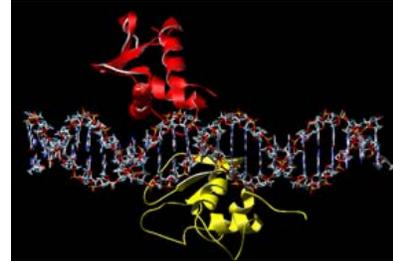


Fall 2018

In This Issue

1. Letter from the Program Director
2. Incoming students
3. Recent PhD defenses and Graduations
4. Current student publications
5. Reflections from Dean Joan Hendricks



Dear VMD-PhD Alumni and Students,
Greetings from the Penn VMD-PhD program! This newsletter contains a few things of importance.

- Information is provided on our three incoming new VMD-PhD students.
- Updates are included about PhD defenses, and recent student publications
- Rather than the usual alumni updates, we provide thoughts from Dean Joan Hendricks as she hands over the reins to new Dean, Andrew Hoffman. Dean Hendricks has been a tireless advocate of the VMD-PhD program and was the program's first female graduate. We are proud of her accomplishments, and use this newsletter to provide her thoughts and perspectives of an exemplary career at PennVet.
- Finally, we will be celebrating the 50th Anniversary of the VMD-PhD program with a Symposium March 21-22, 2019. **WE HOPE YOU WILL ALL ATTEND**
- Alumni: we need from you (1) an updated CV, (2) a photo headshot, (3) a paragraph of your research interests, and (4) honors/awards over the last 10 years so that we can update the booklets that we hand out at the 50th Anniversary event.

In other activities, the annual Combined Degree Retreat was held in August at Villanova University and included a keynote address, as well as student posters and student talks. In September we held the annual Penn Vet Student Research BBQ at Dr. Michael May's home and a good time was had by all. We are now entering a new admissions cycle and admissions interviews will be held in January 2019. Upcoming is also the annual December Dinner Party at my home. We wish you the best as 2018 comes to a close.

Sincerely,
Michael Atchison, Ph.D.
Director, VMD-PhD Program



Alumni are Online!

Check out:

<http://www.vet.upenn.edu/education/academics-and-training/vmd-phd-program/vmd-phd-alumni-profiles>

Find your profile, and send us feedback!

Incoming VMD-PHD Students

Carissa (Emerson) Hunter (Year 1)
Emory University
Genomics and Computational Biology

Emerson graduated from Emory University in May 2014. Before joining the VMD-PhD Program, she worked as a full-time Research Specialist at Dr. Anthony Chan's laboratory in the Emory University Yerkes National Primate Research Center. She explored gene therapy and stem cell replacement therapy, especially in regards to Huntington's disease. Her interests include botany, and because she grew up on a farm, animal welfare. Emerson is in the Genomics and Computational Biology Graduate Group



Elisabeth Lemmon (Year 1)
University of Delaware
CAMB Development Stem Cell and Regenerative Biology

Elisabeth graduated from University of Delaware in May 2018. She worked in Dr. Megan Killian's laboratory at Delaware University studying musculoskeletal development and rehabilitation. She also worked in Dr. Amy Biddles laboratory at University of Delaware studying the equine microbiome. Her interests include dog agility training and competitions. Elisabeth is in the Cell and Molecular Biology Graduate Group (Development, Stem Cell, Regenerative Biology track).

Ariel Shepley-McTaggart (Year 3)
Columbia University
CAMB Microbiology, Virology, and Parasitology

Ariel graduated from Columbia University in May 2014, and she has attended the University of Pennsylvania Veterinary School since the Fall of 2016. Ariel's past research includes working with Dr. James Gregory at Mt. Sinai Hospital studying immunotherapy using algal-produced recombinant peanut protein to suppress peanut allergy. She also worked with Dr. Hemali Phatani at Columbia University at the Maniatis Laboratory investigating gene expression and the role of the transforming growth factor beta (TGF- β) signaling pathway in glia-neuron interactions in murine models of Amyotrophic Lateral Sclerosis (ALS). Ariel's other interests include dance, specifically ballet as she was a professional ballet dancer for many years in New York City. Ariel is in the Cellular and Molecular Biology Graduate Group (Microbiology, Virology, and Parasitology track)



Recent PhD Defenses

Student: Jeffrey Carey

Date: April 30, 2018

Title: All the right noises: Causes and consequences of stochastic trimethylamine oxide reductase expression in *Escherichia coli*.

Mentor: Mark Goulian

BMB



Student Honors, Awards, Publications



The Frazer Award was given to Jeffrey Carey.

Current Student 2017-2018 Publications

2017

Pardi, N., Hogan, M.J, Pelc, R., Muramatsu, H., Andersen, H., Demaso, C.R., Dowd, K.A., Sutherland, L.L., Scarce, R.M., Parks, R., Wagner, W., Granados, A., Greenhouse, J., Walker, M., **Willis, E.**, Yu, J.S., McGee, C.E., Sempowski, G.D., Mui, B.L., Tam, Y.K., Huang, Y.J., Vanlandingham, D., Holmes, V.M., Harikrishnan, B., Sahu, S., Lifton, M., Higgs, S., Hensley, S.E., Madden, T.D., Hope, M.J., Kariko, K., Santra, S., Graham, B.S., Lewis, M., Pierson, T., Haynes, B.F., and Weissman, D., Zika virus protection by a single low dose nucleoside modified mRNA vaccination. *Nature* 543:248-251 (2017). PMID: PMC5344708

Willis, E. and Hensley, S.E., Characterization of Zika virus binding and enhancement potential of a large panel of flavivirus murine monoclonal antibodies. *Virology* 508:1-6 (2017). PMID: PMC5539878

Xie, S., Greenblatt, R., Levy, M.Z., Himes, B.E., Enhancing Electronic Health Record Data with Geospatial Information. *AMIA Joint Summits on Translational Science* 2017:123-132 (2017) PMID: PMC5543367

Reiner, D. J., E. G. Mietlicki-Baase, L. E. McGrath, D. J. Zimmer, K. K. Bence, **G. L. Sousa**, V. R. Konanur, J. Krawczyk, D. H. Burk, S. E. Kanoski, G. E. Hermann, R. C. Rogers, and M. R. Hayes, Astrocytes Regulate GLP-1 Receptor-Mediated Effects on Energy Balance. *J Neurosci*, 36: 3531-40 (2016). PMID: PMC4804010

De La Peña, M.A., **Jimenez, M.T.**, Hansen, L.M., Solnick, J.V., Miller, L.A., The Helicobacter pylori Type IV Secretion System Promotes IL-8 Synthesis in a Model of Pediatric Airway Epithelium Via p38 MAP Kinase. *PLOS ONE* in press PONE-D-17-12733R1 (2017)

Baumann, B., Sterling, J., Song, Y., Fruttiger, M., Gillies, M., Shen, W., and Dunaief, J.L. Conditional Muller cell ablation leads to retinal iron accumulation. *Invest. Ophthalmol. Vis. Sci.* 58:4223-4234 (2017) PMID: PMC5574447

Novais, F.O., Carvalho, A.M., **Clark, M.L.**, Carvalho, L.P., Beiting, m D.P., Brodsky, I.E., Carvalho, E.M., and Scott, P. CD8+ T cell cytotoxicity mediates pathology in the skin by inflammasome activation and IL-1beta production. *PLoS Pathog.* 13(2):e1006196 (2017) PMID: PMC5325592

2018

Zhang, Q., **Li, S.**, Wong, H-T C., He, X.J., Beirl, A., Petralia, R.S., Wang, Y-X., and Skindt, K.S. Synaptically silent sensory hair cells in zebrafish are recruited after damage. *Nature Commun.*, 9:1388 DOI: 10.1038/s41467-018-03806-8 (2018)

Mumau, M., **A, Vanderbeck.**, Lynch, E., Golec, S., Punt, J.A., Emerson, S. (2018) Identification of a multipotent progenitor population in the spleen that is regulated by NR4A1. *J. Immunol* 200: 1078-1087 (2018) PMID: PMC5793861

- Carey, J.N.**, Mettert, E.L., Roggiani, M., Myers, K.S., Kiley, P.J., and Goulian, M. Regulated stochasticity in a bacterial signaling network permits tolerance to a rapid environmental change. *Cell* 173:196-207. e14 (2018) PMID: PMC5866230
- Carey, J.N.** and Goulian, M. A bacterial signaling system regulates noise to enable bet hedging. *Curr Genet*, in press (2018). Jun 12. doi: 10.1007/s00294-018-0856-2. [Epub ahead of print]
- Pardi N, Hogan MJ, Naradikian MS, Parkhouse K, Cain DW, Jones L, Moody MA, Verkerke HP, Myles A, **Willis E**, LaBranche CC, Montefiori DC, Lobby JL, Saunders KO, Liao HX, Korber BT, Sutherland LL, Searce RM, Hraber PT, Tombácz I, Muramatsu H, Ni H, Balikov DA, Li C, Mui BL, Tam YK, Krammer F, Karikó K, Polacino P, Eisenlohr LC, Madden TD, Hope MJ, Lewis MG, Lee KK, Hu SL, Hensley SE, Cancro MP, Haynes BF, Weissman D. Nucleoside-modified mRNA vaccines induce potent T follicular helper and germinal center B cell responses. *J. Exp. Med.* 215:1571-1588 (2018) PMID: PMC5987916
- Favero M, **Sotuyo NP**, Lopez E, Kearney JA, Goldberg EM. A transient developmental window of fast-spiking interneuron dysfunction in a mouse model of Dravet Syndrome. *J. Neurosci.* 38: 7912-7927 (2018) PMID: PMC6125809
- Mumau MD, **Vanderbeck AN**, Lynch ED, Golec SB, Emerson SG, Punt JA. Identification of a multipotent progenitor population in the spleen that is regulated by NR4A1. *J. Immunol* 200: 1078-1087 (2018) PMID: PMC5793861
- Das KK, Heeg S, Pitarresi JR, Reichert M, Bakir B, Takano S, Kopp JL, Wahl-Feuerstein A, **Hicks P**, Sander M, **Rustgi AK**. ETV5 regulates ductal morphogenesis with Sox9 and is critical for regeneration from pancreatitis. *Dev. Dyn* 247: 854-866 (2018) PMID: PMC5980739
- Chatterji P, Hamilton KE, Liang S, Andres SF, Wijeratne HRS, Mizuno R, Simon LA, **Hicks PD**, Foley SW, Pitarresi JR, Klein-Szanto AJ, Mah AT, Van Landeghem L, Gregory BD, Lengner CJ, Madison BB, Shah P, Rustgi AK. The LIN28B-IMP1 post-transcriptional regulon has opposing effects on oncogenic signaling in the intestine. *Genes. Dev.* 32:1020-1034. (2018) PMID: PMC6075153
- Lemmon EA**, Locke RC, Szostek AK, Ganji E, Killian ML. Partial-width injuring of the rat rotator cuff heal with fibrosis. *Connect Tissue Res.* 2:1-10 (2018)
- Hunter CE**, Pongos AL, Chi TY, Payne C, Stroud FC, Chan AWS. Longitudinal anthropometric assessment of Rhesus Macaque (*Macaca mulatta*) model of Huntington Disease. *Comp. Med* 68:163-167 (2018) PMID: PMC5897973

Reflections from Dean Joan Hendricks

About a thousand years ago (or since it was 1973, perhaps 46), I realized that my interest in discovering the biology behind behavior, combined with a clinical degree, was going to work far better for me as a veterinarian than as an MD. I had always been keenly interested in animals but as a girl I was dissuaded by the general prohibition at vet schools against women. In college, I found I really wanted to pursue what would now be called neuroscience, and in 1972 Title IX made it costly for higher education to discriminate against women, putting their federal funding in jeopardy. It took the schools a while to get the message—I got a written notice from Cornell that they had a quota for women in 1974. In any case, in doing undergraduate research I was riveted by the variation among species and also very fond of the mice and rats I was studying. While very interested in the clinical impact for people and society, I didn't see any particular advantage to actually being trained to heal people; being trained in the many species of animals we study to learn about biology seemed more relevant—and definitely more enjoyable. I thought the pre-med office would have information on combining a veterinary degree with a Ph.D. In a limited way, they did. On the far right side of all the information, at the very bottom, was a pamphlet from a vet school in Pennsylvania; not only did they have a fully funded combined degree program, but as a private school they admitted students from out of state more readily than most veterinary schools. Obviously, this was the VMSTP at the University of Pennsylvania and I happily applied.



There are more wrinkles to the story, but the upshot was that in 1974 I enrolled in the University of Pennsylvania's NIH-funded VMSTP and began a Penn career that will end with my retirement in the summer of 2019. From the beginning, through a quirk of the way I was admitted, I took some Medical School courses, some Penn Vet courses, and also did research as an independent study. I always had Med School mentors as well as the robust support of the many veterinary school faculty interested in neuroanatomy (Peter Hand and Adrian Morrison), neurology (Shel Steinberg), and neuropathology (Jack McGrath). The Institute of Neurological Sciences was an early example of the kind of pan-university integrated faculty program that provided access to faculty from all of the health schools but also to the SAS faculty, and to speakers from around the world. I quickly connected to Adrian Morrison as my thesis advisor. The Anatomy Department (there was not yet a neuroscience department) included pioneers I was lucky to work with directly such as Elliot Stellar and Bill Chambers. There were essentially no formal course requirements, the comprehensive exams were a series of guided readings with thesis committee members. There were no letter grades in veterinary school, and the thesis defense was a conversation with the committee. There were no formal lab rotations for the Anatomy degree; it was simply a matter of finding an appropriate thesis advisor and getting to work. I don't know if it was better or worse, but it was certainly more loosely structured than today's programs--and it was perfect for me. I had time to sit in on veterinary pathology and neuropathology rounds, and neurology clinics, and to volunteer at a local general clinic in small animals. I put together clinical independent studies to satisfy my curiosity and interest in large animal ophthalmology and neurology, and had a wonderful 2-week visit with Sandy Delahunta in Cornell (in February—not the best choice climatologically). The sense of openness and access to friendly, curious, supportive faculty was always conversation away.

Frankly, all of those strengths are still a feature of the Penn VMSTP, although formalized now with joint social, curricular, and research opportunities. I learned that the discomfort of overcoming my shyness to

<http://www.vet.upenn.edu/education/academics-and-training/vmd-phd-program>

just talk to invited speakers or impressive professors was worth it to get into conversations about ideas and interpreting studies. We were all working together to find a path to knowledge. Since, as it turned out, I spent my whole career at Penn, I have been able to see how the guard rails and signposts that now

outline the MSTP/VMSTP have allowed more people, more consistently, to move into careers in clinically relevant science (and sometimes clinical careers with an extra helping of laboratory time to pursue scientific questions to advance clinical medicine—of whatever species).



Penn was, and remains, a place where creative paths including veterinarians seeking serious research credentials and careers are welcomed. Beyond Penn, the scientific and clinical community has not changed as much as I would have assumed in those years. What seemed obvious to me and to everyone involved in the VMSTP in 1974 is still often considered novel, almost to the point of heresy: non-human animals share much biology and behavior with humans. Studying them is not just a matter of reduced expense and ethical/regulatory burden, but actually a scientific advantage, as species comparisons highlight some fundamental similarities—and also fascinating differences—that provide perspective and depth to our search for robust reproducible scientific findings. While for me being a veterinarian was in part a pure fondness for the animals themselves, I also found serious advantages to being able to move from rodents (my undergraduate psychology and reproduction studies) to cats (my thesis studies about sleep physiology) to dogs (English bulldogs as a natural model of sleep apnea) to fruit flies

(showing that *Drosophila* have a sleep-like state and allowing dozens of labs to begin to apply the powerful tools of molecular genetics to dissecting the mysteries of how and why we sleep). As I became an administrator advocating for this type of training, it has been clear that the biggest advances in understanding the power of cross-species studies has been in cancer biology, where the obvious quantum leap provided by sequencing the genomes and then probing for molecular similarities in naturally occurring cancers have truly been embraced by the research community. Specific funding opportunities, both from the NIH but also from private foundations, have followed. There is never enough support, but as the science proves the value of working not only across species but also across disciplines in teams, advances are attracting more excitement and support. We can only hope—and staunchly advocate for—other crucial areas that need to benefit from comparative approaches to also pay attention to the important advantages. Gene therapy seems poised to really get there next.

I have been able to watch the growth of the VMSTP/MSTP programs as Skip Brass and Mike Atchison forged an every-tighter working relationship, and learned from each others' ideas. While the VMSTP is smaller in numbers than the MSTP, the applicant pool has steadily increased, and the quality of both programs is superb—and interrelated. Specific T32 grants for the VMSTP to support areas where studies across species are not only useful but vital—such as infectious diseases—has also been supplemented by the many University Centers and incentives to work across institutions at Penn.

Beyond the importance of comparative medicine, is there a specific strength to the VMSTP's approach of integrated co-curricular training? I was particularly delighted to find the program in 1974, however, because I was certain I wanted to do clinically relevant research, and I didn't want to waste any time.

The VMSTP allowed me to do exactly that—and I think continues to serve that purpose for like-minded applicants. Even more, though, the ability to work simultaneously with clinician-scientists and bench scientists across the University gave me a broad perspective on my own work and on what was possible as I entered a life of research and teaching. Focus and expertise in a narrow area is crucial, and frankly having more focus would have benefited me. But having many broad lines of thought available to me at all times was intensely fun and stimulating—and remains so today.

Why do it all at once? As I realized during my career bridging clinical and laboratory studies, the approach and culture of the lab and clinic are distinct and often truly separate. The distance in the approach (clinicians react and work in teams; hypothesis-driven researchers contemplate, generate testable hypotheses, and often initiate their work in solitude though collaboration is more and more vital

for executing good work). Teamwork, sharp descriptive skills and empathy are crucial to being a good clinician; independence of thought, analytical skills, and objectivity are vital strengths for the hypothesis-driven researcher. Their daily rhythms are incompatible (clinicians expect 12-16 hour days starting around 6am plus on-call; lab scientists tend to have later starts, but commonly go late into the night and even around the clock but motivated by their own enthusiasm). Never stopping for lunch, or other requirements of daily life such as child-bearing or healthcare is the typical clinician's ethos; lunch, happy hours, cocktails, and retreats are important work tools for laboratory researchers. Even as a young faculty member I found myself routinely trying to explain these groups to each other after completing a basic science Ph.D. and then joining a clinical department. As Dean, the division between lab researchers and clinicians was harder to bridge than other divisions. Harder than between veterinarians and other healthcare areas; between students and faculty; and even between men and women. The joint VMSTP (and of course MSTP) weaves together the best of clinical and laboratory science into every aspect of developing successful candidates. We never have the luxury of indulging in thinking the other guys have it easy—we ARE the other guys. Ideally the clinical methods of detailed observation and broad embrace of complex problems can be strengthened by the analysis and focus of the hypothesis-driven researcher. Objectivity can test, strengthen, and refine the results of the passionate mission to cure disease or prevent suffering.

In the long run, reproducible, high-impact outcomes can be achieved. And when one adds the breadth of the veterinary multi-species training it can be even more delightful. Vets cannot be blinded by anthropocentrism, immersed as we are in the wonders of various body plans and different physiological solutions to the same problem. The advances may be agonizingly slow in coming, but the promise is that they may be game-changing.

So, salud and mazal tov to the VMSTP! Brainchild of Ralph Brinster, crown jewel of Penn Vet's research training, and hope for the future of academic veterinary medicine! I would not be who I am without you, and I see others with the same debt*.

*Which, by the way, is another OBVIOUS but far too mundane an aspect to mention—I literally never had any educational debt. That made a huge difference, too!

Joan C. Hendricks, V.M.D., Ph.D.

Gilbert S. Kahn Dean Emerita

School of Veterinary Medicine of the University of Pennsylvania

Upcoming Events:

December Dinner Party at the Program Director's Home.

March 21-22, 2019

VMD-PhD 50th Anniversary Reunion Symposium

You are all invited to celebrate 50 years of the program's existence.

The event will include student talks and posters, alumni talks, former director reflections, and vignettes of synergies between PennVet and the wider University and beyond.

A registration page will be up soon. There is no charge for attending.

Please put this on your calendar. We truly hope all our alumni will attend. We look forward to seeing you all there.

Remember, we need from you (1) an updated CV, (2) a photo headshot, (3) a paragraph of your research interests, and (4) honors/awards over the last 10 years. We will need this information to update the Alumni/Current Student booklets.

We want to know....

New position, promotion, patent, publication, etc.? Please share your news!
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