

CURRICULUM VITAE
7/7/2022
BIOGRAPHICAL

Name: Peter F. Drain

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Business Address: Department of Cell Biology
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Birthplace: Cambridge, MA

Citizenship: USA

EDUCATION AND TRAINING

UNDERGRADUATE:

<i>Dates Attended</i>	<i>Name and Location of Institution</i>	<i>Degree Received and Year</i>	<i>Major Subject</i>
1976-1980	Haverford College Haverford, PA	B.A., 1980	Biology

GRADUATE:

<i>Dates Attended</i>	<i>Name and Location of Institution</i>	<i>Degree Received and Year</i>	<i>Major Subject</i>
1980-1987	M.I.T. Cambridge, MA	Ph.D., 1987	Biochemistry & Genetics Mentor: Paul R. Schimmel

POST-GRADUATE:

<i>Dates Attended</i>	<i>Name and Location of Institution</i>	<i>Major Subject</i>
1987-1990	M.I.T. Cambridge, MA	Biochemistry & Germline Transgenics Mentor: William G. Quinn
1990-1994	Stanford University/HHMI Stanford, CA	Ion Channel Biophysics Mentor: Richard W. Aldrich

APPOINTMENTS AND POSITIONS
ACADEMIC:

<i>Years Inclusive</i>	<i>Name and Location of Institution of Organization</i>	<i>Rank/title</i>
1994 - 1999	University of Pennsylvania Department of Physiology	Assistant Professor
1995-1999	University of Pennsylvania Department of Biochemistry & Biophysics	Assistant Professor Secondary Appointment
1999 -2007	Department of Cell Biology University of Pittsburgh School of Medicine	Assistant Professor
2007 -	Department of Cell Biology University of Pittsburgh School of Medicine	Associate Professor with tenure

MEMBERSHIPS IN PROFESSIONAL AND SCIENTIFIC SOCIETIES

<i>Organization</i>	<i>Year</i>
Biophysical Society	1993-
American Association for the Advancement of Science	1996-
Society of General Physiologists	1996-
American Diabetes Association	2001-

HONORS

Title of Award, Year(s)

Outstanding Freshman in Chemistry, Chemical Rubber Company, 1976

Honors in Biology, Haverford College, 1980

Stella and Charles Guttman Scholar, Haverford College, 1980

Sigma Xi Honorary Research Society, M.I.T. Chapter, elected 1987

McKnight Postdoctoral Fellowship, 1987-1988, M.I.T.

Institute Fellow at M.I.T., 9/88-8/90

Nominated for 1990 Markey Scholars Program from M.I.T., Department of Biology

NIH NRSA Postdoctoral Fellowship, Stanford University, Department of Molecular & Cellular Physiology, 9/90-8/92

Bugher Foundation Cardiology Fellowship at Stanford University School of Medicine, 7/93-6/94

McCabe Faculty Fellow 1995 at The University of Pennsylvania, 7/95-6/96

NIH Pilot Project Grant, 4/1/96-3/31/98

National Science Foundation Grant, 9/1/99-8/30/03

Juvenile Diabetes Research Foundation Grant, 10/1/00-9/30/04

NIH R01 Grant, 10/1/02-9/30/04, Co-Investigator

NIH R21 Grant 7/1/04-6/30/06

Pittsburgh Foundation Grant 10/1/09-9/30/2011

Juvenile Diabetes Research Foundation Innovation Grant, 6/1/2014 – 5/31/2016

Foundation for Prader-Willi Research Grant “Understanding Multiple Hormone Secretion Deficits in Prader-Willi Syndrome” PI: Robert Nichols CHP; Co-Investigator: Peter Drain (5% effort); likely start date 10/1/2016-9/30/2017

Invited to the permanent Grant Review Panel of ADA for the 2004-2007 term; again 2007-2010 term; again 2011-2014; resigned 12/2014 due to increasing UPSOM Commitments

Invited to the permanent Grant Review Panel of the Juvenile Diabetes Research Foundation International (JDRFI) for the 2008-2011 term; extended annually through 2015; resigned 6/2015 due to increasing UPSOM Commitments

Invited and participated in a three-year appointment to the Grant Review Panel of the European Research Council (ERC) 1/1/2011 – 12/31/2013

ADA Research Award 7/1/06-6/30/09

Sheldon Alder Award from Medical School for Innovation in Medical Education, 10 May 2005.

Elected Member of the Academy of Master Educators (AME), University of Pittsburgh School of Medicine, Term 2006-2011 and again term 2011-2017, and again 2018-2023.

Award (actually pretty nice trophy) for innovation in Pre-Clinical Medical Education, American Association of Medical Colleges (AAMC), in Philadelphia, Saturday 4th March 2006

Appointed to MD Admissions Interview Committee 2005-

Appointed to MD Admissions Committee 2009-

Dean's Master Educator Award from Medical School, October 2014

National Board of Medical Examiners (NBME), Invited member of Step 1 and 3 Test Development Questions Committee in Cell Biology and Physiology, 2013-2015; resigned 6/2015 due to increasing UPSOM Commitments

Appointed to the Full UPSOM Curriculum Committee as voting member, 1/2016-

Appointed to the Executive Subcommittee of the MD Admissions Committee 2020-

Appointed as Thread Lead to the newly formed Basic Science Thread in the MD Curriculum – 10/2020-

Appointed to the Executive Subcommittee of the Full MD Admissions Committee 12/2020-

Voted in as the Co-Chair of the UPSOM Curriculum Reform for the 'Planning' Year, 9/2020-12/2021

Invited as Co-Chair of the UPSOM Curriculum Reform for the 'Formation' Year, 1/2022-6/2022

Appointed as Thread Lead to the newly formed Basic Science Thread in the MD Curriculum – 10/2020

Chancellor's Distinguished Teaching Award 2022

PUBLICATIONS

1) Refereed articles

1. Drain, P. and P. Schimmel (1986). LEU5 is a PET-like gene that is not essential for leucine biosynthesis. **Mol. Gen. Genetics** 204: 397-403.
2. Drain, P. and P. Schimmel (1988). Multiple new genes that determine activity for the first step of leucine biosynthesis in *Saccharomyces cerevisiae*. **Genetics** 119: 13-20.

3. Drain, P., E. Folkers, and W. Quinn (1991). cAMP-dependent protein kinase and the disruption of learning in transgenic flies. **Neuron** 6: 71-82.
4. Folkers, E., P. Drain, and W. G. Quinn (1993). *radish*, a *Drosophila* mutant deficient in consolidated memory. **Proc. of the Natl. Acad. Sci USA** 90: 8123-8127.
5. Drain, P., A.E. Dubin, and R.W. Aldrich (1994). Regulation of Shaker K channel inactivation gating by the cyclic AMP dependent protein kinase. **Neuron** 12: 1097-1109.
6. Drain, P., L. Li, and J. Wang. 1998. K_{ATP} channel inhibition by ATP requires distinct functional domains of the cytoplasmic C terminus of the pore-forming subunit. **Proc. Natl. Acad. Sci. USA** 95: 13953-13958.
7. Li, L., J. Wang, and P. Drain. 2000. I182 of K_i6.2 Is Closely Associated With Ligand Binding Steps In The Mechanism By Which ATP Inhibits the K_{ATP} Channel. **Biophysical J.** 79: 841-852.
8. Li, L., X. Geng, and P. Drain. 2002. Open state destabilization by ATP occupancy is mechanism speeding burst exit underlying K_{ATP} channel inhibition by ATP. **J. Gen. Physiol.** 199:105-116.
9. Watkins, S., Geng, X., Li, L., Papworth, G., Robbins, P.D., and Drain, P. 2002. Image Secretory Vesicles by Fluorescent Protein Insertion into Propeptide Rather Than Mature Secreted Peptide. **Traffic** 3: 461-471.
10. Rizzo, M.A., Magnuson, M.A., Drain, P., Piston, D.W. 2002. A functional link between glucokinase binding to insulin granules and conformational alterations in response to glucose and insulin. **J. Biol. Chem.** 277: 34168-34175.
11. Geng, X., Li, L., Robbins, P.D., and Drain, P. 2003. The insulin secretory granule is the major site of K_{ATP} channels of the endocrine pancreas. **Diabetes** 52: 767-776.
12. Susan Bertera, Xuehui Geng, Zakaria Tawadrous, Rita Bottino, A.N. Balamurugan, William A. Rudert, Drain, P., Simon C., Watkins, and Massimo Trucco. 2003. In Vivo Multicolor Imaging of Transplanted Ins-C-TIMER Mouse Islets Through a Newly Developed Body Window. **BioTechniques** 35: 718-722.
13. Drain, P., X. Geng, and L. Li. 2004. Concerted gating mechanism underlying K_{ATP} channel inhibition by ATP. **Biophysical J.** 86: 2101-2112. (April 2004)
14. D. J. Michael, X. Geng, Y. P. Loh, C. J. Rhodes, P. Drain and R. H. Chow. 2004. Michael DJ, Geng X, Cawley NX, Loh YP, Rhodes CJ, Drain P, Chow RH. 2004. Fluorescent cargo proteins in pancreatic beta-cells: design determines secretion kinetics at exocytosis. **Biophys J.** 87:3-5.
15. L. Li, X. Geng, M. Yonkunas, A. Su, E. Densmore, P. Tang, and P. Drain. 2005. Ligand-Dependent Linkage of the ATP Site to Inhibition Gate Closure of the K_{ATP} Channel, **J. Gen. Physiology** 126: 285-299. (September 2005)
16. K. Nakahira, H.P. Kim, X. Geng, A. Nakao, N. Murase, P. F. Drain, Wang X, Shaw-Fang Yet S-F, Nabel EG, Takahashi T, Morita K, Choi, AMK. 2006. Carbon monoxide differentially inhibits TLRs

- signaling pathways by regulating ROS-induced trafficking of TLRs to lipid rafts. **The Journal of Experimental Medicine** 203:2377-89.
17. Sun F, Zhang R, Gong X, Geng X, **Drain PF**, Frizzell RA.2006. Derlin-1 promotes the efficient degradation of the cystic fibrosis transmembrane conductance regulator (CFTR) and CFTR folding mutants. **J Biol Chem** 281(48):36856-63.
 18. X. Geng, L. Li, R. Bottino, A.N. Balamurugan, S. Bertera, . Densmore, A. Su, Y. Chang, M. Trucco, **P. Drain**. 2007. Antidiabetic sulfonylurea stimulates insulin secretion independently of plasma membrane KATP channels. **Am. J. Physiol. Endocrinol. Metab.** 293:E293-E301.
 19. D.J. Michael, W. Xiong, X. Geng, **P. Drain**, and R.H. Chow. 2007. Human Insulin Vesicle Dynamics During Pulsatile Secretion. **Diabetes** 56:1277-1288.
 20. Luppi P, Geng X, Cifarelli V, **Drain P**, Trucco M. 2009. C-peptide is internalised in human endothelial and vascular smooth muscle cells via early endosomes. **Diabetologia** 52(10):2218-28.
 21. X. Geng, H. Lou, J. Wang, L. Li, R. G. Perez, and **P. Drain**. 2011. Alpha-Synuclein Binds the KATP Channel at Insulin Secretory Granules and Inhibits Insulin Secretion. **Am. J. Physiol. Endocrinol. Metab.** 300(2): E276-86.
 22. Mihaela Stefan, Rebecca A. Simmons, Suzanne Bertera, Massimo Trucco, Farzad Esni, **Peter Drain**, Robert D. Nicholls. 2011. Global deficits in development, function, and gene expression in the endocrine pancreas in a deletion mouse model of Prader-Willi syndrome. **Am. J. Physiol. Endocrinol. Metab:** 300(5): E909-22.
 23. Chu KY, Briggs MJ, Albrecht T, **Drain PF**, Johnson JD. 2011. Differential regulation and localization of carboxypeptidase D and carboxypeptidase E in human and mouse beta-cells. **Islets** 3(4): 155-65.
 24. **Drain, P.** 2013. ATP and sulfonylurea linkage in the KATP channel solves a diabetes puzzler. **Diabetes** 62(11):3666-8. Invited Review
 25. 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.
 26. Luppi, P., and **P. Drain**. 2017. C-peptide antioxidant adaptive pathways in β Cells and diabetes. **Journal of Internal Medicine** 281(1): 7-24. Doi:10.1111/joim. 12522.
 27. D. Brüning, K. Reckers, **P. Drain**, and I. Rustenbeck. 2017. Glucose but not KCl diminishes submembrane granule turnover in mouse beta-cells. **J Mol Endocrinol** Oct;59(3):311-324. doi: 10.1530/JME-17-0063. PMID: 28765259.
 28. Luppi P, Drain N, To R, Stolz D, Wallace C, Watkins S, and **Drain P**. 2020. Autocrine C-peptide protects INS1 β cells against palmitic acid-induced oxidative stress in peroxisomes by inducing catalase. **Endocrinol Diab Metab.** 2020;00:e00147. <https://doi.org/10.1002/edm2.147>

29. Elnicki DM, **Drain P**, Null G, Rosenstock J, Thompson A. 2021. Riding the Rapids: COVID-19, the Three Rivers Curriculum, and the Experiences of the University of Pittsburgh School of Medicine. **FASEB BioAdvances**. 2021;3:387–391. <https://doi.org/10.1096/fba.2020-00099>
30. Koppes EA, Johnson MA, Moresco JJ, Luppi P, Lewis DL, Stolz DB, Diedrich JK, Yates III JR, Wek RC, Watkins SC, Gollin SM, Park HJ, **Drain P**, Nicholls RD. 2022. A β -cell model of Prader-Willi syndrome reveals chronic deficits in endoplasmic reticulum chaperones and insulin secretion. 2022. submitted 6/2022.

3) Published Abstracts:

1. **Drain, P.**, E. Folkers, and W. Quinn. 1990. Reverse-Genetic Studies of Learning and Memory in *Drosophila*. Cold Spring Harbor Symposium on Quantitative Biology LV. The Brain. Abstract.
2. Folkers, E., **P. Drain**, and W.G. Quinn. 1991. Genetic and molecular analysis of the *Drosophila* memory mutant radish. Molecular Neurobiology of *Drosophila* 25-29 September 1991, Cold Spring Harbor, NY. Abstract.
3. **Drain, P.**, A.E. McEachern, and R.W. Aldrich. 1992. Modulation of Shaker K channel inactivation gating by phosphatase and protein kinase. Biophysical Society Meeting, 9-13 February 1992, Houston, Texas. Abstract.
4. **Drain, P.**, L. Li, N. Chehab, and C. Engle. 1997. A mouse pancreatic β cell Kir4.1 channel: Cloning, sequence, and analysis of inward rectification properties in *Xenopus* oocytes. Biophysical Society Meeting, March 2-6, 1997. New Orleans, Louisiana. Abstract. Biophysical J. 72: A251.
5. **Drain, P.**, L. Li, and J. Wang. 1998. ATP-dependent inhibition gating of a mouse β -cell K_{ATP} channel requires two distinct segments of the cytoplasmic C-terminal domain of the pore-forming subunit. Biophysical J. 74: A241. Biophysical Society Meeting, February 22-26, 1998. Kansas City, Missouri. Abstract.
6. Li, L., J. Wang, and **P. Drain**. 1999. Multiple independent components & subunit interactions in the ATP-dependent inhibition gating of the K_{ATP} channel. Biophysical Society Meeting, February 13-17, 1999. Baltimore, MD. Biophys. J. 76, A77.
7. Wang, J., L. Li, and **P. Drain**. 1999. Evidence for ATP binding to the $K_{ir}6.2$ pore-forming subunit of the K_{ATP} channel. Biophysical Society Meeting, February 13-17, 1999. Baltimore, MD. Biophysical J. 76: A329.
8. **Peter Drain**, Lehong Li, and Xuehui Geng. 2000. ATP-dependent and -independent transitions from the open state of K_{ATP} channels. Biophysical Society Meeting, February 12-16, 2000. New Orleans, LA. Biophysical J. 78: 463A.
9. **Peter Drain**, Lehong Li, and Xuehui Geng. 2001. The T171 and G334 regions of $K_{ir}6.2$ in the mechanism of K_{ATP} channel inhibition by ATP. Biophysical Society Meeting, February 12-16, 2000. New Orleans, LA. Biophysical J. 78: 463A.

10. **Peter Drain**, Lehong Li, and Xuehui Geng. 2001. Incremental stabilization of the shut inhibition gate of the K_{ATP} channel by simultaneous occupation of up to four independent sites by ATP. Biophysical Society Meeting, February 18-22, 2001. Boston, MA. Biophysical J. 80: 626a.
11. X. Geng, L. Li, R. Bottino, A.N. Balamurugan, M. Trucco, **P. Drain**. Secretory granule trapping and localizing fluorescent proteins: evidence for granule K_{ATP} channels coupling glucose metabolic and insulin release rates. Biophysical Society Meeting, February 24-27, 2002. San Francisco, CA. Platform Talk.
12. Geng, X., Li, L., Watkins, S, Robbins, P.D., and **Drain, P.** The insulin secretory granule is the major site of K_{ATP} channels of the endocrine pancreas. Keystone Symposium on “Toward Understanding Islet Biology,” January 21-26, 2003. Keystone, CO. Symposium Talk.
13. L. Li, X. Geng, M. Yonkunas, A. Su, E. Densmore, P. Tang, and P. Drain. 2005. ATP-Dependent Site Linkage to Inhibition Gate Closure in the K_{ATP} Channel. submitted, Annual Biophysics Society of America Meeting, Long Beach, 14 February 2005. Platform Talk.

PROFESSIONAL ACTIVITIES

TEACHING:

University of Pittsburgh School of Medicine

	<i>Lecture Hours Taught</i>	<i>Tutorials or PBL Hour</i>	<i>Years</i>
Methods and Logic in Biomedicine (MLB) 2012-2014, Fall and Spring; 2020, Spring Founding Course Director: Peter Drain This is a seminar series teaching the practices, Principles, and reasoning underling the generation and development of new and important biomedical research. The series is scaffolding educational support for the visiting scholars in the Tshinghua-University of Pittsburgh (T-UP) Research Program.	2	12	2
Experiments and Logic in Cell Biology 2010 Fall-2016 Spring Terms Founding Course Director: Peter Drain	0	20	4
Methods and Logic in Medicine I and II 2005 Spring-2021 Fall Terms (Name but no course content was changed to EBM Applied, and Investigation & Discovery, Respectively in 2017-2018. Founding Course Co-Director: Peter Drain Other Course Co-Director: Rachel Givelber	2	30	9

New 1st and 2nd year Medical Student Courses
in Longitudinal Program in **Scientific Reasoning in Medicine**.
Course Construction began January 2004 with Assoc.
Dean Steve Kanter, based mainly on Medical
Student Journal Club, following the charge of Dean Levine.
Approved March 2004 by Medical School Faculty with
start date January 2005.

Cell Biology of Normal and Disease States

Lecturer	2000-2015 Spring	3	0	13
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Research Seminars in Molecular and Cellular Physiology:

Course Director	2000-2003	20	0	3
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First Year Medical Student Journal Club*

Founding Co-Director with Mary Choi and Amy Justice	2001-2004	27	0	3
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*In 2004 this was expanded by Drs. Drain and Piraino and converted into the course “Methods and Logic In Medicine” required for all first and second year medical students at the University of Pittsburgh, with Dr. Drain and Beth Piraino as Course Directors.

TEACHING:

University of Pennsylvania School of Medicine

a. Medical School Courses:

<i>Course</i>	<i>Lecture Hours</i>	<i>Tutorials or PBL Hour</i>	<i>Years Taught</i>
Physiology 100: “Medical Physiology” Computer Labs (Nernst and Goldman-Hodkin-Katz Equations) Nerve II Lecture: Signal Initiation: Ligand and Mechanically Gated Ion Channels* Nerve III Lecture: Action Potential Machinery: Voltage Gated Channels* Computer Sessions: Resting potentials, action potentials, and propagation. Recitations on Problem Sets Paul DeWeer, Course Director 1995-1996, 1996-1997	3	4	2

b. Graduate Courses:

<i>Course</i>	<i>Lecture Hours</i>	<i>Tutorials or PBL Hour</i>	<i>Years Taught</i>
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2. Teaching, University of Pennsylvania School of Medicine:

INS572: Neuroscience Graduate Core Course “Electrical Language of Cells” One or two lectures per year and one or two computer labs.	3	2	4
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K Channels lecture			
Pacemaking lecture,			
Computer Sessions (Nernst and Goldman-Hodkin-Katz Equations, Resting and Action Potentials),			
Clay Armstrong, Stephen Baylor, and Brian Salzberg, Course Directors.			
1995-1996, 1996-1997, 1997-1998, 1998-1999			
BIOC500: Graduate Core Course	3	1	2
“Principles of Biochemistry”			
Two lectures and a Discussion per year			
Introduction to Ion Channels			
Regulation of Ion Channels			
Discussion			
John Williamson and Helen Korchak, Course Directors.			
1995-1996, 1996-1997			
BIOC550:			
“Molecular Mechanisms of	3	1	1
Signal Transduction & Control”			
Two lectures.			
“Introduction to Ion Channels and Membrane Biophysics”			
“Gating Mechanisms in Ion Channel Proteins”			
Paul Liebman, Course Director			
1995-1996			
Pharmacology Course 300:	4.5	0	1
"Graduate Seminar"			
Three Seminars: Led Journal Paper Critical Presentation and discussion by students on Issues of Structure and Mechanism of Ion channel Proteins.			
Jim Eberwine, Course Director.			
1995-1996			
CELL600:	2	0	1
Graduate Core Course: “Cell Biology”			
Two lectures and a Discussion,			
Introduction to Ion Channels			
Regulation of Ion Channels			
Discussion			
Kevin Foskett and William Skatch, Course Directors.			
1997			
BIOC650:	–	–	1
Dr. George W. Raiziss Biochemical Rounds:			
<i>“Biophysics and Genetics of Ion Channels in Disease”</i>			
Clay Armstrong, Peter Drain, and Franz Matschinsky, Course Directors			
1997			
BIOC Topics:	1.5	0	1
"Proteins as Nanomachines"			
One Seminar: Lecture and Discussion			

“Ion Channel Proteins as Molecular Machines: Structure, Energetics, and Mechanism.”

Les Dutton, Course Director
1996

BIOC Topics: 1.5 0 2
"Transmembrane Signaling"

Mark Lemmon, Course Director

One Lecture per year on the Energetics of Ion Transport and Ion Transport Proteins
1997-1998, 1998-1999

c. Graduate Students:

Lori Gardner	PhD Candidate	1995
Andrei Soboda	PhD Candidate	1995
Nabil Chehab	PhD Candidate	1996
Mark Miedel	Rotation	2003
Janine Bartholomew	Rotation	2005
Xinxian Qiao	Rotation/MS Candidate	2012

d. Research Assistant/Postdoctoral Fellows/Scholars/Research Assistant Professors:

Lehong Li, M.D.	1996-present
Steven Shay, M.D.,Ph.D.	1997-1998
Xuehui Geng, M.D.	1999-2009
Patrizia Luppi, M.D.	2014-present

e. MD student researchers (PREP & Longitudinal Research Project):

Ramsey To, BS, MS, currently MS1 MD student at UPSOM	2021-present
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RESEARCH GRANTS

<u>Grant Title</u>	<u>Role in Project/ Percentage of Effort</u>	<u>Years Inclusive</u>	<u>Source/ \$ Amount</u>
“Live pancreatic alpha-cell glucagon fluorescent reporters towards a type 1 diabetes cure	PI (10%)	06/01/2014- 05/31/2016	Juvenile Diabetes Research Foundation \$75,000 (TDC)
“Molecular Medicine in Shared Secretory Mechanism Underlying Diabetes, Alzheimer’s Disease,	PI (20%)	10/01/09- 09/30/11	Pittsburgh Foundation \$175,000 (TDC)

and Parkinson's Disease

KATP channel openers and secretagogues in neuronal stress modeling Alzheimer's	PI (0%)	4/1/11-3/31/12	Alzheimer Disease Research Center/ NIH Pilot Project \$25,000 (TDC)
"Synchronized Excitation-Secretion of Insulin in Diabetes"	PI (15%)	07/01/06-6/30/10	ADA Research Award \$261,000 (TDC)
"Anesthetic Sites in Transmembrane Peptides by NMR."	Collaborator (5%)	07/01/09-06/30/13	NIH R01
"Human β cell parameters for islet engraftment success"	PI (30%)	07/01/04-06/30/07	NIH R21 \$450,000 (TDC)
"Quantitative live-cell fluorescence imaging of stimulus-evoked insulin secretion"	PI (10%)	10/01/00-09/30/04	JDFI \$414,000 (TDC)
"Optical Imaging of pancreatic Islet mass, function and Engraftment" (Based on Drain's Ins-C::GFP reporter system)	Collaborator (25%) PI: Trucco	10/01/02-09/30/04	NIH R01 \$250,000 (TDC)
Stoichiometry of the inhibitory ATP site and gate of the K_{ATP} channel	PI (17%)	09/01/99-08/31/03	NSF \$345,000 (TDC)
Cloning and characterization of K channels from β HC9 cells	PI (20%)	04/01/96-03/31/98	NIH \$66,000
Cloning and characterization of K channels from β HC9 cells	PI (20%)	03/01/95-02/28/96	McCabe Foundation \$40,000
Structure and Mechanism of the ATP-Sensitive K Channel	PI (20%)	07/01/96-06/30/97	URF \$18,000
Structure and Mechanism of the ATP-Sensitive K Channel	PI (20%)	05/01/97-06/30/98	URF \$20,000
Signal transduction from the	PI (20%)	07/01/98-	URF

K _{ATP} channel through insulin granule exocytosis	06/30/99	\$19,600
Understanding Multiple Hormone Secretion Deficits in Prader-Willi Syndrome. PI: Robert Nicholls (CHP) Start date 10/1/2016 Foundation for Prader-Willi Research	10/1/16- 9/30/17	FPWR \$100,000

ADDITIONAL AWARDS

“Pittsburgh Innovator 2010” – I received this award from Chancellor Nordenberg and Dean Levine at the University Club on the basis of the Ins-C-Fluorescent Protein technology being licensed by Pharma and Biotech, including Eli Lilly and Company, over the last years. The technology enables live-cell imaging of proinsulin and insulin from biosynthesis and insertion into the ER, trafficking and proteolytic maturation to secretory granules, through calcium-triggered exocytic fusion and release from the pancreatic beta cell.

Invited Oral Presentations (selected):

1. "Controlling Inactivation Gating in Potassium Channels,"
Frontiers in Research Seminar Series, Graduate Hospital, Philadelphia, PA,
22 April 1996
2. "ATP-Dependent Inhibition Gating of ATP-Sensitive Potassium Channels,"
Pennsylvania Muscle Institute Symposium, University of Pennsylvania, Philadelphia, PA,
3 November 1997
3. "ATP-Dependent Inhibition Gating of the K_{ATP} Channel: Role of Two Distinct Regions of the Cytoplasmic C-terminal Domain of the Pore-Forming Subunit,"
2nd International Conference on ATP-Sensitive Potassium Channels and Disease
Andersen Worldwide Center for Professional Education, St. Charles, IL
3-5 September 1998
4. "ATP-Inhibition of the K_{ATP} Channel: Ligand Binding and Gate Closure Requires Distinct Cytoplasmic C-terminal Domains of K_{ir}6.2,"
Physiology and Biophysics Seminar Series, University of Colorado School of Medicine,
Denver, CO
4 December 1998
5. "Ligand Binding and Gate Closure in the ATP Inhibition of the K_{ATP} Channel," Department of Physiology Seminar Series, University of Pennsylvania School of Medicine, Philadelphia, PA
2 March 1999
6. “Mechanisms linking ATP binding and gate closure when the K_{ATP} channel is inhibited by ATP,”
Invited Merck Scholar in Cardiology Seminar Series, Mayo Clinic, Rochester Minnesota

30 October 2000

7. “When inhibition Leads to Release: The Role of the K_{ATP} Channel in Glucose-Stimulated Insulin Release,” University of Pittsburgh School of Medicine, Department of Medicine Seminar, Wednesday 27 June 2001.
8. “Ins-C-GFP fluorescent reporter of live-cell insulin release and the granule K_{ATP} channel hypothesis,” Saturday, 15 June 2002. American Diabetes Association Meeting, Mascone Convention Center, San Francisco, CA.
9. “The insulin secretory granule is the major site of K_{ATP} channels of the endocrine pancreas,” Saturday, 25 January 2003, “Islet Biology” Keystone Symposium, Keystone, CO.
10. “When Inhibition Leads to Release: K_{ATP} channel inhibition and live-cell imaging of insulin granule release,” Pittsburgh Development Center Seminar Series, Friday, 18 April 2003 at the Magee-Womens Hospital, Pittsburgh, PA.
11. “ATP Binding and Its Induced Linkage to the Inhibition Gate of the K_{ATP} Channel.” In The Inward Rectifier K Channel Platform Session of the Biophysics Society Annual Meeting, Thursday 16 February 2004, Baltimore Convention Center, Baltimore, MD. Co-Chair of this session which focused on K_{ATP} channels.
12. “Signal Transduction Specializations Targeting Glucose Stimulated Insulin Secretion,” In Signaling Mechanisms in Diabetes Conference, Philadelphia, PA, Thursday-Friday, 22-23 July 2004.
13. L. Li, X. Geng, M. Yonkunas, A. Su, E. Densmore, P. Tang, and P. Drain. 2005. ATP-Dependent Site Linkage to Inhibition Gate Closure in the K_{ATP} Channel. submitted, Annual Biophysics Society of America Meeting, Long Beach, 14 February 2005. Platform Talk.
14. Vice Chancellor’s Seminar Series, 30 September 2005: “Imaging Glucose-Stimulated Insulin Secretory Granules in Live Beta Cells.”
15. Channels R Us, 21 March 2006, Ligand-Dependent Linkage of the ATP Site to Inhibition Gate Closure in the K_{ATP} Channel, University of Pittsburgh.
16. NIDDK Workshop “Imaging the Pancreatic Beta Cell,” 24-25 April 2006, L’Enfant Plaza Hotel. Title of Seminar: “Imaging Insulin Traffic, Secretion, and Diabetes Through the Confocal Microscope.”
17. Pfizer Seminar “Imaging Systems Biology of the Pancreatic Beta Cell January 7, 2008,” Pfizer Research Technology Center, Cambridge, MA,
18. Duquesne University Biology Department Seminar, “Imaging Insulin Secretion Cell Biology in Health and Disease,” March 7, 2008.
19. University of Pittsburgh School of Medicine, Endocrine Conference, “Functional Proteomics of the Insulin Granule,” March 15, 2010.

20. PNC Park, Cell Biology and Physiology Retreat, Annotating the Insulin Granule Proteome, One Protein At a Time,” September 23, 2010.
21. Karolinska Institute, Stockholm, Sweden. European Association for the Study of Diabetes (EASD) Meeting Title: C-Peptide and the Pathophysiology of Microvascular Complications of Diabetes. Invited Speaker will present talk “Pancreatic Beta Cell Biology and Autocrine C-Peptide Mechanisms Adapting to Oxidative Stress. September 14, 2015.

OTHER RESEARCH RELATED ACTIVITIES.

Permanent Member Grant Review Panel Terms

National Grant Review Panel of the American Diabetes Association, 7/04-6/14
 National Grant Review Panel of the Juvenile Diabetes Research Foundation, 7/08- 12/15
 International Grant Review Panel of the European Research Council (ERC), 1/11-12/13

Ad Hoc Referee—Journals:

Am. J. Physiology: Cell Physiology
Am. J. Physiology: Endocrinology
Am. J. Physiology: Heart and Circulatory Physiology.
Biochemical J.
Biophysical Journal
British J. Pharmacology
Cell
Diabetes
J. Biological Chemistry
J. General Physiology
J. Physiology
Metabolism
Nature
Neuron
Plos Biology
Proceedings of National Academy of Sciences
Science

Ad hoc Grant Review Panels:

NIH, NIDDK, 2002, 2011

National Science Foundation, Cell Biology, Signaling, 2000, 2006.

Israeli National Science Foundation, 2006.

Scottish Hospital Endowments Trust, 2003.

Veterans Affairs Merit Review Boards for Medical Research, 1997-2005.

University of Pennsylvania Research Foundation Biomedical Grant Review Committee, 1995-1999.

SERVICE:

1. Committees, University of Pennsylvania School of Medicine:

1995-1996	NIH Graduate Training Grant in Molecular and Cell Biology Faculty Committee that rewrote and successfully resubmitted the grant.
1996-1999	Philadelphia Biomedical Review Panel
1997	Dr. George W. Raiziss Biochemical Rounds, “Biophysics and Genetics of Ion Channels in Disease,” Seminar Series Committee
1997-1998	Neuroscience Seminar Committee

2. Committees, University of Pittsburgh School of Medicine:

2000-2001	Cell Biology and Physiology Seminar Organizer with Allan Zhao.
2000-	Cell Biology and Physiology Graduate Program Committee,
2001-	Cell Biology and Physiology Representative, Graduate Student Recruitment Committee
2000	Ph.D. Candidacy Examination—Chairman for Kelly Weixel.
2003	Ph.D. Candidacy Examination—Member for Adedotun Adebamiro.
2003-2004	Ph.D. Candidacy Examination—Member for Romesh Draviam
1999-2000	Ph.D. Thesis Committee—Chairman for Aaron C. Gerlach’s “Kinase-dependent regulation of the intermediate conductance, calcium-dependent potassium channel, hK1.” (CBP, Medicine)
2002-2004	First year Mentor—Three first year graduate students each year.
2003	Ph.D. Thesis Committee—Member for Anqi Qian’s “Permeant Ion and Subunit Dependence of Mg ²⁺ Block of NMDA Receptors.” (Neuroscience-lower campus)
2004-2005	Comprehensive Examination Committee, Chair, for candidate Mark Bailey, Cell Biology and Physiology

2004- present	Member of the UPSOM interviewing committee
2004-	Course Design Committee for “Methods and Logic in Medicine,” a new course for 1 st and 2 nd year medical students teaching major critical scientific thinking components that are developing in evidence-based and translational medicine, how it compares, contrasts, and compliments methods and logic in more traditional clinical medicine.
2004	Ph.D. Thesis Committee for Peter Keyel, Ph.D. candidate in Cell Biology and Physiology.
2004-2007	Ph.D. Thesis Committee for Romesh Draviam, Ph.D. candidate in Cell Biology and Physiology.
2004-2007	Ph.D. Thesis Committee for Adedotun Adebamiro, M.D., Ph.D. candidate in Cell Biology and Physiology.
2001-2007	Ph.D. Thesis Committee for Richard Clarke, Ph.D. candidate Department of Neuroscience: “Kinetics of magnesium unblock from NMDA receptors.”
2006-2009	Scholarly Project Executive Committee Member
2006- present	Member, University of Pittsburgh School of Medicine (UPSOM) MD Candidate Interview Committee
2007-2011	Ph.D. Thesis Committee for Mark Bailey, Ph.D. candidate, Molecular Physiology and Cell Biology Graduate Program
2008-2012	Ph.D. Thesis Committee for Cavita Chotoo, Ph.D. candidate, Molecular Physiology and Cell Biology Graduate Program
2009- present	Member, University of Pittsburgh School of Medicine (UPSOM) Admissions Committee
2012- present	Member, Steering Committee, Tsinghua-University of Pittsburgh (T-UP) Research Program
2012-present	In November 2012, I designed and authored the original eight-page vision statement, a blueprint for the “Biomedical Master’s Program (BMP),” granting the Masters of Sciences degree in Biomedical Sciences. Approval by the University of Pittsburgh’s Provost Office was Spring 2016. The Master’s program aims to educate and train 100 or more students annually and uses the 3-4-3 design layout which features three major components of academics, experientials, and advising. The three-segment cycle academics include state-of-the-art hybrid educating-learning strategies with small group active learning, digital learning in virtual classrooms, and lectures, and pre- and post-NBME-like MCQ summative assessments and NBME-like MCQ and Learning Concept Item Inventories. The four-segment experientials include clinical shadowing, patient volunteering, community service and research. The original two-segment advising component included BMP program advising and post-BMP professional degree program

application and interview day advising, but was expanded by others to three-segment advising, now also including career and life coaching. The inaugural class has over 40 master's students with a very high acceptance of offer of admission rate commensurate with the innovative design of the program. This year, I designed, and began implementing with BMP Administrator Stephen Mattiace and iTarget, a portfolio system for all BMP students and advisors to track progress through not only the program but also the professional school application and interview process. This paper and soon-to-be web-based BMP student advising portfolio platform dovetails with the final required course in the program in the Summer Term, "BMP Communications Capstone." The course will explore professional communication skills, including those for interviews and written applications. The object of study will focus on a practical summation of individual student educational and experiential activities in the BMP. Large group and small group workshops will be used to analyze and evaluate student educational and experiential activities in the context of professional goals. Faculty mentored, collaborative team-based, and self-directed learning activities will continue to develop student skills and strategies for narrative, analytic and interpretative scholarly products including professional school application essays, research posters, and manuscripts. For 2018, introduced additional design elements and improved previously established design elements based on the first year of the BMP program experience, including developing the BMP Health Professions Committee and curriculum as Director of Academics feat. scientific active learning and teaching, designing with the Lab of Educational Technology BMPnavigator with technology directly supporting scientific active learning and teaching, two core required courses in the BMP, Method and Logic in Biomedicine, and Professional Communications Reflection, the latter purpose-focused on mentoring, advising, and coaching to the next steps in the BMP students careers in the health sciences.

- 2016- present Block Director, MD Curriculum Courses in the "Evidence and Discovery Block" (formerly Scientific Reasoning in Medicine Block) of the MD program at UPSOM
- 2016- present UPSOM Curriculum Committee
- 2017-2018 Chair, Small Working Group of UPSOM Curriculum Committee on MS SRP Mentoring. This group worked with AY2016-2017 MS1 Curriculum Committee Student Representatives to develop recommendations to the UPSOM Curriculum Committee for improving the effectiveness and timeliness of the process by which MS establish faculty mentorships for his or her research project proposals for Evidence-Based Medicine Applied, Research Design course, for the DSRP, and for the SRP.
- 2020-2022 Co-Chair, MD Curriculum Reform 2: Planning Steering Committee of the Three Rivers Curriculum Reform Committee. This is the second of a five phase project which will be the first major reform of the MD program since 2004. A blueprint plan of the new curriculum was completed June 2022 as part of the second phase. Curriculum Committee approved 22-4 in June 2022.
- 2021- Working Group Member, Curriculum Reform Phase 3: Formation. This is part of a projected five-year project which will be the first major reform of the MD program since

2004. 2022-2023 is the Formation Year, which will be followed by Implementation (2023), for an August 2023 rollout.

Events, including Series presentations at UPSOM

2021 – Presented two of the Quarterly Curriculum Reform Reports to the Full Curriculum Committee. These are prepared together with Mike Elnicki and we alternate who presents through the year.

2021 – Twice-monthly Curriculum Reform Steering Committee meetings of the 16-member Steering Committee. Mike Elnicki and I alternate who leads the agenda and discussion each session.

2020-2021 – Presented as Director an overview the Evidence & Discovery Block which features three Evidence-Based Medicine courses and the Longitudinal Research Program, all required components of the MD degree. Labeled ‘MD Student Research Info Sessions by the MD Admissions Committee, these are, twice monthly from September through January, 30-60 minute-long information, presentation and discussion session I do with Don DeFranco and Peter Veldkamp to the hundreds of applicants who have been invited to interview for our MD program.

2021-2023 – Have been asked and have accepted to continue with the MD Student Research Info Sessions.

8/2020, 8/2021 – BMP Café – In response to masters students request, I have designed and present the first Wednesday of the month from September through December, an appetizer with some instructional guides, of the Professional Communications Reflection course I direct for all BMP students each spring term. These are live sessions where I am assisted by BMP administrative staff, Steve Mattiace and Rebecca McMillen. In response to increasing demand from more students, we have continued with these monthly session for Fall Semester 2021. For AY2022-2023, in response to overwhelming BMP student requests, the Fall BMP Café has been integrated into the previous Spring Term only course for which I am Course Director “Professional Communications Reflection, “ which will now run from August through April beginning AY2022-2023 for the first time.

8/2022, 8/2021, 8/2020, 8/2019, 8/2018, 8/2017, - Presented the ‘Nuts & Bolts’ talk and discussion of the BMP Orientation. This presentation overviews the components and opportunities designed into the BMP, as well as, highlights the strategies for success in the BMP for students to individualize their year ahead.

2020 – Designed and presented synchronously (in-person and remote via Zoom and Panopto) the Method and Logic in Biomedicine (MLB) course required for all BMP students. Fall 2020 MLB was placed by the Provost in the Carnegie Music Hall and had to adapt to its 1920 seat space for social distancing. Fall 2020, 11 to 24 of 49 BMP students, depending on the week, took MLB in-person at the Carnegie Music Hall, with the remainder taking it remotely through Zoom.

2021 – MLB was placed by the provost back in its inaugural year auditorium, Victoria Hall 123, where it now continues to be presented synchronously – BMP students can take the weekly active learning in-class session with Poll Everywhere questions and Panopto recording in-person or remotely through Zoom, as they see fit, including switching from week to week. This Fall 2021, so far the vast majority (over 40) of BMP students take the in-class session in-person in Victoria Hall. Six students take it remotely so far.

