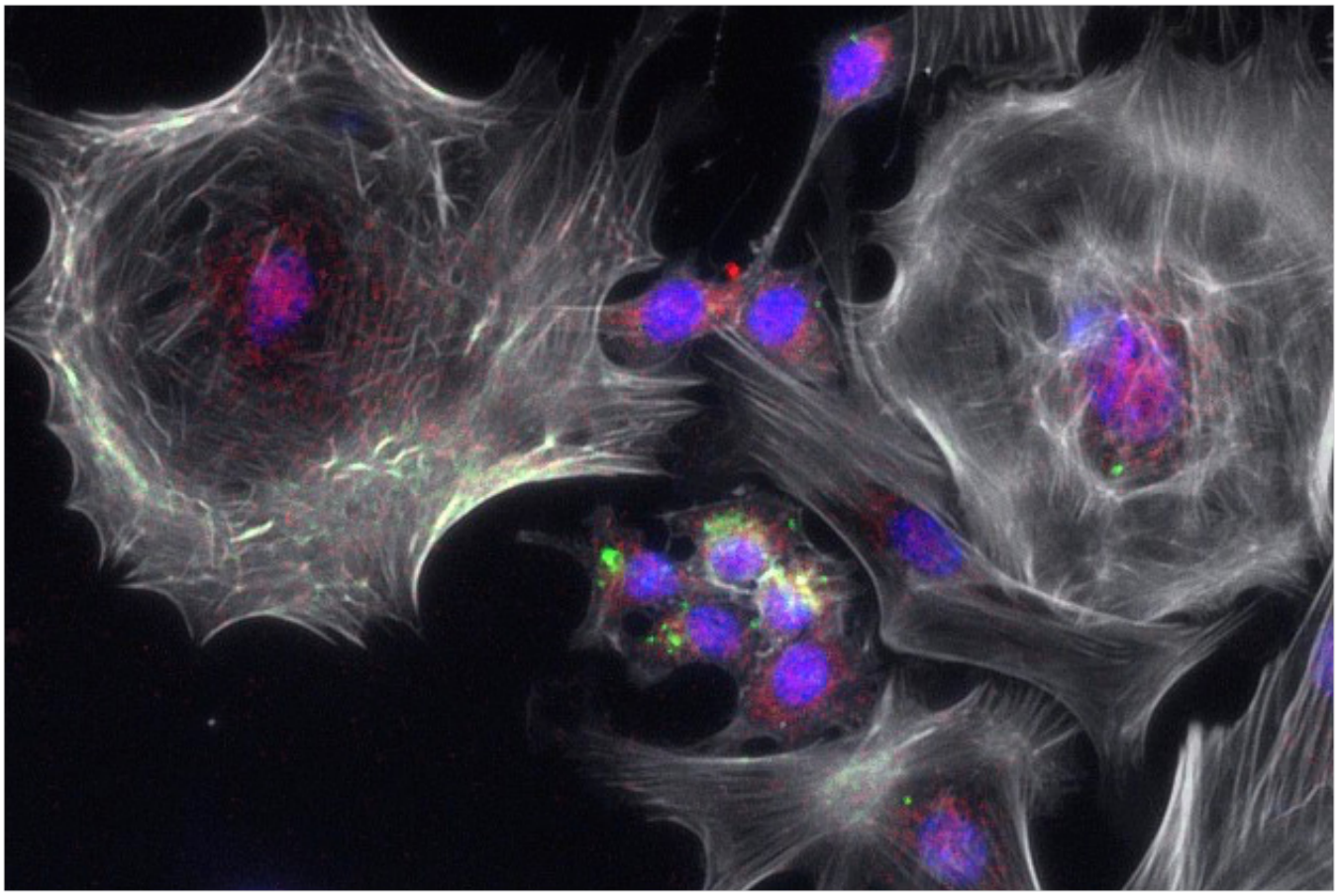
UNIVERSITY OF PITTSBURGH
SCHOOL OF MEDICINE

CELL BIOLOGY



FY16 ANNUAL REPORT
AND
FY17 BUSINESS PLAN

Front Page

Cover figure by Dr. Stephen Thorne. Virus in infected colorectal cancer cells (Virus – green; autophagasomes – red; nucleus – blue)

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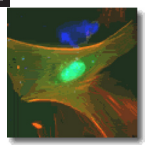


In the cell, life is governed by a multitude of molecular systems that shape and sustain the organellar system of the cell, maintain cellular homeostasis and respond to extracellular cues. These systems are dynamic, multicomponent macromolecular complexes. Maintaining and regulating the function of these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

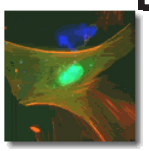
The Department of Cell Biology is one of eight basic science departments in the School of Medicine. Members of our Department benefit from close and collegial interactions with researchers in other Departments, and with basic scientists in other Schools of the University of Pittsburgh and Carnegie-Mellon University. The Department is comprised currently of nineteen one primary faculty, seventeen of them with vigorous 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 the Cell Biology Block, which comprises approximately one-third of the first year graduate course, Foundations of Biomedical Science. Our flagship course departmental offering, "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 housed in administrative and research space in the South Wing of the Biomedical Science Tower (SBST). We also have laboratories in BST3 and the Hillman Cancer Institute. Our modern facilities and support cores provide the faculty with space designed to optimize their research efforts.

Faculty member featured in this Report: Dr. Stephen Thorne

It was first reported that viral infections, on occasion, result in tumor regressions over 100 years ago. This was further advanced 20 years ago with the development of viral vectors engineered to display tumor-selectivity in their replication (oncolytic viruses).

Although clinical responses were reported, it has become clear that directly lytic viral replication



alone is rarely sufficient to eradicate large tumors or metastatic disease. However in the last several years, the combination of faster replicating vectors and the expression of immune-activating transgenes from the viruses themselves have resulted in improved clinical responses. This resulted in the first in class approval of the oncolytic virus IMLYGIC for the treatment of metastatic melanoma earlier this year and has led to extensive interest in the field.

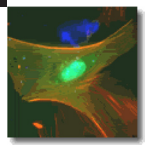
Our interest has primarily focused on the pre-clinical and translational development of enhanced, next generation oncolytic virus vectors based on vaccinia virus. This has focused on several key areas that were determined to be of special interest;

We felt that the immune response raised against the virus in the tumor can play a critical role in the successful application of this platform. Tumor-selective viral replication leads to localized acute inflammation, helps direct the immune response towards the tumor and transiently overcomes tumor-mediated immunosuppression. Meanwhile, lysis of tumor cells releases relevant tumor antigens and associated danger molecules, resulting in priming of anti-tumor immunity and in situ vaccination. Previously this immunotherapeutic activity has relied on the viral vector's naturally evolved interactions with the host immune response, often boosted by the expression of a single cytokine transgene. We have successfully implemented a variety of strategies to enhance the immune interactions, including altering Toll Like Receptor signaling pathways, targeting of immunosuppressive cells within the tumor, selectively activating anti-tumor CTL responses and altering trafficking patterns to direct activated immune cells into the tumor.

In addition, the limited ability to deliver oncolytic viral vectors intravenously to tumors in the clinic, especially in the face of anti-viral immunity, has seriously hampered the field. We have examined a variety of novel approaches to enhance this delivery, including altering the viral surface envelope, creating synthetic membranes to envelop the virus and delivering the virus within immune cell therapies.

Through combining these approaches we are looking to develop novel therapies that can be produced at clinical grade for early Phase I clinical trials.

Several images of the data from Thorne lab are included with this report.



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 and the Cystic Fibrosis Research Center. 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.

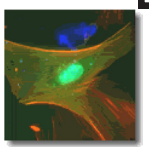
Regulation of channels and transporters

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). The department is home to a Translational Core Center in CF funded by the NIH and to a program grant from the CF Foundation.

Cellular organization and cell-cell communications

Hong
Kwiatkowski
Murray
Stoltz
Traub
Watkins



This group uses various state-of-the-art cell imaging, biochemical and genetic approaches to define the mechanisms involved in development and maintenance of epithelial cell polarity, regulation of gap junctions, angiogenesis and vasculogenesis, and various routes of functional communication between dendritic cells.

Regulation of intracellular signaling and gene expression

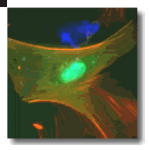
Drain
Hammond
Leuba
Sorkin
Thorne
Wan

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, DNA repair and transcription, and the mechanisms underlying virus replication. The particular focus is on the events leading to dysregylation of cellular signaling networks leading in the disease such as cancer.

Mass-spectrometry and proteomics

Yates

This laboratory is focused on developing new methodologies of quantitative mass-spectrometric analyses of proteins including new approaches to data acquisition, analysis and storage.



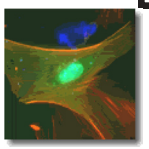
Center for Biologic Imaging

Over the last several years, microscopy as a scientific tool has reivented 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), fifteen 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. The Center is split between the medical research facility of the UPSOM (in approximately 5500 sq ft. of space) and within the Hillman Cancer Center (700 sq ft). Both locations have been designed as dedicated, state of the art imaging facilities. The medical school location is the mainstay of the core and has fully equipped microscopy suites, computer labs, and wet and dry bench space for light and electron microscopic preparations. It incorporates a continuum of optical imaging technologies from routine histology to more exotic procedures such as EM, in situ hybridization and fluorescent imaging of live cells with multiple fluorochromes in 3 dimensions and time. The smaller Hillman Cancer Center location houses basic confocal and immunofluorescence imaging facilities. 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) 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 19 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 multipe (30) online image processing work stations equipped with Metamorph, Elements, Imaris and Photoshop. Real time storage is 150 terabytes at gigabit speed and a half Petabyte tape library.

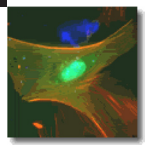
The Director: Dr. Simon C. Watkins was recruited to the University of Pittsburgh from the Dana Farber Cancer Institute (DFCI) in Boston in 1991 to provide scientific leadership of the Center. He is a tenured Professor in the Department of Cell Biology within the School of Medicine. His experience in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

The Associate Director: Dr. Donna Beer-Stolz is an Associate Professor in Cell Biology. Her funded research interests are in liver regeneration and vasculogenesis. She has been the Assistant Director of the CBI for 12 years to this date. 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.

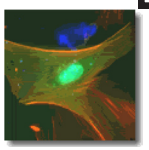
Other Faculty
Dr. Claudette St. Croix is another faculty who has become closely involved in the Center. Dr. St. Croix has research interests focused around the application of live cell and tissue imaging to the lung and pulmonary physiology

Postdoctoral Research Associates:

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, book-keeping, 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, 2016]

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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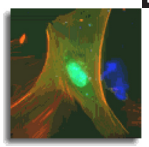
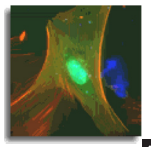
Devor, Daniel	Professor	S312 BST-South Wing	dd2@pitt.edu	412-383-8755	412-648-8330
Drain, Peter	Associate Professor	S323 BST-South Wing	drain@pitt.edu	412-648-9412	412-648-8792
Duker, Georgia	Assistant Professor	322 Scaife Hall	gduker1@pitt.edu	412-648-9409	412-648-8330
Ford, Marijn	Assistant Professor	S326 BST-South Wing	marijn@pitt.edu	412-383-9025	412-648-8330
Ford, Natalia	Res. Asst. Professor	S355 BST-South Wing	nw@pitt.edu	412-383-9026	412-648-8330
Hammond, Gerald	Assistant Professor	S327 BST-South Wing	ghammond@pitt.edu	412-383-2215	412-648-8330
Hong, Yang	Associate Professor	S325 BST-South Wing	yhong@pitt.edu	412-648-2845	412-648-8330
Kwiatkowski, Adam	Assistant Professor	S324 BST-South Wing	adamkwi@pitt.edu	412-383-8139	412-648-8330
Leuba, Sanford	Associate Professor	2.26g Hillman Cancer Center	leuba@pitt.edu	412-623-7788	412-623-4840
Murray, Sandra	Professor	S313 BST-South Wing	smurray@pitt.edu	412-648-9566	412-648-8330
Sorkin, Alexander	Professor and Chair	S368 BST-South Wing	sorkin@pitt.edu	412-624-3116	412-648-8330
Stolz, Donna Beer	Associate Professor	S221 BST-South Wing	dstolz@pitt.edu	412-383-7283	412-648-8330
Syeed, Sameera	Visiting Instructor	2.26g Hillman Cancer Center	sas69@pitt.edu	412-623-7822	412-623-4840
Thorne, Stephen	Assistant Professor	1.46 Hillman Cancer Center	thornesh@upmct.edu	412-623-7713	412-623-4840
Traub, Linton	Associate Professor	S325 BST-South Wing	traub@pitt.edu	412-648-9711	412-648-8330
Wan, Yong	Professor	2.6 Hillman Cancer Center	yow4@pitt.edu	412-623-3275	412-623-4840
Watkins, Simon C.	Distinguished Professor	S225 BST-South Wing	swatkins@pitt.edu	412-648-3051	412-383-8894
Yates, Nathan	Associate Professor	9043B BST3	yatesn@pitt.edu	732-718-9739	412-648-9009





CELL BIOLOGY
FY16 ORGANIZATIONAL CHART

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

CBMP Graduate Program
Michael Butterworth, Ph.D.
Director

Cell Biology and Pharmacology Shops

Machine Shop
Travis Wheeler,
Manager

Matthew Greb

Electronics Shop
Dominick Caimano

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

Tenured/Tenure Track Faculty
Meir Aridor, Ph.D.
Michael B. Butterworth, Ph.D.
Daniel Devor, Ph.D.
Peter Drain, Ph.D.
Marijn Ford, Ph.D.
Gerald Hammond, Ph.D.
Yang Hong, Ph.D.
Adam Kwiatkowski, Ph.D.
Sanford Leuba, Ph.D.
Sandra Murray, Ph.D.
Donna Beer Stolz, Ph.D.
Stephen Thorne, Ph.D.
Linton Traub, Ph.D.
Yong Wan, Ph.D.
Simon Watkins, Ph.D.

Non-Tenure Track Faculty
Georgia Duker, Ph.D.
Natalia Ford, Ph.D.
Sameera Sayeed, Ph.D.
Nathan Yates, Ph.D.

Cell Biology
Research Seminar Schedule 2015 - 2016

September 25, 2015
Gia Voeltz, PhD
Associate Professor, Molecular, Cellular & Developmental Biology
University of Colorado, Boulder
"Unraveling New Functions for the Endoplasmic Reticulum at Organelle Contact Sites"

October 20, 2015
Anne Muesch, PhD
Professor, Developmental & Molecular Biology
Albert Einstein College of Medicine
"A Matter of Architecture: Building Epithelia with Kidney and Hepatocyte Polarity"

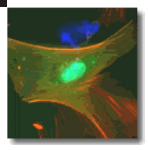
November 10, 2015
Jill Bargonetti, PhD
Professor, Biological Sciences
Hunter College, City University of New York
"Mutant p53 and MDM2 Signaling in Breast Cancer"

December 1, 2015
Yi Shi, PhD
Research Associate, Laboratory for Mass Spectrometry and Gaseous Ion Chemistry
The Rockefeller University
"Dissecting the Architectures of Endogenous Macromolecular Assemblies"

March 8, 2016
Gerry Hammond, PhD
Assistant Professor, Cell Biology
University of Pittsburgh
"The Where and What For of Inositol Lipid Metabolism"

March 15, 2016
Mary Munson, PhD
Associate Professor, Biochemistry and Molecular Pharmacology
University of Massachusetts Medical School
"Molecular Architecture and Function of the Exocyst Complex in Vesicle Trafficking"

March 22 2015
Adam Kwiatkowski, PhD
Assistant Professor, Department of Cell Biology
University of Pittsburgh



"Mechanisms of intercellular adhesion in a contractile system"

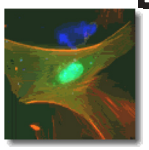
March 29, 2016
Michael Butterworth, PhD
Assistant Professor, Department of Cell Biology
University of Pittsburgh
"MicroRNA Regulation of Renal Sodium Transport: A Deep Dive"

April 12, 2016
William Brieher, PhD
Associate Professor, Molecular & Cellular Biology
University of Illinois
"New Insights into how cells control the stability of actin filaments and networks"

April 19, 2016
Marijn Ford, PhD
Assistant Professor, Cell Biology
University of Pittsburgh
"The role of Vps1 in Microautophagy"

April 26, 2016
Jen Liou, PhD
Assistant Professor, Physiology
University of Texas, Southwestern Medical Center
"Signaling at ER membrane contract sites"

May 24, 2016
Dennis Zimmerman, PhD
Postdoctoral Fellow, Molecular Genetics & Cell Biology
University of Chicago
"Novel insights into the interplay of myosin motors and a dynamic actin cytoskeleton at the single-molecule level"



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.

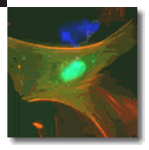
We take a multi disciplinary approach using a wide range of molecular, biochemical, biophysical and cellular techniques to unravel the molecular basis for protein and lipid sorting in the ER. Specifically, we use these approaches to address several related questions including the following: 1. What is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

Dr. Butterworth's research interest is in the regulation of epithelial channels by vesicle trafficking and recycling. Research is focused into two broad areas. First, ongoing studies aim to characterize the mechanisms that underlie channel regulation by membrane trafficking in the mammalian kidney. Three renal transporters, namely the epithelial sodium channel (ENaC), potassium channel (ROMK) and aquaporin water channels are investigated. The work aims to map the intracellular itinerary of these channels and identify protein mediators that regulate channel surface density. In separate, but related studies, primary human bronchiolar epithelial cells are used to characterize ENaC regulation in the human distal airway, in particular mechanisms which may contribute to disease states like cystic fibrosis. By comparing ENaC regulation in two distinct systems, areas of common and divergent regulation have been established. The second research focus investigates the regulation of ENaC by microRNAs (miRNA). miRNAs are small RNAs that pair to the mRNA of protein coding genes to direct their post-transcriptional repression. Channel density in epithelial cells is determined to a large extent by steroid hormone signaling. The regulation of miRNAs by these hormones and impact of changes in miRNA expression on channel regulation is being studied.

Daniel C. Devor, Ph.D.
Professor

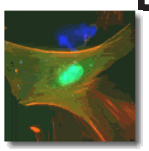
Intermediate (KCa3.1 or IK) and small (KCa2.3 or SK3) conductance, calcium-activated potassium channels play critical roles in a host of physiological processes, including the endothelial derived hyperpolarizing factor (EDHF) response which is critical to the maintenance of vascular tone and hence blood 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 Ca2+ 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 Ca2+ 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 Ca2+ affinity. These results suggest this region of the channel is similarly involved in the coupling between Ca2+ 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 Ca2+ and gating.

Second, as any physiological response is dictated by not only the likelihood that channels are in the open state (Po), 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

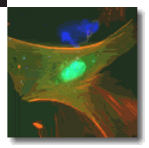


and cell biological techniques.

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 Ca2+-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.



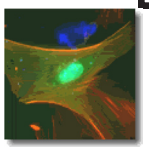
While the majority of our studies are being carried out in HEK cells in order to facilitate an initial understanding of these processes which have not heretofore been studied in the context of KCa2.3 and KCa3.1, we similarly carry out crucial studies using the HMEC-1 microvascular endothelial cell line. 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 Ca2+ 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

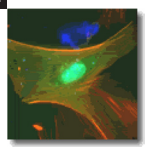


fraction of time the KATP channel spends in the inhibited state determines insulin secretory rates. When this regulation goes awry, serious complications at the whole-organism level lead to diabetes and other diseases. The research has fundamental importance to pharmaco-genetics, in which certain diabetic 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.

Georgia K. Duker, Ph.D.
Assistant Professor

My contributions to the University Of Pittsburgh School Of Medicine are primarily through teaching. I contribute as a faculty member to twelve separate courses throughout the first and second years of the medical students' education. My responsibilities include course director, lectures, problem based learning sessions, microscopy laboratories, physiology workshops, designing and leading team-based learning and tutorial sessions. For seven of these courses, I direct the microscopy labs in normal histology. My photographs have been formed into slide-based lab sessions to cover many of the organ system studied. In recent years, a focus has been to contribute to the medical education web site: http://navigator.medschool.pitt.edu. Annotated image collections now guide medical students through the renal, gastrointestinal, pulmonary, endocrine, musculoskeletal, reproductive and nervous systems. The Normal Histology image collection for the entire body is available to students on the Navigator site. In 2003, I served as the course director for the Cell Structure, Metabolism & Nutrition course. 2003-04 also saw my participation in both the Basic Science Task Force and the Organ Systems Task Force; these committees oversaw the restructuring of the first two years of the medical school curriculum. From 2004 through to 2016, I am a co-director for the second-year Digestion and Nutrition course.



Within the Department of Cell Biology and Molecular Physiology I am course director for the Graduate Histology course (1995-2016). This course is taken by the majority of our students. It is abroad survey of all the organ systems, focusing on structure/function at the cellular, tissue and organ levels, with multiple clinical and pathological correlations. For most students it is the only time they encounter a full body overview of systems beyond their own research. Graduate students within the Department of Cell Biology and Molecular Physiology may then serve as Teaching Assistants for the Histology labs within seven Medical School courses. One of my roles is coordinator of the Teaching Assistants, especially to oversee their training and preparation.

A third role has emerged for me as a School of Medicine Coordinator for the Undergraduate Honors College Program. I created a new course, Biomedicine: Past, Present and Future, 2002-2015. We examine 12 significant biotechnologies via their history and future applications. Twenty-eight faculty from the School of Medicine contribute. This course is one of three from the School of Medicine to form the core requirements for a new Certificate in the History of Medicine. The Certificate program, coordinated by Dr. Johnathon Erlen, will be offered through the Undergraduate Honors College. It is an inter-university program with course offering from the University of Pittsburgh, Duquesne University and Carnegie Mellon University. Students from all three universities are permitted to cross register for the courses. This is the first inter-university certificate program in Pittsburgh.

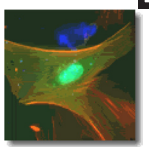
Marijn Ford, Ph.D.
Assistant Professor

Our laboratory is interested in understanding the mechanism of action of the Dynamin-Related proteins, and, particularly, how they remodel membranes. To this end, we have been focusing on a poorly characterized fungal-specific DRP, Vps1 (Vacuolar Protein Sorting 1, initially identified in a screen for yeast mutants defective in sorting CPY).

We are approaching this problem in a number of ways:

Cell Biology:
We have made an comprehensive collection of yeast strains allowing us to monitor and dissect membrane remodeling in yeast under normal and stress conditions. We have identified novel functions of Vps1 in autophagic processes as well as other stress response pathways.
We extensively use the imaging facilities in the Center for Biologic Imaging for this purpose. In addition, we use other yeast cell biological techniques (processing assays etc.) as well as western blotting and RNA analysis to assay trafficking, autophagy and vacuolar responses in normal and stressed cells.

Mass Spectrometry:
Physical binding partners for Vps1 remain unknown, though some genetic interactors have been identified in the literature. A significant reason for this has been an inability to purify Vps1 to homogeneity in abundance. We have tried extensively to purify *S cerevisiae* Vps1 with limited success. However, we have succeeded in preparing Vps1 from closely related fungal sources (to the extent that heterologous expression of these Vps1 sequences under the control of native UTRs in *S cerevisiae* fully rescues the temperature-sensitive defect observed in Δvps1 cells. Consequently, we are doing mass spectrometry using these alternative Vps1 proteins as bait and



probing *S cerevisiae* cytosol for interacting partners for identification by mass spectrometry.

High-throughput genomics:
We have conducted a screen using synthetic genetic array technology, where a yeast query strain, deleted in Vps1, is systematically crossed with a library containing yeast systematically deleted for every non-essential open reading frame in the yeast genome. A series of controlled replica-plating steps results in sporulation and selection for double mutant offspring. The readout is colony size, taken as a proxy for fitness of the double mutants. This allows rapid identification of genes that have a genetic interaction with the query (alleviating or synthetic sick/lethal). The screen with the Δvps1 query identified hits in multiple genes involved in endosome function, tethering and MVB formation.
As an extension, in collaboration with Kara Bernstein's lab, we have extended this approach to **synthetic dose lethality**, where we systematically heavily overexpress our query (Vps1) in a library of strains where each non-essential yeast gene has been deleted. We are looking for strains where the absence of a particular gene results in particular sensitivity to the presence of elevated levels of Vps1. This study will be followed by additional screens where assembly-deficient mutants of Vps1 and components of the nucleus-vacuole junction are overexpressed in turn.

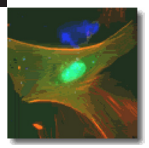
Biochemistry:
We are purifying vacuoles from wild-type yeast and yeast deficient in several candidate proteins for in vitro reconstitution of microautophagic processes.

Bioinformatics:
In collaboration with Nathan Clark's lab, we are using bioinformatic approaches to complement and strengthen our high-throughput genomic screening. To date, this work has suggested some connections between Vps1, TOR signaling and microautophagy which we have confirmed by experimental approaches.

Structural Biology:
We are screening carefully selected targets identified in our genetic screens with Vps1 for crystallization studies, as well as possible cryo-EM (which will be done in collaboration with Peijun Zhang's lab). To date we have focused extensively on VAC8, a peripheral membrane protein essential for nuclear-vacuolar junction formation, vacuole inheritance and micronucleophagy. Despite thousands of trials, suitable crystals have not yet been obtained and we are currently using bioinformatic and data-mining approaches to optimize the construct, as well as new tools developed in Pitt by the vanDemark lab.

Summary of our results to date:

i) Purified functional Vps1 from several sources as well as S. cerevisiae proteins involved in nuclear-vacuolar junction formation
ii) Functionally tagged Vps1 in vivo, as well as numerous other trafficking, autophagy and vacuolar resident proteins
iii) Identified a novel function of Vps1 in microautophagy and TOR signaling
iv) Uncovered a link between ESCRT and Vps1 function on endosomes and vacuoles
v) Identified a genetic interaction between Vps1 and GARP tethering complex responsible for endosomal-TGN trafficking which may be implicated in lipid transport or dissemination



and ER homeostasis

vi) Identified a role for Vps1 in the newly identified process of piecemeal microautophagy of the nucleus and its role in nuclear-vacuolar contact sites

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?

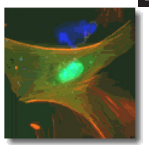
Answering these basic questions is crucial, because genetic diseases ranging from cancer to hereditary hearing loss are caused by disruption of membrane function resulting from mutations in inositol lipid metabolizing enzymes. Furthermore, many bacterial and viral pathogens re-model host cell membranes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

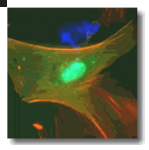
We have developed genomic engineering tools that allow efficient generation of knock-in alleles of *Drosophila* genes. We also developed comprehensive imaging tools for visualizing the dynamic subcellular localizations of polarity proteins under various physiological conditions including hypoxia.

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.

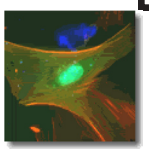
- We have used spFRET to demonstrate fast, long-range, reversible conformational fluctuations in nucleosomes between two states: fully folded (closed) with the DNA wrapped around the histone core, and open, with the DNA significantly unraveled from the histone octamer (Tomschik et al., 2005), implying 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).

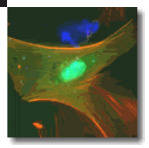
Our future goals are to build combination single-molecule instruments to image and manipulate intramolecular nanometer movements in submillisecond real-time with piconewton force sensitivity (e.g., we want to observe directly what happens to the histones in a nucleosome in the path of a transcribing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

Alexander D. Sorkin, Ph.D.
Professor, Chair of Department

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 processes in the regulation of



dopaminergic neurotransmission by the plasma membrane dopamine transporter (DAT). In both of these research areas we are using multidisciplinary methodological approach in in vitro and in vivo experimental models.

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.

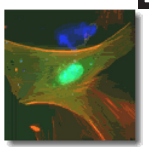
Dr. Stolz is Associate Director of the Center for Biologic Imaging and directs the electron microscopy facility of CBI. Her main role as Associate Director of CBI is to facilitate PI usage with the facility, as well as assist in design, execution and interpretation of experiments involving all types of imaging technologies in general. Additionally, she coordinate 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.

Stephen Thorne, Ph.D.
Assistant Professor

It was first reported that viral infections, on occasion, result in tumor regressions over 100 years ago. This was further advanced 20 years ago with the development of viral vectors engineered to display tumor-selectivity in their replication (oncolytic viruses).

Although clinical responses were reported, it has become clear that directly lytic viral replication alone is rarely sufficient to eradicate large tumors or metastatic disease. However in the last several years, the combination of faster replicating vectors and the expression of immune-activating transgenes from the viruses themselves have resulted in improved clinical responses. This resulted in the first in class approval of the oncolytic virus IMLYGIC for the treatment of metastatic melanoma earlier this year and has led to extensive interest in the field.

Our interest has primarily focused on the pre-clinical and translational development of enhanced,



next generation oncolytic virus vectors based on vaccinia virus. This has focused on several key areas that were determined to be of special interest;

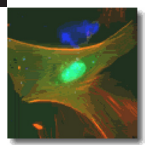
We felt that the immune response raised against the virus in the tumor can play a critical role in the successful application of this platform. Tumor-selective viral replication leads to localized acute inflammation, helps direct the immune response towards the tumor and transiently overcomes tumor-mediated immunosuppression. Meanwhile, lysis of tumor cells releases relevant tumor antigens and associated danger molecules, resulting in priming of anti-tumor immunity and in situ vaccination. Previously this immunotherapeutic activity has relied on the viral vector's naturally evolved interactions with the host immune response, often boosted by the expression of a single cytokine transgene. We have successfully implemented a variety of strategies to enhance the immune interactions, including altering Toll Like Receptor signaling pathways, targeting of immunosuppressive cells within the tumor, selectively activating anti-tumor CTL responses and altering trafficking patterns to direct activated immune cells into the tumor.

In addition, the limited ability to deliver oncolytic viral vectors intravenously to tumors in the clinic, especially in the face of anti-viral immunity, has seriously hampered the field. We have examined a variety of novel approaches to enhance this delivery, including altering the viral surface envelope, creating synthetic membranes to envelop the virus and delivering the virus within immune cell therapies.

Through combining these approaches we are looking to develop novel therapies that can be produced at clinical grade for early Phase I clinical trials.

Linton M. Traub, Ph.D.
Associate 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.

Yong Wan, Ph.D.
Professor

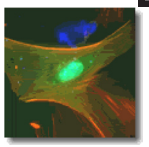
Posttranslational modifications such as ubiuqitylation, methylation, ADP-ribosylation as well as phosphorylation orchestrate genome stability, cell division, signal transduction, apoptosis and tumorigenesis. Posttranslational modifications act as critical molecular switches or fine-tune operators that determine the activation, deactivation or subcellular localization of functional proteins. Emerging evidence has drawn attention to the modulation of regulatory proteins in response to extrinsic/intrinsic signaling being executed simultaneously by multiple posttranslational modifications. Research interests in my laboratory seek to address how defects in the ubiquitin-proteasome system (E3 ligase/deubiquitinase), protein methyltransferase and poly (ADP-ribose) polymerase 1 (PARP1) would result in genomic instability, abnormal cell cycle or apoptosis, and aberrant signal transductions (e.g., ER, TGF-beta and EGFR) that predispose otherwise normal cells to become cancerous tumor cells. The ultimate objective is to integrate our basic research with clinical translational studies that would allow the development of new anti-cancer therapy thereby fully exploiting our knowledge of posttranslational modifications. To achieve our goals, we have developed a multidisciplinary approach that includes biochemical, cell biological and genetic analyses as well as the use of animal models and analyses of clinical samples.

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

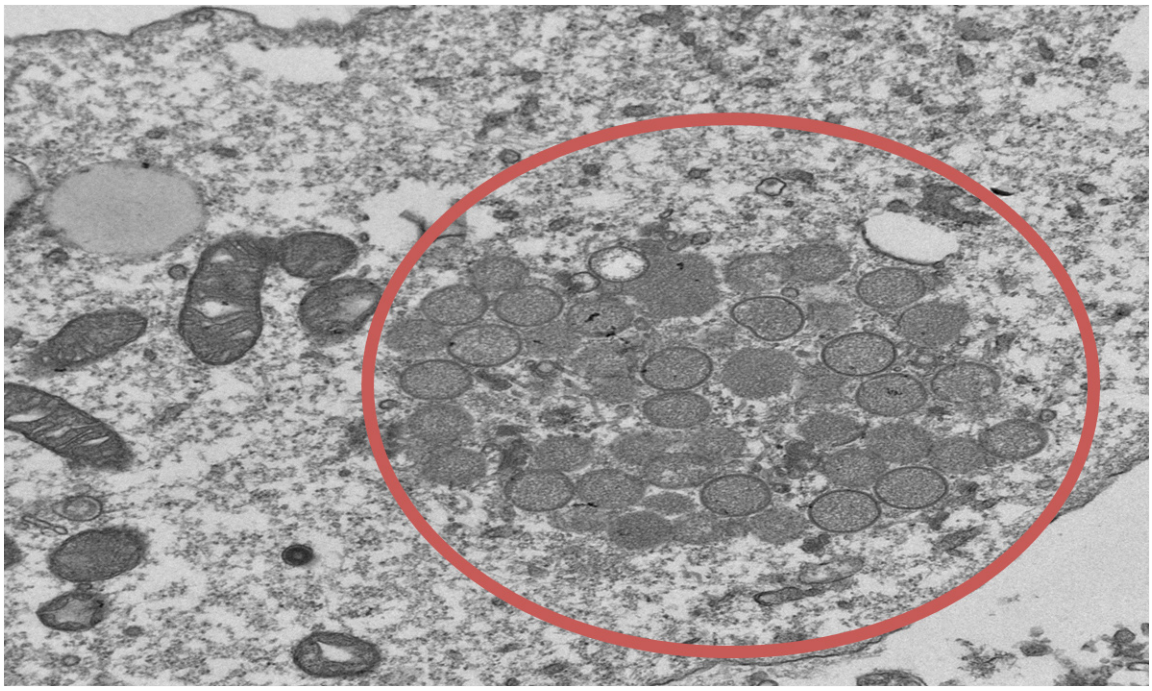
The application of advanced imaging tools to the field of cell biology is constantly revealing new facets of cellular and molecular behavior. The goals of my research program are two-fold. To develop novel quantitative fluorescent based assays using optical microscopy, and secondly to develop novel imaging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

Nathan Yates, Ph.D.
Associate Professor

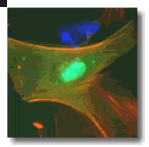
The systematic goal motivating our work is to develop and apply powerful mass spectrometry based tools that represent a new “microscope” for studying biology and advancing efforts to understand and treat disease. By integrating mass spectrometry, automation, and informatics, we are developing new analytical tools for the characterization and quantification of complex biological systems. These –omics tools provide exciting opportunities to probe biology with absolute molecular specificity, however, significant hurdles must be cleared before they tools have widespread impact in basic and clinical research. A specific aim of our research is to develop distributed informatics tools and mass spectrometry data analysis techniques. Prior to joining the University of Pittsburgh, Dr. Yates’ work at Merck & Co. Inc. led to the invention and eventual the commercialization of Differential Mass Spectrometry; an unbiased quantitative proteomics method for comparing complex biological systems. The lab is also focused on the



development of innovative technologies that are designed to improve the throughput and reliability of quantitative proteomics assays. In collaboration with several industry partners, the lab is developing "easy to use" assay platforms that will enable scientists in basic and clinical research.



Dr. Stephen Thorne. TEM of vaccinia virus replication factory in cellular cytoplasm. Progeny viral particles appear as grey ovals



Study Sections (Fiscal Year 2015 - 2016)

Michael Butterworth, Ph.D.
Assistant Professor

VA Merit Award Study Section (Nephrology Council) 2015

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

ASIRC - Italian Association for Cancer Research; Standing Member
Association for International Cancer Research (mail)
Springboard UK/Ireland (mail) 2016
World Cancer research (Italy) (mail) 2015
WelcomeTrust-India Alliance (mail) 2015
NIH/NCI Omnibus Cancer Biology 3 ZCA1 RPRB-O (J1) 2015

Donna B. Stolz, Ph.D.
Associate Professor

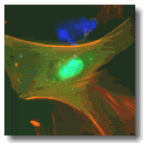
ZDK1 GRB-8 J1 review of NIH NIDDK P01 special emphasis grants) 1 meeting grant, phone meeting. 2015
ZDK1 GRB-8 M21 review of NIH NIDDK P01 grants 1 meeting grant, phone meeting. 2015

Yong Wan, Ph.D.
Professor

Molecular Oncogenesis Study Section (MONC), NIH, Standing member (2013-2019)

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

NIH Study section “the 4D Nucleome” Co-Chair of panel, 07/22/2015
NIH study section, EM S10’s October 13th 2015 Chair of panel
National institute for Child Health, External review panel, panelist November 12th-13th 2015
Winship Cancer Center External Reviewer December 10, 2015
ACS Study Section (Peer Review Committee on Clinical Cancer Research and Epidemiology), Chair of Panel, Atlanta, GA, January 27st-28th 2016
ACS Study Section (Peer Review Committee on Clinical Cancer Research and Epidemiology), Chair of Panel, Atlanta, GA, June 29th-30th 2016



Faculty Advisory Committee Memberships (Fiscal Year 2015 - 2016)

Meir Aridor, Ph.D.
Associate Professor

University of Pittsburgh School of Medicine Interdisciplinary Biomedical Graduate Program- Cell Biology and Molecular Physiology Program Committee
Local Traffic Symposium; Organizing Committee Member
Cell Biology Space Committee
Cell Biology Faculty Recruitment Committee
Integrated Systems Biology (ISB) Admission's Committee

Michael Butterworth, Ph.D.
Assistant Professor

Cell Biology Space Committee
University of Pittsburgh: Faculty Assembly Member
Integrated Systems Biology (ISB) Program Committee
Integrated Systems Biology (ISB) Course Director, Core Course (Imaging)
Cell Biology and Molecular Physiology Graduate Program, Director

Daniel Devor, Ph.D.
Professor

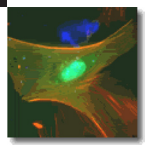
Cell Biology Departmental Tenure and Promotions Committee
Chair, Interdisciplinary Biomedical Graduate Program Admissions Committee

Peter F. Drain, Ph.D.
Associate Professor

University of Pittsburgh School of Medicine Interdisciplinary Biomedical Graduate Program- Cell Biology and Molecular Physiology Program Committee
Cell Biology Representative, Graduate Student Recruitment Committee
Scholarly Project Executive Committee Member
University of Pittsburgh School of Medicine (UPSOM) Admissions Committee
Biomedical Masters Program Committee
UPSOM Curriculum Committee

Georgia K. Duker, Ph.D.
Assistant Professor

President of the C. F. Reynolds History of Medicine Society of the University of Pittsburgh
Honor Council Hearing Board – School of Medicine



Marijn Ford, Ph.D.
Assistant Professor

Organizer – Cell Biology Department Retreat

Gerald Hammond, Ph.D.
Assistant Professor

Organizer – Cell Biology Department Retreat

Yang Hong, Ph.D.
Associate Professor

Director, Summer Undergraduate Research Program (SURP) in Cell Biology and Molecular Physiology
Cell Biology Space Committee
Cell Biology Faculty Recruitment Committee

Adam Kwiatkowski, Ph.D.
Assistant Professor

Organizer – Cell Biology Department Retreat
Local Traffic Symposium Organizing Committee
Integrative Systems Biology Admissions Committee

Sanford Leuba, Ph.D.
Associate Professor

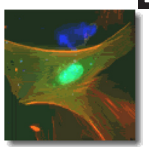
University Molecular Biophysics and Structural Biology Graduate Program Chair of Admissions Committee & Curriculum Committee

Sandra A. Murray, Ph.D.
Professor

Graduate School of Public Health Research Advisory Committee – Center for Minority Health
Provost Advisory Committee for the Provost Development Fund Awards
Morehouse College of Medicine Advisory Board
Cell Biology and Physiology Tenure and Promotions Committee
Advisory Board, NIH-R25 Vascular Medicine and Cell Biology Research A –
Advisory Board Pittsburgh Undergraduate Research Diversity Program
Member of Scientific Advisory Committee for the International Gap Junction Society Meeting

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

Executive Committee – School of Medicine
University of Pittsburgh and Carnegie Mellon Medical Scientist Training Program Committee -



MSTP
Center for Neuroscience University of Pittsburgh – CNUP
University of Pittsburgh Cell Biology and Molecular Physiology Program Committee
Cell Biology Tenure and Promotions Committee
Cell Biology Faculty Recruitment Committee
External Advisory Committee for Nevada's Cell Biology COBRE Grant, University of Nevada School of Medicine, Reno, NV
Dickson Prize Selection Committee - SOM

Donna Beer Stolz, Ph.D.
Associate Professor

University of Pittsburgh School of Medicine Interdisciplinary Biomedical Graduate Program- Cell Biology and Molecular Physiology Program Admissions Committee
Director - Cell Biology and Molecular Physiology Program
Interdisciplinary Biomedical Graduate Program Admissions Committee Tour Guide

Stephen Thorne, Ph.D.
Assistant Professor

University of Pittsburgh and University of Pittsburgh Cancer Institute, UPCI;
Director, Small Animal Imaging Core, UPCI
Leader, Viral Vector and Gene Delivery Section, Molecular Virology Program at UPCI
Steering Committee, UPCI Flow Cytometry Facility

Linton M. Traub, Ph.D.
Associate Professor

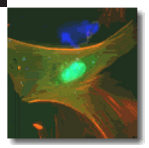
University of Pittsburgh School of Medicine Health Sciences Research Advisory Committee
Cell Biology Tenure and Promotions Committee
Cell Biology Faculty Recruitment Committee
Cell Biology Space Committee

Yong Wan, Ph.D.
Professor

Cell Biology Tenure and Promotions Committee
Cell Biology Departmental Tenure and Promotions Committee

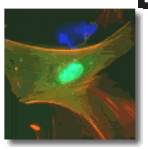
Simon C. Watkins, Ph.D.
Distinguished Professor and Vice Chairman, Director of Center of Biologic Imaging

Cell Biology Tenure and Promotions Committee
Cell Biology Student Advisory Committee
Cell Biology Space Committee
Cell Biology Faculty Recruitment Committee
Graduate Program, Curriculum Committee
University of Pittsburgh School of Medicine, Research Advisory Committee



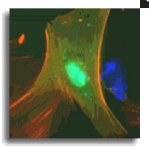
University of Pittsburgh Cancer Institute Core Resources Committee
University of Pittsburgh Tenure and Promotions Committee
Scientific Advisory Board: Roper Scientific

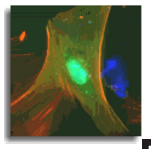
Cell Biology/Pharmacology Machine Shop



Cell Biology Sponsored Research Funding (FY16)

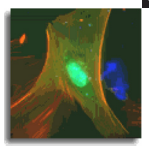
Name	Agency Name	Title	Annual DC	Annual IDC
Daniel Byrd	National Institutes of Health	Combing STAT3-Silencing and Oncolytic Vaccinia Virus to Enhance Anti-tumor Therapeutic	14,030	0
Michael Butterworth	National Institutes of Health	Role of MicroRNAs in kidney sodium regulation	203,119	109,654
Raymond Frizzell	National Institutes of Health	Basic and Clinical Studies of Cystic Fibrosis - Administrative Core	22,257	12,019
Raymond Frizzell	National Institutes of Health	Basic and Clinical Studies of Cystic Fibrosis - Core A	70,124	37,867
Raymond Frizzell	Cystic Fibrosis Foundation	Program Enrichment and Administration Core	16,000	0
Raymond Frizzell	Cystic Fibrosis Foundation	Molecular Biology and Gene Expression Core A	50,000	0
Raymond Frizzell	Cystic Fibrosis Foundation	Research Training Core	35,000	0
Raymond Frizzell	Cystic Fibrosis Foundation	Selective Steps in WIld-Type and DF508 CFTR Processing	38,450	3,076
Raymond Frizzell	Cystic Fibrosis Foundation	Selective Steps in WIld-Type and DF508 CFTR Processing	66,600	5,328
Raymond Frizzell	National Institutes of Health	Chaperone Actions in CFTR Biogenesis	111,250	60,075
Raymond Frizzell	Cystic Fibrosis Foundation	Fluorogen detection of ASL composition and mucin secretion	45,000	3,600
Christine Klemens	American Heart	Ankyrin G A Regulation of the Epithelial Sodium Channel after Adosterone Stimulation	26,000	0
Adam Kwiatkowski	American Heart	Alpha-Catenin Function in Cardiomyocyte Adhesion and Cytoskeletal Organization	17,500	1,750
Adam Kwiatkowski	National Institutes of Health	Alpha-Catenin Function in Cardiomyocyte Adhesion and Cytoskeletal Organization	83,250	42,527
Sanford Leuba	National Institutes of Health	NNRTI Induced Conformational Changes in HIV 1 RT (Sluis-Cremer)	62,973	26,715
Sanford Leuba	National Institutes of Health	Novel Mechanisms of HIV Resistance ti RTIS (Sluis-Cremer)	5,628	3,040
Sandra Murray	National Science Foundation	Regulation of annular gap junctionp rocessing	179,261	96,801
Alexander Sorkin	National Institutes of Health	The Influence of Gene-environment Interaction on Neuroanal Mitochondrial Fission, Fusion and Transport in Chronic Parkinsons Disease-Relevant Environmental Toxins (Berman)	6,753	5,701
Alexander Sorkin	National Institutes of Health	Dopamine Transporter Regulation by Endocytosis	185,093	95,292
Alexander Sorkin	National Institutes of Health	Pathogenesis of Cancer - Role of EGF Receptor Endocytosis	234,085	103,253
Donna Beer Stolz	National Institutes of Health	Endogenous Regulators of Inflammaion in Liver Ischemia/Reperfusion	9,939	5,119
Donna Beer Stolz	National Science Foundation	Engineering Research Center	27,314	8,916
Donna Beer Stolz	National Institutes of Health	Core A Cell and tissue Imaging Core	70,644	38,148
Donna Beer Stolz	National Institutes of Health	All Human Microphysical Model of Metastasis Therapy	65,121	30,846
Donna Beer Stolz	MWRI-NIH	Primary Human Trophoblasts and the Transfer of Viral Resistance	7,268	3,743
Donna Beer Stolz	National Institutes of Health	Bid-mediated killing of oncogenic stem cells in chemoprevention	3,574	1,930
Donna Beer Stolz	National Institutes of Health	Bid-mediated killing of oncogenic stem cells in chemoprevention	1,198	647
Donna Beer Stolz	National Institutes of Health	Mechanisms of Arsenic-induced Muscle Morbidity and Reduced Regenerative Capacity	12,775	6,829
Donna Beer Stolz	National Institutes of Health	Signaling pathways influencing liver disease phenotype in antitrypsin deficiency	14,665	7,244
Donna Beer Stolz	National Institutes of Health	Nitric Oxide and Hepatic Function in sepsis and Trauma	11,929	4,512

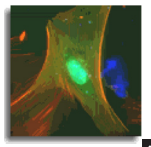




Donna Beer Stolz	National Institutes of Health	Proteotoxicity in the Pathophysiology of Pancreatitis	10,779	3,040
Donna Beer Stolz	National Institutes of Health	Mechanisms of Trabecular Meshwork Regeneration by stem cell	10,000	4,253
Donna Beer Stolz	National Institutes of Health	Critical Role for Fibroblast Growth Factor Receptors in Bladder Development	6,061	3,273
Donna Beer Stolz	National Institutes of Health	Dysfunctional Muscle remodeling and regeneration in environmental disease	8,294	4,478
Donna Beer Stolz	National Institutes of Health	Elucidting Mechanisms Involved in Lamin B1 Medited Demyelination	987	533
Stephen Thorne	National Institutes of Health	Improving Vaccinia fpr Pertioneal Tumors Enhanced Distribution and Immune Evasion	6,996	3,603
Stephen Thorne	National Institutes of Health	Combinational Immunotherapy Targeting Melanoma-Associated Vasculature	14,283	7,715
Stephen Thorne	National Institutes of Health	Exosomal Recombinase-a tool to disect metastasis and the cancer microevviro	792	428
Stephen Thorne	National Institutes of Health	Creation of Immuno-Oncolytic Viruses for Cancer Therapy	176,418	95,266
Stephen Thorne	Lustgarten	Novel oncolytic vaccinia strans for targeted pancreatic cancer therapy	175,872	35,173
Stephen Thorne	Devacell CRA	Silacate Coating of Oncolytic Vaccinia Virus to Enhance Delivery	28,041	2,804
Stephen Thorne	National Institutes of Health	Thorne-Combining Immuno-oncolytic Viruses with Blockade of Immune Checkpoint Inhibitors to Treat Melanoma	15,000	8,100
Linton Traub	National Institutes of Health	Clatherin-coated vesicles and endocytic function	257,263	123,374
Simon Watkins	Cystic Fibrosis Foundation	Research Development Project - Imaging Core	40,000	0
Simon Watkins	National Institutes of Health	University of Pittsburgh Center for HIV Protein Interactions (PCHPI)	80,347	41,378
Simon Watkins	National Institutes of Health	Pittsburgh Center for Kidney Research	15,000	7,020
Simon Watkins	National Institutes of Health	Cancer Center Support Grant	82,258	44,245
Simon Watkins	National Institutes of Health	Basic and Clinical Studies of Cystic Fibrosis - Core C	83,805	39,422
Simon Watkins	National Institutes of Health	DNA Damage Recognition by Nucleotide Excision Repair Proteins	20,311	2,944
Simon Watkins	National Institutes of Health	DNA Damage Recognition by Nucleotide Excision Repair Proteins	4,084	2,205
Simon Watkins	National Institutes of Health	Adipose Triglyceride Lipases (ATGL) in Liptoxicity and the Metabolic Syndrome	2,085	1,074
Simon Watkins	National Institutes of Health	ROS Mechanisms in BAV Aortopathy	5,301	2,730
Simon Watkins	National Institutes of Health	ROS Mechanisms in BAV Aortopathy	479	247
Simon Watkins	National Institutes of Health	Vascular Subphenotypes of Lung Disease - Core B	5,209	1,738
Simon Watkins	National Institutes of Health	Vascular Subphenotypes of Lung Disease - Project 1	11,567	4,582
Simon Watkins	National Institutes of Health	Mapping Lipid Oxidation in Traumatic Brain Injury by Mass Spectrometric Imaging	11,284	5,811
Simon Watkins	National Institutes of Health	Combinatioal Immunotherapy targeting the Malonoma	20,718	9,820
Simon Watkins	National Institutes of Health	Cell Autonomous and Non-Autonomous Mechanisms of Again	100,079	48,640
Simon Watkins	National Institutes of Health	Targeted Fluorescent Indicators for Endothelial Physiology	22,944	7,098
Simon Watkins	National Institutes of Health	Biochemical and Spatial Regulation of IKKa/NEMO During T-Cell Activation	11,258	6,079
Simon Watkins	National Institutes of Health	Cardiolipin as a Novel Mediator of Acute Lung Injury	108,518	50,330
Simon Watkins	National Institutes of Health	CYP 450 Mediated CBF Dysregulation and Neurotoxicity in Pediatric Cardiac Arrest	10,324	4,603

Simon Watkins	National Institutes of Health	PQC2 Alteration of 3D nuclear organization at nanoscale in breast tumorigenesis	8,697	4,763
Simon Watkins	National Institutes of Health	Mechanisms of Perineural Invasion in Head and Neck Cancer	9,993	5,396
Simon Watkins	National Institutes of Health	Mechanisms of Perineural Invasion in Head and Neck Cancer	5,006	1,207
Simon Watkins	National Institutes of Health	Mesoscale MR imaging of cellular connectivity in the ex vivo human hippocampus-	3,453	1,217
Simon Watkins	National Institutes of Health	ROS driven mitochondrial-telomere dysfunction during environmental stress-	8,918	2,115
Simon Watkins	National Institutes of Health	In vivo localization and mechanism of regultory B cell function in alloimmunity and trasplant tolerance	11,225	6,078
Simon Watkins	National Institutes of Health	Pulmonary Arteriole Occlusion by Platelet Neutrophil Micro Emboll in acute chest syndrom	24,471	2,414
Simon Watkins	Department of Defense	Predictive understanding of the effects of encephalitic virus exposure on the blood brain barrier	50,000	21,600
Simon Watkins	National Institutes of Health	Mechanima-directed sequential deliver of radiation mitgagors	147,809	71,265
Simon Watkins	National Institutes of Health	Aging of MSCs missing Link in IPF	2,450	1,324
Simon Watkins	National Institutes of Health	Inhibition of Neural Electrode-Mediated Inflammation and Neuronal Cell Death	10,003	4,403
Simon Watkins	National Institutes of Health	In Host Remodeling of Grafts to Functional Arteries Translation to Mature animals (Robertson)	14,481	7,819
Simon Watkins	National Institutes of Health	Exosomes as paracrine signal mediators in cardiac allograft rejection	7,931	3,157
Simon Watkins	National Institutes of Health	Genetics of Extracellular Matrix in Health and Disease (Urban)	2,499	540
Simon Watkins	National Institutes of Health	Stem Cells for Corneal Engineering	1,250	675
Simon Watkins	National Institutes of Health	Request for a Leica 3X STED microscope	1,239,503	0
Simon Watkins	National Institutes of Health	Countering the Pro-Inflammatory Attributes of IL-33 During Hematopoietic Cell Tansplantation for Tolerance Induction	1,884	613
Nathan Yates	National Institutes of Health	Cell Autonomous and Non-Autonomous Mechanism of Aging	132,562	48,821
Nathan Yates	National Institutes of Health	Plasticity of Auditory Cortical Circuits in Schizophrenia	11,264	6,082
Nathan Yates	National Institutes of Health	Bioengineering Tracheas through Targeting Activated Cell	17,891	9,660
Nathan Yates	National Institutes of Health	Request for triple quadrupole mass spectrometer for the University of Pittsburgh	6,561	3,543
			4,761,008	1,489,330

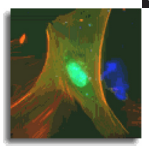


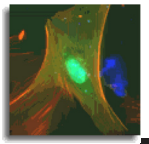


Cell Biology Sponsored Research Funding (FY17)

Name	Agency Name	Title	Annual DC	Annual IDC
Daniel Byrd	National Institutes of Health	Combing STAT3-Silencing and Oncolytic Vaccinia Virus to Enhance Anti-tumor Therapeutic Activity	16,818	
Michael Butterworth	National Institutes of Health	Role of MicroRNAs in kidney sodium regulation	220,059	118,833
Peter Drain	Prader-Willi Syndrome	Understanding Multiple Hormone Secretion Deficits in Prader-Willi Syndrome	6,188	495
Marijn Ford	National Institutes of Health	The Roles of the Dynamin-Related Protein Vps1 and the ESCRT Complex in Microautophagy	197,500	91,932
Gerry Hammond	National Institutes of Health	Directing Membrane Function with Inositol Lipids in Health and Disease	229,458	124,463
Christine Klemens	American Heart	Ankyrin G A Regulation of the Epithelial Sodium Channel after Adosterone Stimulation	26,000	0
Adam Kwiatkowski	National Institutes of Health	Alpha-Catenin Function in Cardiomyocyte Adhesion and Cytoskeletal Organization	250,000	127,710
Sanford Leuba	National Institutes of Health	NNRTI Induced Conformational Changes in HIV 1 RT (Sluis-Cremer)	62,411	25,923
Sanford Leuba	National Institutes of Health	Novel Mechanisms of HIV Resistance ti RTIS (Sluis-Cremer)	5,734	3,104
Sandra Murray	National Science Foundation	Regulation of annular gap junctionp rocessing	169,553	88,859
Alexander Sorkin	National Institutes of Health	Pathogenesis of Cancer - Role of EGF Receptor Endocytosis	214,656	94,683
Alexander Sorkin	US Dept of Veterans Affairs	Investigating the Role of TMEM16A/AN01 in SCCHN	16,578	0
Alexander Sorkin	National Institutes of Health	Exosome Based Placental Maternal Communication	22,914	12,391
Donna Beer Stolz	National Science Foundation	Engineering Research Center	2,775	1,429
Donna Beer Stolz	National Institutes of Health	Core A Cell and tissue Imaging Core	59,850	32,463
Donna Beer Stolz	National Institutes of Health	All Human Microphysical Model of Metastasis Therapy	59,512	27,816
Donna Beer Stolz	MWRI-NIH	Primary Human Trophoblasts and the Transfer of Viral Resistance	6,659	3,429
Donna Beer Stolz	National Institutes of Health	Bid-mediated killing of oncogenic stem cells in chemoprevention	4,791	2,587
Donna Beer Stolz	National Institutes of Health	Mechanisms of Arsenic-induced Muscle Morbidity and Reduced Regenerative Capacity	12,226	6,603
Donna Beer Stolz	National Institutes of Health	Nitric Oxide and Hepatic Function in sepsis and Trauma	11,517	4,924
Donna Beer Stolz	National Institutes of Health	Mechanisms of Trabecular Meshwork Regeneration by stem cell	8,330	3,586
Donna Beer Stolz	National Institutes of Health	Critical Role for Fibroblast Growth Factor Receptors in Bladder Development	6,293	3,398
Donna Beer Stolz	National Institutes of Health	Dysfunctional Muscle remodeling and regeneration in environmental disease	19,890	10,740
Donna Beer Stolz	National Institutes of Health	Elucidting Mechanisms Involved in Lamin B1 Medited Demyelination	3,947	2,124
Donna Beer Stolz	National Institutes of Health	Endogenous Regulators of Inflammation in Liver Ischemia/Reperfusion	12,865	4,247
Stephen Thorne	National Institutes of Health	Combinational Immunotherapy Targeting Melanoma-Associated Vasculature	1,201	649
Stephen Thorne	National Institutes of Health	Creation of Immuno-Oncolytic Viruses for Cancer Therapy	168,733	91,116
Stephen Thorne	Lustgarten	Novel oncolytic vaccinia strans for targeted pancreatic cancer therapy	68,559	13,712
Stephen Thorne	Stand Up 2 Cancer	Metabolic reprogramming suing oncolytic viruses toimprove immunotherapy	55,968	5,597
Stephen Thorne	National Institutes of Health	Visualization of in vivo HIV-1 vaginal transmission in the presence and absence of PrEP	23,627	10,150

Linton Traub	National Institutes of Health	Clatherin-coated vesicles and endocytic function	169,258	91,400
Simon Watkins	National Institutes of Health	Combinatioal Immunotherapy targeting the Malonoma	1,721	817
Simon Watkins	National Institutes of Health	Combinatioal Immunotherapy targeting the Malonoma	19,014	9,030
Simon Watkins	National Institutes of Health	Pittsburgh Center for Kidney Research	13,755	6,437
Simon Watkins	National Institutes of Health	Pittsburgh Center for Kidney Research	1,245	583
Simon Watkins	National Institutes of Health	CYP 450 Mediated CBF Dysregulation and Neurotoxicity in Pediatric Cardiac Arrest	9,467	4,221
Simon Watkins	National Institutes of Health	CYP 450 Mediated CBF Dysregulation and Neurotoxicity in Pediatric Cardiac Arrest	857	382
Simon Watkins	National Institutes of Health	Cardiolipin as a Novel Mediator of Acute Lung Injury	105,256	50,908
Simon Watkins	National Institutes of Health	PQC2 Alteration of 3D nuclear organization at nanoscale in breast tumorigenesis	8,087	3,067
Simon Watkins	National Institutes of Health	Mechanisms of Perineural Invasion in Head an Neck Cancer	10,056	5,430
Simon Watkins	National Institutes of Health	Mesoscale MR imaging of cellular connectivity in the ex vivo human hippocampus-	2,168	811
Simon Watkins	National Institutes of Health	ROS driven mitochondrial-telomere dysfunction during environmental stress-	7,910	2,112
Simon Watkins	National Institutes of Health	University of Pittsburgh Center for HIV Protein Interactions (PCHPI)	6,366	3,331
Simon Watkins	National Institutes of Health	University of Pittsburgh Center for HIV Protein Interactions (PCHPI)	71,745	36,807
Simon Watkins	National Institutes of Health	In vivo localization and mechanism of regultory B cell function in alloimmunity and trasplant tolerance	11,356	6,128
Simon Watkins	National Institutes of Health	Pulmonary Arteriole Occlusion by Platelet Neutrophil Micro Emboll in acute chest syndrom	24,472	2,415
Simon Watkins	National Institutes of Health	Cancer Center Support Grant	82,294	44,438
Simon Watkins	National Institutes of Health	Aging of MSCs missing Link in IPF	2,450	1,324
Simon Watkins	National Institutes of Health	Basic and Clinical Studies of Cystic Fibrosis - Core C	80,270	39,242
Simon Watkins	National Institutes of Health	Mechanima-directed sequential deliver of radiation mitgagors	24,684	11,887
Simon Watkins	National Institutes of Health	Mechanima-directed sequential deliver of radiation mitgagors	122,745	59,670
Simon Watkins	National Institutes of Health	Inhibition of Neural Electrode-Mediated Inflammation and Neuronal Cell Death	9,995	4,437
Simon Watkins	National Institutes of Health	DNA Damage Recognition by Nucleotide Excision Repair Proteins	8,168	4,410
Simon Watkins	National Institutes of Health	Exosomes as paracrine signal mediators in cardiac allograft rejection	19,020	7,571
Simon Watkins	National Institutes of Health	Genetics of Extracellular Matrix in Health and Disease (Urban)	7,497	1,618
Simon Watkins	National Institutes of Health	Countering the Pro-Inflammatory Attributes of IL-33 During Hematopoietic Cell Tansplantation for Tolerance Induction	7,552	2,459
Simon Watkins	National Institutes of Health	Stem Cells for Corneal Engineering	5,000	2,700
Simon Watkins	National Institutes of Health	ROS Mechanisms in BAV Aortopathy	4,816	2,480
Simon Watkins	National Institutes of Health	Biochemical and Spatial Regulation of IKKg/NEMO During T Cell Activation	11,449	6,183
Simon Watkins	National Institutes of Health	T Cell Memory in Organ Transplantation	10,000	5,400
Simon Watkins	National Institutes of Health	Inhibition of the ALT Pathway by Interfering with Poly-ADP-Ribose Metabolism	15,062	5,434
Simon Watkins	National Institutes of Health	Mapping Lipid Oxidation in Traumatic Brain Injury by Mass Spectrometric Imaging	11,284	5,811





Simon Watkins	National Institutes of Health	BMP10 in Cardiovascular Development and Hereditary Hemorrhagic Telangiectasia.	9,969	5,383
Simon Watkins	National Institutes of Health	Targeted Fluorescent Indicators for Endothelial Physiology	22,944	7,098
Simon Watkins	Department of Defense	Predictive understanding of the effects of encephalitic virus exposure on the blood brain barrier	50,000	21,600
Simon Watkins	National Institutes of Health	Cell Autonomous and Non-Autonomous Mechanisms of Again	95,650	46,245
Simon Watkins	Cystic Fibrosis Foundation	Research Development Project - Imaging Core	3,199	1,727
Simon Watkins	NIH - Univ of Maryland	Structure and Activation of a Multiprotein Signaling Complex (Vignali)	15,049	4,617
Simon Watkins	Cystic Fibrosis Foundation	Research Development Project - Imaging Core	40,000	0
Simon Watkins	American Cancer Society	Epstein-Barr Virus Oncogenesis in Nasopharyngeal Carcin	10,047	2,009
Simon Watkins	National Institutes of Health	Mechanistic Elucidation and Targeted Therapy of Platelet Dysfunction After Trauma	7,523	4,062
Simon Watkins	National Institutes of Health	Improving Cerebral Aneurysm risk Assessment Through Understanding Wall Vulnerability and Failure Models	29,155	10,898
Simon Watkins	National Institutes of Health	The role of RTK Signaling in Opiod Tolerance	25,974	14,026
Simon Watkins	National Institutes of Health	B Cells in the Pathogenesis of Allograft Rejection	5,726	3,106
Simon Watkins	National Institutes of Health	Reprogramming the Chemokine System in Cancer Immunotherapy - Core B	51,534	24,050
Simon Watkins	National Institutes of Health	Center for Biological Imaging - Biogen - Gutstein	12,500	0
Simon Watkins	National Institutes of Health	PINK1 Regulation of Neuronal and Mitochondrial Homeostatis	2,500	1,353
Simon Watkins	National Institutes of Health	Center for Biological Imaging - Bakkenist	2,500	0
Simon Watkins	National Institutes of Health	Regulated Activation of Latent-TGfb Determines Leukocyte Occupancy of the Epidermal Niche	2,500	0
Nathan Yates	National Institutes of Health	Cell Autonomous and Non-Autonomous Mechanism of Aging	126,548	54,836
Nathan Yates	National Institutes of Health	Plasticity of Auditory Cortical Circuits in Schizophrenia	11,434	6,175
Nathan Yates	National Institutes of Health	Request for triple quadrupole mass spectrometer for the University of Pittsburgh	11,412	6,161
Nathan Yates	National Institutes of Health	Novel and Robust Methods for Differential Protein Network Analysis of Proteomics Data in Schizophrenia Research	16,192	2,475
Nathan Yates	National Institutes of Health	Regulation of Fuel Utilization by Lysine Acetylation in the Falling Heart	15,840	8,732
Nathan Yates	National Institutes of Health	Novel and Robust Methods for Differential Protein Network Analysis of Proteomics Data in Schizophrenia Research	2,852	1,541
			3,420,679	1,568,000

Faculty Editorships (Fiscal Year 2015 - 2016)

Michael B. Butterworth, Ph.D.
Assistant Professor

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

Adam Kwiatkowski, Ph.D.
Assistant Professor

Associate Editor, BMC Cell Biology

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

Molecular Biology of the Cell – Reviewing Editorial Board
Traffic, Associate Editor
Scientific Reports Editorial Board

Donna Beer Stolz, Ph.D.
Associate Professor

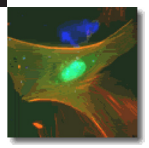
Editorial Board: Cell Transplantation: The Regenerative Medicine Journal. Hepatocyte Section

Stephen Thorne, Ph.D.
Assistant Professor

Journal of Clinical and Cellular Immunology
American Journal of Cancer Research
American Journal of Nuclear Medicine and Molecular Imaging
Molecular Therapy - Oncolytics

Linton Traub, Ph.D.
Associate 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

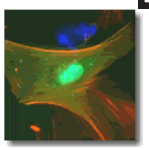


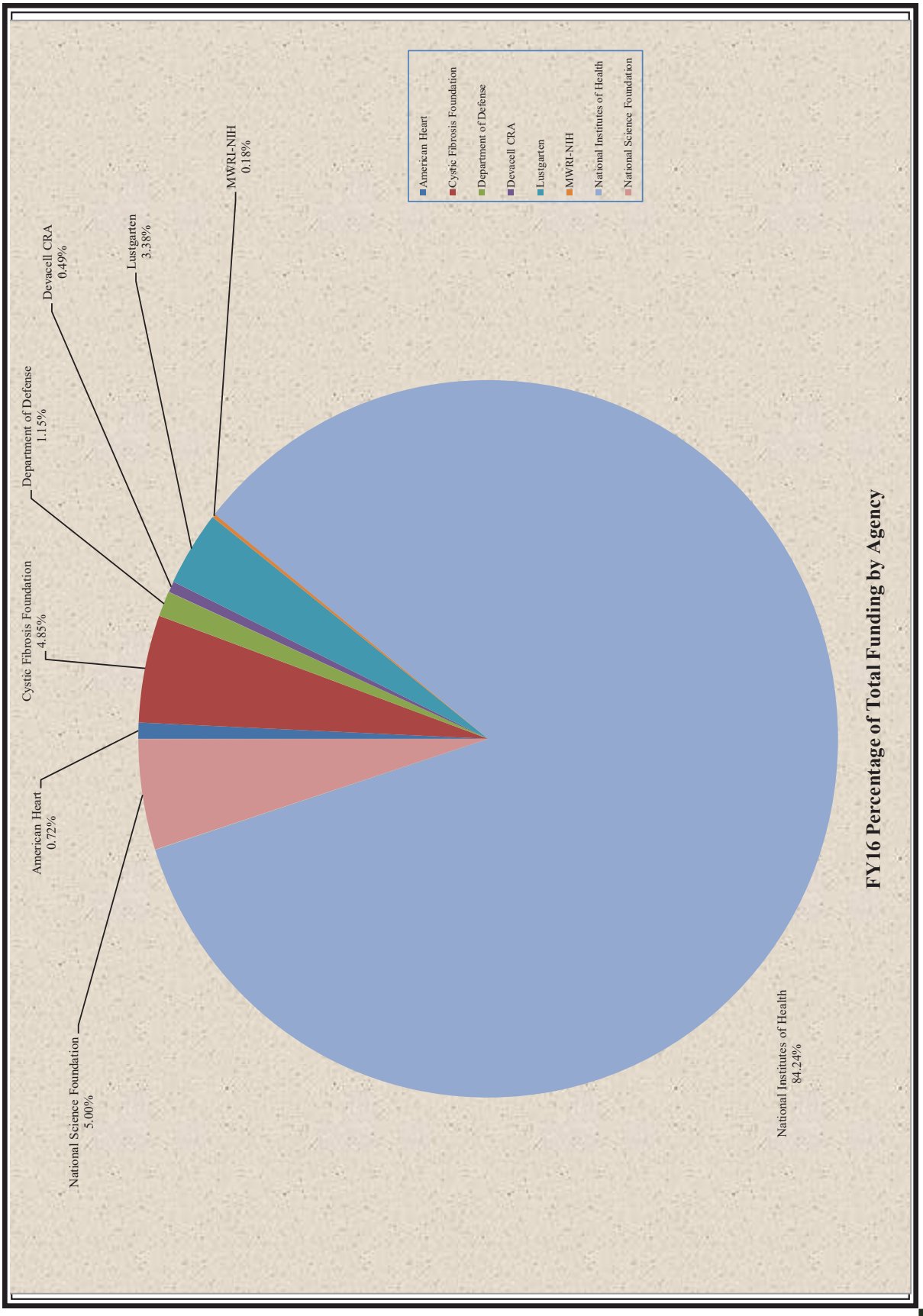
Yong Wan, Ph.D.
Professor

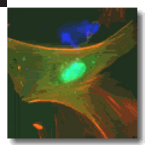
Member, Editorial Board, Journal of Biological Chemistry

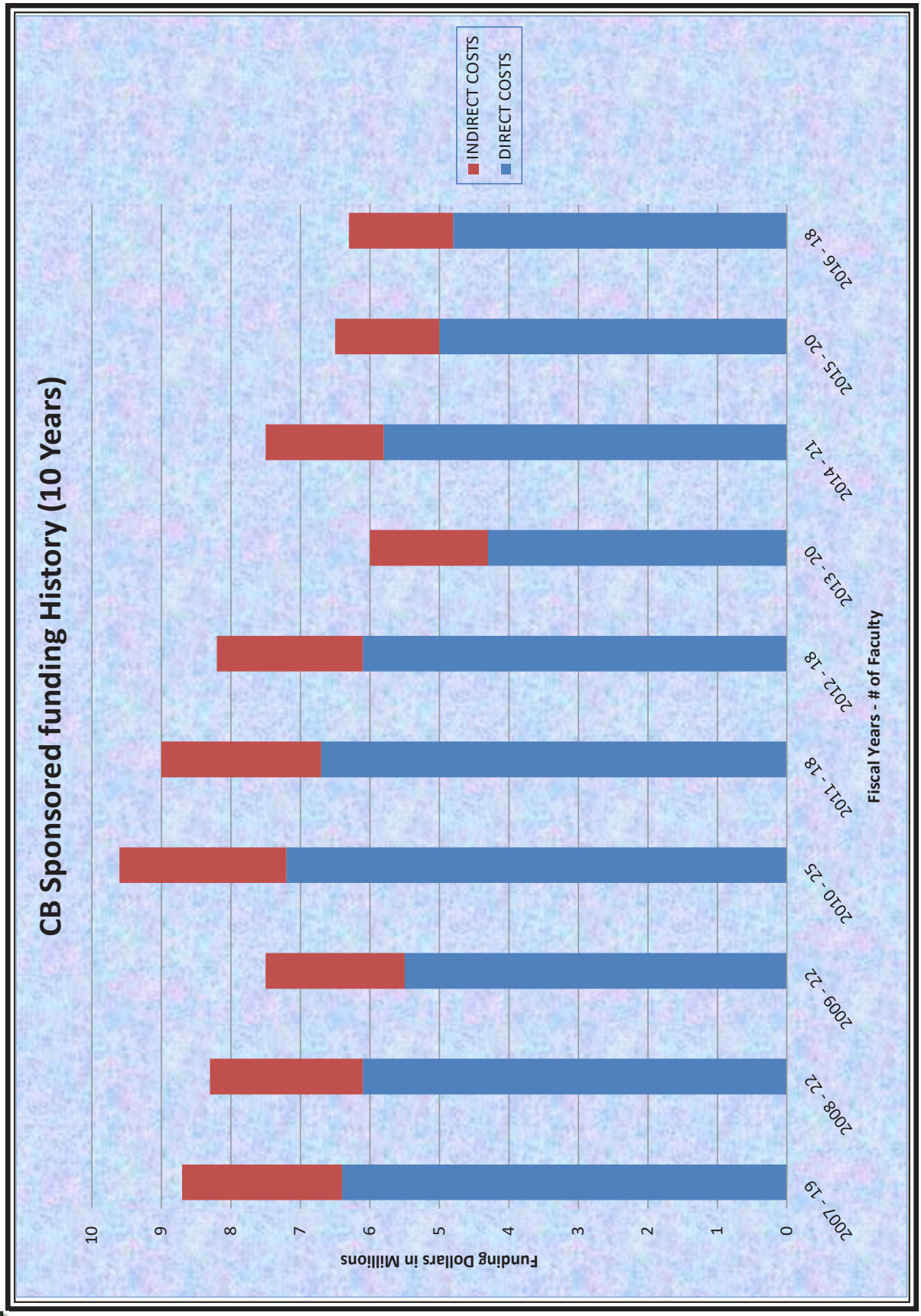
Simon C. Watkins, Ph.D.
Distinguished Professor and Vice Chairman, Director of Center of Biologic Imaging

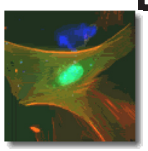
Member, Editorial Board, PittMed
Associate Editor, Experimental Biology and Medicine
Editor, Current Protocols in Cytometry
Editor, Experimental Science and Medicine
Editor, Microscopy Today

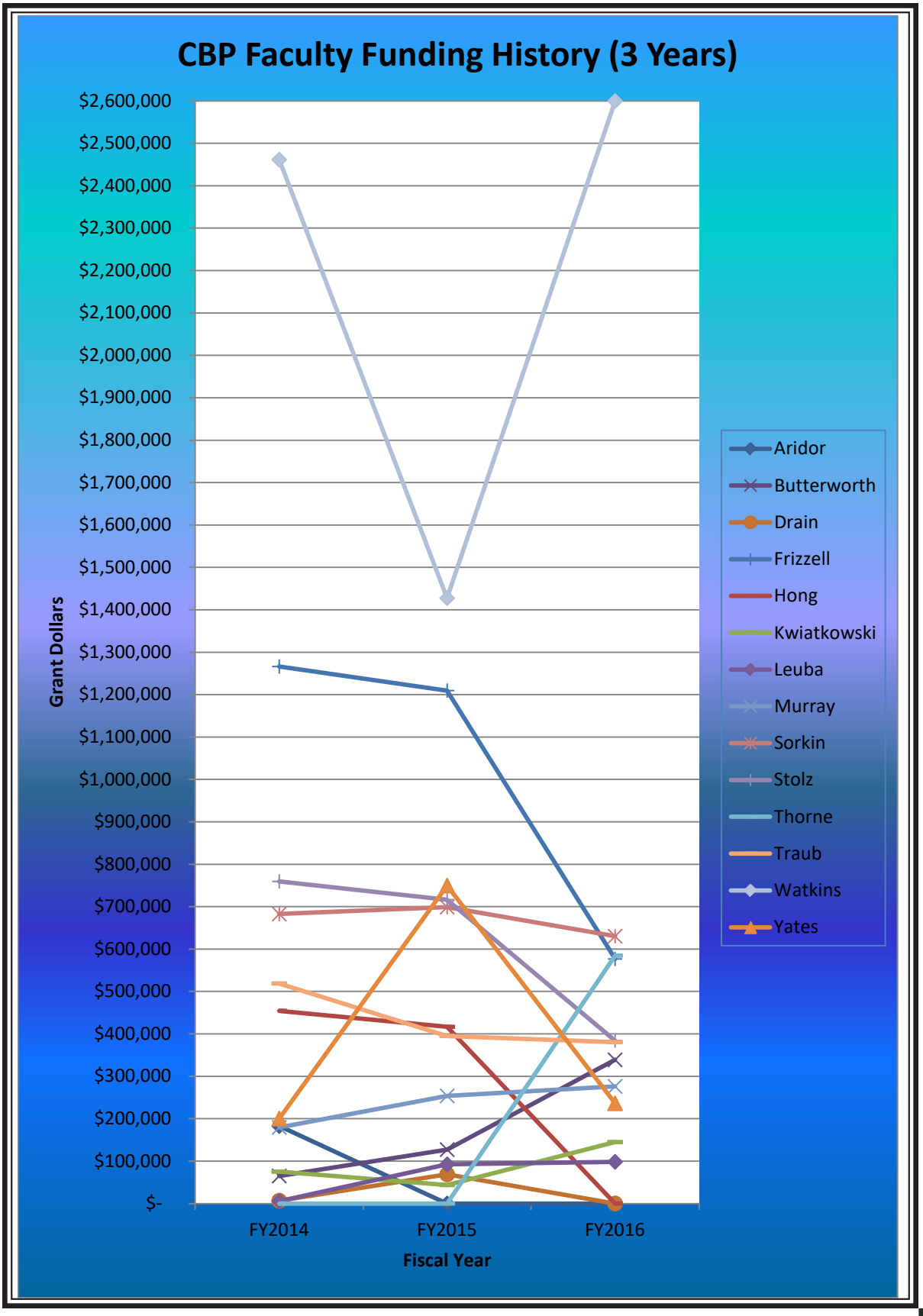


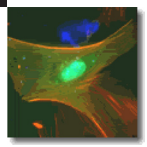

FY16 Percentage of Total Funding by Agency
American Heart
Cystic Fibrosis Foundation
Department of Defense
Devacell CRA
Lustgarten
MWRI-NIH
National Institutes of Health
National Science Foundation
American Heart 0.72%
Cystic Fibrosis Foundation 4.85%
Department of Defense 1.15%
Devacell CRA 0.49%
Lustgarten 3.38%
MWRI-NIH 0.18%
National Institutes of Health 84.24%
National Science Foundation 5.00%




CB Sponsored funding History (10 Years)
INDIRECT COSTS
DIRECT COSTS
Funding Dollars in Millions
0
1
2
3
4
5
6
7
8
9
10
2007 - 19
2008 - 22
2009 - 22
2010 - 25
2011 - 18
2012 - 18
2013 - 20
2014 - 21
2015 - 20
2016 - 18
Fiscal Years - # of Faculty



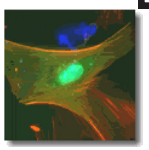

CBP Faculty Funding History (3 Years)
$2,600,000
$2,500,000
$2,400,000
$2,300,000
$2,200,000
$2,100,000
$2,000,000
$1,900,000
$1,800,000
$1,700,000
$1,600,000
$1,500,000
$1,400,000
$1,300,000
$1,200,000
$1,100,000
$1,000,000
$900,000
$800,000
$700,000
$600,000
$500,000
$400,000
$300,000
$200,000
$100,000
$-
Grant Dollars
FY2014
FY2015
FY2016
Fiscal Year
Aridor
Butterworth
Drain
Frizzell
Hong
Kwiatkowski
Leuba
Murray
Sorkin
Stolz
Thorne
Traub
Watkins
Yates



CBP FACULTY ROSTER
(Effective June, 2016)

Faculty Member	Salary Support on Grants	Rank	Status
Sayeed, Sameera	100.0%	Visiting Instructor	Non-tenure Track
Stolz, Donna	78.1%	Associate Professor	Tenured
Watkins, Simon*	77.4%	Professor	Tenured
Thorne, Stephen	70.5%	Assistant Professor	Tenure Track
Butterworth, Michael	56.6%	Assistant Professor	Tenure Track
Traub, Linton	55.0%	Associate Professor	Tenured
Sorkin, Alexander*	35.3%	Professor	Tenured
Yates, Nathan*	34.9%	Associate Professor	Non-tenure Track
Leuba, Sanford	20.0%	Associate Professor	Tenured
Murray, Sandra	18.7%	Professor	Tenured
Kwiatkowski, Adam	18.2%	Assistant Professor	Tenure Track
Hong, Yang	1.9%	Associate Professor	Tenured
Drain, Peter	1.0%	Associate Professor	Tenured
Aridor, Meir	0.0%	Associate Professor	Tenured
Devor, Daniel	0.0%	Associate Professor	Tenured
Duker, Georgia	0.0%	Assistant Professor	Non-tenure Track
Ford, Marijn	0.0%	Assistant Professor	Tenure Track
Ford, Natalia	0.0%	Res. Assistant Professor	Non-tenure Track
Hammond, Gerald	0.0%	Associate Professor	Tenured

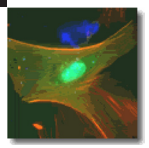
*Calculated using year appropriate NIH salary cap as upper limit for each grant



STUDENTS INVOLVED IN RESEARCH IN CBP FACULTY LABS
Snapshot as of June, 2016

GRADUATE STUDENTS ENROLLED IN CBMP PROGRAM

Amity Eaton	Dr. Gerard Apodaca Renal-Electrolyte Division	Dr. Gerard Apodaca Cell Biology & Teaching Fellowship
Paige Rudich	Dr. Todd Lamitina Dept. Pediatrics	Dr. Todd Lamitina Dept. Pediatrics
Chelsea Merkel	Adam Kwiatkowski, Ph.D. Cell Biology	Adam Kwiatkowski, Ph.D. Cell Biology & Teaching Fellowship
Christine Klemens	Michael Butterworth, Ph.D. Cell Biology	Michael Butterworth, Ph.D. AHA Training Grant &Teaching Fellowship
George Michael Preston	Jeffrey Brodsky, Ph.D. Biological Sciences	Jeffrey Brodsky, Ph.D. Biological Sciences



Cell Biology Training Grants
FY15 and FY16

The Department of Cell Biology has secured individual post-doctoral fellow sponsorship for a number of our research personnel.

FY15 Projects

Traub lab: *Mechanistic Role of Clarthrin Endocy*
(American Heart Association)

Sorkin lab: *Regulation of Protein Kinase C-mediated Dopamine Transporter Endocytosis in Vivo*
(National Institutes of Health)

The combined funding for this post doctoral fellowship grants is $51,471 in FY15 (Total costs, annualized).

FY16 Projects

Butterworth lab: *Ankyrin G A Regulation of the Epithelial Sodium Channel after Adosterone Stimulation*
(American Heart Association)

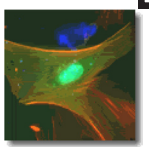
Thorne lab: *Combining STAT3-silencing and Oncolytic Vaccinia Virus to Enhance Anti-tumor Therapeutic Activity*
(National Institutes of Health)

The combined funding for this post doctoral fellowship grants is $40,030 in FY16 (Total costs, annualized).

Program Grant Training Program:

The Cystic Fibrosis Center funded Research Development Program (RDP) offer training funds to qualified post doctoral candidates, as follows:

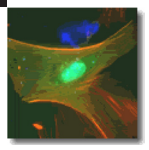
FY15 Program Grant Training Funds - $70,000
FY16 Program Grant Training Funds - $35,000 (Transferred to Pediatrics January 1, 2016)



Cell Biology Program Grants (Fiscal Year 2015-16)

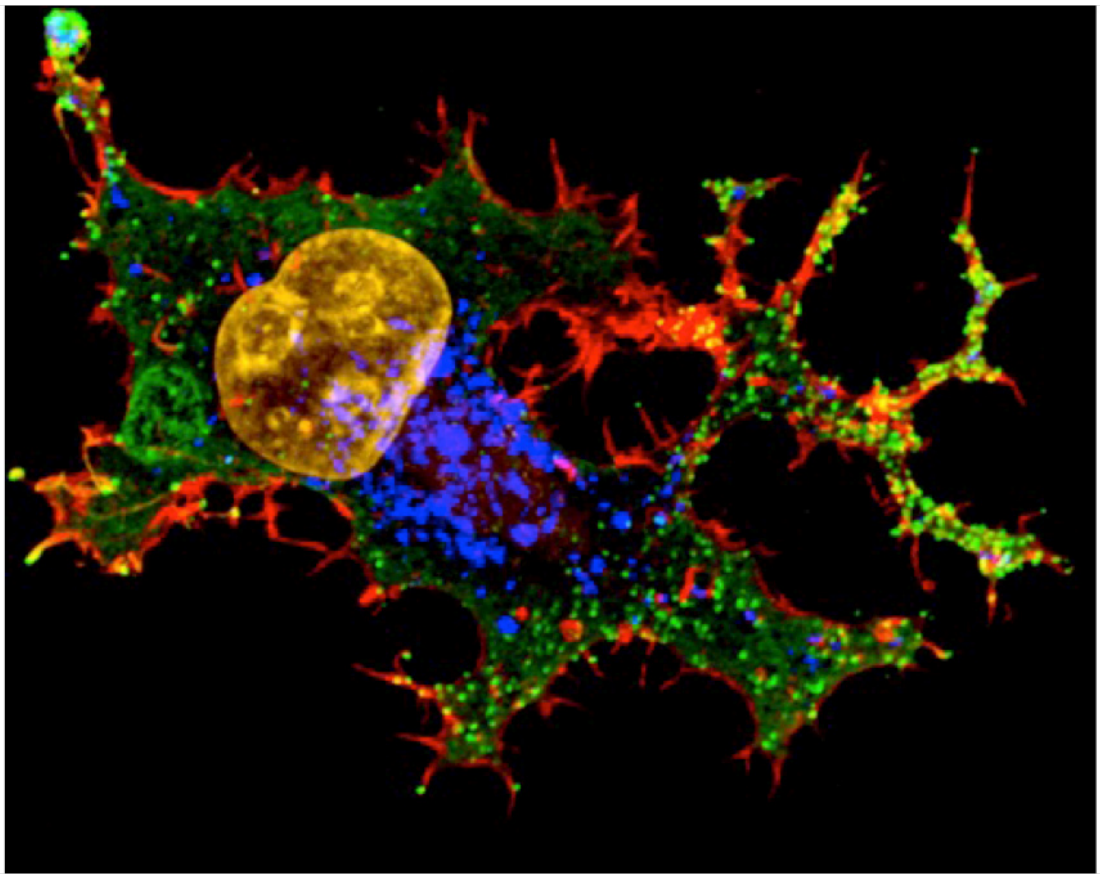
The Department of Cell Biology is funded for four Program Grants, two by the National Institutes of Health and one by the Cystic Fibrosis Foundation, as follows:

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 11 currently funded program grants including "Cancer Center support Grant" (PI Nancy Davidson P30 CA047904), "Basic and clinical studies of Cystic Fibrosis" (PI Ray Frizzell P30 DK072506) "Research studies in CF" (PI Ray Frizzell R8883-CR07), "Molecular Biology of Hemorrhagic Shock" (PI Tim Billiar, P50 GM053789 "Cell Autonomous and Non-Autonomous Mechanism of Aging" (PI Robbins P., 1P01AG043376-01A1); "DirectingTumor-specific T cells to Tumors" (PI Kalinski P, 5P01CA132714-05), University of Pittsburgh Center for HIV rotein interactions (PCHPI, PI Gronenborn A., 5P50GM082251-07);National Center Fluoresent Biosensors for Networks and Pathways (PI Alan Waggoner, Co-director Watkins, 5U54GM103529-09), autophagy (PI Perlmutter D., 5P01DK096990-02), Cardiolipin as a Novel Mediator of Acute Lung Injury. (Mallampalli R. P01 HL114453)and pulmonary medicine (PI Gladwin M. 5P01HL103455-03).

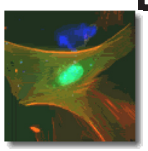


New CBP Research Recruits in FY16

Name	Rank	Lab Association
Faculty Level		
Sameera Sayeed	Visiting Instructor	
Stephen Thorne	Assistant Professor	
Post Doctoral Level		
Daniel Byrd	Post Doctoral Scholar	Dr. Stephen Thorne
Sachin Holkar	Post Doctoral Associate	Dr. Linton Traub
Weizhou Hou	Research Associate	Dr. Stephen Thorne
Karina Pena	Post Doctoral Associate	Dr. Simon Watkins
Padmavathi Sampath	Research Associate	Dr. Stephen Thorne
Sachin Surve	Research Associate	Dr. Alexander Sorkin



Dr. Stephen Thorne. Human breast cancer cell infected with vaccinia viral therapy (actin – red; virus – green; nucleus – orange; autophagosomes - blue



Graduate Program in Cell Biology and Molecular Physiology

The program in Cell Biology and Molecular Physiology has a rich tradition of scientific training and discovery. Graduates of the Ph.D. program are now chairs of departments at six major U.S. medical schools. Today, the department brings together basic and clinical research faculty who are dedicated to their research programs and to the training of 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 to understand the integrated functions of cells, tissues, organs and model organisms in the era following description of the human genome.

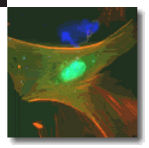
The educational component of the program offers students the opportunity to interact with multiple, well-supported faculty with international reputations. Stipends are provided for the students throughout their training. Students in the program enjoy a rich experience going far beyond formal classroom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

CBMP students have the opportunity to 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 in using microscopes and presentations to identify tissues and cells as well as to understand the functions of the tissues and cells that they are observing. Teaching responsibilities normally 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 will prepare them for their teaching responsibilities. Senior students may have the opportunity to develop and present lectures in the graduate Histology Course. Beyond the teaching experience, these fellowships also provide students with funding for the majority of their stipend and tuition for two years.

The central theme of integrative biology in our program plays out in research projects that are focused on important diseases, including heart disease, cancer and diabetes, as well as inherited disorders of metabolic, developmental and reproductive functions.

Cell Communication and Imaging
Controlled cell-cell communication is the basis of tissue homeostasis. Member faculty use a variety of techniques to study these phenomena.

Gerard Apodaca, Ph.D. (Medicine, Renal)
Yang Hong, Ph.D.
Adam V. Kwiatkowski, Ph.D.
Sandra Murray, Ph.D.
Matthew Nicotra, Ph.D. (Immunology)
Claudette St Croix, Ph.D. (EOH)
Donna Beer Stolz, Ph.D.
Stephen Thorne, Ph.D.
Simon C. Watkins, Ph.D.



Cellular Injury and Wound Healing

James L. Funderburgh, Ph.D. (Ophthalmology)
Todd Lamitina, Ph.D. (Children's Hospital)
Rama K. Mallampalli, M.D. (Medicine)
Sandra Murray, Ph.D.
Sunder Sims-Lucas, Ph.D. (Children's Hospital)
Shivalingappa Swamynathan, Ph.D. (Ophthalmology)

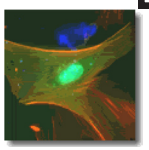
Chromatin, DNA Repair, Cell Cycle Control, Gene expression and Cancer
Areas of study include the regulation of chromatin structure and repair that is essential for faithful function of the cell at the DNA level and the modifications of proteins that are required for the correct timing of cell division.

Arjumand Ghazi. Ph.D. (Children's Hospital)
Eric Goetzman, Ph.D. (Children;s Hospital)
Sanford Leuba, Ph.D.
Shivalingappa Swamynathan, Ph.D. (Ophthalmology)
William Walker, Ph.D. (MWRI)
Yong Wan, Ph.D. (UPCI)
Judith Yanowitz, Ph.D. (MWRI)

Ion Channel Biology
Inherited mutations in ion channels are responsible for many genetic diseases, including cystic fibrosis (CF). The department is home to a Specialized Center of Research in CF funded by the NIH (one of only two in the country) and the CF Foundation. Here, scientists are defining the factors that regulate ion channel activity and their expression on the plasma membrane. Inherited disorders of ion channels beyond CF include chronic obstructive pulmonary disease and hypertension. Program scientists are using biochemical, molecular expression, electrophysiologic, cell biologic and transgenic techniques to identify the channels involved in these processes and to define their regulation.

Michael B. Butterworth, Ph.D.
Marcelo Carattino, Ph.D. (Medicine, Renal)
Daniel C. Devor, Ph.D.
Raymond A. Frizzell, Ph.D. (Children's Hopsital)
Ossama Kashlan, Ph.D. Medicine, Renal)
Thomas R. Kleyman, M.D. (Medicine, Renal)
Guy Salama, Ph.D. (Medicine, Cardiology)
Arohan Subramanya, M.D. (Medicine, Renal)
Patrick Thibodeau, Ph.D.

Membrane Traffic of Proteins and Lipids
Much of modern cell biology is focused on the mechanisms that target proteins and lipids to their proper cellular destinations. The controlled movement of membranes is critical for the actions of growth factors, the secretion of hormones and neurotransmitters, the processing of antigens



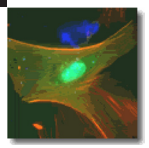
during the immune response, the maintenance of cell polarity and many other vital cell functions. Scientists in this program are identifying the cellular compartments involved in these processes and the mechanisms that regulate membrane flow between them. Success in this venture leads to identification of the cell's sorting and targeting machinery, high-resolution structures of the proteins that mediate these processes and an understanding of how the physical interactions among these proteins are regulated.

Gerard Apodaca, Ph.D. (Medicine, Renal)
Meir Aridor, Ph.D.
Jeffrey Brodsky, Ph.D. (Biological Sciences)
Michael Butterworth, Ph.D.
Marcelo Carattino, Ph.D. (Medicine, Renal)
Dan Devor, Ph.D.
Marijn Ford, Ph.D.
Ray Frizzell, Ph.D. (Children's Hospital)
Eric Goetzman, Ph.D. (Children's Hopsital)
Gerry Hammond, Ph.D.
Yang Hong, Ph.D.
Rebecca Hughey, Ph.D. (Medicine, Renal)
Tom Kleyman, M.D. (Medicine, Renal)
Sandra Murray, Ph.D.
Alexander Sorkin, Ph.D.
Donna Stolz, Ph.D.
Agnieszka Swiatecka-Urban, M.D. (Children's Hospital)
Stephen Thorne, Ph.D.
Linton Traub, Ph.D.
Ora Weisz, Ph.D. (Medicine, Renal)

Regulation of Gene Expression during Development
Identifying the factors that control gene expression is central to understanding how normal and malignant cell growth is regulated. Scientists in this program are identifying components of the gene transcription machinery that mediate signaling by steroid and peptide hormones, which control germ cell development and somatic cell differentiation. The regulation of gene expression is critical for many differentiated cell functions including fertility, hormone secretion, cell-cell communication and motor development. Members of this program are studying how alterations in these processes can lead to infertility, changes in wound healing, muscular dystrophy and cancer.

Arjumand Ghazi, Ph.D. (Children's Hospital)
Judith Yanowitz, Ph.D. (MWRI)
Donna Beer Stolz, Ph.D.
Simon C. Watkins, Ph.D.
Yang Hong, Ph.D.

Reproductive Biology
The neuroendocrine control of the hypothalamic-pituitary-gonadal axis is central to human sexual maturation and fertility. To better understand and replicate human reproductive processes, program members utilize rhesus monkeys as a model system. For this work, the Center for



Research in Reproductive Physiology maintains a colony of 350 rhesus monkeys. Studies of these animals are conducted in tandem with investigation of human pathophysiology, and contemporary molecular and cell imaging techniques are applied to physiological paradigms to study signal transduction pathways, stress, puberty, spermatogenesis, fertility preservation, ovarian function, parturition, aging and endocrine disruptors.

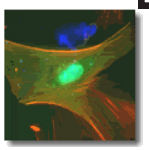
Arjumand Ghazi, Ph.D. (Children's Hopsital)
Tony Plant, Ph.D. (MWRI)
Aleksandar Rajkovic, M.D., Ph.D. (MWRI)
Abhirim Sahu, Ph.D. (MWRI)
Gerald P. Schatten, Ph.D. (MWRI)
William Walker, Ph.D. (MWRI)
Judith Yanowitz, Ph.D. (MWRI)

Signal Transduction in Diabetes and Metabolism
Regulated secretion of insulin by the pancreas and the actions of insulin and leptin in muscle, fat and liver cells are critical for controlling the body's energy metabolism. Disruption of these processes leads to diabetes or obesity. Researchers in this program are defining the cell signaling mechanisms that control glucose-stimulated insulin secretion by pancreatic cells, and those that underlie the actions of insulin and leptin in the control of glucose and fat metabolism in peripheral tissues. By using cell models to identify the important response components, researchers are generating transgenic animal models to alter the expression of these signaling components to determine the mechanisms that lead to diabetes and obesity.

Peter Drain, Ph.D.
Arjumand Ghazi, Ph.D. (Children's Hospital)
Eric Goetzman, Ph.D. (Children's Hospital)
David Whitcomb, M.D., Ph.D. (Medicine, Gastroenterology)

Center for Biological Imaging
A state-of-the-art imaging center which is actively involved in the development and application of all aspects of cutting edge microscopic imaging. Through this unique facility, advances in laser confocal microscopy, live cell multicolor fluorescence microscopy, electron microscopy and computer-assisted image processing have facilitated program research efforts and collaborations. Currently the center is developing new methods for imaging multi-parallel data sets both in vitro and in vivo. See current resources at www.cbi.pitt.edu.
Additionally, Center faculty are active in teaching graduate courses in imaging technologies as well as their research specialties.

Director of CBI: Simon Watkins, Ph.D.
Associate Director: Donna Beer Stolz, Ph.D.
Assistant Director: Claudette M. St. Croix, Ph.D.



Courses in the Cell Biology and Molecular Physiology Graduate Program

Courses in FY-16

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

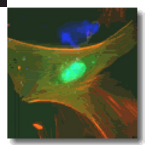
Description: A directed research project that results in a thesis for a Master's Degree.

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

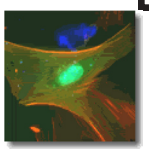
Description: Advanced Research Seminar with Journal Club format specializing in current aspects of molecular and cellular physiology.

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: Georgia Duker
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: Peter Drain, and Donna Beer Stolz
When: Spring and Fall Term
Prerequisites: INTBP 2000 Foundations of Biomedical Sciences
INTBP 2005 Conference

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

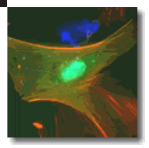
Title: Cellular Biology of Normal and Disease States
Course Number: 2880
Course Director: Daniel Devor
When: Spring Term
Prerequisites: INTBP 2000 Foundations of Biomedical Sciences
INTBP 2005 Conference
Core Course for: Cell Biology and Molecular Physiology Program

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

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

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

Title: Directed Study
Course Number: 2890



Course Director: Donna Beer Stolz
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.

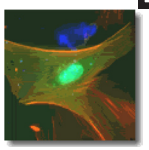
Title: Ph.D. Dissertation Research
Course Number: 3800
Course Director: Donna Beer Stolz
When: Fall Term, Spring Term, Summer Term
Prerequisites: Successful completion of the Comprehensive Examination
INTBP 2000 Foundations of Biomedical Sciences
INTBP 2005 Conference

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.

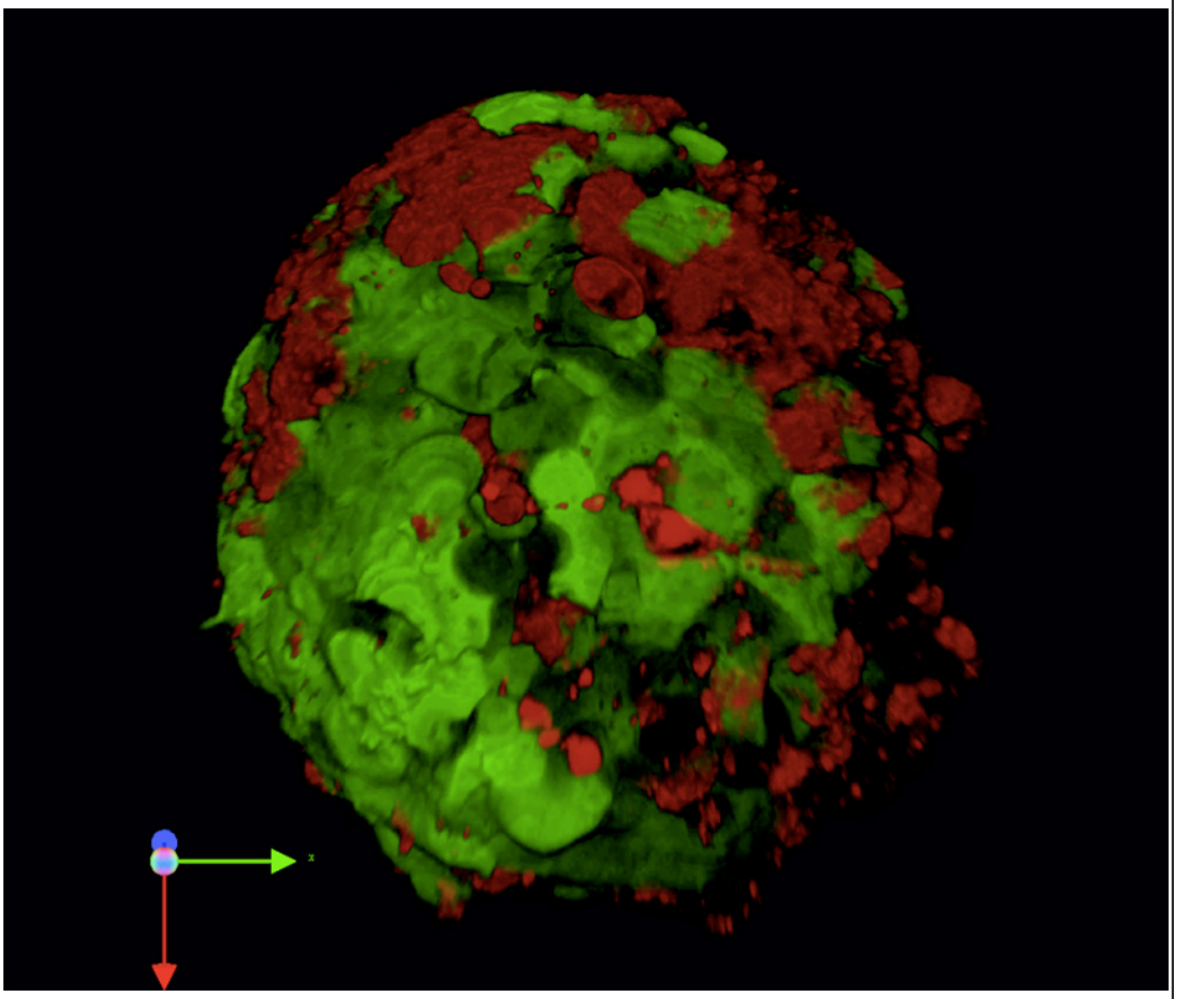
Title: DNA Repair Journal
Course Number: 3835
Course Director: Bennett Van Houten
When: Fall Term, Spring Term
Prerequisites: INTBP 2000 Foundations of Biomedical Sciences
INTBP 2005 Conference

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%).

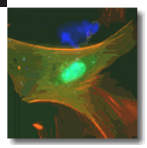
Title: Reproductive Development from Model Organisms to Humans
Course Number: 3840
Course Directors: Judith Yanowitz
When: Fall Term
Prerequisites: None



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.



Dr. Stephen Thorne. Multicellular tumor spheroid (red) following infection with viral therapy (green)

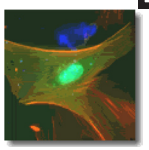


Faculty Teaching Honors (Fiscal Year 2015 - 2016)

Georgia K. Duker, PhD
Assistant Professor

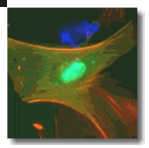
Excellence in Education Award (2015) – Basic Science Lecturer
From the Medical Graduating Class of 2018

Golden Apple Best Educator (2016) in MS-1 & MS-2
From the Medical Graduating Class of 2018



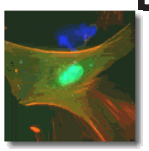
University of Pittsburgh School of Medicine
Educational Credit Units (AY 14-15)
Department of Cell Biology
Summary of Faculty ECU's

Faculty Name	Activity	ECURV	Units	ECUs
Aridor, Meir				
	GS - Journal Club/Seminar Series Program Director	25.0	1.0	25.0
	GS - Lecture	2.0	10.0	20.0
	GS - Member: Admissions Committee	75.0	1.0	75.0
	GS - Member: Program Steering Committee	40.0	1.0	40.0
	GS - Small group (e.g., PBL, conference, workshop)	2.0	27.0	54.0
		Total ECUs:		214.0
Butterworth, Michael				
	MS-1, MS-2 - Laboratory	2.0	8.3	16.7
	MS-1, MS-2 - Lecture	2.0	1.3	2.7
	MS-1, MS-2 - Small group (e.g., PBL, conference, workshop)	2.0	12.6	25.2
	GS - Lecture	2.0	4.0	8.0
	GS - Member: Comprehensive, Dissertation, Thesis, Preliminary or Reprint	5.0	1.0	5.0
	GS - Member: Curriculum, Recruiting, Program, or other SOM Committee	2.0	1.0	2.0
	GS - Ph.D. or M.Sc. Mentor	50.0	1.0	50.0
	GS - Small group (e.g., PBL, conference, workshop)	2.0	14.0	28.0
		Total ECUs:		137.5
Devor, Daniel				
	MS-1, MS-2 - Laboratory	2.0	31.0	62.0
	MS-1, MS-2 - Small group (e.g., PBL, conference, workshop)	2.0	8.0	16.0
	MS - AOC/LCP Lecture	2.0	3.0	6.0
	GS - Course Director	50.0	1.0	50.0
	GS - Lecture	2.0	2.0	4.0
	GS - Member: Admissions Committee	75.0	1.0	75.0
	GS - Member: Comprehensive, Dissertation, Thesis, Preliminary or Reprint	5.0	1.0	5.0
		Total ECUs:		218.0
Drain, Peter				
	MS-1, MS-2 - Course Director	200.0	2.0	400.0
	MS-1, MS-2 - Lecture	2.0	1.5	3.0
	MS-1, MS-2 - Small group (e.g., PBL, conference, workshop)	2.0	19.5	39.0
	MS - Applicant Interviewer	1.0	21.0	21.0
	MS - Member, Admissions Committee	75.0	1.0	75.0
	MS - Member, Promotions Committee	5.0	1.0	5.0
	GS - Journal Club/Seminar Series Program Director	25.0	1.0	25.0
	GS - Lecture	2.0	4.0	8.0



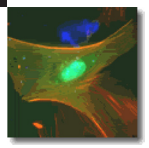
University of Pittsburgh School of Medicine
Educational Credit Units (AY 14-15)
Department of Cell Biology
Summary of Faculty ECU's

Faculty Name / Activity	ECURV	Units	ECUs
		Total ECUs:	576.0
Duker, Georgia			
MS-1, MS-2 - Course Director	200.0	1.0	200.0
MS-1, MS-2 - Course Laboratory Segment/Session Coordinator	5.0	1.0	5.0
MS-1, MS-2 - Laboratory	2.0	18.9	37.8
MS-1, MS-2 - Lecture	2.0	52.8	105.7
MS-1, MS-2 - Other	2.0	8.0	16.0
MS-1, MS-2 - Small group (e.g., PBL, conference, workshop)	2.0	59.3	118.7
MS - Member, Promotions Committee	5.0	1.0	5.0
GS - Course Director	50.0	1.0	50.0
GS - Lecture	2.0	48.0	96.0
GS - Other	2.0	6.0	12.0
GS - Small group (e.g., PBL, conference, workshop)	2.0	30.0	60.0
		Total ECUs:	706.2
Ford, Marijn			
GS - Lecture	2.0	4.0	8.0
		Total ECUs:	8.0
Frizzell, Raymond			
MS-1, MS-2 - AOC/Longitudinal Curriculum Program Director	20.0	1.0	20.0
MS-1, MS-2 - Laboratory	2.0	46.0	92.0
MS - AOC/LCP Lecture	2.0	3.0	6.0
GS - Lecture	2.0	4.0	8.0
		Total ECUs:	126.0
Hong, Yang			
GS - Lecture	2.0	8.0	16.0
		Total ECUs:	16.0
Kwiatkowski, Adam			
MS-1, MS-2 - Lecture	2.0	2.0	4.0
GS - Lecture	2.0	9.0	18.0
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	2.0	100.0
		Total ECUs:	207.0
Leuba, Sanford			
GS - Chair: Curriculum, Recruiting, Program, or other SOM Committee	5.0	1.0	5.0



University of Pittsburgh School of Medicine
Educational Credit Units (AY 14-15)
Department of Cell Biology
Summary of Faculty ECU's

Faculty Name	Activity	ECURV	Units	ECUs
	GS - Lecture	2.0	2.7	5.3
	GS - Member: Comprehensive, Dissertation, Thesis, Preliminary or Reprint	5.0	1.0	5.0
	GS - Member: Curriculum, Recruiting, Program, or other SOM Committee	2.0	1.0	2.0
	GS - Member: Program Steering Committee	40.0	1.0	40.0
	GS - Small group (e.g., PBL, conference, workshop)	2.0	45.0	90.0
		Total ECUs:		147.3
Murray, Sandra				
	MS-1, MS-2 - Laboratory	2.0	34.8	69.5
	MS-1, MS-2 - Lecture	2.0	4.0	8.0
	MS-1, MS-2 - Other	2.0	17.0	34.0
	MS - Member, Promotions Committee	5.0	1.0	5.0
	GS - Lecture	2.0	1.0	2.0
		Total ECUs:		118.5
Peters, Kathryn				
	MS-1, MS-2 - Laboratory	2.0	46.0	92.0
	MS - AOC/LCP Lecture	2.0	3.0	6.0
		Total ECUs:		98.0
Sorkin, Alexander				
	GS - Laboratory supervision (e.g., MSTP, Ph.D. & M.Sc.)	1.0	8.0	8.0
	GS - Lecture	2.0	10.0	20.0
	GS - Member: Comprehensive, Dissertation, Thesis, Preliminary or Reprint	5.0	4.0	20.0
	GS - Member: Program Steering Committee	40.0	1.0	40.0
	GS - Ph.D. or M.Sc. Mentor	50.0	1.0	50.0
		Total ECUs:		138.0
Stolz, Donna				
	MS-1, MS-2 - Laboratory	2.0	16.6	33.2
	MS-1, MS-2 - Lecture	2.0	2.2	4.3
	MS-1, MS-2 - Small group (e.g., PBL, conference, workshop)	2.0	5.8	11.7
	MS - Mentored Scholarly Project (MSP) Mentor	25.0	1.0	25.0
	GS - Chair: Comprehensive, Dissertation, Thesis, Preliminary or Reprint Committee	5.0	3.0	15.0
	GS - Course Director	50.0	8.0	400.0
	GS - Journal Club/Seminar Series Program Director	25.0	1.0	25.0
	GS - Lecture	2.0	31.5	63.0
	GS - Member: Comprehensive, Dissertation, Thesis, Preliminary or Reprint	5.0	8.0	40.0
	GS - Member: Curriculum, Recruiting, Program, or other SOM Committee	2.0	1.0	2.0
	GS - Member: Program Steering Committee	40.0	1.0	40.0

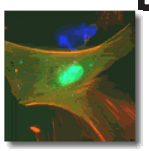


University of Pittsburgh School of Medicine
Educational Credit Units (AY 14-15)
Department of Cell Biology
Summary of Faculty ECU's

Faculty Name / Activity	ECURV	Units	ECUs
GS - Ph.D. or M.Sc. Mentor	50.0	1.0	50.0
GS - Small group (e.g., PBL, conference, workshop)	2.0	21.0	42.0
	Total ECUs:		751.2
Traub, Linton			
GS - Course Director	50.0	2.0	100.0
GS - Lecture	2.0	22.0	44.0
GS - Member: Comprehensive, Dissertation, Thesis, Preliminary or Reprint	5.0	1.0	5.0
GS - Small group (e.g., PBL, conference, workshop)	2.0	27.0	54.0
	Total ECUs:		203.0
Wan, Yong			
GS - Laboratory supervision (e.g., MSTP, Ph.D. & M.Sc.)	1.0	12.0	12.0
GS - Member: Comprehensive, Dissertation, Thesis, Preliminary or Reprint	5.0	1.0	5.0
	Total ECUs:		17.0
Watkins, Simon			
MS - Mentored Scholarly Project (MSP) Mentor	25.0	1.0	25.0
GS - Course Director	50.0	2.0	100.0
GS - Lecture	2.0	26.5	53.0
GS - Member: Comprehensive, Dissertation, Thesis, Preliminary or Reprint	5.0	2.0	10.0
	Total ECUs:		188.0
Yates, Nathan			
GS - Lecture	2.0	8.0	16.0
GS - Member: Comprehensive, Dissertation, Thesis, Preliminary or Reprint	5.0	1.0	5.0
	Total ECUs:		21.0
	Subtotal:		**3890.7**

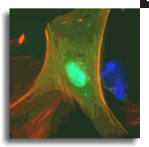
Total Faculty Reporting: 18

Total ECU's for Cell Biology: 3890.7



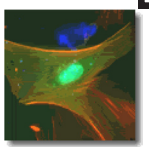
Post Doctoral Personnel Data
[Current as of June, 2016]

Name	Title	Office Address	Email Address	Office Phone	Fax	Research Focus
Bell, Cheryl	Post Doctoral Associate	S346 BSTWR	clb206@pitt.edu	412-648-9565	412-648-8330	Murray Lab
Bell-Temin, Harris	Post Doctoral Associate	BST3-9th Fl	hbb16@pitt.edu	412-383-5937	412-641-2458	Yates Lab
Byrd, Daniel	Post Doctoral Associate	HCCLB G.21	byrddj@upmc.edu	412-623-1390	412-623-7709	Thorne Lab
Holkar, Sachine	Post Doctoral Associate	S306 BSTWR	ssh21@pitt.edu	412-624-9713	412-648-8330	Traub Lab
Hou, Weizhou	Vis. Research Associate	HCCLB G.16	weh29@pitt.edu	412-623-1390	412-623-7709	Thorne Lab
Chen, Nianhong	Post Doctoral Associate	HCCLB-2.7	nic40@pitt.edu	412-623-7811	412-623-7761	Wan Lab
Dong, Wei	Post Doctoral Associate	S333 BSTWR	wed16@pitt.edu	412-648-2846	412-648-8330	Hong Lab
Edinger, Robert	Vis. Research Associate	S353 BSTWR	rse9@pitt.edu	412-383-5173	412-648-8330	Butterworth Lab
Larsen, Mads	Post Doctoral Associate	S234 BSTWR	mbl6@pitt.edu	412-648-9796	412-648-8330	Watkins Lab
Pena, Karina	Post Doctoral Associate	S220.5BSTWR	kapena@pitt.edu	412-648-9796	412-648-2797	Watkins Lab
Pinilla-Macua, Itziar	Post Doctoral Associate	S372 BSTWR	itp2@pitt.edu	412-624-8147	412-648-8330	Sorkin Lab
Sampath, Padmavathi	Vis. Research Associate	HCCLB G.16	pas6@pitt.edu	412-623-1390	412-623-7709	Thorne Lab
Surve, Sachin	Research Associate	S372 BSTWR	svs23@pitt.edu	412-624-8147	412-648-8330	Sorkin Lab
Zhou, Zhuan	Post Doctoral Associate	HCCLB-2.6	zhouz2@upmc.edu	412-623-7811	412-623-7761	Wan Lab



Current Cell Biology and Molecular Physiology Graduate Program Students as of June 30, 2016

Student	Mentor	Year
Christine Klemens	Dr. Mike Butterworth	4th
George Michael Preston	Dr. Jeff Brodsky	4th
Chelsea Merkel	Dr. Kwiatkowski	2nd
Paige Rudich	Dr. Todd Lamitina	1st
Amity Eaton	Dr. Gerard Apodaca	1st



Prior Graduates of the Cell Biology and Molecular Physiology Program as of June 2016 (Past five years)

Kathryn Wack, Ph.D.
Defended July 23, 2014
Clinical Scientist, Omxyx, GE, Healthcare/UPMC Pittsburgh

Arvind Suresh, M.S.
Defended October 11, 2013
Scientist Consultant, Men's Mentis Consulting Service

Christina Szalinski, Ph.D.
Defended May 20, 2013
Science Writer, American Society for Cell Biology (ASCB), Bethesda, MD

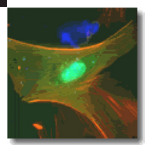
Cavita Kitty Chotoo, Ph.D.
Defended March 26, 2013
Rutger's, Post-Doc

Elizabeth Delorme-Axford, Ph.D.
Defended March 14, 2013
Research Fellow, University of Michigan

Xinxian Qiao, M.S.
Defended December 17, 2012
Technician, Hillman Cancer Center, Pittsburgh, PA

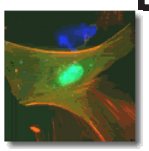
Anupma Jha, Ph.D.
Defended December 8, 2011
Pos-Doc, Dept. Development Biology, University of Pittsburgh

Siobhan Gregg, Ph.D.
Defended November 4, 2011
New York Academy of Sciences Event Organizer



Daniel Rho, Ph.D.
Defended July 15, 2011
Clinical Fellow, Bringham Woman's Hospital

James R. Thieman, Ph.D.
Defended June 9, 2011
Product Manager, Olympus Corporation

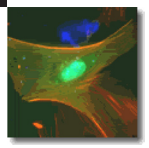


Student Ratings of CBMP Faculty Teaching FY2016

Name	Course	Type	Date	Rating	Ave
Butterworth	Investigation and Discovery	SGCS	Fall-15	4.80	
Butterworth	Cellular and Pathological Basis of Disease	LAB	Spring-16	5.00	
Butterworth	Cellular and Pathological Basis of Disease	PBL	Spring-16	4.50	4.77
Devor	Investigation and Discovery	SGCS	Fall-15	5.00	5.00
Drain	Investigation and Discovery	SGCS	Fall-15	5.00	5.00
Duker	Introduction to Being a Physician	SGCS	Fall-15	4.50	
Duker	Body Fluid Homeostasis Cardiovascular	WKSP	Fall-15	4.80	
Duker	Body Fluid Homeostasis-Renal Segment	LEC	Fall-15	4.70	
Duker	Body Fluid Homeostasis-Pulmonary Segment	LEC	Fall-15	4.90	
Duker	Digestion and Nutrition	LEC	Fall-15	4.80	
Duker	Digestion and Nutrition	LAB	Fall-15	5.00	
Duker	Cellular and Pathological Basis of Disease	LEC	Spring-16	4.90	
Duker	Cellular and Pathological Basis of Disease	LAB	Spring-16	4.90	
Duker	Cellular and Pathological Basis of Disease	PBL	Spring-16	5.00	
Duker	Endocrine Disorders	LEC	Spring-16	4.80	
Duker	Immunology in Health and Disease	LAB	Spring-16	4.80	
Duker	Immunology in Health and Disease	LEC	Spring-16	4.90	
Duker	Reproductive and Developmental Biology	LAB	Spring-16	4.70	4.83
Kwiatkowski	Cellular and Pathological Basis of Disease	LEC	Spring-16	2.80	2.80
Murray	Medical Anatomy	LEC	Fall-15	3.70	
Murray	Medical Anatomy	LAB	Fall-15	4.40	4.05
Stolz	EMB – App – Evidence-Based Medicine Applied	PBL	Spring-16	4.60	
Stolz	Cellular and Pathological Basis of Disease	LEC	Spring-16	3.60	
Stolz	Cellular and Pathological Basis of Disease	LAB	Spring-16	4.70	
Stolz	Cellular and Pathological Basis of Disease	PBL	Spring-16	4.80	
Stolz	Digestion and Nutrition	LAB	Fall-15	5.00	4.54
	Overall Teaching Average			**4.64**	

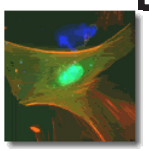
Type codes:

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



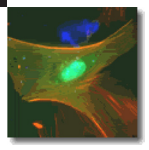
CBP FACULTY ROSTER
(Effective June, 2016)

Last Name	First	Rank	Status
Sorkin	Alexander	Professor & Chair	Tenured
Devor	Daniel	Professor	Tenured
Murray	Sandra	Professor	Tenured
Wan	Yong	Professor	Tenured
Watkins	Simon	Professor	Tenured
Aridor	Meir	Associate Professor	Tenured
Drain	Peter	Associate Professor	Tenured
Hong	Yang	Associate Professor	Tenured
Leuba	Sanford	Associate Professor	Tenured
Stolz	Donna	Associate Professor	Tenured
Traub	Linton	Associate Professor	Tenured
Yates	Nathan	Associate Professor	Non-tenure Track
Butterworth	Michael	Assistant Professor	Tenure Track
Ford	Marijn	Assistant Professor	Tenure Track
Hammond	Gerald	Assistant Professor	Tenure Track
Kwiatkowski	Adam	Assistant Professor	Tenure Track
Thorne	Stephen	Assistant Professor	Tenure Track
Duker	Georgia	Assistant Professor	Non-tenure Track
Ford	Natalia	Res. Assistant Professor	Non-tenure Track
Sayeed	Sameera	Visiting Instructor	Non-tenure Track



New CBP Faculty in FY16

Name	Prior Institution /Rank	Current Rank
Sameera Sayeed	Marywood University Science Department Scranton, PA	Visiting Instructor
Stephen Thorne	University of Pittsburgh Department of Surgery Pittsburgh, PA	Assistant Professor



Faculty Honors, Recognition and Professional Affiliations (Fiscal Year 2015 - 2016)

Michael Butterworth, Ph.D.
Assistant Professor

Member, American Physiological Society
Member, Elected Secretary, 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

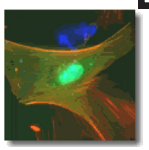
Member, Biophysical Society
Member, American Association for the Advancement of Science
Member, Society of General Physiologists
Member, American Diabetes Association

Georgia Duker, Ph.D.
Assistant Professor

Excellence in Education Award - Basic Science Lecturer - Class of 2018

Gerry Hammond, Ph.D.
Assistant Professor

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



Yang Hong, Ph.D.
Associate Professor

Member of Faculty 1000

Adam Kwiatkowski, Ph.D.
Assistant Professor

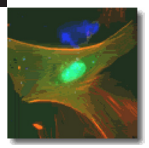
Member, American Society for Cell Biology
American Society for Biochemistry and Molecular Biology
American Heart Association

Sanford Leuba, Ph.D.
Associate Professor

Member, Biophysical Society

Sandra A. Murray, Ph.D.
Professor

Member, American Society for Cell Biology
Member, Society for In Vitro Biology
Member, The Pittsburgh Cancer Institute
Member, Corporation of the Marine Biological Laboratory
Member, Cell Transplant Society
Member, Endocrine Society
Member, American Physiological Society
Member, International Society for Preventive Oncology
University of Pittsburgh Helen Faison Council of Elders
School of Medicine Summer "Minority" Work-Study Program
Member, Medical Student Promotions Committee
Member, Training Faculty Immunology Graduate Training Program
NIH - Biomedical Faces of Science Mentors
Co-Chair of the Research Center of Excellence Committee Graduate School of Public Health, University of Pittsburgh
Graduate School of Public Health Community Engagement Research Core
Graduate School of Public Health Research Advisory Committee- Center for Minority Health
Provost Special Advisory Committee
Provost Selection Committee for the Provost Development Fund Awards
University Community Representative for Equipoise
Junior Faculty Advancement – Panel Member
Profile featured in NSF Molecular and Cellular Biology Newsletter Blog for Principal Investigator Spotlight



Sameera Sayeed, Ph.D.
Research Assistant Professor

American Society for Microbiology
Bangladesh Society of Microbiologist, Dhaka, Bangladesh

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

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
Member, North American Vascular Biology Association
Member, American Society for the Study of Liver Diseases
Member, American Society for Investigative Pathology
Member, American Physiological Society
Nikon Small World Award Winner - 2015

Stephen Thorne, Ph.D.
Assistant Professor

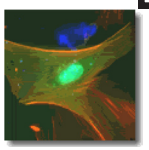
American Association of Cancer Research
American Society of Cellular and Gene Therapy
Society of Nuclear Medicine and Molecular Imaging
Pitt Innovator Award 2016

Linton M. Traub, Ph.D.
Associate Professor

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

Yong Wan, Ph.D.
Professor

Member, American Association for Cancer Research



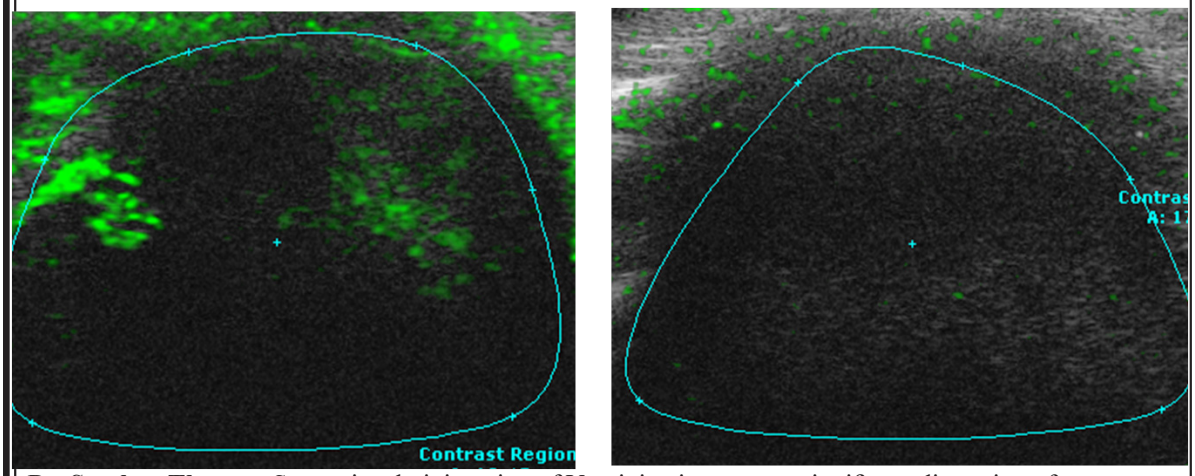
Member, American Association of Cell Biology
Member, American Association for The Advancement of Science

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

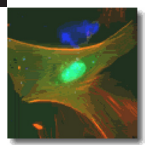
Member, The Pittsburgh Cancer Institute

Nathan Yates, Ph.D.
Associate Professor

American Chemical Society
American Society for Mass Spectrometry



Dr. Stephen Thorne. Systemic administration of Vaccinia virus causes significant disruption of tumor vasculature. Ultrasound images of tumor cross sections measuring tumor blood perfusion at various time points following administration of vaccinia virus



Faculty Presentations (Fiscal Year 2015-2016)

Meir Aridor, Ph.D.
Associate Professor

"Regulation of COPII at the ER-Golgi Interface" Department of Cell Biology, university of Pitsburgh School of Medicine, September 2015

"The roads travelled, protein traffic in cells,traffic jams, and disease".Science on Tap, American Committee for the Weizmann Institute of Science, Pittsburgh, June 2016

Michael Butterworth, Ph.D.
Assistant Professor

"Kidney microRNAs: Central players in sodium regulation or innocent bystanders?" Department of Human Biology, University of Cape Town, South Africa. 2015

"More than Just a Pinch of Salt: Regulation of Sodium Transport in the Kidney". Division of Nephrology, University of the Witwatersrand, South Africa. 2015

Daniel Devor, Ph.D.
Professor

"Trafficking of KCa2.3: What have we learned and where are we heading?" Midwestern University, Glendale, Department of Physiology, Glendale, AZ. November 2015

Peter Drain, Ph.D.
Associate Professor

Karolinska Institute, Stockholm, Sweden. European Association for the Study of Diabetes (EASD) "Pancreatic Beta Cell Biology and Autocrine C-Peptide Mechanisms Adapting to Oxidative Stress" September 2015.

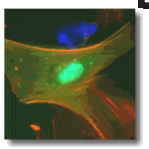
Gerald Hammond, Ph.D.
Assistant Professor

Children's Hospital of Pittsburgh, Molecular Medicine Seminar Series, 2016

AMBMB Annual Meeting "Does Ptdlns (4.5)P2 Concentrate So It Can Multitask" Boston, MA 2015

Signalling 2015: Cellular Functions of Phosphoinositides and Inositol Phosphates, "How to multitask without concentrating". Cambridge UK 2015

Toronto Organelle Function and Dynamics Conference, "Does a lipid concentrate to multitask?" Toronto, Canada, 2016



Department of Cell Biology, Hospital for Sick Children, Toronto, Canada 2016

Department of Cell Biology, University of Pittsburgh, 2016

New York Lipid and Vascular Biology Research Club, "to where and what for of inositol lipid signaling" Weill Cornell, New York 2016

Duquesne University "How inositol lipids charge cell membranes", Pittsburgh 2016.

Sandra Murray, Ph.D.
Professor

Presenter International Gap Junction Meeting, Valparaiso, Chile 2015.

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

MMBioS Mini Symposium on "Multiscle Modeling and Visualization of Signaling" September 2015
(Pittsburgh)

EB2016, San Diego April, 2016

Traffic Meeting, Braga, Portugal. Endocytosis, signaling and cancer. April, 2016

University of Texas at Austin, Inst for Cellular & Molecular Biology, Austin, TX. October 2015

Traffic Meeting, Braga, Portugal. Neurotransmitter transporters, trafficking and role in disease. May, 2016

Donna B. Stolz, Ph.D.
Associate Professor

Career Choices with a Biochemistry degree. University of Massachusetts, Amherst. November 2015.

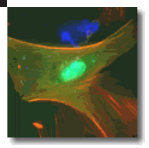
Stephen Thorne, Ph.D.
Assistant Professor

University of Baltimore, Maryland, Department of Microbiology and Immunology Seminar Series, Student invited speaker. 2016

University of Pittsburgh Department of Cell Biology Seminar Series, 2015

University of Miami Cell Biology Seminar Series, 2015

International Meeting on Oncolytic Virus Therapeutics, 2015



Oncolytic Virotherapy Summit, 2015

University of Pennsylvania, GTV seminar series, 2015

University of California, San Francisco, Immunology Seminar Series, 2015

Stephen Thorne, Ph.D.
Assistant Professor

University of Baltimore, Maryland, Department of Microbiology and Immunology Seminar Series, Student invited speaker. 2016

University of Pittsburgh Department of Cell Biology Seminar Series, 2015

University of Miami Cell Biology Seminar Series, 2015

International Meeting on Oncolytic Virus Therapeutics, 2015

Oncolytic Virotherapy Summit, 2015

University of Pennsylvania, GTV seminar series, 2015

University of California, San Francisco, Immunology Seminar Series, 2015

Linton Traub, Ph.D.
Associate Professor

'So why study clathrin-mediated endocytosis anyway?' Department of Biological Sciences, Lehigh University, Bethlehem, PA. October 2015

'Clathrin-mediated endocytosis: a trio opening act' Department of Biological Sciences, Vanderbilt University, Nashville, TN. March 2016

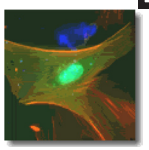
Yong Wan, Ph.D.
Professor

Impact of UPS: from Kruppling development to tumorigenesis. Symposium of frontier cell biology and human disease, Harvard Medical School, 2015

Posttranslational modification in genome stability and carcinogenesis. South University of Science and Technology of China, 2015

Impact of posttranslational modification in human diseases. Sun Yat-sen University School of Medicine. China, 2015

Crosstalk between ubiquitylation and protein methylation in tumorigenesis. University of Florida, 2015



Interplay between ubiquitylation and protein methylation in mammary carcinogenesis UNC Lineberger Cancer Center. 2015

Regulation of XIAP Turnover Reveals a Role for USP11 in mammary tumor initiation. Great Lake Area Breast Cancer Symposium. 2016

Posttranslational modifications in tumor initiation and invasion. 8th International Conference of Ubiquitin, Sumo, UBL proteins. 2016

Regulation of XIAP Turnover Reveals a Role for USP11 in Promotion of Tumorigenesis

Cold Spring Harbor Conference (Ubiquitin family, Autophagy and Diseases) 2016

The role of KLF4 in tumorigensis University of West Virginia 2016

Targeting interplay between KLF4 and PRMT5 in carcinogenesis Epply Cancer Institute 2016

Targeting Ubiquitin-proteasome system in mammary tumor initiation and invasion University of Texas Health Science System at San Antonio 2016

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

From Little Animals to Moving Molecules, Rosswell Park Post Graduate Association annual symposium, Keynote speaker, September 23rd 2015

New Opportunities for FAPs in Cell Biology, Departement of Cell Biology, University of Pittsburgh of Pittsburgh, Annual Retreat, September 25th 2015

New Imaging Probes and Fast Microscopies, GLIIFCA annual symposium, Invited Speaker, Buffalo NY September 26th 2015

Imaging biology in Mitochondria, Scripps FL October 23rd 2015

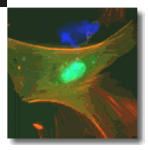
Optics World Webinar Invited speaker, October 21at 2015

Funding Imaging Solutions Nikon Instruments annual retreat, Tucson AZ November 6th 2015

Imaging Opportunities Nikon Instruments annual retreat, Keynote Speaker, Tucson AZ November 5th 2015

Caliber Scientific high speed imaging limitations and advantages Rochester NY April 14th 2016 invited speaker

UPCI annual retreat Invited speaker “Super-resolution imaging: Fact or Fiction” University of Pittsburgh Greensburg campus June 16th 2016



Nathan Yates, Ph.D.
Associate Professor

"Differential Mass Spectrometry – Proteomics Applications in Basic, Translational, and Clinical Research" CPSA Brazil, São Paulo, Brazil. August 2015

"Development and Application of Differential Mass Spectrometry As An Enabling Technology For Biomarker Discovery and Drug Development" ISPROF 2015, Caparica-Lisbon, Portugal. September 2015

"Simplifying Complex Workflows for Larger Scale and Speed" CPSA 2015 USA, Langhorne, PA. October 2015

"Proteomic Profiling via Label Free Differential Mass Spectrometry" Sanofi US, Cambridge, MA. October 2015

"Elucidation of Proteins that Bind Small Molecule Drugs via Chemical Proteins" Drug Discovery Institute, External Advisory Board, Pittsburgh, PA. November 2015

"Differential Mass Spectrometry – An Enabling Technology For Biomarker Discovery and Drug Development" Albert Einstein College of Medicine, Bronx, NY. November 2015

"Discovering Drug-Protein Interactions by Proteomics" MBSB Seminar, University of Pittsburgh, Pittsburgh, PA. December 2015

"Differential Mass Spectrometry – An Enabling Technology For Biomarker Discovery and Drug Development" University of South Alabama Mitchell Cancer Institute, Mobile, AL. December 2015

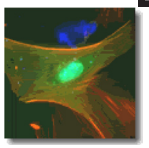
"MS Bioinformatics in the Cloud: CHORUS and Beyond" CPSA Metabolomics, Gainsville, FL. March 2016

"Development and Application of Differential Mass Spectrometry as an Enabling Technology for Biomarker Discovery and Drug Development" 1st PHOENIX Mini-Symposium on Frontiers of Proteomics, Beijing, China. April 2016

"Emerging Issues and Needs with Personalized Healthcare: Pittsburgh Pirates and Performance Analytics" Mozaic Solutions Annual Meeting, Pittsburgh PA. May 2016

"High-Resolution Mass Spectrometry Discovering Molecular Profiles in Previously Un-Analyzed Data" CPSA Analytics, Pittsburgh, PA May 2016

"Benefits of Larger Studies in Discovery Proteomics" New Objective ASMS Users Meeting, San Antonio, TX. June 2016



Peer Reviewed Publications (Fiscal Year 2014-2016)

Meir Aridor, Ph.D.
Associate Professor

Klinkenberg D, Long KR, Shome K, Watkins SC, Aridor M. (2014) A cascade of ER exit site assembly that is regulated by p125A and lipid signals. J. Cell Sci. 127:1765-78.

Ernst W. Jr., Shome K., Wu C.C., Frizzell R.A. and M. Aridor (2016) VAMP –associated proteins (VAP) as receptors that couple cystic fibrosis transmembrane conductance regulator (CFTR) proteostasis with lipid homeostasis". J Biol Chem 2016 Mar 4; 291 (10):5206-20. PMID: 26740627.

Michael Butterworth, Ph.D.
Assistant Professor

Butterworth, M.B., Zhang, L and Thibodeau, P.H. (2014). Modulation of the Proteolytic Activation of the Epithelial Sodium Channel (ENaC) by a Pseudomonas aeruginosa Protease Inhibitor. PLOS One. 9(6):e100313.

Edinger. R.S., Coronnello. C., Bodnar, A.J., LaFramboise, W.A., Benos, P.V., Ho, J., Johnson, J.P and Butterworth, M.B. (2014). Aldosterone regulates microRNAs in the CCD to alter sodium transport. Journal of the American Society of Nephrology. 25 (11):2445-57

Bertuccio, C.A., Lee, S-L., Wu, G., Butterworth, M.B., Hamilton, K.L. and Devor, D.C. (2014). Anterograde trafficking of KCa3.1 in polarized epithelia is Rab1- and Rab8-dependent and recycling endosome-independent. PLOS One. 9 (3): e92013

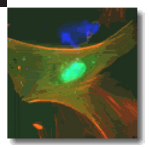
Roy, A., Al-Qusairi, L., Donnelly, B.F., Ronzaud, C., Marciszyn, A., Gong, F., Chang, Y.P, Butterworth, M.B., Pastor-Soler, N., Hallows, K.R., Staub, O. and Subramanya, A.R. (2015). Alternatively spliced proline-rich cassettes link WNK1 to aldosterone-dependent signaling cascades. Journal of Clinical Investigation. 125(9):3433-48.

Li, Y., Hu, H., Butterworth, M.B. and O'Neil, R.G. (2016). Expression of a Diverse Array of Ca2+-Activated K+ Channels (SK1/3, IK1, BK) that Functionally Couple to the Mechanosensitive TRPV4 Channel in the Collecting Duct System of Kidney. Resubmitted to PLOS One

Daniel Devor, Ph.D.
Professor

Bertuccio, C.A., Lee, S-L., Wu, G., Butterworth, M.B., Hamilton, K.L. and Devor, D.C. (2014). Anterograde trafficking of KCa3.1 in polarized epithelia is Rab1- and Rab8-dependent and recycling endosome-independent. (2014) PLOS One. 9 (3): e92013.

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



Peter F. Drain, Ph.D.
Associate Professor

Luppi, P., and P. Drain. 2014. Autocrine C-Peptide Mechanism Underlying INS1 Beta Cell Adaptation to Oxidative Stress. Diabetes and Metabolism Research and Reviews, 30(7):599-609.

Luppi, P., and P. Drain. 2016. C-peptide antioxidant adaptive pathways in β cells and diabetes. Journal of Intern Medicine. Jun 2 epub. doi: 10.1111/joim.12522/in press.PMID: 27251308

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Luppi, P., and P. Drain. 2016. Autocrine C-Peptide Mechanism Underlying INS1 Beta Cell Adaptation to Free Fatty Acid-Induced Oxidative Stress. In preparation.

Li Ma, Vytautas P. Bindokas, Christine Labno, Jie Wang, Andrey Kuznetsov, Manani Hara, Xuehui Geng, Peter Drain, Christopher J. Rhodes, Donald F. Steiner, and Louis H Philipson. 2016. Non-Crystallized Cargo Protein Shifts Insulin LDCV Exocytosis From Full to Transient Fusion, in revision

Marijn Ford, Ph.D.
Assistant Professor

Ford M, Nunnari J, Jenni S. An integrated structural analysis of dynamin assembly. Microsc. Microanal. (2013) vol. 18 (Suppl. 2), pp. 48-9. DOI: 10.1017/S1431927612002097 Pubmed: 23177442

Varlakhanova NV, Clark N, Watkins SC & Ford MGJ. A role for the dynamin related protein Vps1 in microautophagy in Saccharomyces cerevisiae. Autophagy submitted

Natalia Varlakhanova Ford, Ph.D.
Research Assistant Professor

Varlakhanova NV, Clark N, Watkins SC & Ford MGJ. A role for the dynamin related protein Vps1 in microautophagy in Saccharomyces cerevisiae. Autophagy submitted

Gerald Hammond, Ph.D.
Assistant Professor

Bojjireddy, N. Botyanszki, J., Hammond, G. R. V., Creech, D., Peterson, R., Kemp, D., Snead, M., Brown, R., Wilson, S., Harrison, S., Moore, C. and Balla, T. Pharmacological and Genetic targeting of PI4KA reveals its important role in maintaining plasma membrane PtdIns4P and PtdIns(4,5)P2 levels and cellular responsiveness to Gq-coupled receptors. J Biol Chem. 2014. 289 (9): 6120-32. PMID 24415756

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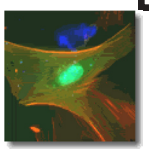

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Yang Hong, Ph.D.
Associate Professor

Haltom AR, Lee TV, Harvey B, Leonardi J, Chen Y-J, Hong Y, Haltiwanger RS, and Jafar-Nejad H. (2014) The protein O-glucosyltransferase Rumi modifies Eyes shut to promote rhabdomere separation in Drosophila. PLoS Genetics 10(11):e1004795. PMID: 25412384

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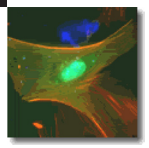

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Adam Kwiatkowski, Ph.D.
Assistant Professor

McConnell RE, van Veen JE, Vidaki M, Kwiatkowski AV, Meyer AS, Gertler FB. A Requirement for Filopodia Extension Towards Slit During Robo-Mediated Axon Repulsion. J Cell Biol. 2016 Apr 25;213(2):261-74. PMID: 27091449

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Sanford Leuba, Ph.D.
Associate Professor

Sanford H Leuba, Sean M Carney, Elizabeth M Dahlburg, Rebecca J Eells, Harshad Ghodke, Naveena Yanamala, Grant Schauer and Judith Klein-Seetharaman. (2014) Early integration of the individual student in academic activities: a novel classroom concept for graduate education in molecular biophysics and structural biology. BMC Biophysics 7:6 doi:10.1186/2046-1682-7-6. PMID: 25132964.

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Sandra A. Murray, Ph.D.
Professor

Falk, M.M., Bell, C.L., Kells Andrews, R.M., and Murray, S.A. Formation, Trafficking and Processing of Annular Gap Junctions, BMC Cell Biology Journal, Section: Cell-Cell Contacts & Adhesion 17:5-23, 2016, Doi: 10.1186/s12860-016-0087-7.

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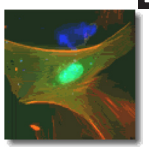

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Sameera Sayeed, Ph.D.
Research Assistant Professor

Vanessa Ante, Xiaowen Bina, Mondraya Howard, Sameera Sayeed, and James Bina. 2015. Vibrio cholerae leuO transcription is positively regulated by ToxR and contributes to bile resistance. J Bacteriol. 197(22):3499-510.

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

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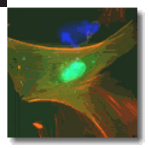

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Donna B. Stolz, Ph.D.
Associate Professor

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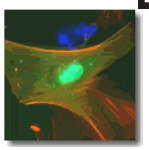

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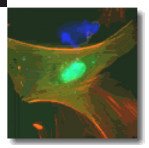

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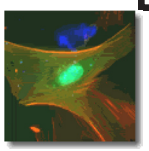

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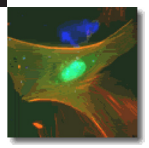

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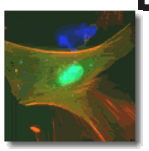

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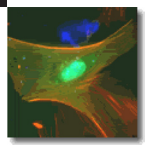

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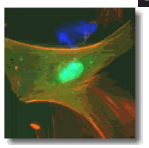

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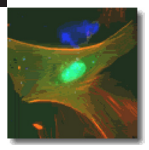

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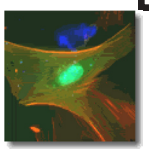

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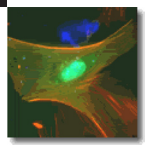

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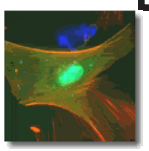

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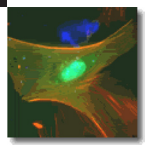

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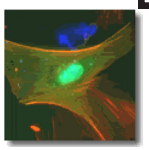

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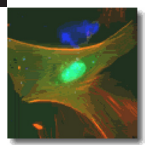

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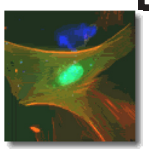

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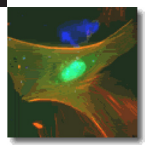

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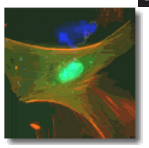
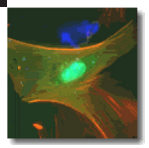


Executive Summary for the Cell Biology FY2017 Business Plan

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 six years significant changes in the Department took place with nine members of the primary faculty leaving the Department and seven new members joining the faculty. This year one new primary faculty, Drs. Yi Shi, was recruited and will be joining the Department in the fall of 2017. 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 FY2017 plan. To this end, we hope that we will start a search for a new mid-career faculty to join the Department in the FY2017. We plan to recruit a scientist who studies fundamental aspects of cell biology, in particular, in the area of protein folding and homeostasis, 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 2017 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, cell cycle, transcription, intercellular interactions and channel 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 top tier general and cell biology journals such as cancer Cell (Stephen Thorne) Developmental Cell (Linton Traub), Proc. Natl. Acad. Sci. USA (Alexander Sorkin) and Cell Reports (Stephen Thorne).

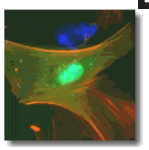
Membrane trafficking is a particular strength of the Department with research covering the entire spectrum of traffic-related issues from general mechanisms of protein and lipid trafficking, endocytosis and membrane organelle biogenesis, to cargo-specific mechanisms of anterograde and endocytic trafficking 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 successful in obtaining extramural research funding in the past cycle, as evidenced by the renewal of the P30 grant (Watkins), the competitive renewal of NIH and NSF grants (Frizzell, Murray). 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 new recruit, Dr. Yi She will join the Department in the fall of 2016. His research is focused on structure-0functional analysis of macromolecular complexes using cross-linking mass-spectrometry.

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, Drs. Watkins and Stolz were awarded multiple NIH shared instrumentation grants including two confocal microscopes which are essential to the continued growth of the CBI and departmental infrastructure. Dr. Yates, Director of the Biomedical Mass Spectrometry Center, SOM and UP, is currently building an infrastructure of a new facility to study metabolomics.

The Center for Cystic Fibrosis has been recently transferred to the Department of Pediatrics, although faculty in the Department of cell Biology continue to participate in CF Center research. Our faculty also participated in NIH funded program projects (Fluorescent Probes and Imaging for Networks and Pathways; Center for HIV Protein Interactions; Molecular Biology of Hemorrhagic Shock) and is involved in multiple collaborations with basic science faculty and various divisions of the Departments of Medicine and Pediatrics, as well as with the researchers at Carnegie Mellon University. Individual CB faculty hold major roles in organization of the annual “Local Traffic” and “Ubiquitin” symposiums, running the Membrane Trafficking journal club and participate in various School committees.



Teaching

Medical Curriculum: The department contributes extensively to the teaching of medical and graduate students in the School of Medicine. Our faculty has been actively participating in the remodeling of the first year curriculum, particularly in the area of biochemistry and cell biology, involving formal lectures in these areas and contributing to small group PBLs.

Graduate Curriculum: We now have 6 students in the graduate Ph.D. program in Cell Biology and Molecular Physiology. One student graduated in 2014, taking position as a postdoctoral fellow. 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, Neuroscience among others.

New Biomedical master's Program (BMP). Faculty in the Department together with the Department of Pharmacology participated in organization of a new BMP program that has been recently approved by the Provost. Teaching will begin in September 2017. At least four faculty will be teaching didactic courses, Dr. Peter Drain will serve as the Director of Academic Affairs, and Dr. Sorkin will be 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 extensive changes in the faculty and the associated transfer of multiple grants to and from the Department, recruitment of new faculty, as well as with changes in the administrative staff. The fact that all these tasks were successfully accomplished in a timely and efficient manner attests to the experience and strength of our administrative staff.

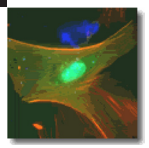
Weaknesses

While not a problem at the present time, limited research space will likely become a weakness of the program in the future. Because of budgetary issues some space in BST South was temporarily rented to another department. Hopefully, more space will be required to allow for growth of the research programs of the current faculty located at BST South.
Several of the CBP faculty Drs. Thorne, Wan and Leuba are located in the Hillman Cancer Center. There is clear separation from the rest of the Department leading to a lesser engagement of these three laboratories in the main activities of the Department.

Opportunities

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

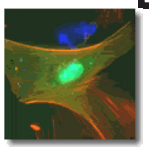
Cohesiveness of the faculty research expertise in the Department creates exceptional opportunities for collaborative research, which should open doors to building new program



projects and centers. The Department is now in the position to lead the assembly of new interdisciplinary research programs that would be competitive in obtaining the extramural funding.

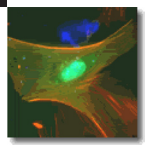
Threats

The steady decrease in federal and private funding opportunities to support basic cell biology research will continue to be the most significant threat during next several years. Several faculty are currently struggling with sustaining level of funding necessary to support their research programs. Yet, in order for the Department to become one of the elite cell biology departments, total funding of the Department must increase 2-fold above the current level. Another difficult challenge we face is to strengthen the Cell Biology and Molecular Physiology Graduate Program through the recruitment of top-tier students and provision of the best possible training environment in the laboratories of the Department.



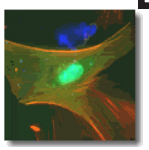
Cell Biology FY2016 Fiscal Issues

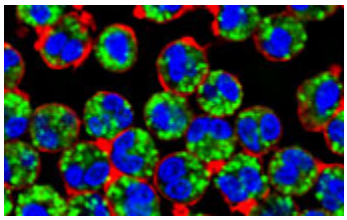
The main budgetary issue that faced the Department in the FY16 budget was maintaining the extramural funding of the faculty at the level necessary to support their research program and as required by the SOM Policies. Our goal is to increase the funding level of previous years. Main efforts will be devoted to ensure 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 2017 Budget

	University	UPP and Other	Total Budget FY 2017
Revenue			
Patient Care	$ -	$ -	$ -
Grant:			
Directs	3,277,337	-	3,277,337
Indirects	1,315,259	-	1,315,259
Hospital Contract	-	-	-
School of Medicine	3,750,578		3,750,578
VAMC		-	-
Other	395,134	-	395,134
Total Revenue	$ 8,738,308	$ -	$ 8,738,308
Expenses			
Salaries and Fringe Benefits:			
Faculty	$ 2,705,082	$ -	$ 2,705,082
Non-Faculty	2,419,156	-	2,419,156
Malpractice Insurance		-	-
Space Rental	124,019	-	124,019
UPP Overhead		-	-
University Overhead	2,428,971		2,428,971
Other Operating Expenses	1,061,080	-	1,061,080
Total Operating Expenses	$ 8,738,308	$ -	$ 8,738,308
Excess Revenue over Expenses	$ -	$ -	$ -
Capital Equipment/Improvements	$ -	$ -	$ -
Fund Balances			
University Restricted Accounts as of 6/30/16	$ 2,904,018	$ -	$ 2,904,018
University Endowments as of 6/30/16	395,134		395,134
UPP Fund Balance as of 6/30/16		-	-
UPMC Endowments as of 6/30/16		-	-
UPMC SPF Accounts as of 6/30/16		-	-
Total Fund Balances	$ 3,299,152	$ -	$ 3,299,152





Thank you for your kind attention.