M.D./Ph.D. News

PENN STATE MILTON S. HERSHEY MEDICAL CENTER • PENN STATE COLLEGE OF MEDICINE

Alumni Spotlight

Stacey Clardy is currently a PGY-3 neurology resident at Penn State Hershey. She answers some questions from a current student in the M.D./Ph.D. program.

How did you decide on your residency? What role did your research interest play in your residency selection?

In terms of specialty, like many things in life, neurology found me, not the other way around. I pursued the clinical years of medical school with an open mind, realizing it would be the only opportunity I had to gain exposure to many of the fields. At the end of the year, I realized neurology was the only rotation where I was so excited each day that I woke up before my alarm clock.

In terms of choosing an actual neurology program, I knew that I wanted to incorporate a research year into my clinical training. At the time, that was less commonly accepted than it is now (it is now endorsed and encouraged as an official residency track by the American Academy of Neurology). My top residency choices became those programs that could offer the flexibility to pursue a research year and could also provide support during that time, with the latter being especially tricky since such support must be obtained by an institution outside the traditional funding methods utilized for residents. Additionally, my husband and I preferred a place where we could enjoy the outdoors and avoid long commutes. As you can imagine, only a few places in the country met all of these criteria. In the end, I felt the neurology department here at Hershey was unquestionably the most supportive of its trainees in general, and specifically of my goals, and that philosophy made the decision very easy.

You've started a family during residency. Do you believe your physician scientist career path has made it easier or more difficult to develop a balanced life compared to doing research or medicine alone?

In any career, I think there is always a struggle to balance family with career goals.

Certainly the training is longer for a dual degree program than either alone, and so I think we as M.D./Ph.D.s have to be careful

not to "put off" our plans for building a family indefinitely. I think one of the benefits of M.D./Ph.D. training is that we are forced to learn balance early on in our career, because we always want to have one foot in each door — while doing clinical training, we miss research, and vice versa.

Ultimately, it is about priorities. At the end of the day, contributing to society through your career is tremendously important, but family and relationships are the stuff of life, and I don't think we talk openly enough about this.

There is never a perfect time to start or build your family, and if you worry too much about the impact raising children may have on your career, you will probably never find time to do it.

What advice do you have about choosing a research mentor? Are there important M.D./Ph.D. issues that most graduate students wouldn't need to consider?

It is obviously important that the research is interesting to you and compatible with your career goals. Beyond that, the best advice I ever received was this: If at all possible, make sure that you choose a mentor that you respect and view as a good person in all aspects of life.

What should applicants do to make the most of their dual degree?

The dual degree lends itself to tremendous career options. The path to completing the degrees helps one learn to use it effectively, in that the training demands creativity, patience, flexibility and most importantly, unwavering determination (especially around year 5 in the program, when you have invested a tremendous amount of time and energy, but still don't have either degree!). It is important to effectively communicate your

goals to mentors and prospective employers in your career development, as they often differ from the traditional routes pursued by

Stacey Clardy

clinicians and/or researchers.

moving on from the program that you wish you had known sooner?

2010

The program is best viewed as a journey—less like a sprint, more like a marathon—and because the program is so long in duration, it is unrealistic to expect that there will not be any bumps in the road whether it be personal or family illness, difficulty with

a particular class or experiment, or even the stress of a PI changing institutions. Try to keep a larger perspective on the small challenges, and if and when these challenges come up for you or your colleagues, do not underestimate the importance of supporting each other—your M.D./ Ph.D. classmates are invaluable, and are often your best allies during your years in the program.

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Hometown Highlights

New to the M.D./Ph.D. Steering Committee

Dr. Melissa Rolls received her Ph.D. in biological and biomedical science at Harvard University. She then went on to complete a postdoctoral fellowship in conjunction with the University of Oregon and the Howard Hughes Medical Institute. Following her formal training, Dr. Rolls was appointed as assistant professor in the Department of Biochemistry and Molecular Biology at Penn State. She currently serves as director of the Center for Cellular Dynamics at University Park. Dr. Rolls' current research interests involve understanding the intracellular



events that mediate degeneration and regeneration of neuronal axons, using Drosphilia as a model system. Through her research Dr. Rolls hopes to make fundamental contributions to understanding the behavior or injured neurons. Her recent publications include articles in the prestigious journals *Nature – Cell Biology* and the *Journal of Cell Biology*. In addition, Dr. Rolls currently holds awards from the American Heart Association, the March of Dimes, and is a Pew Scholar in the Biomedical Sciences.

Dr. Kenneth C. Keiler is an associate professor of biochemistry and molecular biology at Penn State University Park. Dr. Keiler earned his Ph.D. in biology from the Massachusetts Institute of Technology. He has completed post-doctoral research in structural biology at the Institut de Genetique et de Biologie Moleculaire et Cellulaire in Illkirch, France, as well as research in bacterial development at Stanford University Medical School. Dr. Keiler came to Penn State in 2002. He studies bacterial development, looking at protein expression regulation and protein localization in



bacteria. More specifically, Dr. Keiler studies transfer-messenger RNA (tmRNA), an RNA molecule involved in protein translational regulation in bacteria. In addition to studying the physiological role of tmRNA, Dr. Keiler is currently screening for antibacterial agents that target the tmRNA pathway in collaboration with Novartis and the Broad Institute.

Dr. C. Bart Rountree is a recent member of the M.D./Ph.D. Steering Committee and a recent training faculty member. He received his M.D. from the University of Texas San Antonio; completed a residency in pediatrics at Childrens Hospital Los Angeles, Calif. and a fellowship in pediatric gastroenterology at Childrens Hospital Los Angeles, Calif. He is an assistant professor of pediatrics with a joint appointment in pharmacology where he does research on the role of liver stem cells in liver regeneration and liver cancer. His research includes three main



areas: 1) Investigating the regenerative potential of adult liver stem cells isolated from mouse models of chronic liver injury; 2) Defining the role of liver stem cells in liver cancer progression during chronic liver injury in mouse models of liver cancer; and 3) Characterizing the specific immune-phenotypes of adult liver stem cells isolated from human patients. Several M.D./Ph.D. students have rotated in Dr. Rountree's lab over the past two years. Dr. Jennifer Baccon joined the M.D./Ph.D. steering committee in August of 2010. She currently serves as an assistant professor in the Division of Anatomic Pathology and is the medical director of Autopsy Services. Dr. Baccon received her bachelor's degree from Cornell University and worked as a visiting student at Pembroke College in Oxford University. An alumnus of the University of Pennsylvania's M.D./Ph.D. program in cell and molecular biology, Dr. Baccon will bring the experience of having personally succeded in a Medical



Scientist Training Program to our steering committee. Following her M.D./Ph.D. training, Dr. Baccon continued to train in the University of Pennsylvania Hospital system, completing a combined anatomic pathology and neuropathology residency and fellowship followed by a second fellowship in surgical pathology. As a research scientist, Dr. Baccon's interests primarily lie with neuropathology. In addition, she serves on the Neuropathology, Renal Pathology and Autopsy Services at Penn State Hershey Medical Center.

Dr. John W. Wills is a distinguished professor of microbiology and immunology at Penn State College of Medicine. After earning his Ph.D. in microbiology from the University of Tennessee, Dr. Wills completed a postdoctoral fellowship at the University of Alabama in Birmingham. It was through this fellowship that he began to study viruses. He came to Hershey from Louisiana State University in 1991. Since 2005 has focused on Herpes Simplex Virus (HSV). His research focuses on the tegument – a region of the virus not well understood, but that undergoes rearrangement



of its many proteins when the virus binds to its host cell. A better understanding of the mechanism by which HSV binds and infects host cells would enable development of novel means of prevention or therapy. In addition to operating a productive laboratory, he plays an active role in teaching the students at the College of Medicine. The Graduate Student Association voted him as "Most Enthusiastic Professor" for the 2009–'10 academic year.

On the Web

We have a new website! Check it out at: pennstatehershey.org/mdphd

Also stay connected through our Facebook group, "PSU MD/PhD Program."

Research Spotlight

Individualized medicine in psychiatry

By Kathryn Erickson

Why do some drugs work in certain patients and not others? Why do blood levels of a drug remain high for longer periods of time in one patient and drop quickly in another? These are the fundamental questions that are driving the next generation of research in therapeutics. Not only is discovery of new and novel medications important, but optimizing the way in which we dose the medicines we do have, individualizing care, is equally important (Fig. 1).

One class of enzymes in the body that is critically important for metabolism of several drugs is the UGTs (UDP glucuronosyltransferases) (Fig. 2). It has recently come to light that different people may have slightly different arrays of isoforms (similarly shaped, but function slightly differently) of these enzymes in their liver and elsewhere, resulting in differential abilities to metabolize various drugs based on how well those drugs bind to the particular cluster of isoforms a person has. If we know how well the various isoforms of a UGT metabolize a specific drug we can genotype that person (examine their DNA) to learn which isoforms of UGTs they possess and in what relative amounts, and this can guide dosing or warn that certain drugs may not be appropriate for that patient.

My research characterizes UGT activity on anti-psychotic medications and correlates genotypes in humans with their ability to metabolize a drug. This is significant because some anti-psychotics, such as olanzapine, have been shown to cause severe weight gain; even to the point of precipitating diabetes in these patients. Recently, I have found that certain UGT variants can increase or decrease formation of olanzapine-glucuronides, the major olanzapine metabolites in humans, by as much as 2 fold. Increasing or decreasing formation of olanzapineglucuronide metabolites can increase or decrease plasma levels and clearance of olanzapine in humans, and plasma levels of olanzapine have been correlated with inter-individual variability in response and development of metabolic side-effects. The connection between UGTs and olanzapine metabolism will help us evaluate patients for their risk of deleterious side-effects while on olanzapine, therefore avoiding adding yet another medical problem onto a person who is already suffering.

I am currently applying this same methodology of investigation to several other drugs of the same or similar class and our aim is to contribute significantly to the quality of treatment of psychiatric patients. This work has been well received at recent meetings such as the American Association of Cancer Research and the American Diabetes Association (ADA) and is partially funded by a grant from the ADA.



Figure 1: Taken from http://ki.se/ki/jsp/polopoly.jsp?l=en&d=9785



UDP-glucuronosyltransferases (UGTs)

Figure 2 – UDP-glucuronosyltransferases (UGTs) (Adapted from http:// physiophysio.blogspot.com/2010/01/pharmacokinetics-and-and.html)

Milestones Through the Years

New Students

Richard Albertson

Education: B.S. in molecular biology (Grove City College)

Hometown: Berwick, Pa.

Awards/Honors: Chi Alpha Sigma, 2009 and 2010; CoSIDA First Team Academic All-District ; Grove City College Scroll & Key Inductee; Beta Beta Beta John C. Johnson Award Winner; Third place at Tri-Beta National Convention for Cell, Organismal, & Developmental Biology posters



Research Interests: Neuroscience, cardiology, genetics, and structural biology. I performed my first laboratory rotation here with Dr. Robert Levenson, with a focus on the effects of stimulation of opioid receptors on Wnt secretion.

Medical Interests: Neurology and cardiology

Why Penn State Hershey? I never realized how nice the Hershey area is, despite living within two hours of the area. I was also impressed with the research opportunities available not only on the Hershey campus, but also at University Park and the NIH. In addition, the friendly atmosphere was an indication that this would be a great place for my MD/PhD training.

Any Surprises Since Starting the Program? Not much has surprised me. However, Dr. Levenson was correct when he told me to start studying anatomy... back in January.

Hobbies: Swimming, reading, running, cooking, movies, spending time with friends.

Yanli Wang

Education: B.S. in computer science, biological sciences (U of Pittsburgh)

Hometown: Pittsburgh, Pa.

Awards/Honors: University Scholar of University of Pittsburgh, Outstanding Academic Achievement; National Merit Scholarship Program finalist

Research Interests: Bioinformatics, bioengineering/biotechnology. I participated in the Pitt in TanzaniaStudy Abroad Program.

Medical Interests: Pathology, radiology and internal medicine.

Why Penn State Hershey? The opportunity to experience a wide variety of research and the safe neighborhood.

Any Surprises Since Starting the Program? The large amount of small-group clinical training classes.

Hobbies: Singing, ballet, bird watching

Tulasi Khandan

Education: B.S. in chemistry (MIT)

Hometown: New Haven, Conn.

Awards/Honors: Alpha Chi Sigma; MIT Undergraduate Association Executive Board

Research Interests: Heme/onc and immunology. I completed undergraduate research at the Yale Cancer Center and the Harvard Medical School/Howard Hughes Medical Institute.

Medical Interests: Oncology, heme/onc.

Why Penn State Hershey? The college of medicine community, not just the students but also the faculty, advisors, and instructors. The tremendous support and guidance the students receive is incomparable, and the overall approach to medical education and research training is perfect for my academic and career objectives.

Any Surprises Since Starting the Program? Because I have never lived outside of a city, I did not expect to have so much fun in Hershey!

Hobbies: Running, cooking/baking, singing

Ruby Jackson-Atogi

Education: B.S. in biochemistry and molecular biology (U of Maryland, Baltimore)

Hometown: Raleigh, N.C.

Awards/Honors: Golden Key International Honor society; National Society of Collegiate Scholars; Meyerhoff Program; MARC U*STAR Pgm 9

Research Interests: Infectious diseases

(Host-pathogen interactions). I participated in the Tri-Institutional Gateways to the Lab Program and a summer research program at the University of Notre Dame

Medical Interests: Internal medicine

Why Penn State Hershey? The town and the people were both inviting. The program directors and administrator showed a genuine interest in supporting their students both professionally and personally. Also, there is ample infectious disease research so that I can pinpoint what I would like to focus my thesis work on.

Any Surprises Since Starting the Program? Learning anatomy is kind of fun.

Hobbies: Piano



Milestones Through the Years

New Students

We welcome our incoming students for fall 2009: Their orientation week finished with the annual White Coat Ceremony, which has been a Penn State tradition since 1996. In the presence of their families and friends, incoming students received their first white medical coat, a symbol of their entrance into the medical profession.

Michal Kidacki

Education: B.S. in biology (Rutgers)

Hometown: Elizabeth, N.J.; Rzeszow, Poland

Awards/Honors: Postbac Intramural Training Award, NIH

Research Interests: Cancer and signalings pathways, synthetic lethality. I completed a Postbac Intramural Research funded by NIH at Rutgers

Medical Interests: Oncology, pediatric oncology

Why Penn State Hershey? Proximity to the chocolate factory.

Entering the Lab

Shane Lloyd

PI: Henry Donahue

Wolff's Law, a central tenant of bone biology, states that bone form follows function. A classic example of this is the finding that the bones in the racquet arm of a tennis player have greater mass than their opposite arm. The mechanisms that underlie this finding are not well understood. The Donahue Lab is interested in the process of skeletal mechanotransduction, that is, how bone is able to sense and respond to force at the cellular level. Specifically, the lab is concerned with the role of a gap junction protein called Connexin43 in this process. My area of interest is in the mechanisms that lead to bone loss during unloading, such as in cases of prolonged bed rest or in astronauts floating in the weightless environment of space. I will utilize a transgenic mouse model to explore the response to unloading, pharmacological countermeasures, and the role of Connexin43 in this process.

Cody Weston

PI: James Connor

The Connor lab has a broad range of interests rooted heavily in the iron metabolism of the brain. With this focus, we examine neurologic diseases such as ALS, Alzheimer's disease, and Restless Leg Syndrome. Another emphasis is the investigation of hemochromatosis gene mutations (HFE mutations) prevalent in brain tumors. Another group within the lab investigates drug delivery and imaging methods for primary and metastatic brain tumors. As a student within the College's newly-found Center for Emerging Neurotechnology and Imaging, my work in the lab will focus on novel methods of identifying abnormal cells and proteins in the CSF with the aim of improving diagnosis and management of invasive and metastatic cancers.

Ron Panganiban

Education: B.A. in molecular biology (UC Berkeley)

Hometown: Laguna Hills, Calif.

Awards/Honors: Graduated with Honors

Research Interests: DNA repair, druginduced obesity. I participated in the HHMI Summer Undergraduate Research Symposium at Berkeley.

Medical Interests: Pediatrics

Why Penn State Hershey? Has a lot of very supportive faculty and staff who are involved in very interesting science.

Hobbies: Swimming, cooking

Eugene Cozza

PI: Todd Schell

In the Schell lab, we are investigating the role of adoptively transferred cytotoxic T cells in the treatment of cancer. Specifically, I am interested in the effects of irradiation on the tumor microenvironment in the context of T cell adoptive immunotherapy.

Katrina Heyrana

PI: Rebecca Craven

My advisor is Rebecca Craven in micro/immuno. Our lab tries to characterize the various changes required to form the retroviral capsid that permits infectivity. Though the lab has focused on molecular biology strategies in the past, we've been moving more towards structural methods of exploration lately, employing studies of assembly kinetics, electron microscopy, and NMR to extend our findings from previous genetics studies.

Jonathan Talor

PI: Akif Undar

Our lab is interested in devices for pediatric and neonatal mechanical circulatory support, including cardiopulmonary bypass and extracorporeal life support. We evaluate new oxygenators, pumps, cannulae, and other circuit components to determine which combination provides the highest perfusion quality with a minimization of vital organ injury to our patients. In addition, we are investigating microdevices for the real-time detection of various inflammatory and other cytokines during cardiopulmonary bypass.



Congratulations to recent award recipients

ALLISON CLEARY

Department of Defense Breast Cancer Predoctoral Traineeship Award

BOZO TODORIC

Judith Bond M.D./Ph.D. Award for overall performance in M.D./Ph.D. training; Ruth S. Wolfe Memorial Scholarship

CAROLINA PINZON-GUZMAN

Alumni Endowed Scholarship

EMILIE MUELLY

Travel award to attend the 2010 Wisconsin Symposium on Emotion, Madison, Wis.; 2010 Alumni Scholarship Class of 1971

FRANCIS LEBLANC

Judith Bond M.D./Ph.D. Award for academic achievement in preclinical years

Recent publications

Culnan DM, **Albaugh VL**, Sun MJ, Lynch CJ, Lang CH, Cooney RN (2010) "Ileal interposition improves glucose tolerance and insulin sensitivity in the obese Zucker rat" Am J of Phys: Gastrointestinal & Liver Phys doi: 10.1152/ajpgi.00525 PMID: 20634437

Lee AJ*, Wu X*, Cheng H, Zhou X, Cheng X, Sun SC (2010) "CARMA1 regulation of Treg development involves modulation of IL-2 receptor signaling" *co-author J Biol Chem 285(21):15696-703 PMID: 20233721

Lee AJ, Zhou X, Chang M, Hunzeker J, Bonneau RH, Zhou D, Sun SC (2010) "Regulation of natural killer T-cell development by deugiquitinase CYLD" EMBO J 29(9):1600-12 PMID: 20224552

Kivovich V, Gilbert L, Vuento M, Naides SJ (2010) "Parvovirus B19 Genotype Specific Amino Acid Substitution in NS1 Reduces the Protein's Cytotoxicity in Culture" Int J Med Sci 7:110-119

Todorich B, Zhang X, Connor JR (2009) "H-ferritin and transferring are complementary iron delivery systems in oligodendrocytes" GLIA (accepted pending revisions)

Jin J, Morse M, Frey C, Petko J and Levenson R (2010) "Expression of GPR177 (Wntless/Evi/Sprinter). a Highly Conserved Wnt-Transport Protein, in Rat Tissues, Zebrafish Embryos, and Cultured Human Cells" Devel. Dynamics [Epub ahead of print] PMID: 20652957

Pinzon-Guzman C, Shaomin Zhang S, Barnstable CJ (2010) "Protein Kinase C Regulates Rod Photoreceptor Differentiation Through Modulation of STAT3 signaling" Adv Exp Med Biol 664:21-8 PMID: 20237998

JAMES BAUER

Poster presentation at the National M.D./ Ph.D. Conference in Keystone, Colo.

KATHRYN ERICKSON

Poster presentation at the National M.D./ Ph.D. Conference in Keystone, Colo.; 2010 Alumni Scholarship Class of 1971

MELANIE DISPENZA

Travel award to attend the Montagna Symposium on the Biology of the Skin, Salishan, Ore.; Eugene M. Farber Travel Award for Young Investigators; Morgan Travel Award from the Department of Cellular and Molecular Physiology; 2010 Finkelstein Memorial Student Research Award

RYAN MITCHELL

Alpha Omega Alpha (AOA) Honor Medical Society inductee; Sylvia and Gilbert Nurick Medical Achievement award; Department of Surgery award; John Kreider CMB award; Dean's Award for Graduate Education

STEVEN STEINWAY

North American Society for Pediatric Gastroenterology, Hepatology and Nutritiongrant

SHANE LLOYD

Judith Bond M.D./Ph.D. Award for academic achievement in preclinical years

THERESA CARR

2010 Alumni Scholarship Class of 1973

Schmitt HF, Huang LZ, Son JH, **Pinzon-Guzman C**, Slaton GS, Winzer-Serhan UH (2010) "Acute nicotine activates c-fos and activity-regulated cytoskeletal associated protein mRNA expression in limbic brain areas involved in the central stress-response in rat pups during a period of hypo-responsiveness to stress" Neuroscience 157(2): 349-59 PMID: 18848603

Allen DL, Uyenishi JJ, **Cleary AS**, Mehan RS, Lindsay SF, Reed JM (2010) Calcineurin activates interleukin-6 transcription in mouse skeletal muscle in vivo and in C2C12 myotubes in vitro Am J Physiol Regul Integr Comp Physiol 298(1):198-210 PMID: 19907005

Allen DL, Greyback BJ, Hanson AM, **Cleary AS**, Lindsay SF (2010) "Skeletal muscle expression of bone morphogenetic protein-1 and tolloid-like-1 extracellular proteases in different fiber types and in response to unloading, food deprivation and differentiation" J Physiol Sci PMID: 20658214

Allen DL, **Cleary AS**, Lindsay SF, Loh A, Reed JM (2010) "Myostatin Expression is Increased by Food Deprivation in a Muscle-Specific Manner and Contributes to Muscle Atrophy during Prolonged Food Deprivation in Mice" J Appl Physiol PMID: 20595541

Talor J, Yee S, Rider A, Kunselman AR, Guan Y, Undar A (2010)"Comparison of perfusion quality in hollow-fiber membrane oxygenators for neonatal extracorporeal life support" Artif Organs 34(4):E110-116

Staying Connected . . .

Alumni News

Do you have an update? Send it to us.

Brian Blasiole

Brian is now in his final year of anesthesiology residency at the University of Pittsburgh. Currently, he is completing six months of research on traumatic brain injury and hemorrhagic shock resuscitation in mice. His future plans include a fellowship in Pediatric Anesthesia (2011-2012) followed by two years of research under an NIH T32 award.

Stacey Clardy

Congratulations to Stacey and her husband, Tom, on the birth of their first child, daughter Annamaria Catherine Clardy, in December 2009. Career-wise, at the national level, Stacey is serving as an appointed member of the Resident and Fellow Section Editorial Board for the journal Neurology. At the state level, she was elected as the Resident and Fellow Representative to the Pennsylvania Neurological Society, and organized the 1st Annual Resident and Fellow Research Day at the society's annual meeting.

Michael Saulino

Michael recently published the following articles:

Francisco GE, Saulino MF, Yablon SA, Turner M (2009) Intrathecal baclofen Therapy: An Update. PM&R 1:852-858.

Ooi YC, Saulino M, Williams KA, Sharan A (in press) Observational analysis of successful re-implantation of explanted intrathecal delivery systems. *PM&R*

Melissa Cunningham

Melissa completed the American Board of Internal Medicine "fasttrack" residency and is now in her third year of fellowship/postdoc at the Medical University of South Carolina in the division of Rheumatology and Immunology. She has completed her clinical year in Rheumatology and is currently in her protected research years. She is interested in gender bias in autoimmune diseases (SLE in particular) and is investigating the role of estrogen receptor alpha in modulating the inflammatory response (via Toll-like receptor signaling) in lupus mouse models. She won a Loan Repayment Program grant from the NIH in the health disparities subcategory and recently published the following review article:

Cunningham M and Gilkeson G. Estrogen Receptors in Immunity and Autoimmunity. *Clin Rev Allergy Immunol.* 2010 Mar 30.

Rick Conn

Rick is still in solo practice in his own family medicine office. He is adjunct clinical faculty in both the Seton Hill College Physician Assistant Program and the Carlow College Nurse Practitioner Program. This semester, he started teaching Advanced Practice Clinical Pharmacology at the Carlow College Nurse Practitioner Program.

Student Life

Congratulations to the current G1's for finishing the USMLE Step 1 Examination. Cody, his wife Jenni, and Shane celebrated by completing a week-long hiking trip in British Columbia, Canada (pictured right) before Cody and Shane entered the lab.

Darrin Bann (G2) got married to Stephani Smith on September 5, 2010. Congratulations, Darrin & Stephani.





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U.Ed. MED 11-3271 MDC

Penn State M.D./Ph.D. Program

Penn State College of Medicine M.D./Ph.D. Program provides an opportunity for students interested in careers in academic medicine and research to obtain the necessary training in clinical and basic sciences. This eight-year, dual-degree program provides students with knowledge of the breadth of clinical science plus the ability to design experiments and conduct biomedical research with modern technology.

Applications to the Penn State College M.D./Ph.D. Program can be submitted through the AMCAS application service by choosing the Combined Medical Degree/Ph.D. program.

For students in the MD/PhD Program, tuition and stipend are provided for all years in the program.

For more information, visit www.pennstatemdphdprogram.com or contact Barb Koch at 717-531-1188, bkoch2@hmc.psu.edu.

THE GRADUATE PROGRAM CHOICES FOR THE PH.D. PART OF THE DUAL **DEGREE ARE:**

- Anatomy
- Biochemistry and Molecular Biology
- Bioengineering
- Cell and Molecular Biology
- Genetics
- Immunobiology

 Integrative Biosciences (including Chemical Biology and Molecular

- Microbiology and Immunology
- Molecular Medicine

- Neuroscience

- Pharmacology

- Physiology

Toxicology)