodies. In parallel, we are harnessing the tools that we invented and the novel biomolecules that discovered to advance biomedicine. We are also interested in understanding the mechanisms of antigen-antibody interactions by structural biology approaches.

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

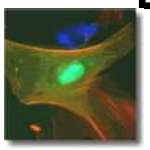
The focus of the research in the laboratory is currently split into two major directions which are distinct from each other with respect to the biological systems involved, their relation to the human disease, and experimental models used. However, the main idea underlying both directions is conceptually 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

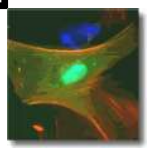


and requires that the specialized resident cells lining the vasculature, the endothelial cells (ECs), proliferate, migrate and differentiate spatially and temporally in response to specific signals. Vasculogenesis, on the other hand, has only recently emerged as an alternative mechanism of blood vessel 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 two years ago, I contribute as a faculty member to separate courses throughout the first and second years 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, 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.

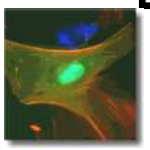
Lastly, this past year I became course director for Histology and Cell Function in Health and Disease within the Biomedical Master's program. In collaboration with the Laboratory of Educational Technology, I have transformed the course curriculum by creating a virtual microscopy slide collection that has been added to the medical education Navigator website and allows students to study microscopy remotely. These virtual slides have also been 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.

Alan M. Watson, Ph.D.
Assistant Professor

A need for rapid, high-resolution imaging of large tissues has become important as researchers grapple with the need to characterize rare events within whole organs or trace neurons throughout a brain. The goals of my research program is to make fluorescent imaging of large biologic systems accessible to any researcher. This involves the development of novel tissue preparation techniques, imaging methods and computational pipelines aimed at increasing the size of tissues and the speed at which they can be imaged. Most recently we have developed computational neural networks to accelerate imaging by almost an order of magnitude.



Nathan Yates, Ph.D.
Associate Professor

I am an analytical chemist with more than 30 years of experience in the development and application of mass spectrometry (MS). The principle goal motivating our group's work is to develop and apply ultra-sensitive MS-based proteomics tools for studying biology and advancing efforts to understand and treat disease. Through nurturing a large number of interdisciplinary collaborations, we have used MS-based proteomics to: identify molecular biomarkers and hallmarks of disease and aging [1-4], map important post-translational modifications of proteins [5-7], identify partners in protein-protein interactions [8, 9], and help elucidate other fundamental details of molecular processes in cells [10-12]. Our lab's funded research collaborations extend across academic departments and institutions and include partners in the biopharmaceutical industry.

MS-based proteomics offers unique opportunities for translational research, and one exciting area of current research in the lab is the development and validation of blood-based assays to help identify Alzheimer's disease and assess its progression. We have implemented a streamlined method for measuring amyloid beta peptides from patient plasma samples on a commercially-available, bench-top mass spectrometer that is already in use in the clinical setting. This assay shows good agreement with PET-PiB measurements (the current 'gold-standard' for assessing amyloid beta plaque formation, a hallmark of Alzheimer's disease) and may help to establish a simple and reliable blood test for Alzheimer's disease. Related efforts in the lab seek to develop methods to measure the rates at which amyloid beta peptides are metabolized in patients. This work has benefited enormously from a close collaboration with researchers at the University of Pittsburgh Alzheimer's Disease Research Center (ADRC).

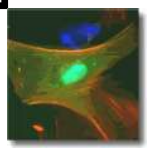
Prior to joining the University of Pittsburgh, I helped to develop key aspects of MS technology for use in proteomics. My work at Merck & Co. Inc. led to the invention and eventual commercialization of Differential Mass Spectrometry, an unbiased quantitative proteomics method for comparing complex biological systems. Our lab continues this commitment to advancing the frontiers of MS-based proteomics and making MS-based proteomics tools more accessible to researchers in order to foster greater discovery and development of new clinical applications.

1. Bell-Temin, H., et al., *Measuring biological age in mice using differential mass spectrometry.* Aging (Albany NY), 2019. **11**(3): p. 1045-1061.

2. Hendrickson, R.C., et al., *High Resolution Discovery Proteomics Reveals Candidate Disease Progression Markers of Alzheimer's Disease in Human Cerebrospinal Fluid.* PLoS One, 2015. **10**(8): p. e0135365.

3. Mazur, M.T., et al., *Quantitative analysis of intact apolipoproteins in human HDL by top-down differential mass spectrometry.* Proc Natl Acad Sci U S A, 2010. **107**(17): p. 7728-33.

4. Paweletz, C.P., et al., *Application of an end-to-end biomarker discovery platform to identify target engagement markers in cerebrospinal fluid by high resolution differential mass spectrometry.* J Proteome Res, 2010. **9**(3): p. 1392-401.



5. Huang, F., et al., *Lysine 63-linked polyubiquitination is required for EGF receptor degradation.* Proc Natl Acad Sci U S A, 2013. **110**(39): p. 15722-7.

6. Khetarpal, S.A., et al., *A human APOC3 missense variant and monoclonal antibody accelerate apoC- III clearance and lower triglyceride-rich lipoprotein levels.* Nat Med, 2017. **23**(9): p. 1086-1094.

7. Tan, R., et al., *Nek7 Protects Telomeres from Oxidative DNA Damage by Phosphorylation and Stabilization of TRF1.* Mol Cell, 2017. **65**(5): p. 818-831.e5.

8. Li, Y., et al., *The N-cadherin interactome in primary cardiomyocytes as defined using quantitative proximity proteomics.* J Cell Sci, 2019. **132**(3).

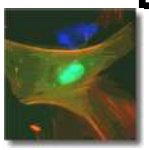
9. Buck, T., et al., *The Capture of a Disabled Proteasome Identifies Erg25 as a Substrate for Endoplasmic Reticulum Associated Degradation.* Mol Cell Proteomics, 2020.

10. Kirkwood, C.M., et al., *Altered Levels of Visinin-Like Protein 1 Correspond to Regional Neuronal Loss in Alzheimer Disease and Frontotemporal Lobar Degeneration.* J Neuropathol Exp Neurol, 2016. **75**(2): p. 175-82.

11. MacDonald, M.L., et al., *Altered glutamate protein co-expression network topology linked to spine loss in the auditory cortex of schizophrenia.* Biol Psychiatry, 2015. **77**(11): p. 959-68.

12. Toptan, T., et al., *Proteomic approach to discover human cancer viruses from formalin-fixed tissues.* JCI Insight, 2020.

Cell Biology/Pharmacology Machine Shop



Study Sections (Fiscal Year 2019 - 2020)

Adam Kwiatkowski, Ph.D.
Assistant Professor

Ad hoc member, AHA Transformational Project Award Review Section
Ad hoc reviewer, NSF CAREER proposal

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

ASIRC - Italian Association for Cancer Research; Standing Member

Claudette St. Croix, Ph.D.
Associate Professor

American Cancer Society - Clinical Cancer Research and Epidemiology (CCE), Standing Member
NIH CMT Standing Panel - Cellular and Molecular Technologies, Temporary Member

Donna B. Stolz, Ph.D.
Associate Professor

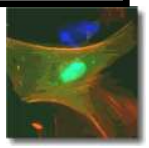
ZDK1 GRB-7 M4 NIDDK P30 DDRCC reviews
NIH-NIGMS COBRE Phase 1 (P20) reviews

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

NIH Study Section 2020/01 ZRG1 CB-H (30) I Chair
NIH study section, ZDK1 GRB-J (M1) Panelist
NIH study section, ZDK1 GRB-J (M2) Panelist
ZRG1 CB-S (70) R RFA-RM-20-005 Panelist
ZRG1 CB-W (07) R RFA-RM-20-005 Panelist
ZRG1 CB-S (71) R RFA-RM-20-006 Panelist



Faculty Advisory Committee Memberships (Fiscal Year 2019 - 2020)

Meir Aridor, Ph.D.
Associate Professor

University of Pittsburgh, Department of Cell Biology Recruitment Committee
Local Traffic Symposium; Organizing Committee Member
University of Pittsburgh Department of Cell Biology Graduate Program Steering Committee
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
Integrative Systems Biology Graduate Program, Curriculum Committee
Integrated Systems Biology Graduate Program, Course Director
Cell Biology and Molecular Physiology Graduate Program, Course Director
Cell Biology and Molecular Physiology Graduate Program, Associate Program Director, 2015-2016. 2020-present
Cell Biology and Molecular Physiology Graduate Program, Graduate Program Director, 2016-2020

Daniel Devor, Ph.D.
Professor

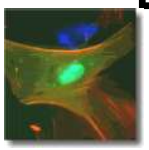
Cell Biology Departmental Tenure and Promotions Committee

Peter F. Drain, Ph.D.
Associate Professor

Cell Biology and Physiology Graduate Program Committee
Cell Biology and Physiology Representative, Graduate Student Recruitment Committee
Member of the UPSOM interviewing committee
Course Design Committee for "Methods and Logic in Medicine"
Member, University of Pittsburgh School of Medicine (UPSOM) Admissions Committee
Member, Steering Committee, Tsinghua-University of Pittsburgh (T-UP) Research Program
Block Director, MD Curriculum Courses in the "Evidence and Discovery Block" (formerly Scientific Reasoning in Medicine Block) of the MD program at UPSOM
UPSOM Curriculum Committee
Voted in as the Co-Chair of the Steering Committee of UPSOM Curriculum Reform
(UPSOM) MD Candidate Interview Committee
Co-Chair, Steering Committee of the Three Rivers Curriculum Reform Committee

Marijn Ford, Ph.D.
Associate Professor

Organizing Committee, Pittsburgh "Local Traffic" symposium



Cell Biology Space Committee
Institutional Biosafety Committee

Natalia Ford, Ph.D.
Research Assistant Professor

Organizer – Cell Biology Department Retreat

Gerald Hammond, Ph.D.
Assistant Professor

Organizer – Cell Biology Department Retreat
Cell Biology Space Committee
Chair, Pittsburgh "Local Traffic" symposium organizing committee
Chair, 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

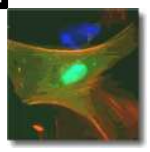
Cell Biology Space Committee
Associate Director, Cell Biology and Molecular Physiology Graduate Program 2019-2020
Director, Cell Biology and Molecular Physiology Graduate Program 2020-present
UPSOM Student Promotions Committee
Member, NIH T32 "Interinstitutional Program in Cell and Molecular Biology"

Sanford Leuba, Ph.D.
Associate Professor

University Molecular Biophysics and Structural Biology Graduate Program: Admissions Committee, 2003-present; Chair of Admissions since 2012; Curriculum Committee, Spring 2009-present

Sandra A. Murray, Ph.D.
Professor

School of Medicine Summer "Minority" Work-Study Program
Member of Medical Student Promotions Committee
Advisory Committee - Child Health Research Center Grant
Member Pittsburgh Cancer Institute
Medical School Representative Senior Woman Faculty Group
NIMH Training Grant Faculty Member - Advisory Committee
University of Pittsburgh Helen Faison Council of Elders



Member of the Training Faculty Immunology Graduate Training Program

Member of the Training Faculty Cell Biology and Physiology
University of Pittsburgh M.D./Ph.D. Selection Committee Member
University of Pittsburgh Commencement and Honors Convocation Speaker Selection
University of Pittsburgh Provost's Development Fund Review Committee
Search Committee for the Senior Vice Chancellor/Dean of the School of Medicine, Equipoise Representative, University of Pittsburgh
Advisory Board Member for Survival Skills and Ethics Program
Graduate School of Public Health Community Engagement Research Core
Cell Biology Tenure and Promotions Committee
Cell Biology Faculty Recruitment Committee

Yi Shi, Ph.D.
Assistant Professor

Organizer – Cell Biology Department Retreat

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

Cell Biology Tenure and Promotions Committee
Chair Cell Biology Faculty Recruitment Committee
Chair Cell Biology Department Seminar Series
Integrated Systems Biology Executive Committee
Biomedical Masters Program Executive Committee
Dickson Prize Selection Committee-SOM

Claudette St. Croix, Ph.D.
Associate Professor

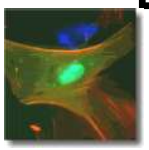
Cell Biology Faculty Recruitment Committee

Donna Beer Stolz, Ph.D.
Associate Professor

Associate Director, Center for Biologic Imaging (CBI)
Assistant Director, Cell Biology and Molecular Physiology Graduate Program
School of Medicine Tenured Faculty Promotions and Appointments Committee
Year of Creativity (Overseen by Provost Ann E. Cudd), Steering Committee Member, Signature Events, Initiatives Sub-Committee Member
Human Resources: Subject Matter Expert. Reevaluating staff job descriptions
Curator of Science Symposia's Science as Art Shows

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

Steven Truschel, Ph.D.
Assistant Professor

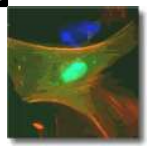
Tissues in Health and Disease, University of Pittsburgh School of Medicine, Course design committee

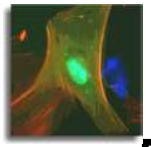
Simon C. Watkins, Ph.D.
Distinguished Professor and Vice Chairman, Director of Center of Biologic Imaging

Departmental Financial Affairs Committee (CBP)
Departmental Chairmans Advisory Committee (CBP)
Departmental Student Advisory Committee (CBP)
Interdisciplinary Graduate Program, Curriculum Committee
University of Pittsburgh School of Medicine, Research Advisory Committee
University of Pittsburgh Cancer Institute Core Resources Committee
Chair Cell Biology Space Allocation Review Committee
PittMed Editorial Board
Scientific Advisory Board, Starzl Transplant Institute
Associate Editor, Experimental Biology and Medicine
Intramural Bridging Fund Review Committee (2006-present)
Scientific Advisory Board: Roper Scientific
Chair Cell Biology Tenure and Promotions Committee
Cell Biology Faculty Recruitment Committee
Chair UPCI Luminex advisory committee (2017-present)
Chair UPCI proteomics advisory committee (2015-present)
Chair UPCI flow cytometry advisory committee (2014-present)
UPCI chemical biology advisory committee

Nathan Yates, Ph.D.
Associate Professor

Director of a campus wide Mass Spectrometry Center

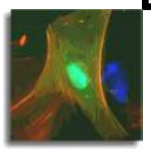


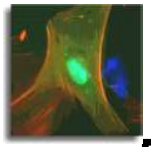


Cell Biology Sponsored Research Funding (FY20)

Name	Agency Name	Account	Title	Annual DC	Annual IDC
Michael Butterworth	National Institutes of Health	126596	Role of MicroRNAs in kidney sodium regulation	168,988	91,253
Michael Butterworth	National Institutes of Health	130427	Altered Biosynthesis and Function of ABCC6 in Systemix Mineralization Disorders	8,814	4,981
Dan Devor	Abbvie	714832	Proposal to Evaluate AbbVie Compounds on KCa3.1 Function	41,667	25,625
Dan Devor	Cystic Fibrosis Foundation	715030	Role of Potassium Channelsin Ion Transport Across HBEs	20,833	2,500
Marijn Ford	National Institutes of Health	128551	The Roles of the Dynamin-Related Protein Vps1 and the ESCRT Complex in Microautophagy	193,752	99,936
Gerry Hammond	National Institutes of Health	128053	Directing Membrane Function with Inositol Lipids in Health and Disease	249,404	140,914
Gerry Hammond	National Institutes of Health	134155	Defining how T cells measure the strength of T cell receptor signals (PI: Hawse)	8,333	4,708
Gerry Hammond	National Institutes of Health	134196	Endocytic Pathway Dysfunction in Dent Disease (PI: Weisz)	2,111	1,193
Yang Hong	National Institutes of Health	129185	Membrane Targeting and Retargeting of Polarity Proteins	196,500	106,582
Adam Kwiatkowski	National Institutes of Health	127250	Alpha-Catenin Function in Cardiomyocyte Adhesion and Cytoskeletal Organization	231,668	123,003
Sanford Leuba	National Institutes of Health	412481	Evolved DNA Contacts Required for Hexameric Helicase Unwinding.	42,141	23,810
Chelsea Merkel	National Institutes of Health	129459	The Role of Vinculin in Cardiomyocyte Adhesion and Mechanical Continuity	8,181	-
Sandra Murray	National Science Foundation	011642	Regulation of Annular Gap Junction Processing	40,000	21,600
Yi Shi	National Institutes of Health	132802	Mechanisms of Signaling Protein Retention in the Primary Cilium	16,641	9,402
Yi Shi	UPMC	713121	Novel Tools to Study Mitochondria and Postsynaptic Densities in Aging	20,000	-
Yi Shi	MJFF	714314	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	133630	Pathogenesis of Cancer	204,064	107,116
Alexander Sorkin	National Institutes of Health	413147	Exosome Based Placental Maternal Communication	45,626	25,780
Alexander Sorkin	National Institutes of Health	012007	Modeling Spatiotemporal Control of EGFR-ERK Signaling in Gene-Edited Cell Systems	116,400	65,767
Alexander Sorkin	National Institutes of Health	130202	Signaling by them EGF Receptor from Endosomes	207,966	117,378
Alexander Sorkin	National Institutes of Health	130262	Regulation of Dopamine Transporter by Trafficking	234,912	118,782
Claudette St. Croix	National Institutes of Health	126356	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	126422	Pulmonary Arteriole Occlusion by Platelet Neutrohil micro emboli in acute chest syndrome	23,771	1,828
Claudette St. Croix	National Institutes of Health	128929	Vascular Subphenotypes of Lung Disease - Preclinical Assessment Core	68,014	38,428
Claudette St. Croix	National Institutes of Health	128930	Signaling Mechanisms by which Mitochondria Regulates Fibrosis in the Lung	4,623	2,496
Claudette St. Croix	National Institutes of Health	129016	Anti-Inflammatory Lipid Mediators in Asthma	8,855	5,003
Claudette St. Croix	National Institutes of Health	129017	Vascular Smooth Muscle and Blood Pressure Regulation By cyb5R2	7,632	4,312
Claudette St. Croix	National Institutes of Health	129028	Novel Role of Smooth Muscle B5 Reductase in Sickle Cell Disease	4,540	2,565
Claudette St. Croix	National Institutes of Health	129631	Regulation of Fuel Utilization by Lysine Acetylation in the Failing Heart	3,707	2,094
Claudette St. Croix	National Institutes of Health	130121	Exploring and Exploiting Metabolic Plasticity in Regulatory T Cells	9,194	5,195
Claudette St. Croix	National Institutes of Health	130393	The Anti-Aging Role of Klotho in Skeletal Muscle Regeneration	27,998	10,170
Claudette St. Croix	National Institutes of Health	130798	Host Control Mechanisms Against K. Pneumoniae Infection in the Lungs	25,920	14,645
Claudette St. Croix	National Institutes of Health	130807	Mechanisms of Myocardial-Infarction Induced Insulin Resistance	11,160	6,306
Claudette St. Croix	National Institutes of Health	132826	Mechanisms and Promotion of Immune Regulation by CD4+	14,241	5,220

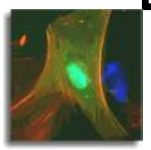
Claudette St. Croix	National Institutes of Health	131514	Mechanism-Directed Sequential Delivery of Radiation Mitigators Imaging Radiation Apathology Core	6,429	3,472
Claudette St. Croix	National Institutes of Health	131935	Biological and Physical Mechanisms of Ultrasound/Microbubble-Mediated Therapeutic Gene Delivery Across the Endothelial Barrier	26,829	10,074
Claudette St. Croix	National Institutes of Health	132029	Obesity-associated Mitophagy Resistance	13,588	7,678
Claudette St. Croix	National Institutes of Health	132049	The Role of Telomerase in Valvular Calcification	3,706	2,094
Claudette St. Croix	American Heart Association	713814	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	415050	The Function of EGFL6 in Ovarian Cancer Cell Biology, Tumor Initiation, and Therapy	5,633	3,183
Claudette St. Croix	Pitt Foundation	713793	PET imaging of vaso-occlusion in sickle cell disease: from mice to humans	11,502	-
Claudette St. Croix	National Institutes of Health	132829	Mechanisms of platelet exosome-mediated acute chest syndrome in sickle cell disease	24,753	11,443
Claudette St. Croix	National Institutes of Health	132768	Epigenetic Control of Smooth Muscle Cell Phenotype during Microvascular Remodeling	9,713	3,228
Claudette St. Croix	National Institutes of Health	415438	Cardiolipin as a Novel Mediator of Acute Lune Injury	74,824	39,451
Claudette St. Croix	National Institutes of Health	132863	Role of Necroptosis in Colorectal Cancer Therapy	11,392	6,436
Claudette St. Croix	National Institutes of Health	132923	Tead1 and Cardiac Adaptation	10,000	3,390
Claudette St. Croix	Department of Defense	415701	Neomorphic cell-cell adhesive reprogramming facilitates metastasis of ESR1 mutant breast cancer	8,373	4,731
Claudette St. Croix	National Institutes of Health	133222	Endothelial Reprogramming in Pulmonary Hypertension	9,955	3,930
Claudette St. Croix	National Institutes of Health	133336	Role of extracellular matrix in age-related declines of muscle regeneration	24,571	9,740
Claudette St. Croix	National Institutes of Health	133628	Inhibition of DNA double strand break repair in TNBC by nitro-fatty acids	7,697	4,348
Claudette St. Croix	National Institutes of Health	134015	Physical exercise and Blood-brain communication: exosomes, Klotho and choroid plexus (PI: Koldamova)	4,690	2,650
Claudette St. Croix	National Institutes of Health	134119	Druggable Mitochondria Targets for Treatment of Cerebral Ischemia (PI - Clark/Bayir)	4,734	2,675
Claudette St. Croix	National Institutes of Health	134320	Protein-Oxidized Phospholipid Interactions Determine Epithelial Cell Fate and Asthma Control (PI: Wenzel & Kagan)	7,145	3,331
Donna Beer Stolz	National Institutes of Health	126595	Mechanisms of Trabecular Meshwork Regeneration by Stem Cell (PI - Du)	11,279	4,593
Donna Beer Stolz	National Institutes of Health	127224	Dysfunctional Muscle remodeling and regeneration in environmental disease (PI - Ambrosio/Barchowsky)	24,736	13,975
Donna Beer Stolz	National Institutes of Health	127330	Elucidating Mechanisms Involved in Lamin B1 Mediated Demyelination (PI - Padiath)	5,149	2,780
Donna Beer Stolz	National Institutes of Health	133061	Luminal Epithelial Junctions, Polarity and Permeability in BPH (PI - Wang)	9,584	4,777
Donna Beer Stolz	National Institutes of Health	129224	Alpha Catenin Function in Cardiomyocyte adhesion and Cytoskeletal (PI - Kwiatkowski)	8,477	4,578
Donna Beer Stolz	National Institutes of Health	414776	Characterization of Meiotic Crossover Surveillance System (PI - Yanowitz)	8,952	5,058
Donna Beer Stolz	National Institutes of Health	133459	Core G: Signature-Directed, Sequential Delivery of Radiation Mitigators (PI - Greenberger)	13,531	7,307
Donna Beer Stolz	National Institutes of Health	131556	Melatonin Biosynthesis in Neuronal Mitochondria - (PI - Friedlander)	5,222	2,950
Donna Beer Stolz	National Institutes of Health	131819	Fox01 in Beta-Cell Compensation (PI - Dong)	697	394
Donna Beer Stolz	National Institutes of Health	131934	Biological and Physical Mechanisms of Ultrasound/Microbubble-Mediated Therapeutic Gene Delivery Across the Endothelial Barrier (PI - Villaneuva)	2,981	1,684
Donna Beer Stolz	National Institutes of Health	132401	Correcting Pathogenic TGF beta Activity in the Airway (PI - Swiatecka Urban)	9,152	4,800
Donna Beer Stolz	National Institutes of Health	132623	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	415439	Cardiolipin as a Novel Mediator of Acute Lune Injury (PI- Mallampalli)	23,885	13,495
Donna Beer Stolz	National Institutes of Health	132583	Mechanisms of hypersensitivity to sound-induced cochlear damage (Rubio)	9,419	4,418

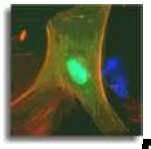




Donna Beer Stolz	National Institutes of Health	133785	Advanced Imaging Core (Core A)	102,539	39,239
Donna Beer Stolz	National Institutes of Health	133682	Beta-catenin-driven hepatobiliary reprogramming as a therapeutic modality for cholangiopathies	3,372	3,229
Donna Beer Stolz	National Institutes of Health	133897	Astrocytes-Mediated Regulation of Wnt/b-Catenin Pathway in Ischemic Brain	4,953	2,798
Donna Beer Stolz	National Institutes of Health	134174	Lamin B2 regulates nuclear remodeling in cardiomyocyte terminal differentiation (PI - Kuhn)	4,665	1,223
Linton Traub	National Institutes of Health	133979	Protein Mechanics Regulating Endocytic Clathrin Coat	140,892	72,065
Steven Truschel	National Institutes of Health	131651	Bladder Mucosal Dysfunction During Aging	29,322	16,567
Simon Watkins	National Institutes of Health	126509	Cancer Center Support Grant	82,665	43,946
Simon Watkins	National Institutes of Health	126772	Inhibition of Neural Electrode-Mediated Inflammation and Neuronal Cell Death	9,840	4,331
Simon Watkins	National Institutes of Health	127024	DNA Damage Recognition by Nucleotide Excision Repair Proteins	9,173	5,160
Simon Watkins	National Institutes of Health	127140	Exosomes as paracrine signal mediators in cardiac allograft rejection	9,505	4,503
Simon Watkins	National Institutes of Health	127963	Inhibition of the ALT Pathway by Interfering with Poly-ADP-Ribose Metabolism	15,720	5,624
Simon Watkins	National Institutes of Health	128531	BMP10 in Cardiovascular Development and Hereditary Hemorrhagic Telangiectasia.	10,318	3,852
Simon Watkins	National Institutes of Health	128592	Regulated Activation of latent-TGfB Determines Leukocyte Occupancy of the Epidermal Niche	2,500	-
Simon Watkins	National Institutes of Health	128760	Mechanistic Elucidation and Targeted Therapy of Platelet Dysfunction After Trauma (Neal)	12,262	6,917
Simon Watkins	National Institutes of Health	128922	B Cells in the Pathogenesis of Allograft Rejection (Chalasani)	7,138	4,033
Simon Watkins	National Institutes of Health	128926	Improving cerebral aneurysm risk assessment through understanding wall vulnerability and failure models	22,236	12,563
Simon Watkins	National Institutes of Health	129889	ROS driven mitochondrial-telomere dysfunction during environmental stress-	44,578	25,187
Simon Watkins	National Institutes of Health	129919	Mechanisms of HMGB1 Release from Ischemic Muscle in Peripheral Arterial Disease (Hartman)	13,322	7,527
Simon Watkins	National Institutes of Health	130203	Signaling by the EGF Receptor from Endosomes	12,071	6,819
Simon Watkins	National Institutes of Health	130302	A Confocal fluorescence Microscopy Brain Data Archive	40,000	22,660
Simon Watkins	National Institutes of Health	130405	Structure and Activation of Multiprotein Signaling Complex (PI Vignali)	13,398	4,304
Simon Watkins	National Institutes of Health	130520	Mechanisms of HMGB1 Release from Ischemic Muscle in Peripheral Arterial disease	8,942	3,360
Simon Watkins	National Institutes of Health	131100	Caspace-1 and Inflammasome Activation in Traumahemorrhagic Shock	18,159	6,869
Simon Watkins	National Institutes of Health	131235	Mechanisms of Immune Dysfunction After Trauma and Surgical Sepsis	21,307	10,344
Simon Watkins	National Institutes of Health	131289	Illuminating Metabolic Pathways Enabled by Early T Cell Activation	11,893	6,711
Simon Watkins	National Institutes of Health	131359	Damage Sensor role of UV-DDB during base excision repair	12,486	7,054
Simon Watkins	National Institutes of Health	131417	Lipid Imaging in Traumatic Brain Injury by High Resolution GCIB-Secondary Ion Mass Spectrometry	17,776	10,043
Simon Watkins	National Institutes of Health	131523	HIV-Reservoir in Naive CD4 + T Cells (PI - Sluis -Cremer)	2,134	1,018
Simon Watkins	National Institutes of Health	131671	IFITM-Mediated Virus Restriction	26,688	11,152
Simon Watkins	National Institutes of Health	131755	Pgh Center for Kidney research	5,237	2,959
Simon Watkins	National Institutes of Health	131835	Exploring Antisense Oligonucleotides as potential therapy for autosomal dominant	4,867	2,750
Simon Watkins	National Institutes of Health	131942	Visualization of Influenza Viral RNA Assembly (PI - Lakdowala)	10,187	4,344
Simon Watkins	National Institutes of Health	132058	Engineering Biologic Topography into Vascular Grafts	4,041	1,752
Simon Watkins	National Institutes of Health	132085	Molecular Mechanisms of Eastern Equic Encephalitis Virus Pathogenesis	26,173	11,962
Simon Watkins	National Institutes of Health	132109	Project 1 for SSC Cort	10,000	5,566

Simon Watkins	National Institutes of Health	132196	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	132286	Benzodiazepine Treatment Induced Neuroplasticity (PI - Jacob)	7,152	4,042
Simon Watkins	National Institutes of Health	132413	Role of RAN peptides in polyQ-Independent Toxicity in a new C. Elgans Model	14,578	6,484
Simon Watkins	National Institutes of Health	132465	Structure, Function and Mechanistic Analysis of LAG3	44,018	13,570
Simon Watkins	National Institutes of Health	132817	Excision Repair of environmental Telomere Damage	34,880	19,707
Simon Watkins	National Institutes of Health	132906	NitriteTherapy to Improve Mitochondrial Energetics	15,138	4,553
Simon Watkins	National Institutes of Health	133048	Administrative Supplement to Bladder Mucosal Dysfunction during Aging (PI Birder)	18,460	10,430
Simon Watkins	National Institutes of Health	133141	Immunity to Live Mosquito Probing and Flavivirus Infection in Human Skin (Barratt Boyes - PI)	2,387	1,349
Simon Watkins	National Institutes of Health	133193	Pittsburgh Center for HIV Protein Interactions (PCHPI) Gronenborn-	23,750	13,201
Simon Watkins	National Institutes of Health	133445	Core G: signature-directed sequential delivery	103,757	48,468
Simon Watkins	National Institutes of Health	133499	Role of Purine Dysregulation in the Underactive Bladder	24,748	13,983
Simon Watkins	National Institutes of Health	133668	Placental Extracellular vesicles ...	10,000	4,802
Simon Watkins	National Institutes of Health	133673	Understanding & Countering Mechanisms Underlying IL-33_driven support of Graf vs host disease	14,678	3,208
Simon Watkins	National Institutes of Health	133799	Seal r01 renewal	10,163	5,742
Simon Watkins	National Institutes of Health	133910	DNA Damage Signaling …	26,688	15,079
Simon Watkins	National Institutes of Health	133913	CD91 and Cancer Immunosurveillance (PI Binder)	7,061	3,989
Simon Watkins	National Institutes of Health	413419	Visualizing Synaptic Connection Between Distinct Cell types in Whole Mouse Brain (Bruchez - CMU subcontract)	81,198	40,227
Simon Watkins	National Institutes of Health	415574	Targeting Host Responses to Prevent Virus-Induced ARDS in the Nonhuman primate model	11,023	6,228
Simon Watkins	National Institutes of Health	416600	Targeting the Chemokine System to Sensitize Tumors to Immunotherapy	10,046	4,970
Simon Watkins	National Institutes of Health	714570	RFP/IRRF Catalyst Award for Innovated Research Approaches for Agre Related Macular Degeneration (PI Sinha)	20,000	-
Simon Watkins	National Institutes of Health	714888	UPMC Immune Transplant and Therapy Center (ITTC) AAVision: gene therapy (Byrne PI)	14,153	-
Alan Watson	National Institutes of Health	131623	Closed-Loop Neuroelectric Control of Meesis and Gastric Motility (supplement 1)	20,000	-
Alan Watson	National Institutes of Health	133044	Contribution of Sympathetic Nerves to Herpes Stromal Keratitis	21,842	12,340
Alan Watson	National Institutes of Health	133060	U54 Pilot Project - A comprehensive Approach to Imaging Benign rostatic Hyperplasia (BPH) (Wang PI)	70,000	28,251
Alan Watson	National Institutes of Health	134245	Evaluate Ferret as a New Small Animal Model of Aerosol Exposure to Encephalitic alpha viruses (Reed PI)	988	558
Alan Watson	National Institutes of Health	415188	ENSMAP: Molecular and Functional Mapping of the Enteric Nervous System (Southard-Smith PI)	16,721	9,424
Alan Watson	National Institutes of Health	415650	Atlas of Autonomic and Neuormodulatory Lineages in the Developing Lower Urinary Tract	29,952	16,923
Alan Watson	National Institutes of Health	415635	Understanding Functional Connectivity of Sensory and Motor Pathways to Specific Regions of the Lower Urinary Tract	62,137	35,107
Alan Watson	Department of Defense	416302	Evaluate Ferret as a New Small Animal Model of Aerosol Exposure to Encephalitic alpha viruses (Reed PI)	5,822	3,289
Rachel Wills	National Institutes of Health	134057	PIP5K1A Enhances Phosphoinositide Signaling to Drive Breast Cancer	3,793	
Nathan Yates	National Institutes of Health	129632	Regulation of Fuel Utilization by Lysine Acetylation in the Falling Heart	17,591	9,939
Nathan Yates	National Institutes of Health	132770	Alpha-Catenin Function in Cardiomyocyte Adhesion and Cytoskeletal Organization	6,483	3,532
Nathan Yates	National Institutes of Health	132357	Alzheimer's Disease Research center-funding	8,945	4,830
Nathan Yates	National Institutes of Health	134094	Alzheimer's Disease Research center-funding	20,793	11,748
Nathan Yates	National Institutes of Health	130398	The Metabolic Evolution of Staphylococcus Aureus	12,070	6,820

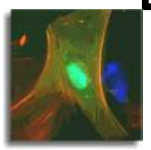


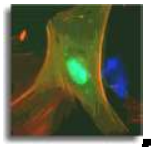


Nathan Yates	National Institutes of Health	130992	Mechanisms by Which Cyanotriazoles Activate Latent HIV	8,945	5,054
Nathan Yates	Department of Defense	414535	Physiological Biomarkers of Resilience and Musculoskeletal Readiness	40,412	17,183
Nathan Yates	National Institutes of Health	132016	Synaptic Resilience to Psychosis in Alzheimer Disease	7,990	4,514
Nathan Yates	National Institutes of Health	132084	Liver-enriched Transcription Factors as Prognostic markers and Therapeutic Targets in Alcoholic Hepatitis	7,205	4,071
Nathan Yates	National Institutes of Health	415291	Novel Approaches to Enhance Tumor Cell Cytotoxicity of Alkylating Agents	10,364	5,855
Nathan Yates	National Institutes of Health	132754	Omega-3, Isoflavones & Amyloid Deposition in Cognitively	20,000	11,300
Nathan Yates	National Institutes of Health	Brodsky	ER and post-ER quality control of integral membrane proteins	4,167	2,354
Nathan Yates	UPMC	714088	Discovering the Protein Signature of Synapse Loss and Cognitive Decline During Aging	70,182	-
Nathan Yates	National Institutes of Health	7133804	Imaging Pathophysiology in Aging and Neurodegeneration	30,000	16,200
Nathan Yates	National Institutes of Health	133797	Mild Cognitive Impairment: A Prospective Community Study	60,000	32,400
Nathan Yates	Alzheimer's Association	714526	Measurement of Blood-Based Amyloid -Beta Biomarkers by Immuno-Precipitation Mass Spectrometry in a Population Cohort Sub-Group	36,422	-
Nathan Yates	Alzheimer's Association	714527	Measurement of Blood-Based Amyloid -Beta Biomarkers by Immuno-Precipitation Mass Spectrometry in a Population Cohort Sub-Group	18,518	-
Nathan Yates	National Institutes of Health	133814	Targeting defective necroptosis in colorectal cancer	5,649	3,191
				4,892,312	2,272,706

Cell Biology Sponsored Research Funding (FY21)

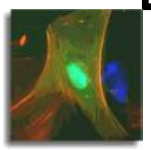
Name	Agency Name	Account	Title	Annual DC	Annual IDC
Butterworth	National Institutes of Health	130427	Altered biosynthesis and function of ABCC6 in systemic mineralizatin disorders	1,284	726
Butterworth	American Heart Association	waiting #	Monitoring MicroRNA Function in Living Cell	40,771	4,077
Butterworth	National Institutes of Health	R01	Role of MicroRNAs in kidney sodium regulation	54,745	30,931
Devor	Abbvie	714832	Abbvie Inc.	58,333	35,875
Devor	Cystic Fibrosis Foundation	715030	Role of Potassium Channelsin Ion Transport Across HBEs	125,000	15,000
Ford	National Institutes of Health	128551	The roles of the dynamin-related protein Vps1 and the ESCRT Complex in microautophagy	193,740	99,948
Hammond	National Institutes of Health	128053	Directing membrane function with inositol lipids in health and disease	250,000	141,250
Hammond	National Institutes of Health	134155	Defining how T cells measure the strength of T cell receptor signals	25,000	14,125
Hammond	National Institutes of Health	134196	Endocytic Pathway Dysfunction in Dent Disease	6,624	3,744
Hammond	National Institutes of Health	134696	Directing membrane function with inositol lipids in health and disease	68,964	0
Hong	National Institutes of Health	129185	Membrane Targeting and Retargeting of Polarity Proteins	147,375	79,937
Kwiatkowski	National Institutes of Health	127250	Alpha-Catenin Function in Cardiomyocyte Adhesion and Cytoskeletal Organization	154,389	81,954
Kwiatkowski	National Institutes of Health	416787	A novel autoinflammatory skin disease in a patient with mutations in alpha-T-catenin	35,502	20,059
Leuba	National Science Foundation	412481	Evolved DNA Contacts Required for Hexameric Helicase Unwinding.	3,512	1,984
Leuba	National Science Foundation	412481	Evolved DNA Contacts Required for Hexameric Helicase Unwinding.	18,442	10,420
Murray	National Science Foundation	012513	Recycling: An Alternative Method for Rapid Gap Junction Plaque Assembly	184,671	90,663
Murray	National Institutes of Health	134998	A Graduate Training Path to Promote Traditional and Non-Traditional Professional Outcomes	274,920	14,314
Perez	National Cancer Center	715180	Improving the Tumor-Suppressing Efficacy of EGFR Antibodies on Head-and-Neck Squamous Cell Carcinoma	40,000	0
Shi	National Institutes of Health	132802	Mechanisms of Signaling Protein Retention in the Primary Cilium	15,941	9,008
Shi	MJFF	714314	Gaining Access to the Brain: Robust Integrative Proteomics to Produce Novel, Highly Potent Blood-Brain Barrier (BBB)	100,000	10,000
Shi	National Institutes of Health	135342	Development of the Next Generation Antibody Technologies and Their Applications	208,333	117,708
Sorkin	National Institutes of Health	413147	Exosome Based Placental Maternal Communication	45,626	25,779
Sorkin	National Science Foundation	012007	Modeling Spatiotemporal Control of EGFR-ERK Signaling in Gene-Edited Cell Systems	42,070	23,630
Sorkin	National Institutes of Health	130202	Signaling by them EGF Receptor from Endosomes	207,895	117,460
Sorkin	National Institutes of Health	130262	Regulation of Dopamine Transporter by Trafficking	233,415	118,239
Sorkin	National Institutes of Health	133630	Pathogenesis of Cancer - Role of EGR Receptor Endocytosis	242,962	115,686
Sorkin	National Institutes of Health	134682	admin supplement egf grant	69,255	0
St. Croix	National Institutes of Health	128929	Vascular Subphenotypes of Lung Disease - Preclinical Assessment Core	57,468	32,469
St. Croix	National Institutes of Health	129017	Vascular Smooth Muscle and Blood Pressure Regulation By cyb5R2	6,396	3,613
St. Croix	National Institutes of Health	129028	Novel Role of Smooth Muscle B5 Reductase in Sickle Cell Disease	379	214
St. Croix	National Institutes of Health	129631	Regulation of Fuel Utilization by Lysine Acetylation in the Failing Heart	3,653	2,064
St. Croix	National Institutes of Health	130121	Exploring and Exploiting Metabolic Plasticity in Regulatory T cells	9,470	5,350
St. Croix	National Institutes of Health	130393	The Anit-Aging Role of Klotho in Skeletal Muscle Regeneration	25,610	8,853
St. Croix	National Institutes of Health	130798	Host Control Mechanisms against K. Pneumoniae Infection in the Lungs	27,003	15,257
St. Croix	National Institutes of Health	130807	Mechanisms of Myocardial Infarction-Induced Insulin Resistance	11,701	6,611

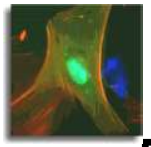




St. Croix	National Institutes of Health	134448	Mechanisms and Promotion of Immune Regulation by CD4+ regulatory T cells within allografts	14,236	5,427
St. Croix	National Institutes of Health	133458	Core G: Signature-Directed, Sequential Delivery of Radiation Mitigators	1,076	581
St. Croix	National Institutes of Health	131935	Biological and Physical Mechanisms of Ultrasound/Microbubble-Mediated Therapeutic Gene Delivery Across the Endothelial Barrier	32,502	12,714
St. Croix	National Institutes of Health	132029	Obesity-associated Mitophagy Resistance	13,714	7,748
St. Croix	National Institutes of Health	132049	The Role of Telomerase in Valvular Calcification	3,696	2,088
St. Croix	National Institutes of Health	714854	Reprogramming of the Vascular Matrisome and Matrix Cellularity as a Pathogenic Lynchpin for Pulmonary Hypertension	4,893	489
St. Croix	National Institutes of Health	415050	The Function of EGFL6 in Ovarian Cancer Cell Biology, Tumor Initiation, and Therapy	5,558	3,140
St. Croix	National Institutes of Health	132829	Mechanisms of platelet exosome-mediated acute chest syndrome in sickle cell disease	24,671	11,584
St. Croix	National Institutes of Health	132768	Epigenetic Control of Smooth Muscle Cell Phenotype during Microvascular Remodeling	9,737	3,241
St. Croix	National Institutes of Health	415438	Cardiolipin as a Novel Mediator of Acute Lune Injury	81,966	43,486
St. Croix	National Institutes of Health	132863	Role of Necroptosis in Colorectal Cancer Therapy	10,552	5,962
St. Croix	National Institutes of Health	132923	Tead1 and Cardiac Adaptation	20,000	7,910
St. Croix	American Heart Association	415701	Neomorphic cell-cell adhesome reprogramming facilitates metastasis of ESR1 mutant breast cancer	10,555	5,964
St. Croix	American Heart Association	133222	Endothelial Reprogramming in Pulmonary Hypertension	9,888	3,892
St. Croix	National Institutes of Health	133336	Role of extracellular matrix in age-related declines of muscle regeneration	26,040	10,091
St. Croix	National Institutes of Health	133628	Inhibition of DNA double strand break repair in TNBC by nitro-fatty acids	9,147	5,168
St. Croix	Pitt Foundation	134015	Physical exercise and Blood-brain communication: exosomes, Klotho and choroid plexus	5,712	3,228
St. Croix	National Institutes of Health	134119	Druggable Mitochondrial Targets for Treatment of Cerebral Ischemia	11,361	6,419
St. Croix	National Institutes of Health	134320	Protein-Oxidized Phospholipid Interactions Determine Epithelial Cell Fate and Asthma Control	28,580	13,323
St. Croix	National Institutes of Health	134923	Mucin sialylation drives epithelial cell senescence and severe asthma	19,793	8,923
St. Croix	National Institutes of Health	134736	Mechanisms of myelopoiesis after myocardial infection (Dutta)	5,897	3,332
St. Croix	National Institutes of Health	Nejak-Bowen	Beta-catenin inhibition as novel therapeutic strategy for porphyria	11,472	1,773
St. Croix	National Institutes of Health	Sadovsky	Ferroptosis in Placental Injury and Adverse Pregnancy Outcome	1,458	824
St. Croix	National Institutes of Health	Poholek	Lung-specific expression and function of Blimp-1 in T cells impacting allergic asthma	2,500	752
St. Croix	National Institutes of Health	Bayir	Oxidative Lipidomics in Pediatric Traumatic Brain Injury	6,250	3,531
Stolz	National Institutes of Health	126595	Mechanisms of Trabecular Meshwork Regeneration by Stem Cells	1,921	789
Stolz	National Institutes of Health	127224	Dysfunctional Muscle remodeling and regeneration in environmental disease	14,461	8,171
Stolz	National Institutes of Health	127330	Elucidting mechanisms involved in lamin B1 mediated demyelination	4,170	2,252
Stolz	National Institutes of Health	134790	Luminal Epithelial Junctions, Polarity, and Permeability in BPH Pathogenesis	9,505	4,856
Stolz	National Institutes of Health	129224	Alpha-Catenin Function in Cardiomyocyte Adhesion and Cytoskeletal Organization	5,702	3,079
Stolz	National Institutes of Health	414766	Characterization of a Meiotic Crossover Surveillance System	8,952	5,058
Stolz	National Institutes of Health	133459	Core G Signature-Directed, Sequential Delivery	2,264	1,223
Stolz	National Institutes of Health	131556	Melatonin Biosynthesis in Neuronal Mitochondria	5,151	2,910
Stolz	National Institutes of Health	131934	Biological and Physical Mechanisms of Ultrasound/Microbubble-Mediated Therapeutic Gene Delivery Across the Endothelial Barrier	3,334	1,884
Stolz	National Institutes of Health	132401	Correcting Pathogenic TGF beta Activity in the Airway	10,164	4,895
Stolz	National Institutes of Health	132623	Progressive degenerative role of Nox and thrombospondin-1 in the aging vasculature	8,520	4,814

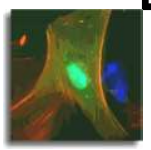
Stolz	National Institutes of Health	415439	Cardiolipin as a Novel Mediator of Acute Lune Injury	18,158	10,259
Stolz	National Institutes of Health	132583	Mechanisms of hypersensitivity to sound-induced cochlear damage	10,344	4,859
Stolz	National Institutes of Health	133785	Advanced Imaging Core (Core A)	90,749	51,273
Stolz	National Institutes of Health	133682	Beta-catenin-driven hepatobiliary reprogramming as a therapeutic modality for cholangiopathies	17,361	3,878
Stolz	National Institutes of Health	133897	Astrocytes-Mediated Regulation of Wnt/b-Catenin Pathway in Ischemic Brain	8,683	4,906
Stolz	National Institutes of Health	134174	Lamin B2 regulates nuclear remodeling in cardiomyocyte terminal differentiation	18,660	4,893
Stolz	National Institutes of Health	134739	Pharmacological studies of rhodopsin metabolism	5,000	2,825
Stolz	National Institutes of Health	134844	Understanding mechanisms of vaping-associated lung injury	18,570	10,492
Stolz	National Institutes of Health	135211	Fox01 in Gestational Diabetes	3,577	2,021
Traub	National Institutes of Health	133979	Protein Mechanics Regulating Endocytic Clathrin Coat	140,892	72,065
Truschel	National Institutes of Health	131651	Bladder Mucosal Dysfunction During Aging	4,740	2,679
Watkins	National Institutes of Health	126509	Cancer Center Support Grant	82,591	43,831
Watkins	National Institutes of Health	127024	DNA Damage Recognition by Nucleotide Excision Repair Proteins	3,822	2,137
Watkins	National Institutes of Health	127963	Inhibition of the ALT Pathway by Interfering with Poly-ADP-Ribose Metabolism	15,720	5,624
Watkins	National Institutes of Health	128592	Regulated Activation of latent-TGfB Determines Leukocyte Occupancy of the Epidermal Niche	2,292	0
Watkins	National Institutes of Health	128760	Mechanistic Elucidation and Targeted Therapy of Platelet Dysfunction After Trauma (Neal)	12,601	7,121
Watkins	National Institutes of Health	128922	B Cells in the Pathogenesis of Allograft Rejection	7,263	4,104
Watkins	National Institutes of Health	128926	Improving cerebral aneurysm risk assessment through understanding wall vulnerability and failure models	18,530	10,469
Watkins	National Institutes of Health	129919	Mechanisms of HMGB1 Release from Ischemic Muscle in Peripheral Arterial Disease (Hartman)	19,593	11,070
Watkins	National Institutes of Health	130203	Signaling by the EGF Receptor from Endosomes	12,105	6,839
Watkins	National Institutes of Health	130302	A Confocal fluorescence Microscoy Brain Data Archive	40,000	22,660
Watkins	National Institutes of Health	130405	Structure and Activation of Multiprotein Signaling Complex (PI Vignali)	13,409	4,322
Watkins	National Institutes of Health	130520	Mechanisms of HMGB1 Release from Ischemic Muscle in Peripheral Arterial Disease	8,988	3,383
Watkins	National Institutes of Health	131100	Caspace-1 and Inflammasome Activation in Traumahemorrhagic Shock (PI - Scott)	18,159	6,869
Watkins	National Institutes of Health	131235	Mechanisms of Immune Dysfunction After Trauma and Surgical Sepsis	21,307	10,343
Watkins	National Institutes of Health	131359	Damage Sensor role of UV-DDB during base excision repair	12,486	7,054
Watkins	National Institutes of Health	131417	Lipid Imaging in Traumatic Brain Injury by High Resolution GCIB-Secondary Ion Mass Spectrometry	17,776	10,043
Watkins	National Institutes of Health	131755	Pgh Center for Kidney research	5,237	2,959
Watkins	National Institutes of Health	131835	Exploring Antisense Oligonucleotides as a potnetial therapy for autosomal dominant	811	458
Watkins	National Institutes of Health	131942	Visualization of Influenza Viral RNA Assembly (PI - Lakdowala)	10,187	4,345
Watkins	National Institutes of Health	132085	Molecular Mechanisms of Eastern Equic Encephalitis Virus Pathogenesis	26,173	11,962
Watkins	National Institutes of Health	132196	Role of the Snail1-Twist-p21 axis on cell cycle arrest and renal fibrosis development	30,101	11,679
Watkins	National Institutes of Health	132286	Benzodiazepine Treatment Induced Neuroplasticity (PI - Jacob)	4,358	2,462
Watkins	National Institutes of Health	132413	Role of RAN peptides in polyQ-Independent Toxicity in a new C. Elgans Model	8,503	3,782
Watkins	National Institutes of Health	132465	Structure, Function and Mechanistic Analysis of LAG3	44,017	13,570
Watkins	National Institutes of Health	132817	Excision Repair of environmental Telomere Damage	37,787	21,349





Watkins	National Institutes of Health	132906	Nitrite Therapy to Improve Mitochondrial Energetics	15,138	4,553
Watkins	National Institutes of Health	133141	Immunity to Live Mosquito Probing and Flavivirus Infection in Human Skin (Barratt Boyes - PI)	2,387	1,349
Watkins	National Institutes of Health	133193	Pittsburgh Center for HIV Protein Interactions (PCHPI) Gronenborn-	23,750	13,201
Watkins	National Institutes of Health	133445	Core G: Mechanism-directed sequential delivery of radiation mitigators	16,500	7,650
Watkins	National Institutes of Health	133499	Role of Purine Dysregulation in the Underactive Bladder	24,748	13,983
Watkins	National Institutes of Health	133668	Placental Extracellular vesicles ...	10,000	4,803
Watkins	National Institutes of Health	133700	Project 1 for SSC Cort	9,999	5,649
Watkins	National Institutes of Health	133799	Seal r01 renewal	10,163	5,742
Watkins	National Institutes of Health	133910	DNA Damage Signaling to dormant origins of replication	45,750	25,849
Watkins	National Institutes of Health	133913	CD91 and Cancer Immunosurvelliance	12,105	6,839
Watkins	National Institutes of Health	134012	Exploring Antisense Oligonucleotides as a potnetial therapy for autosomal dominant	4,056	2,292
Watkins	National Institutes of Health	134516	Watching cooperative Interactions Between Base and neucleotide	41,588	23,497
Watkins	National Institutes of Health	134566	The role of Srtuin 5 in Acute Kidney Injury	4,842	2,736
Watkins	National Institutes of Health	134630	The role of Srtuin 5 in Acute Kidney Injury	9,000	5,085
Watkins	National Institutes of Health	134725	Effects of HSV-1 Infection on Neural Progenitor Cell Biology in vitro and In vivo (PI D'Aiuto)	17,528	7,756
Watkins	National Institutes of Health	135394	Regulation of Stress-Specific Protein Translation by the O-GlcNaC Transferase ogt-1 and 3' mRNA Processing	18,169	10,266
Watkins	National Institutes of Health	135400	Role of amelogenin phosphorylation during enamel secretion	9,200	4,576
Watkins	National Institutes of Health	413419	Visualizing Synaptic Connection Between Distinct Cell types in Whole Mouse Brain (Bruchez - CMU subcontract)	13,573	6,727
Watkins	Department of Defense	414574	Targeting Host Responses to Prevent Virus-Induced ARDS in the Nonhuman primate model	11,023	6,228
Watkins	National Institutes of Health	416600	MNA-Based Vaccines to Recondition the TME for Improved Therapeutic Response Against Melanoma	40,184	19,879
Watkins	Res Prevent Blin	714570	RFP/IRRF Catalyst Award for Innovated Research Approaches for Agre Related Macular Degeneration (PI Sinha)	10,000	0
Watkins	National Institutes of Health	Sant	Three Dimensional Organoid Models to study breast cancer progression	16,547	6,524
Watkins	UPMC ITTC	714888	UPMC Immune Transplant and Therapy Center (ITTC	33,967	0
Watkins	National Institutes of Health	Vockley	Neuroprotective Anti-Inflammatory Drugs as a Novel Combination Therapy for Neurological Rift Valley Fever (PI - Hartman)	21,906	12,377
Watkins	National Institutes of Health	Robertson	Improving Cerebral Aneurysm Risk Assessment through understanding Wall Vulnerability and Failure Modes	1,493	279
Watson	National Institutes of Health	134245	Endothelial miR-17-92 Protects Against Acute Kidney Injury (PI HO)	4,310	2,435
Watson	National Institutes of Health	134798	U54 Pilot Project - A comprehensive Approach to Imaging Benign rostatic Hyperplasia (BPH) (Wang PI)	70,000	28,250
Watson	National Institutes of Health	134958	Contribution of Sympathetic Nerves to Herpes Stromal Keratitis	11,613	9,457
Watson	National Institutes of Health	415635	A High Resolution 3D Atlas of Spinal Cord and Lower Urinary Tract Nerves (Keast, PI)	5,178	2,926
Watson	National Institutes of Health	416302	Evaluate Ferret as a new small animal model of aerosol exposure to encephalictic alphaviruses	6,985	3,947
Watson	Department of Defense	417021	CDMRP VRP	6,464	3,653
Watson	National Institutes of Health	Logan	High-throughput large-scale whole brain imaging and mapping of opiod-induced neuronal activity changes in dobaminergic and glutamatergic systems	37,500	18,986
Watson	National Institutes of Health	Ross	Neural Circuit Bases for Neurovascular Coupling	7,500	4,238
Watson	National Institutes of Health	Robertson	Improving Cerebral Aneurysm Risk Assessment through understanding Wall Vulnerability and Failure Modes	2,750	1,554
Wills	National Institutes of Health	134057	PIP5K1A Enhances Phosphoinositide Signaling to Drive Breast Cancer	45,522	0

Yates	National Institutes of Health	129632	Regulation of Fuel Utilization by Lysine Acetylation in the Failing Heart	13,100	7,402
Yates	National Institutes of Health	130398	The Metabolic Evolution of Staphylococcus Aureus	12,178	6,881
Yates	National Institutes of Health	132016	Synaptic Resilience to Psychosis in Alzheimer Disease	7,990	4,514
YAtes	National Institutes of Health	132770	Alpha-Catenin Function in Cardiomyocyte Adhesion and Cytoskeletal Organization	4,339	2,343
Yates	National Institutes of Health	133814	Targeting defective necroptosis in colorectal cancer	9,854	5,567
Yates	National Institutes of Health	134094	Alzheimer's Disease Research Center-funding	83,171	46,992
Yates	National Institutes of Health	134531	ER and Post-ER Quality Control of Integral Membrane Proteins	20,835	11,772
Yates	National Institutes of Health	135339	Liver-enriched Transcription Factors as Prognostic markers and Therapeutic Targets in Alcoholic Hepatitis	7,316	4,134
Yates	National Institutes of Health	135378	HEALing LB3P: Profiling Biomechanical, Biological and Behavioral phenotypes	141,388	48,809
Yates	Department of Defense	414535	Physiological Biomarkers of Resilience and Musculoskeletal Readiness	31,148	17,608
Yates	National Institutes of Health	417406	Novel Approaches to Enhance Tumor Cell Cytotoxicity of Alkylating Agents	13,819	7,807
Yates	National Institutes of Health	416558	Neurobiology of Mild Cognitive Impairment in the Elderly	12,765	1,710
Yates	UPMC ITTC	714088	ITTC- Discovering the Protein Signature of Synapse Loss and Cognitive Decline During Aging	40,138	0
Yates	Alzheimer's Disease Research Center	714526	Measurement of Blood-Based Amyloid -Beta Biomarkers by Immuno-Precipitation Mass Spectrometry in a Population Cohort Sub-Group	12,141	0
Yates	Alzheimer's Disease Research Center	714527	Measurement of Blood-Based Amyloid -Beta Biomarkers by Immuno-Precipitation Mass Spectrometry in a Population Cohort Sub-Group	6,173	0
Yates	Epirium	715068	Epirium Coporate Research Agreement	202,000	124,230
Yates	National Institutes of Health	Conley	Epigenomics of Neurocognitive Function in Breast Cancer	34,539	19,515
Yates	Temple	Temple-Rawls	Chemokine CXCL12/CXCR4 system and synthetic cathinones	25,000	14,125
				5,545,728	2,463,744



Faculty Editorships (Fiscal Year 2019- 2020)

Michael B. Butterworth, Ph.D.
Associate Professor

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

Gerry Hammond, Ph.D.
Assistant Professor

Editorial board member, *Contact* (SAGE)
Editorial advisory board member, *Journal of Cell Science* (the Company of Biologists)

Adam Kwiatkowski, Ph.D.
Assistant Professor

Associate Editor, BMC Cell Biology

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

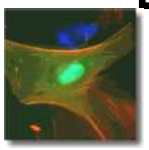
Traffic, Associate Editor
Scientific Reports

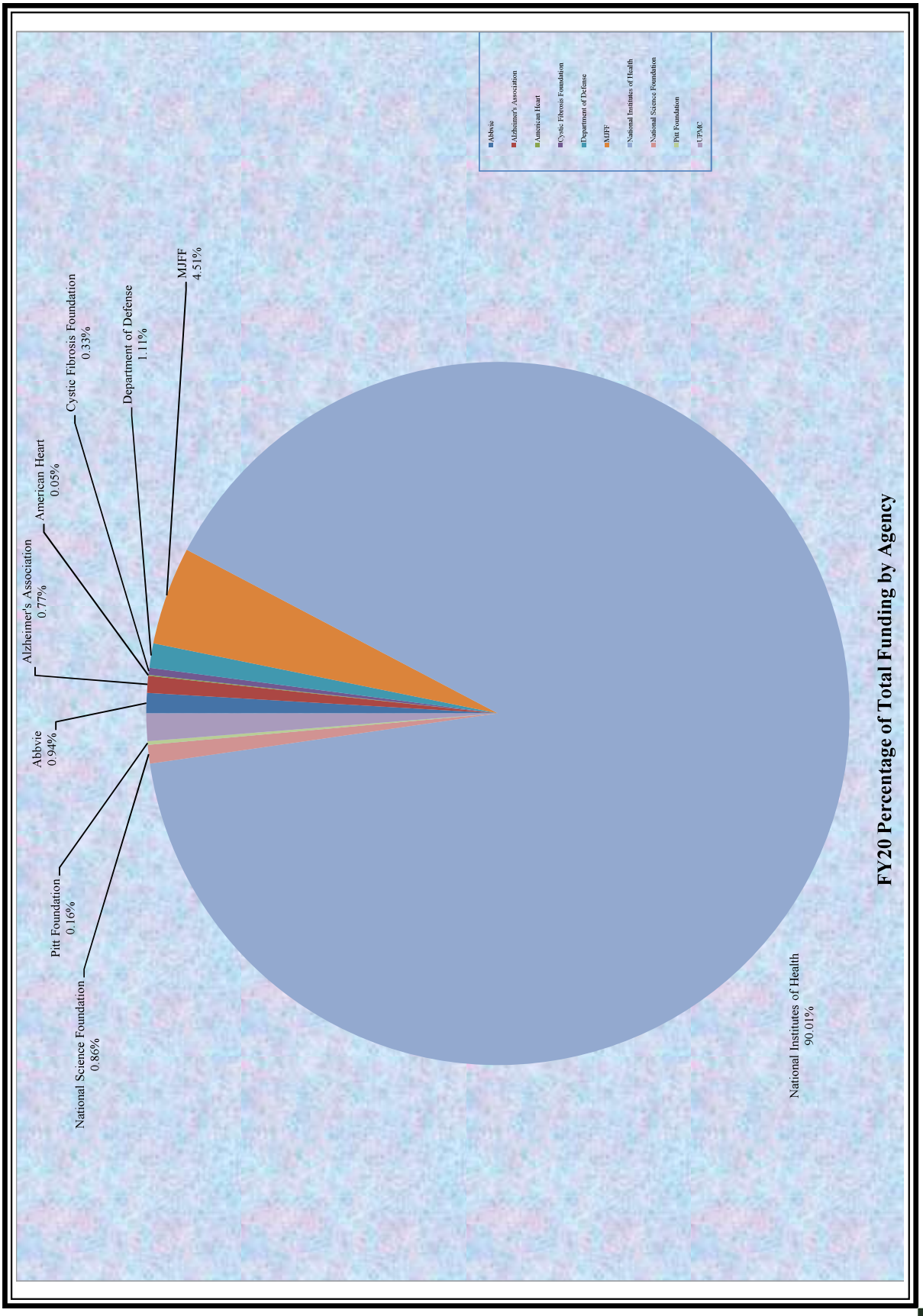
Linton Traub, Ph.D.
Professor

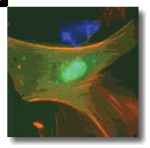
Member of editorial board of Traffic
Member of editorial board of Cellular Logistics
Member of editorial board of Scientific Reports
Member of editorial board of The Journal of Biological Chemistry
Member of board of reviewing editors, Molecular Biology of the Cell

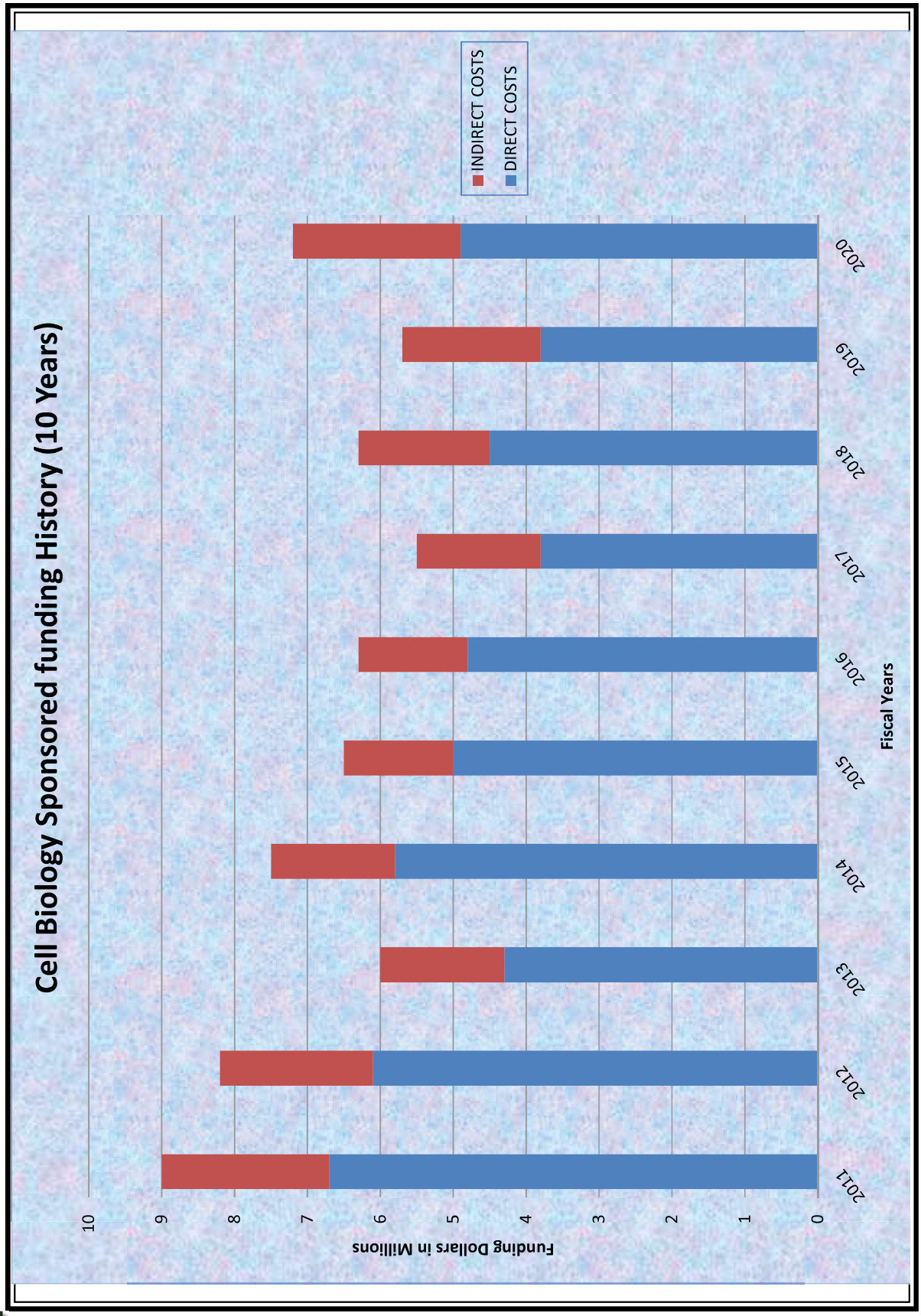
Simon C. Watkins, Ph.D.
Distinguished Professor and Vice Chairman, Director of Center of Biologic Imaging

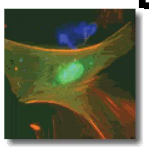
Member, Editorial Board, PittMed
Associate Editor, Experimental Biology and Medicine
Editor, Current Protocols in Cytometry
Editor, Microscopy Today

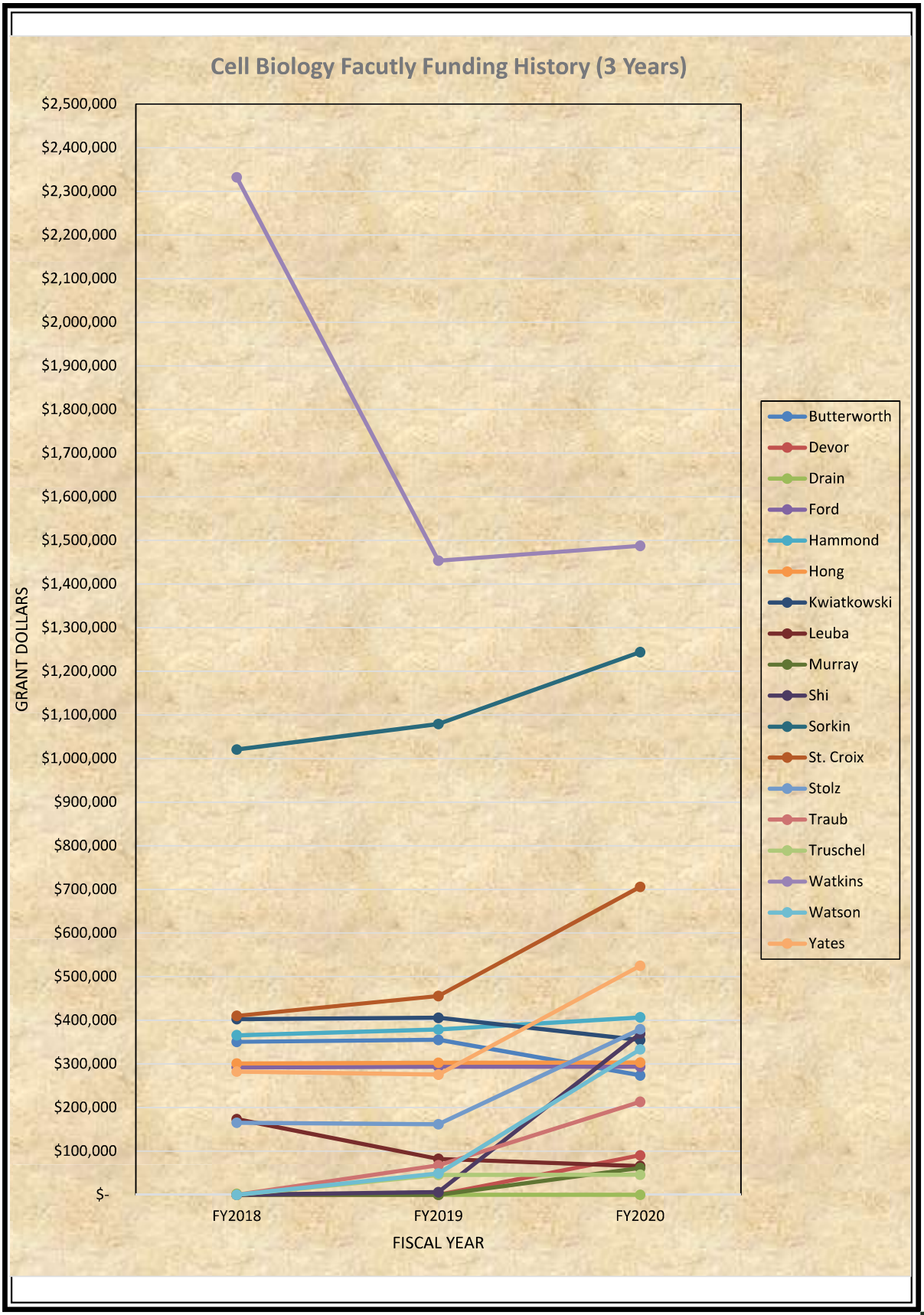


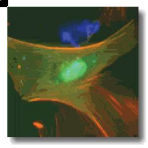

FY20 Percentage of Total Funding by Agency
Abbvie
Alzheimer's Association
American Heart
Cystic Fibrosis Foundation
Department of Defense
MJFF
National Institutes of Health
National Science Foundation
Pitt Foundation
UPMC
Abbvie 0.94%
Alzheimer's Association 0.77%
American Heart 0.05%
Cystic Fibrosis Foundation 0.33%
Department of Defense 1.11%
MJFF 4.51%
National Institutes of Health 90.01%
National Science Foundation 0.86%
Pitt Foundation 0.16%




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
2011
2012
2013
2014
2015
2016
2017
2018
2019
2020
Fiscal Years



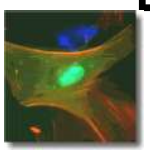

Cell Biology Facutly Funding History (3 Years)
GRANT DOLLARS
$2,500,000
$2,400,000
$2,300,000
$2,200,000
$2,100,000
$2,000,000
$1,900,000
$1,800,000
$1,700,000
$1,600,000
$1,500,000
$1,400,000
$1,300,000
$1,200,000
$1,100,000
$1,000,000
$900,000
$800,000
$700,000
$600,000
$500,000
$400,000
$300,000
$200,000
$100,000
$-
FY2018
FY2019
FY2020
FISCAL YEAR
Butterworth
Devor
Drain
Ford
Hammond
Hong
Kwiatkowski
Leuba
Murray
Shi
Sorkin
St. Croix
Stolz
Traub
Truschel
Watkins
Watson
Yates



CELL BIOLOGY FACULTY ROSTER
(Effective June, 2020)

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	94.49%	Res. Assistant Professor	Non-tenure Track
St. Croix, Claudette	85.15%	Associate Professor	Tenured
Stolz, Donna	82.69%	Associate Professor	Tenured
Watkins, Simon*	79.67%	Professor	Tenured
Sorkin, Alexander*	75.48%	Professor	Tenured
Hammond, Gerald	54.50%	Associate Professor	Tenured
Yates, Nathan*	54.18%	Associate Professor	Non-tenure Track
Kwiatkowski, Adam	50.0%	Assistant Professor	Tenure Track
Ford, Natalia	45.0%	Res. Assistant Professor	Non-tenure Track
Truschel, Steven	43.92%	Assistant Professor	Non-tenure Track
Butterworth, Michael	41.65%	Associate Professor	Tenured
Ford, Marijn	40.0%	AssociateProfessor	Tenurd
Hong, Yang	33.0%	Associate Professor	Tenured
Shi, Yi	30.83%	Assistant Professor	Tenure Track
Traub, Linton*	27.85%	Professor	Tenured
Devor, Daniel	11.0%	Associate Professor	Tenured
Leuba, Sanford	10.0%	Associate Professor	Tenured
Drain, Peter	3.0%	Associate Professor	Tenured
Aridor, Meir	0.0%	Associate Professor	Tenured
Murray, Sandra	0.0%	Professor	Tenured

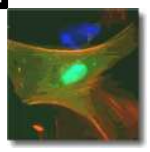
*Calculated using year appropriate NIH salary cap as upper limit for each grant



STUDENTS INVOLVED IN RESEARCH IN CBP FACULTY LABS
Snapshot as of June, 2020

GRADUATE STUDENTS ENROLLED IN CBMP PROGRAM

STUDENT	LAB	SUPPORT
Sarel Urso	Todd Lamitina, Ph.D. Dept. Pediatrics	Todd Lamitina, Ph.D. Cell Biology & Teaching Fellowship
Rachel Wills	Gerald Hammond, Ph.D. Cell Biology	Gerald Hammond, Ph.D. Cell Biology & Teaching Fellowship
Jonathan Heier	Adam Kwiatkowski, Ph.D. Cell Biology	Adam Kwiatkowski, Ph.D. Cell Biology & Teaching Fellowship
Amity Eaton	Gerard Apodaca, Ph.D. Renal-Electrolyte Division	Gerard Apodaca, Ph.D. National Research Service Award (NRSA) NIH Trainee
Laura Bahr	Arjumand Ghazi, Ph.D. Dept. Pediatrics	Arjumand Ghazi, Ph.D. Dept. Pediatrics
Kayla Troutman	Marijn Ford, Ph.D. Cell Biology	Marijn Ford, Ph.D. Cell Biology & Teaching Fellowship
Corinne Farrell	Michael Butterworth, Ph.D. Cell Biology	Michael Butterworth, Ph.D. Cell Biology & Teaching Fellowship



FY20 Projects

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

Hammond lab: *PIP5K1A Enhances Phosphoinositide Signaling to Drive Breast Cancer*
(National Institutes of Health)

The combined funding for these post-doctoral fellowship grants is $11,974 in FY20 (Total costs, annualized).

FY21 Projects

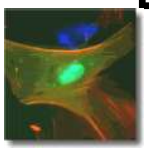
Sorkin lab: *Improving the Tumor-Suppressing Efficacy of EGFR Antibodies on Head-and-Neck Squamous Cell Carcinoma*
(National Cancer Center)

Hammond lab: *PIP5K1A Enhances Phosphoinositide Signaling to Drive Breast Cancer*
(National Institutes of Health)

The combined funding for this post-doctoral fellowship grants is $85,522 in FY21 (Total costs, annualized).

Program Grant Training Program:
The National Institutes of Health funded Interinstitutional Program in Cell and Molecular Biology: A Graduate Training Path to Promote Traditional and Non-Traditional Professional Outcomes (T32) offer training funds to qualified pre-doctoral candidates, as follows:

FY21 Program Grant Training Funds - $94,411



Cell Biology Program Grants (Fiscal Year 2020-2021)

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)

Alzheimer's Disease Research Center (PI Matthew MacDonald P30AG066468)

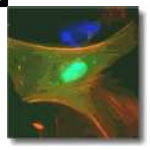
Project 1 for SSc Cort Novel Pathways in Systemic Sclerosis (PI Robert Lafyatis 2P50AR06078006)

Luminal Epithelial Junctions, Polarity and Permeability 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)

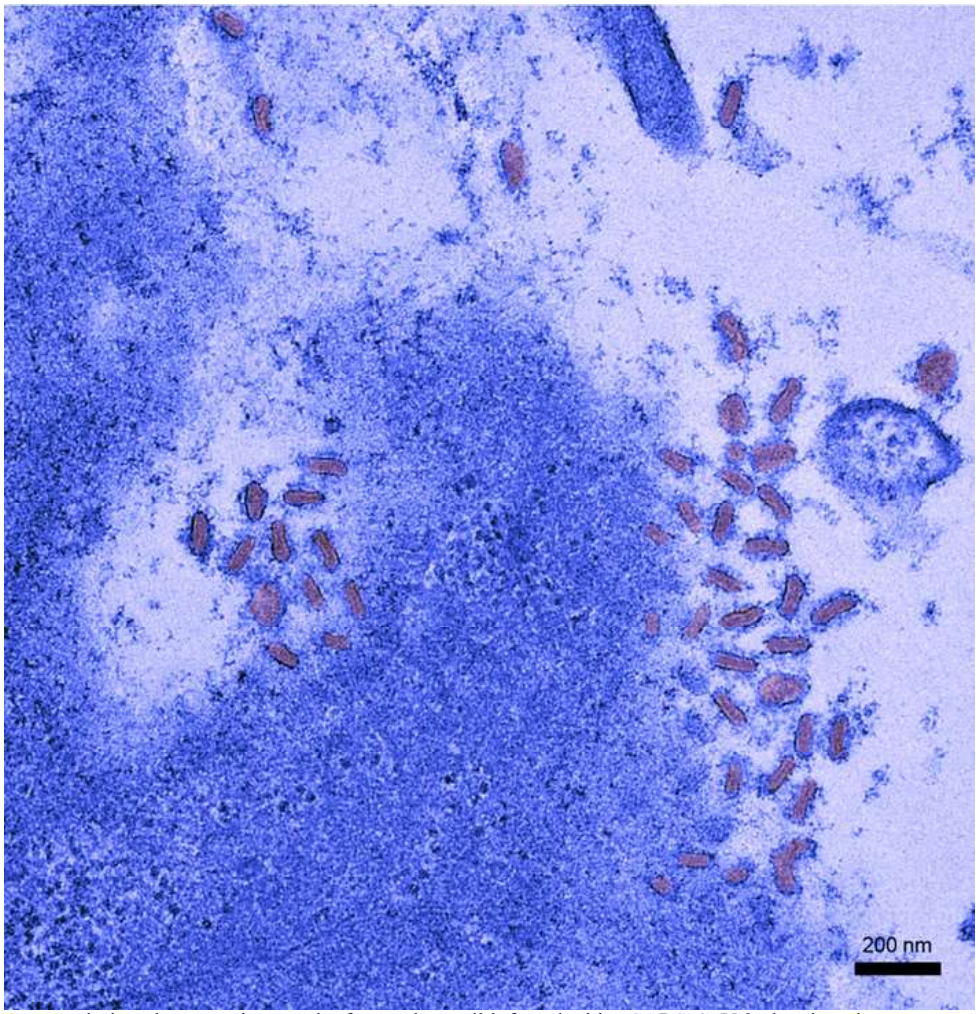
Liver-enriched Transcription Factors as Prognostic markers and Therapeutic Targets in Alcoholic Hepatitis (PI: Bataller U01AA026972)

HEALing LB3P: Profiling Biomechanical, Biological and Behavioral phenotypes (PI: Sowa U19 AR076725)

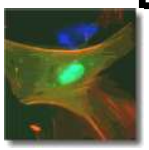


New Cell Biology Research Recruits in FY19

Name	Rank	
Faculty Level		
None		
Name	**Rank**	**Lab Association**
Post Doctoral Level		
Katherine Pfister	Post Doctoral Associate	Dr. Adam Kwiatkowski



A transmission electron micrograph of a monkey cell infected with a SARS-CoV-2, the virus that causes COVID-19. The red particles are individual SARS-CoV-2 virions being released into the and blue is the infected cell at its debris. This cell is in the late stages of death due to virus infection. Visualizing the at virus at various stages of infection will allow us to understand the virus replication cycle more precisely to aid the development of more targeted therapies. This image was generated by Mara Sullivan, Dr. Donna Stolz and Dr. Alan Watson during ongoing studies with Dr. William Klimstra from the Center for Vaccine Research.



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.

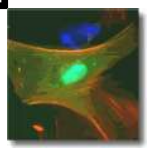
Courses

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

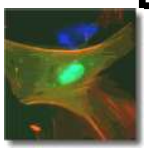
Faculty that aim to describe cellular function as a product of their genomic, proteomic or small molecule interactomes.

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-20

Title: MS Thesis Research
Course Number: 2800
Course Director: Adam Kwiatkowski
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.

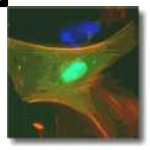
Title: Regulation of Membrane Traffic
Course Number: 2840
Course Director: Gerard Apodaca and Ora Weisz
When: Summer Term
Prerequisites: INTBP 2000 Foundations of Biomedical Sciences
INTBP 2005 Conference
Core Course for: students in the Program in Cell Biology and Molecular Physiology with research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

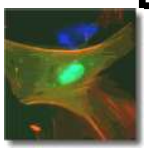
Title: Multiparametric Microscopic Imaging
Course Number: 2860
Course Director: Claudette St. Croix and Donna Beer Stolz
When: Summer Term
Prerequisites: INTBP 2000 Foundations of Biomedical Sciences
INTBP 2005 Conference

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: Adam Kwiatkowski and Michael Butterworth
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.

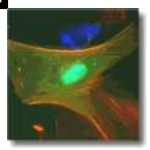
Title: Imaging Cell Biology in Living Systems
Course Number: 2885
Course Director: Simon Watkins
When: Spring Term
Prerequisites: None

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: Adam Kwiatkowski
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: Adam Kwiatkowski
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.

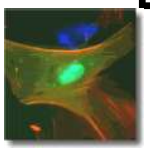
Title: DNA Repair Journal
Course Number: 3835
Course Director: Bennett Van Houten
When: Fall Term, Spring Term
Prerequisites: INTBP 2000 Foundations of Biomedical Sciences
INTBP 2005 Conference

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%).

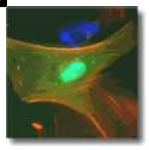
Title: Reproductive Development from Model Organisms to Humans
Course Number: 3840
Course Directors: Judith Yanowitz
When: Fall Term
Prerequisites: None

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

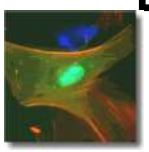


Description: This Course teaches fundamental grantmanship skills using actual NIH training grant submissions. Students construct a competitive research training grant and are instructed on methods to identify funding sources. This course consists of introductory lectures followed by a series of workshops 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.



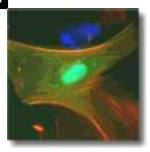
Faculty Teaching Honors (Fiscal Year 2019-2020)

None



University of Pittsburgh School of Medicine
Educational Credit Units (2018-2019)
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	2.0	50.0
	GS - Lecture	2.0	10.0	20.0
	GS - Small group (e.g., PBL, conference, workshop)	2.0	17.0	34.0
			Total ECUs:	104.0
Bruchez, Marcel				
	GS - Chair: Comprehensive, Dissertation, Thesis, Preliminary or Reprint Committee	5.0	1.0	5.0
			Total ECUs:	5.0
Butterworth, Michael				
	MS-1, MS-2 - Laboratory	2.0	9.8	19.7
	MS-1, MS-2 - Lecture	2.0	0.8	1.7
	MS-1, MS-2 - Other	2.0	1.0	2.0
	MS-1, MS-2 - Small group (e.g., PBL, conference, workshop)	2.0	6.3	12.7
	GS - Chair: Comprehensive, Dissertation, Thesis, Preliminary or Reprint Committee	5.0	1.0	5.0
	GS - Course Director	50.0	1.0	50.0
	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	1.0	2.0
	GS - Ph.D. or M.Sc. Mentor	50.0	4.0	200.0
	GS - Program Director	100.0	1.0	100.0
	GS - Small group (e.g., PBL, conference, workshop)	2.0	27.0	54.0
			Total ECUs:	527.0
Devor, Daniel				
	MS-1, MS-2 - Small group (e.g., PBL, conference, workshop)	2.0	29.3	58.5
	GS - Course Director	50.0	1.0	50.0
	GS - Journal Club/Seminar Series Program Director	25.0	1.0	25.0
	GS - Lecture	2.0	4.0	8.0
	GS - Small group (e.g., PBL, conference, workshop)	2.0	14.0	28.0
			Total ECUs:	169.5
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	4.5	9.0



University of Pittsburgh School of Medicine
Educational Credit Units (2018-2019)
Department of Cell Biology
Summary of Faculty ECU's

Faculty Name / Activity	ECURV	Units	ECUs
MS-1, MS-2 - Small group (e.g., PBL, conference, workshop)	2.0	27.5	55.0
MS - Applicant Interviewer	1.0	1.0	1.0
MS - Chair, Task Force/Work Group/Subcommittee/or other SOM Committee	5.0	1.0	5.0
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:		585.0
Duker, Georgia			
MS-1, MS-2 - Laboratory	2.0	8.0	16.0
MS-1, MS-2 - Lecture	2.0	1.3	2.7
MS-1, MS-2 - Small group (e.g., PBL, conference, workshop)	2.0	6.8	13.7
	Total ECUs:		32.3
Ford, Marijn			
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	11.0	11.0
GS - Lecture	2.0	11.0	22.0
GS - Member: Comprehensive, Dissertation, Thesis, Preliminary or Reprint	5.0	2.0	10.0
GS - Small group (e.g., PBL, conference, workshop)	2.0	3.0	6.0
	Total ECUs:		54.0
Hammond, Gerald			
MS-1, MS-2 - Small group (e.g., PBL, conference, workshop)	2.0	12.3	24.5
GS - Laboratory supervision (e.g., MSTP, Ph.D. & M.Sc.)	1.0	32.0	32.0
GS - Lecture	2.0	10.0	20.0
GS - Member: Admissions Committee	75.0	1.0	75.0
GS - Member: Comprehensive, Dissertation, Thesis, Preliminary or Reprint	5.0	2.0	10.0
GS - Ph.D. or M.Sc. Mentor	50.0	1.0	50.0
GS - Small group (e.g., PBL, conference, workshop)	2.0	3.0	6.0
	Total ECUs:		217.5
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	13.0	26.0
	Total ECUs:		106.0
Kwiatkowski, Adam			

OFFICE OF MEDICAL EDUCATION 11/5/2019

DEPARTMENT OF Cell Biology
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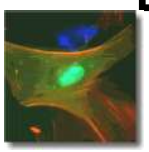
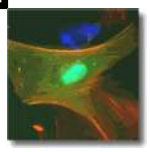


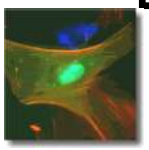
University of Pittsburgh School of Medicine
Educational Credit Units (2018-2019)
Department of Cell Biology
Summary of Faculty ECU's

Faculty Name / Activity	ECURV	Units	ECUs
MS-1, MS-2 - Laboratory	2.0	9.8	19.7
MS-1, MS-2 - Lecture	2.0	1.7	3.3
MS-1, MS-2 - Other	2.0	1.0	2.0
MS-1, MS-2 - Small group (e.g., PBL, conference, workshop)	2.0	7.8	15.7
MS - Course Design Group Member	5.0	1.0	5.0
MS - Member, Promotions Committee	5.0	1.0	5.0
GS - Laboratory supervision (e.g., MSTP, Ph.D. & M.Sc.)	1.0	9.0	9.0
GS - Lecture	2.0	8.0	16.0
GS - Member: Comprehensive, Dissertation, Thesis, Preliminary or Reprint	5.0	3.0	15.0
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:		196.7
Leuba, Sanford			
GS - Course Director	50.0	1.0	50.0
GS - Lecture	2.0	6.8	13.7
GS - Small group (e.g., PBL, conference, workshop)	2.0	16.5	33.0
	Total ECUs:		96.7
Murray, Sandra			
MS-1, MS-2 - Laboratory	2.0	58.3	116.5
MS-1, MS-2 - Lecture	2.0	2.5	5.0
MS-1, MS-2 - Other	2.0	12.0	24.0
MS-1, MS-2 - Small group (e.g., PBL, conference, workshop)	2.0	1.5	3.0
MS - Course Design Group Member	5.0	1.0	5.0
MS - Member, Task Force/Work Group/Subcommittee/or other SOM Committee	5.0	1.0	5.0
GS - Lecture	2.0	1.0	2.0
	Total ECUs:		160.5
Shi, Yi			
GS - Laboratory supervision (e.g., MSTP, Ph.D. & M.Sc.)	1.0	9.0	9.0
GS - Lecture	2.0	5.0	10.0
	Total ECUs:		19.0
Sorkin, Alexander			
GS - Laboratory supervision (e.g., MSTP, Ph.D. & M.Sc.)	1.0	12.0	12.0
GS - Lecture	2.0	6.0	12.0
GS - Member: Comprehensive, Dissertation, Thesis, Preliminary or Reprint	5.0	4.0	20.0
GS - Member: Curriculum, Recruiting, Program, or other SOM Committee	2.0	1.0	2.0
GS - Small group (e.g., PBL, conference, workshop)	2.0	2.0	4.0



University of Pittsburgh School of Medicine
Educational Credit Units (2018-2019)
Department of Cell Biology
Summary of Faculty ECU's

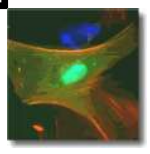
Faculty Name	Activity	ECURV	Units	ECUs
			Total ECUs:	50.0
St Croix, Claudette				
	GS - Course Director	50.0	1.0	50.0
	GS - Lecture	2.0	13.5	27.0
	GS - Member: Comprehensive, Dissertation, Thesis, Preliminary or Reprint	5.0	2.0	10.0
	GS - Small group (e.g., PBL, conference, workshop)	2.0	4.0	8.0
			Total ECUs:	95.0
Stolz, Donna				
	MS-1, MS-2 - Laboratory	2.0	9.8	19.7
	MS-1, MS-2 - Lecture	2.0	0.8	1.7
	MS-1, MS-2 - Other	2.0	1.0	2.0
	MS-1, MS-2 - Small group (e.g., PBL, conference, workshop)	2.0	12.8	25.7
	MS - Course Design Group Member	5.0	1.0	5.0
	MS - Member, Promotions Committee	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	2.0	10.0
	GS - Course Director	50.0	2.0	100.0
	GS - Journal Club/Seminar Series Program Director	25.0	2.0	50.0
	GS - Lecture	2.0	13.8	27.5
	GS - Member: Comprehensive, Dissertation, Thesis, Preliminary or Reprint	5.0	6.0	30.0
	GS - Small group (e.g., PBL, conference, workshop)	2.0	25.0	50.0
			Total ECUs:	401.5
Surve, Sachin				
	GS - Small group (e.g., PBL, conference, workshop)	2.0	1.0	2.0
			Total ECUs:	2.0
Traub, Linton				
	GS - Lecture	2.0	4.0	8.0
	GS - Small group (e.g., PBL, conference, workshop)	2.0	3.3	6.5
			Total ECUs:	14.5
Truschel, Steven				
	MS-1, MS-2 - Laboratory	2.0	9.8	19.7
	MS-1, MS-2 - Lecture	2.0	2.8	5.7
	MS-1, MS-2 - Other	2.0	1.0	2.0
	MS-1, MS-2 - Small group (e.g., PBL, conference, workshop)	2.0	12.8	25.7
	GS - Course Director	50.0	1.0	50.0
	GS - Lecture	2.0	66.0	132.0



University of Pittsburgh School of Medicine
Educational Credit Units (2018-2019)
Department of Cell Biology
Summary of Faculty ECU's

Faculty Name	Activity	ECURV	Units	ECUs
	GS - Other	2.0	9.0	18.0
	GS - Small group (e.g., PBL, conference, workshop)	2.0	1.3	2.5
			Total ECUs:	255.5
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	1.0	5.0
	GS - Course Director	50.0	1.0	50.0
	GS - Lecture	2.0	17.5	35.0
	GS - Member: Comprehensive, Dissertation, Thesis, Preliminary or Reprint	5.0	7.0	35.0
	GS - Small group (e.g., PBL, conference, workshop)	2.0	4.0	8.0
			Total ECUs:	138.0
Watson, Alan				
	GS - Lecture	2.0	3.0	6.0
			Total ECUs:	6.0
			Subtotal:	**3235.7**

Total Faculty Reporting: 21 **Total ECU's for Cell Biology: 3235.7**

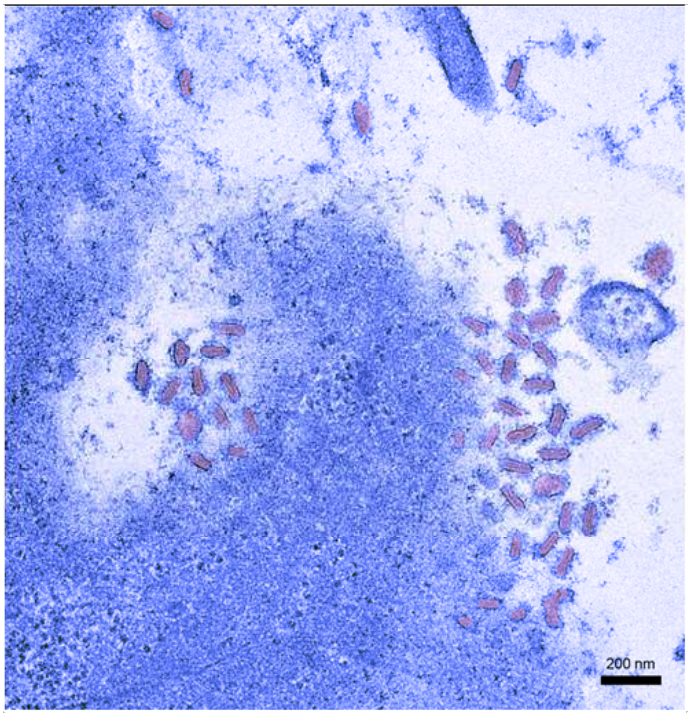


Post Doctoral Personnel Data
[Current as of June, 2020]

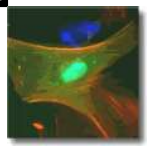
Name	Title	Office Address	Email Address	Office Phone	Fax	Research Focus
Bagalkot, Tarique	Post Doctoral Associate	S372 BSTWR	tariqueb@pitt.edu	412-624-8147	412-648-8330	Sorkin Lab
Boslett, James	Post Doctoral Associate	BST3-9th Fl	jjb179@pitt.edu	412-648-3261	412-641-2458	Yates Lab
Lu, Juan	Post Doctoral 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
Pfister, Katherine	Post Doctoral Associate	S349 BSTWR	kep103@pitt.edu	412-383-7891	412-648-8330	Kwiatkowski 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, 2020

Student	Mentor	Year
Amity Eaton	Dr. Gerard Apodaca	4th
Jonathan Heier	Dr. Adam Kwiatkowski	4th
Rachel Wills	Dr. Gerald Hammond	4th
Sarel Urso	Dr. Lamitina	3rd
Laura Bahr	Dr. Arjumand Ghazi	2nd
Kayla Troutman	Dr. Marijn Ford	2nd
Corinne Farrell	Dr. Michael Butterworth	2nd



SARS-CoV-2 Virions (pink) produced by Vero E6 cells. Electron micrograph by Donna Stolz in collaboration with Drs. Alan Watson and William Klimstra (Center for Vaccine Research).



Prior Graduates of the Cell Biology and Molecular Physiology Program as of June 2020
(Past five years)

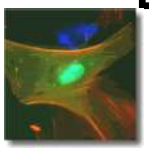
Amity Eaton
Defended: 10/14/19
Post-Doc, Dennis Brown Lab, Boston, Mass.

Chelsea DeAnn Merkel
Defended: 6/21/19
Industry, Associate Consultant, Highmark Health

Paige Davison Rudich
Defended: 5/15/19
Post-Doc, Dept. Neurology & Neurosurgery,
McGill Univ., Montreal, Quebec, 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
T-32 Post-Doc Trainee, Cardiovascular Center,
College of Wisconsin

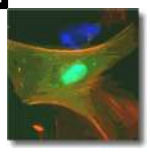


Student Ratings of CBMP Faculty Teaching FY2020

Name	Course	Type	Date	Rating	Ave
Butterworth	Tissues in Health and Disease	LAB	Spring-20	5.00	5.00
Devor	Investigation and Discovery	SGCS	Fall-19	4.30	
Devor	Evidence-Based Medicine Applied	SGCS	Spring-20	4.90	4.60
Drain	Investigation and Discovery	SGCS	Fall-19	4.80	4.80
Hammond	Evidence-Based Medicine Applied	SGCS	Spring-20	4.90	4.90
Kwiatkowski	Tissues in Health and Disease	LEC	Spring-20	4.10	
Kwiatkowski	Tissues in Health and Disease	LAB	Spring-20	4.90	4.50
Murray	Medical Anatomy	LEC	Fall-19	3.70	
Murray	Medical Anatomy	LAB	Fall-19	4.50	4.10
Stolz	Tissues in Health and Disease	LEC	Spring-20	4.10	
Stolz	Tissues in Health and Disease	LAB	Spring-20	4.90	4.50
	Overall Teaching Average			**4.55**	

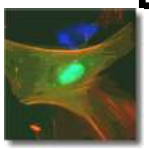
Type codes:

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



CELL BIOLOGY FACULTY ROSTER
(Effective June, 2020)

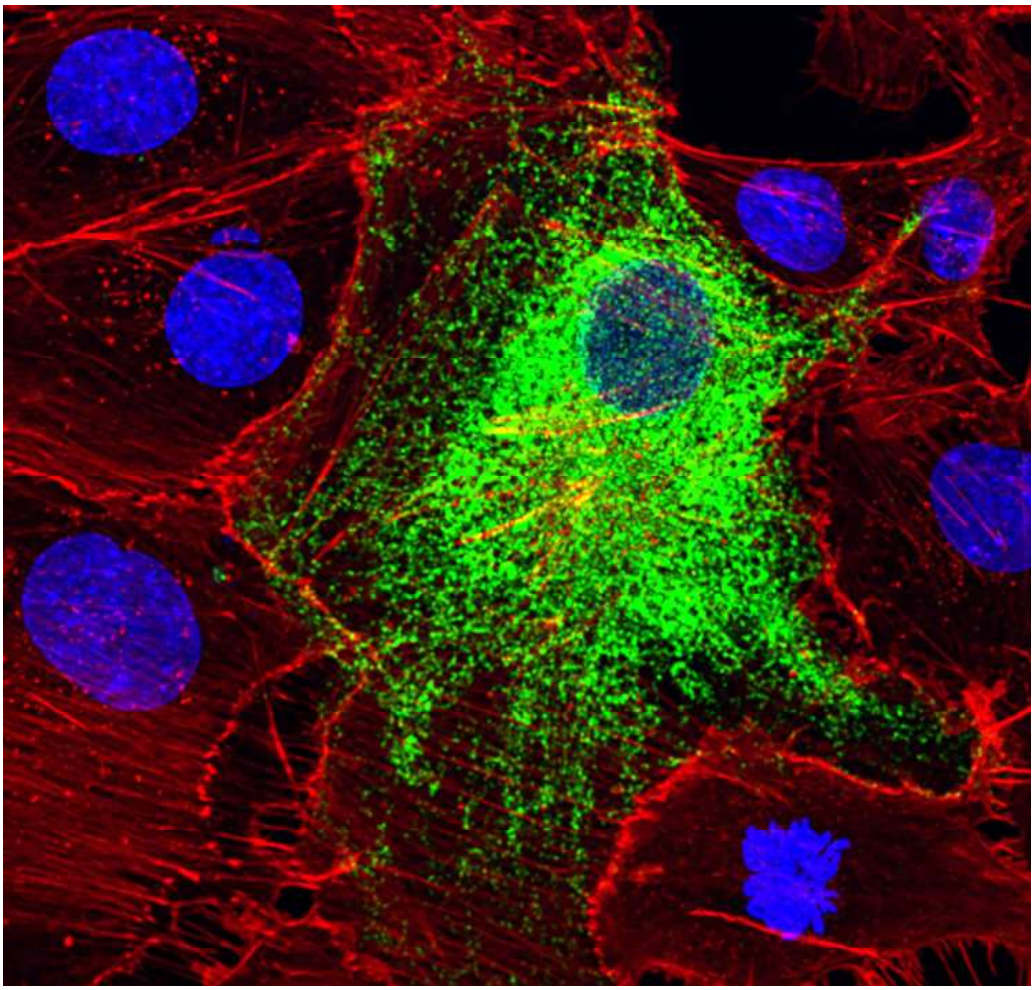
Last Name	First	Rank	Status
Sorkin	Alexander	Professor & Chair	Tenured
Devor	Daniel	Professor	Tenured
Murray	Sandra	Professor	Tenured
Traub	Linton	Professor	Tenured
Watkins	Simon	Professor	Tenured
Aridor	Meir	Associate Professor	Tenured
Butterworth	Michael	Associate Professor	Tenured
Drain	Peter	Associate Professor	Tenured
Ford	Marijn	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
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
Watson	Alan	Assistant Professor	Tenure Track
Dong	Wei	Res. Instructor	Non-tenure Track
Ford	Natalia	Res. Assistant Professor	Non-tenure Track
Li	Yang	Res. Instructor	Non-tenure Track
Pinilla Macua	Itziar	Res. Instructor	Non-tenure Track
Surve	Sashin	Res. Instructor	Non-tenure Track
Tan	Xiaojun (Jay)	Res. Assistant Professor	Non-tenure Track



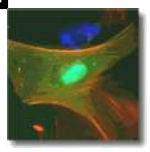
New Cell Biology Faculty in FY20

Name	Prior Institution /Rank	Current Rank

None



A fluorescent photomicrograph of a monkey cell infected with a candidate vaccine for COVID-19. Red staining shows the cell's structural scaffolding, blue marks its DNA, and green reveals the "spike" protein it produces when infected with SARS-CoV-2, as the novel coronavirus is known. This image generated by Mike Calderon and Dr. Simon Watkins during ongoing studies with Paul Dupred (head of the Center for Vaccine Research) and was featured in Esquire Magazine in June



Faculty Honors, Recognition and Professional Affiliations (Fiscal Year 2019 – 2020)

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.
Associate Professor

Member, American Society of Cell Biology

Gerry Hammond, Ph.D.
Assistant Professor

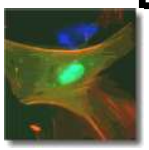
Member, Biochemical Society
Member, American Association for the Advancement of Science
Member, American Society of Cell Biology
Member, American Society for Biochemistry & Molecular Biology

Yang Hong, Ph.D.
Associate Professor

Member of Faculty 1000 (Cell Adhesion Section)

Adam Kwiatkowski, Ph.D.
Assistant Professor

American Society for Cell Biology
American Society for Biochemistry and Molecular Biology



American Heart Association

Itziar Pinilla Macau, Ph.D.
Research Instructor

UPMC Hillman Cancer Center, Cancer Biology Program

Sandra A. Murray, Ph.D.
Professor

Member, American Society for Cell Biology, Minorities Affairs Committee
Member, Society for In Vitro Biology
Member, The Pittsburgh Cancer Institute
Member, Corporation of the Marine Biological Laboratory
Member, Cell Transplant Society
Member, The Endocrine Society
Member, American Physiological Society
Member, International Society for Preventive Oncology
2020 TecBio Outstanding Mentor of the Year Award from NSF Sponsored Training and Experimentation in Computational Biology Program, Department Of Computational and Systems Biology, University of Pittsburgh
Selected by NIH as one of the Biomedical Faces of Science Mentors

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

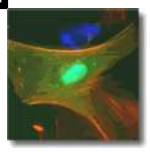
Member, American Society for Cell Biology
Society for Neuroscience

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

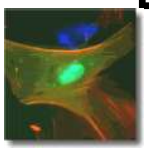
Member, American Society for Cell Biology
American Association for the Advancement of Science
American Society for Biochemistry and Molecular Biology

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



Faculty Presentations (Fiscal Year 2019 - 2020)

Michael Butterworth, Ph.D.
Associate Professor

"The (Sex-Specific) Role of MicroRNAs in Aldosterone Signaling". Renal-Electrolyte Division, School of Medicine, University of Pittsburgh, PA.

"Role of microRNAs in aldosterone signaling and ENaC regulation" presented at "Aldosterone and ENaC in Health and Disease: The Kidney and Beyond" Estes Park, CO.

"Aldosterone Signaling and Sodium Transport: Role of MicroRNAs" American Society of 0Nephrology "Kidney Week" Meeting, Washington, D.C.

Daniel Devor, Ph.D.
Professor

"Role of potassium channels in modulating chloride secretion across primary human bronchial epithelial cells" Thirty-Fourth annual North American Cystic Fibrosis Conference.

Marijn Ford, Ph.D.
Associate Professor

Science 2019, University of Pittsburgh "Using cryo-electron microscopy to catch old dogs doing new tricks: the story of the sorting nexin Mvp1"

Section of Molecular and Cellular Biology, University of California, Davis "Structural Insights into the Sorting Nexin Mvp1"

American Society of Cell Biology, Washington D.C. Minisymposium 4: Membrane Trafficking: Vesicle Formation, Cargo Sorting and Fusion Marta Miaczynska, Mary Munson co-chairs "The Cryo-EM Structure of the SNX-BAR Mvp1 Tetramer"

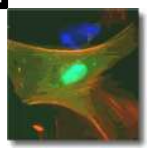
Gerald Hammond, Ph.D.
Assistant Professor

Invited seminar at the Department of Cell Biology, University of Pittsburgh, PA.

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

"PI 3-kinase signaling in cancer: are we targeting the wrong lipid signal?". Invited seminar, Department of Molecular Pharmacology, Albert Einstein College of Medicine, New York, NY. Invited and Scheduled, however cancelled secondary to the COVID19 pandemic

"Eminent Domains: PI(4,5)P_2 distribution homeostasis in the plasma membrane". Invited seminar (remote) at the Department of Biochemistry and Molecular Biology, Wright State University, OH.



"Novel tools to study lipid signaling". FASEB phospholipids meeting, Steamboat CO. Invited and Scheduled, however cancelled secondary to the COVID19 pandemic

"Can PI(3,4)P_2 be the main driver of PI3K Signaling?" Biochemical Society meeting: "The PI3K/PTEN pathway: from basic science to clinical translation". Buxton, UK.

Sandra Murray, Ph.D.
Professor

Invited Speaker- Annual Biomedical Conference for Minority Students, 2020

Yi Shi, Ph.D.
Assistant Professor

HUPO, Seattle, March 2020. ASMS, Houston, TX, June 2020.
Department of Pharmacology and Chemical Biology, University of Pittsburgh, Pittsburgh PA.
Verna Marrs Department of Biochemistry, Baylor College of Medicine.

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

Milwaukee Medical College
MD Anderson Cancer Center, Houston
Gordon Research Conference "Lysosomes and endocytosis. June 24, 2020 (canceled because of Covid-19).

Claudette St. Croix, Ph.D.
Associate Professor

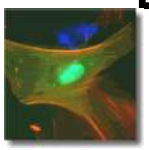
Invited Speaker: X11 Super-Resolution Microscopy: Potential, Mechanics, Implementation, and Practicalities. Microscopy & Microanalysis 2019, Portland OR, Specialized Probes for Super Resolution Imaging

Invited Speaker, Department of Cell Biology Annual Retreat, University of Pittsburgh, Ferroptosis: linking iron metabolism, oxidative stress and regulated cell death.

Invited Speaker: World-wide Validation Meeting, NIS Elements/LIM, Prague, Czech Republic, Advanced image processing methods: insight into novel mechanisms of cellular death.

Invited Panelist, Arizona Imaging and Microanalysis Society Meeting, Core Lab Management, *("invited and scheduled, however canceled secondary to the COVID19 Pandemic")*

Invited Speaker, Big Data, Big Problems Light-Sheet Workshop, Department of Molecular Biology at Princeton University, Specialized probe design and implementation for Light Sheet Imaging *("invited and scheduled, however canceled secondary to the COVID19 Pandemic")*



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

Imaging Opportunities in the US MMC19, Manchester UK, Invited speaker

Super-resolution opportunities and challenges. Organizer and speaker, Microscopy Society of America annual meeting Portland ORE

Limitations and opportunities in massive data processing: LIM annual Meeting, Invited Speaker

Visions for new imaging modalities: LIM annual Meeting, Invited Speaker

Imaging Fast, Imaging Deep, Western US microscopy society, Phoenix Arizona, Keynote Speaker, 03/20/20 (*"invited and scheduled, however canceled secondary to the COVID19 Pandemic".)*

Imaging Africa: Invited Speaker

Alan Watson, Ph.D.
Assistant Professor

Technologies for High-Speed High-Resolution Imaging of Massive Biologic Systems. Featured Speaker, Ohio River Valley Cytometry Association (ORVCA) meeting. Cincinnati, OH.

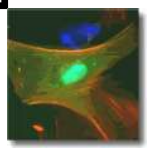
Technologies for High-Speed High-Resolution Imaging of Whole Biologic Systems. Cell Biology Annual Retreat.

Dealing with Big Data in Microscopy. Nikon World Meeting. Prague, Czech Republic.

Technologies for High-Speed High-Resolution Imaging of Whole Biologic Systems. Whitehead Institute. Boston, MA.

Rapid High Resolution Imaging of Neuroanatomy in Large Biologic Systems. Pittsburgh Institute for Neurodegenerative Diseases, University of Pittsburgh.

Technologies for High-Speed High-Resolution Imaging of Whole Biologic Systems. Novartis Institutes for Biomedical Research, Ophthalmology. Virtual.



Peer Reviewed Publications (Fiscal Year 2019 - 2020)

Meir Aridor, Ph.D.
Associate Professor

Stephen D. Carter, Cheri M. Hampton, Robert Langlois, et al. (2020) Ribosome-Associated Vesicles: a dynamic vesicular endoplasmic reticulum in secretory cells. ***Science Advances*** 6 (14)

Michael Butterworth, Ph.D.
Associate Professor

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

Ozbaki-Yagan N., Liu X., Bodnar A.J., Ho J., **Butterworth M.B.** (2020). Aldosterone-induced microRNAs act as feedback regulators of mineralocorticoid receptor signaling in kidney epithelia. *FASEB Journal*. **34**(9): 11714-11728. PMID: 32652691

Wei Dong, Ph.D.
Research Instructor

Wei Dong, Juan Lu, Xuejing Zhang, Yan Wu, Kaela Lettieri , Gerald R Hammond, Yang Hong. A polybasic domain in aPKC mediates Par6-dependent control of membrane targeting and kinase activity. Journal of Cell Biology. 2020 Jul 6;219(7)

Peter F. Drain, Ph.D.
Associate Professor

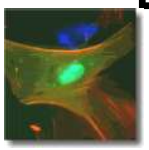
Patrizia Luppi, Nicholas Drain, Ramsey To, Donna Stolz, Callen Wallace, Simon Watkins, and **Peter Drain**. 2020. Autocrine C-peptide protects INS1 β cells against palmitic acid-induced oxidative stress in peroxisomes by inducing catalase. Endocrinology, Diabetes, and Metabolism. May 30;3(3):e00147. doi: 10.1002/edm2.147

Marijn Ford, Ph.D.
Associate Professor

Sun D, Varlakhanova NV, Tornabene BA, Ramachandran R, Zhang P, **Ford MGJ**. The cryo-EM structure of the SNX-BAR Mvp1 tetramer. Nature Comm. 2020. DOI: 10.1038/s41467-020-15110-5. PMID: 32198400; PMCID: PMC7083883

Natalia Ford, Ph.D.
Research Assistant Professor

Sun* D, **Varlakhanova* NV**, Tornabene BA, Ramachandran R, Zhang P & Ford MGJ. The cryo-EM structure of the SNX-BAR Mvp1 tetramer. 2020. Nature Comm. DOI: 10.1038/s41467-020-15110-5. PMID: 32198400. PMCID: PMC7083883. *Joint first



Gerald Hammond, Ph.D.
Assistant Professor

Zewe JP, Miller AM, Sangappa S, Wills RC, Goulden BD, **Hammond GRV**. Probing the subcellular distribution of phosphatidylinositol reveals a surprising lack at the plasma membrane. Journal of Cell Biology. 2020;219(3). PMID: 32211893

Dong W, Lu J, Zhang X, Wu Y, Lettieri K, **Hammond GR**, Hong Y. A polybasic domain in aPKC mediates Par6-dependent control of membrane targeting and kinase activity. J Cell Biol. 2020;219(7). PMID: 32580209

Hammond GRV, Burke JE. Novel roles of phosphoinositides in signaling, lipid transport, and disease. Curr Opin Cell Biol. 2020;63:57–67. PMID: 31972475

Yang Hong, Ph.D.
Associate Professor

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

Dong W, Lu J, Zhang XJ, Wu Y, Lettieri K, Hammond GR and Hong Y. (2020) A polybasic domain in aPKC mediates Par-6-dependent control of membrane targeting and kinase activity. *J Cell Biology* 219(7): e201903031. PMID: 32580209

Adam Kwiatkowski, Ph.D.
Assistant Professor

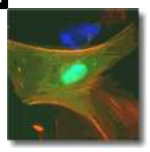
Pang SM, Le S, **Kwiatkowski AV**, Yan J. Mechanical stability of αT-catenin and its activation by force for vinculin binding. Mol Biol Cell. 2019 Jul 22;30(16). PMID: 31318313

Merkel CD, Li Y, Raza Q, Stolz DB, **Kwiatkowski AV**†. Vinculin anchors contractile actin to the cardiomyocyte adherens junction. Mol Biol Cell. 2019 Oct 1;30(21):2639-2650. PMID:31483697 †Corresponding author; *article recommended by **F1000Prime**, DeMali and Salvi, 23 Mar 2020; 10.3410/f.736552890.793572333*

Yang Li, Ph.D.
Research Instructor

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.



Itziar Pinilla Macua, Ph.D.
Research Instructor

Li H, Pinilla-Macua I, Ouyang Y, Sadovsky E, Kajiwara K, Sorkin A & Sadovsky Y *Internalization of trophoblastic small extracellular vesicles and detection of their miRNA cargo in P-bodies.* Journal of Extracellular Vesicles 2020; 9:1, DOI: 10.1080/20013078.2020.1812261

Sandra A. Murray, Ph.D.
Professor

Carter, S.D. et al., Ribosome-Associated Vesicles: a dynamic vesicular endoplasmic reticulum endoplasmic reticulum in secretory cells**, Science Advances** 2020, eaay9572, DOI: 10.1126/sciadv.aay9572

Yi Shi, Ph.D.
Assistant Professor

Yufei Xiang, Zhuolun Shen, and **Yi Shi**. Chemical cross-linking and mass spectrometric (CX-MS) analysis of the endogenous yeast exosome complexes. (2020). ***Methods in Molecular Biology***. PMID: 31768986

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

Perez Verdaguer, M., Larsen, M. B., Bruchez, M. P., Watkins, S. C. and **Sorkin, A.** (2019). Analysis of EGF Receptor Endocytosis Using Fluorogen Activating Protein Tagged Receptor. *Bio-protocol* 9(24): e3463. DOI: 10.21769/BioProtoc.3463.

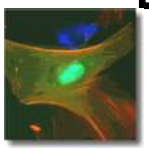
Yoel Sadovsky, Yingshi Ouyang, Juliana S. Powell, Hui Lia, Jean-Francois Mouillet, Adrian E. Morelli, **Alexander Sorkin**, Leonid Margolis. Placental Small Extracellular Vesicles: Current Questions and Investigative Opportunities. (2020) *Placenta*. In press.

Hui Li, Itziar Pinilla-Macua, Yingshi Ouyang, Elena Sadovsky, Kazuhiro Kajiwara, Sorkin, A. &Yoel Sadovsky. Internalization of trophoblastic small extracellular vesicles and detection of their miRNA cargo in P-bodies (2020) J. Extracell. Ves. 9(1):1812261. doi: 10.1080/20013078.2020.1812261.

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. 161:107676. doi: 10.1016/j.neuropharm.2019.107676.

Claudette St. Croix, Ph.D.
Associate Professor

Van Laar VS, Chen J, Zharikov AD, Bai Q, Di Maio R, Dukes AA, Hastings TG, Watkins SC, Greenamyre JT, **St Croix CM**, Burton EA. α-Synuclein amplifies cytoplasmic peroxide flux and oxidative stress provoked by mitochondrial inhibitors in CNS dopaminergic neurons in vivo.



Redox Biol. 2020 Aug 22;37:101695. doi: 10.1016/j.redox.2020.101695. Epub ahead of print. PMID: 32905883.

Bain W, Penaloza HF, Ladinsky MS, van der Geest R, Sullivan M, Ross M, Kitsios GD, Methe B, McVerry BJ, Morris A, Watson AM, Watkins SC, **St Croix CM**, Stolz DB, Bjorkman PJ, Lee JS. Lower respiratory tract myeloid cells harbor SARS-CoV-2 and display an inflammatory phenotype. medRxiv [Preprint]. 2020 Aug 14:2020.08.11.20171967. doi: 10.1101/2020.08.11.20171967. PMID: 32817968; PMCID: PMC7430612.

Vasamsetti SB, Coppin E, Zhang X, Florentin J, Koul S, Götberg M, Clugston AS, Thoma F, Sembrat J, Bullock GC, Kostka D, **St Croix CM,** Chattopadhyay A, Rojas M, Mulukutla SR, Dutta P. Apoptosis of hematopoietic progenitor-derived adipose tissue-resident macrophages contributes to insulin resistance after myocardial infarction. Sci Transl Med. 2020 Jul 22;12(553):eaaw0638. doi: 10.1126/scitranslmed.aaw0638. PMID: 32718989.

Li X, Kim SE, Chen TY, Wang J, Yang X, Tabib T, Tan J, Guo B, Fung S, Zhao J, Sembrat J, Rojas M, Shiva S, Lafyatis R, **St Croix C**, Alder JK, Di YP, Kass DJ, Zhang Y. Toll interacting protein protects bronchial epithelial cells from bleomycin-induced apoptosis. FASEB J. 2020 Jun 28. doi: 10.1096/fj.201902636RR. Epub ahead of print. PMID: 32596871.

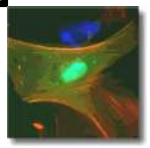
Pham D, Basu U, Pohorilets I, **St Croix CM**, Watkins SC, Koide K. Fluorogenic Probe Using a Mislow-Evans Rearrangement for Real-Time Imaging of Hydrogen Peroxide. Angew Chem Int Ed Engl. 2020 Jun 25. doi: 10.1002/anie.202007104. Epub ahead of print. PMID: 32585075.

Das S, **St Croix C**, Good M, Chen J, Zhao J, Hu S, Ross M, Myerburg MM, Pilewski JM, Williams J, Wenzel SE, Kolls JK, Ray A, Ray P. Interleukin-22 Inhibits Respiratory Syncytial Virus Production by Blocking Virus-Mediated Subversion of Cellular Autophagy. iScience. 2020 Jul 24;23(7):101256. doi: 10.1016/j.isci.2020.101256. Epub 2020 Jun 10. PMID: 32580124; PMCID: PMC7317237.

Zhao J, Dar HH, Deng Y, **St Croix CM,** Li Z, Minami Y, Shrivastava IH, Tyurina YY, Etling E, Rosenbaum JC, Nagasaki T, Trudeau JB, Watkins SC, Bahar I, Bayır H, VanDemark AP, Kagan VE, Wenzel SE. PEBP1 acts as a rheostat between prosurvival autophagy and ferroptotic death in asthmatic epithelial cells. Proc Natl Acad Sci U S A. 2020 Jun 23;117(25):14376-14385. doi: 10.1073/pnas.1921618117. Epub 2020 Jun 8. PMID: 32513718; PMCID: PMC7321965.

Googins MR, Woghiren-Afegbua AO, Calderon M, **St Croix CM,** Kiselyov KI, VanDemark AP. Structural and functional divergence of GDAP1 from the glutathione S-transferase superfamily. FASEB J. 2020 May;34(5):7192-7207. doi: 10.1096/fj.202000110R. Epub 2020 Apr 10. PMID: 32274853.

Xie W, Jiao B, Bai Q, Ilin VA, Sun M, Burton CE, Kolodieznyi D, Calderon MJ, Stolz DB, Opresko PL, **St Croix CM**, Watkins S, Van Houten B, Bruchez MP, Burton EA. Chemoptogenetic ablation of neuronal mitochondria in vivo with spatiotemporal precision and controllable severity. Elife. 2020 Mar 17;9:e51845. doi: 10.7554/eLife.51845. PMID: 32180546; PMCID: PMC7077989.



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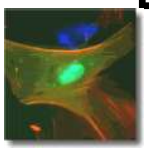

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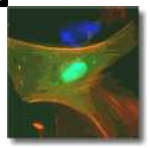

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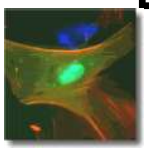

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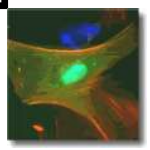

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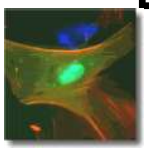

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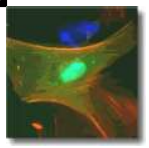

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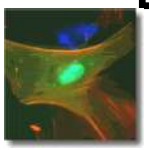

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Nathan Yates, Ph.D.
Associate Professor

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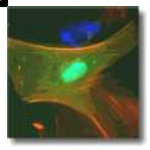
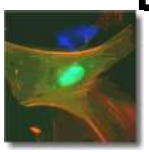


Executive Summary for the Cell Biology FY2020 Business Plan

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, one tenure-stream assistant professor was recruited; we hope that one Assistant Professor will be promoted in FY20, and we will recruit one more tenure-track faculty in the Department in FY21. 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 2021 has been approved and is appended at the end of this analysis.



Strengths

Research

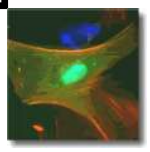
The Department of Cell Biology has a strong research program aimed at addressing fundamental questions of cell biology, including mechanisms controlling membrane trafficking, cell polarity, actin cytoskeleton, signal transduction, intercellular interactions, and membrane channel and transport regulation. 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 Nature Communications (Ford), 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 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” symposium, 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 winning of the first T32 training grant in cell biology which has been a joint effort of the 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:

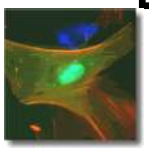
The administrative staff, headed by Susan Conway, has done an excellent job in providing various levels of support to the research, teaching and service activities. There have been additional and substantial loads placed on the administration due to research shutdown and continuing restrictions in all activities in the department during Covid-19 pandemics. The fact that all operations have been sustained and continue 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



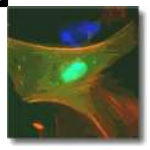
program towards basic cell biology and maintain a premier Department of Cell Biology. The key to accomplishing this task is the recruitment of new dynamic and creative faculty and continue to support productive mid-career and senior faculty. We hope to continue recruiting faculty whose research programs 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

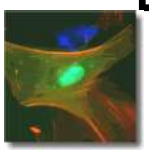
The steady decrease in federal and private funding opportunities to support fundamental cell biology research will continue to be the most significant threat during next several years. Some mid-career faculty are currently struggling with sustaining funding necessary to support their research programs. Yet, in order for the Department to sustain its status as 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.



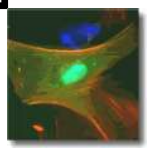
Cell Biology FY2020 Fiscal Issues

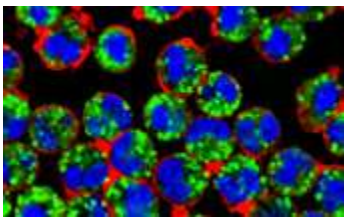
The main budgetary issue that faced the Department in the FY20 budget was maintaining the extramural funding of the faculty at the level necessary to support their research program and as required by the SOM Policies. Our goal for FY21 is to increase the funding level of previous years. Main efforts 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 2021 Budget

	University	UPP and Other	Total Budget FY 2019
Revenue			
Patient Care	$ -	$ -	$ -
Grant:			
Directs	5,159,516	-	5,159,516
Indirects	2,021,515	-	2,021,515
Hospital Contract	-	-	-
School of Medicine	3,295,971		3,295,971
VAMC		-	-
Other		-	
Total Revenue	$ 10,477,002	$ -	$ 10,477,002
Expenses			
Salaries and Fringe Benefits:			
Faculty	$ 3,818,660	$ -	$ 3,818,660
Non-Faculty	2,431,177	-	2,431,177
Malpractice Insurance		-	-
Space Rental	170,782	-	170,782
UPP Overhead		-	-
University Overhead	2,478,810		2,478,810
Other Operating Expenses	1,577,573	-	1,577,573
Total Operating Expenses	$ 10,477,002	$ -	$ 10,477,002
Excess Revenue over Expenses	$ -	$ -	$ -
Capital Equipment/Improvements	$ -	$ -	$ -
Fund Balances			
University Restricted Accounts as of 6/30/20	$ 2,956,210	$ -	$ 2,956,210
University Endowments as of 6/30/20	429,733		429,733
UPP Fund Balance as of 6/30/20		-	-
UPMC Endowments as of 6/30/20		-	-
UPMC SPF Accounts as of 6/30/20		-	-
Total Fund Balances	$ 3,385,943	$ -	$ 3,385,943





Thank you for your kind attention.