CELL AND MOLECULAR BIOLOGY STUDENT NEWSLETTER

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IN THIS ISSUE

LETTER FROM THE EDITORS

Dear students, faculty, and alumni,

We are excited to announce our upcoming "Pie a PI" event to raise money for the Children's Scholarship Fund Philadelphia. All members of the CAMB community can purchase raffle tickets for the opportunity to put a pie in the face of one of the following PIs: Steve DiNardo (DSRB), Mickey Marks (CPM), Craig Bassing (CB), Matthew Weitzman (MVP), Valder Arruda (GTV), or Tom Jongens (GGR). In addition, one lucky first-year student will be chosen to pie CAMB chair Dan Kessler. The drawing will be held on March 14 (pi day) and the event will be held shortly after. All of these PIs will be pied, so it will surely be a memorable event! More information about the fundraiser, including how to purchase raffle tickets, can be found on our blog: **http://cambnewsletter.wix.com/blog**.

This issue marks one year of the CAMB Student Newsletter. Thank you to all of the students who have contributed to the newsletter during its first year, the alumni and faculty who agreed to be featured, and all of our readers for their support and advice. We hope that the newsletter continues to keep members of the CAMB community connected.

Sincerely,

Kate Palozola and Neha Pancholi

Editors-in- chief

RESEARCH SPOTLIGHT

Partial cross-protection of canine influenza vaccines

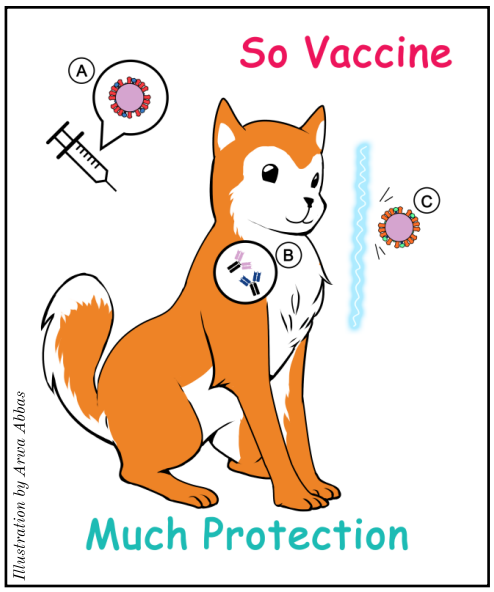
Annie Chen

Influenza A viruses, the causative agent of the annual flu, infect birds and some mammals. The viruses are categorized into different subtypes, depending on the types of hemagglutinin (HA) and neuraminidase (NA) proteins located on the surface of the viral envelope. The trivalent flu vaccine contains HA components of the three circulating strains. These viruses undergo significant genetic drift, necessitating an annual update of the flu vaccine. The effectiveness of the vaccine depends on how well the viruses in the vaccine match those in circulation, but antibodies made in response to the vaccine may still provide cross-protection to related viruses.

Dr. Scott Hensley's lab investigates antigenic drift of influenza viruses and factors that affect vaccine responsiveness. Elinor Willis, a V.M.D.-Ph.D. student in the lab, recently published a paper in *Vaccine* investigating cross-protection of the influenza antibody response in dogs. In 1999, an interspecies transmission of the equine H3N8 virus was first found in racing greyhounds and later became endemic in the United States. Canine H3N8 (cH3N8) virus causes dog flu that is usually mild, although some may develop a severe and fatal illness. A vaccine for cH3N8 became available in 2009 and has been shown to be effective in preventing severe disease caused by cH3N8 infection. Another subtype, H3N2, was isolated in dogs in South Korea in 2006-2007 and was introduced in the Unites States in 2015, causing a large outbreak in the Midwest. There are currently two conditionally licensed cH3N2 vaccines. Since the canine H3N2 (cH3N2) strain shares the H3 hemagglutanin (HA) with H3N8, Elinor sought to determine whether the cH3N2 and cH3N8 strains are antigenically related, and whether the cH3N8 vaccine provides cross-protection against the cH3N8 strain.

Elinor Willis, MVP

Most vaccines are designed against the HA protein, which consists of a stalk



This study explored the benefits of the commercially available canine H3N8 influenza vaccine against an avian H3N2 influenza virus that has been circulating in dogs. Willis *et al.* tested the H3N8 vaccine in a mouse model of influenza infection. They demonstrated that mice previously vaccinated with H3N8 had limited viral replication in the lung during subsequent H3N2 infection. Future studies conducted in dogs may provide evidence on the efficacy of this vaccine against related influenza viruses. The figure above outlines the potential mechanism of this partial protection.

A) Vaccination with the commercially available H3N8 vaccine.
B) Generation of antibodies against conserved viral glycoprotein stalk regions and internal proteins.
C) Cross-reactive antibodies elicited by vaccination can limit infection by H3N8 viruses.

and a globular head domain. five antigenic sites in the globular head of H3, while the stalk domain was more conserved. cH3N2 and cH3N8 are also predicted to have different N-linked glycosylation patterns in HA. Using sera from mice vaccinated with either the cH3N8 or the cH3N2 vaccine, she conducted an enzyme-linked immunosorbent assay (ELISA) to assess antibody reactivity and found that the cH3N8 vaccine induced an antibody response against the cH3N2 virus, and vice-versa. Vaccines may also contain internal viral proteins, so Elinor conducted ELISAs using recombinant HA proteins to test whether the antibodies bound to HA. Surprisingly, the antibodies in sera from cH3N8-vaccinated mice did not bind well to the HA recombinant protein from the cH3N2 virus. ELISAs using chimeric H5/H3 HA protein with an H5 globular head and an H3 stalk or an H5/H1 HA protein showed that antibodies from both cH3N8 and cH3N2 vaccines bound the H3 stalk domain but not the H1 stalk domain. Both the cH3N8 and the cH3N2 vaccines elicited antibody responses against internal viral proteins and epitopes on the HA stalk domain of cH3N2 viruses, but only the cH3N2 vaccine elicited an antibody response against the epitopes on the HA head domain of the cH3N2 virus.

Since cH3N2 infections do not cause morbidity or mortality in mice, Elinor compared vaccine efficacy by measuring viral loads in the lungs. Six out of nine mice vaccinated with cH3N2 had no detectable lung viral titers after infection, but seven out of eight mice vaccinated with cH3N8 had viral titers, though lower compared to those in unvaccinated mice. This suggests that the cH3N8 vaccine helps limit cH3N2 replication in the lung, but does not provide sterilizing immunity against cH3N2 infection.

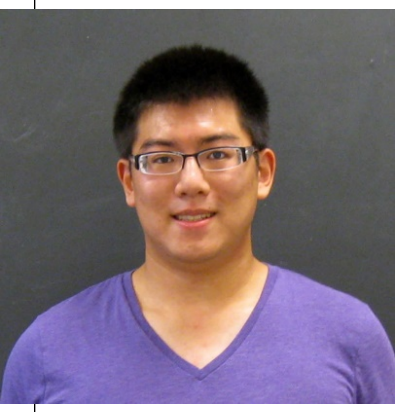
Vaccines take time to generate, and it can be useful to determine whether existing vaccines are effective against new influenza subtypes. While these studies were not performed in dogs, mice have been used as a model system to investigate antibody responses against other influenza viruses. Elinor's results show that the cH3N8 vaccine does not provide complete protection against the cH3N2 virus, and the conditionally licensed cH3N2 vaccine should be used in areas with both cH3N8 and cH3N2 viruses.

Willis, E., Parkhouse, K., Krammer, F., and Hensley, S.E. Canine H3N8 influenza vaccines partially protect mice against the canine H3N2 strain currently circulating in the United States. *Vaccine* 2016;34:5483-87.

En sweet: The subtleties of glucose utilization and compensation

Gleb Bazilevsky

Metabolic flexibility and rewiring is a distinctive feature of the cellular stress response and oncogenesis. The staggering breadth of adaptive pathways simultaneously promises a wealth of therapeutic targets while also acting as obstacles to effective therapies. Therefore, interest centers on linchpin metabolic actors as accessible handles for throttling cellular growth and survival. This idea is exemplified by a study appearing in the October 2016 edition of *Cell Reports* by Steven Zhao, fourth- year graduate student in the Cancer Biology program in the laboratory of Dr. Kathryn Wellen.



Steven Zhao, CB

The Wellen laboratory studies the pathways of production and utilization of the metabolite acetyl-CoA, which is an essential unit for carbon flux, macromolecular biosynthesis, and epigenetic protein modification. The lab uses cell line and animal models through genetic, metabolomic, and proteomic analyses to interrogate the cycling of acetyl-CoA as an essential process that can be a chokepoint and a lever for controlling cancer cell growth. Here Zhao, et al. trace the compensation mechanisms for glucose-derived acetyl-CoA production. The study argues that extracellular acetate can somewhat compensate as an alternative source for acetyl-CoA and is sufficient for restoring some acetyl-CoA dependent processes and viability to transformed cells.

Nuclear and cytosolic acetyl-CoA primarily derives from glucose through the TCA cycle and the activity of ATP-citrate lyase (ACLY). Actively proliferating cells are known to be dependent on ACLY for *de novo* lipid synthesis and other processes to the point that ACLY inhibition can arrest the growth of immortalized cells. Zhao, et al. observe that immortalized MEF and glioblastoma cells drastically slow down cycling upon ACLY ablation. Unfortunately, cells escaping this ablation have a selective advantage that causes them to repopulate the niche with wild-type ACLY cells.

The backbone of the paper consists of the surprising phenotypes the immortalized cells exhibit upon ACLY deletion. At once, it was apparent that the stable knockout clones were extraordinarily debilitated. That there was any cell survival was itself surprising, as previous whole-organism deletions showed that ACLY loss was embryonic lethal. "Frankly, I wasn't even sure the cells were going to be viable long term without it," says Zhao. For his persevering cultivation of the mutants Zhao was rewarded with the clearest picture yet of cell dependence on ACLY and the ability of other acetyl-CoA pathways to compensate for ACLY loss as a model for ACLY-oriented therapy.

Zhao thoroughly demonstrates that total ACLY loss causes a major increase in acetyl-CoA production by acetyl-CoA synthetase (ACSS2) from nonexistent to predominant in both the MEF and glioblastoma models. He confirms that the ACLY knockouts cease slowly dying and begin to proliferate again

at partial speed only when the cells are exposed to physiological concentrations of extracellular acetate, the substrate for acetyl-CoA synthesis by ACSS2. Stable isotope tracing experiments corroborate the near cessation of acetyl-CoA production, fatty acid synthesis, and ketone body synthesis from glucose-derived carbon. The tracing experiments present an almost complete switch to acetate-derived carbon to restore nucleocytosolic acetyl-CoA levels back to wild-type levels. Together, these findings indicate a major reprogramming event when the key ACLY enzyme is lost, shifting the burden of acetyl-CoA production and fatty acid synthesis onto ACSS2. Interestingly, the combined deletion of ACLY and ACSS2 produces a pronounced toxic effect. This promising phenotype is ripe for further investigation and therapeutic leveraging.

Another known consequence of ACLY inhibition is a profound decrease in global histone acetylation. Surprisingly, compensation by ACSS2 could not rescue this observed decrease either globally or at specific histone tail residues. Although the levels of available nucleocytosolic acetyl-CoA were restored, acetylation at H4K5, H3K14, H3K18, H3K23 and H3K27 remained low until extracellular acetate was brought to ten-fold excess over physiological concentrations. This result is both frustrating and stimulating for Zhao, remaining unanswered and yet presenting an enticing avenue for further study. Zhao elaborates that "[the acetylation result] tells us there's obviously much more that ACLY does for the cell besides strictly acetyl-CoA production that we're still unclear about," and ranks elucidating the underlying mechanism of action as one of his top priorities as the work continues. Further priorities for Zhao include understanding the extent and profile of the compensation for ACLY ablation *in vivo*. As seen in the cell models, ACSS2 levels increased because of ACLY deletion in epididymal and inguinal white adipocyte deposits. Moreover, the same enrichment was seen for acetate-derived acetyl-CoA and fatty acids. Nonetheless, *de novo* lipid synthesis decreased and remained decreased in some of the tested adipocyte populations, indicating a complex set of tissue-specific responses wherein glucose and acetate utilization may have differing roles. The elucidation of how these different tissues respond to ACLY loss, through ACSS2 or other unknown mechanisms, would go far to identifying the most promising pathways for ACLY therapies.

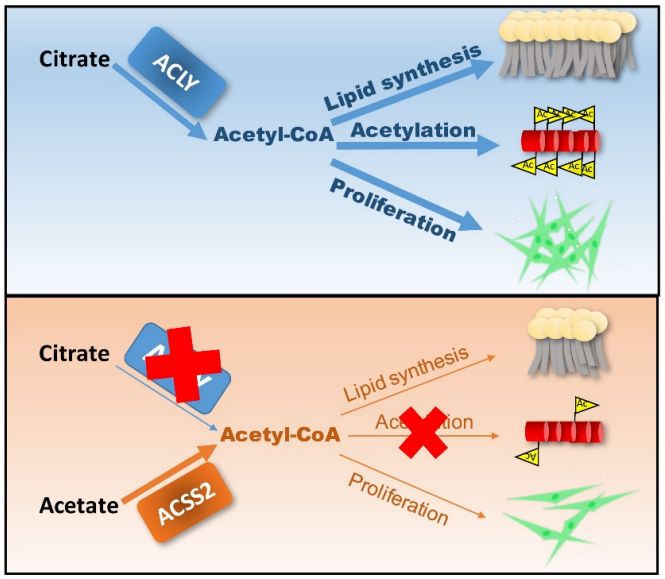


Illustration by Siddharth Kishore

ATP-citrate lyase (ACLY) is the predominant means of acetyl-CoA production, which is important for lipogenesis, maintenance of histone acetylation marks, and cell proliferation. ACLY deficiency causes upregulation of acetyl-CoA synthetase (ACSS2). Under ACLY deficiency, ACSS2 requires exogenous acetate to restore acetyl-CoA levels. This leads to a partial rescue of lipid synthesis and cell viability but not histone acetylation.

Steven Zhao continues to study acetyl-CoA regulation and metabolism and is currently focusing on examining the *in vivo* contexts for these assembled findings.

Zhao, S., Torres, A., Henry R.A., Trefely, S., Wallace, M., Lee, J.V., Carrer, A., Sengupta, A., Campbell, S.L., Kuo, Y.-M., Frey, A.J., Meurs, N., Viola, J.M., Blair, I.A., Weljie, A.M., Metallo, C.M. Snyder, N.W., Andrews, A.J., and Wellen, K.E. ATP-citrate lyase controls a glucose-to-acetate metabolic switch. *Cell Reports* 2016; 17:1037-52.

WHERE ARE THEY NOW?

Geoffrey Hannigan

Lexy Stanley

Most graduate students who want to pursue the academic route aim to complete a "normal" postdoctoral fellowship in a basic research lab at a prestigious institution. CAMB alumnus Geoffrey Hannigan (GTV) is setting himself apart from others on this path by keeping "all his doors open." Geof earned his Ph.D. in Dr. Elizabeth Grice's lab, where he investigated viral communities on the skin in relation to wound healing and open fractures. After defending in 2015, he began his postdoctoral research at the University of Michigan in the lab of Dr. Pat Schloss. As a postdoc, Geof investigates the microbiome of the gut, specifically identifying the viruses in the human gastrointestinal (GI) tract. Geof focuses on developing bioinformatics programs to study viral communities and their effects on colorectal cancer and GI infections. "While a lot is known about bacteria, [the extent of] viral diversity is still fairly unknown. There are [open-source bioinformatics pipelines] like QIIME and MOTHER (written by his current PI) for bacteria, but nothing for viruses." Geof aims to "establish a niche" for [himself] in the field of virology, perhaps by writing such programs.

While this may seem like the traditional postdoctoral path, Geof isn't closing the door on industry. He is also a member of the advisory board for Smart Phage, a start-up company that is based in Washington D.C. Smart Phage is developing custom synthetic bacteriophages. These custom bacteriophages are being designed as therapeutic tools to fight potentially antibiotic-resistant bacterial infections, as well as for other human microbiome therapies. "Before I came to Penn, I hadn't thought about industry, but when I came to Penn, I was shown that industry was a viable option so I didn't want to close that door," says Geof. He found the Smart Phage advisory position through a former classmate at Penn. He says there is "a lot of potential in the microbiome and virome," and that even if "you go into academics, there's always a lot of room to consult with companies. As long as the science is cool, it's always a good opportunity." There are many types of jobs "within the category of industry," muses Geof, so students should not write off the non-academic path until they have "explored it more thoroughly." This advice especially pertains to students who are undecided about the ultimate trajectory of their career path.

In addition to his postdoctoral research and start-up advising, Geof has been writing a blog since 2013. Through his blog "Prophage," Geof aims to "provide thoughtful discussion" about current scientific topics in bacterial and viral science and to offer "insight into the life of a biomedical scientist." His blog posts are thoughtful and knowledgeable accounts about his path to his current position, and they highlight the hottest topics in the bacterial and viral world. Geof was inspired to start a blog by a postdoctoral researcher in the Grice lab, who credited blogging with helping him meet new people and publicizing his research. Geof also says that blogging gives him "experience with writing because you have to keep up the writing constantly." He

recommends that students considering a career in medical writing try blogging as experience to "just write." He also posts shortened versions of his scientific thoughts on Twitter.

Geoffrey Hannigan, GTV

Geof credits his success and desire to pursue research to "a lot of people" he was "fortunate to have in [his] life who exposed [him] to science." His high school biology teacher, Dave Rowe, was "good at exposing students to the sciences and to all of the opportunities out there." He was the first to pique Geof's interest in the "virology stuff [he's] still doing today." Geof's primary career goal is to secure a principal investigator position at a university, but he is keeping his options in industry open with the advising he's doing with Smart Phage. His sentiment is that going into industry after a postdoctoral experience in academia is easier than going into industry after being a faculty member. He views his post-doctoral research as a "great stepping stone to build up skills and experiences" for either an academic faculty position or a career in industry research.

What are Geof's wise words for students looking to go into academia, but perhaps also keeping their minds open to industry? "It's a tough process, finding a postdoc. It's one of the bigger decisions you will make up to this point in your life. You don't get to do rotations like in grad school. You get one day to feel the lab out. Find someone you respect and who is doing interesting science." He also recommends "think[ing] about where you're going to. When the day is over, what are you going to go do?"

"It's the most important thing to have passion for what you're doing," Geof advises. He acknowledges that it is important to work hard, but "if you're curious and motivated, the long hours and work will come." His best advice? "Don't close doors. Don't totally write off industry or academia." Geof offers a great example of the ability to incorporate both paths into one postdoctoral experience.

To hear more from Geof, visit his blog at http://prophage.blogspot.com/ or follow him on Twitter (@iprophage).

Margaret Fleetwood

Neha Pancholi

Most students begin graduate school planning to pursue a traditional academic career path. As the years pass, some maintain this desire, while others explore so-called "alternative" careers to identify the path that excites them. Yet there are a few students, including CAMB alumna Margaret Fleetwood (DSRB), who plan from the beginning to pursue an "alternative," non-research career.

When Margaret began graduate school in 2005, she estimated that 98% of her peers ostensibly planned to complete academic postdoctoral fellowships and continue toward tenure- track faculty positions. Margaret, however, knew that she wanted to enter the field of intellectual property (IP). She credits her interest in IP to her undergraduate advisor, who recognized that Margaret's talents and interests were apt for this field. Margaret's advisor connected her with IP professionals, and after some informational interviews, her interest in IP had been piqued.

Margaret Fleetwood, DSRB

When Margaret applied to graduate schools, she judged schools not only on their academic programs, but also on the connections they would provide to the IP world. She ultimately chose Penn because of its plethora of legal and business connections. In 2012, Margaret completed her doctoral work on the regulation of the human growth hormone locus, co- mentored by Drs. Steve Liebhaber and Nancy Cooke. Today, Margaret is a project manager at the University of Chicago's technology transfer office, the Polsky Center for Entrepreneurship and Innovation, where she is involved in patenting and licensing technology generated by the university. Margaret serves as a liaison between the commercial and academic realms to facilitate partnerships between them. She works on diverse projects simultaneously, and her responsibilities include translating science to companies and explaining to faculty the aspects of their research that can be patented. Margaret notes that the major skills from graduate school that she uses in her job are project management and science communication.

In addition to her project manager position at UChicago, Margaret is pursuing a law degree in intellectual property law at the Chicago-Kent College of Law at Illinois Institute of Technology. Currently in the third year of a four-year program, Margaret laughs at the comparison between graduate and law school. Law school is "so much easier mentally than grad school," she says. "[In graduate school] you bang your head against the wall until you get there…You make it work." In contrast, she describes law school as an environment where you take exams and either you succeed or you do not. Her experience working in technology transfer has also prepared her for much of the material covered in law school. However, she does stress that balancing work and school has been challenging. She is passionate about her job and often works after normal business hours, which cuts into time for schoolwork. It can be especially difficult, she says, to prioritize theoretical tasks like studying over the consequential, real-life tasks of her job. Her advice for anyone seeking to follow a similar path is to have work and life in order before starting law school. She stresses the importance of making life easy and living close to school if possible. Professional night programs like hers are less intense than standard law school programs, and some even have programs specializing in IP.

She advises current students to start thinking about careers early and discourages using a postdoctoral fellowship to bide time. "You can ride the train until it hurts," she says. Margaret did not complete a postdoctoral fellowship, explaining that it would not have helped her reach her current position. In certain non- academic fields, she says, postdoctoral experience can actually be a detriment, as it suggests that the applicant did not prepare for their career path early enough. For students interested specifically in IP, Margaret stresses the importance of gaining relevant experience while in graduate school. Margaret was a fellow at Penn's technology transfer office, Penn Center for Innovation, which she says provided "awesome, awesome experience." The type of work that she completed as a fellow was directly relevant to the work she does today. Margaret was also a member of the Penn Biotech Group where she worked on two IP-based projects. These experiences set her apart when she was applying for jobs, but today, this type of prior experience is expected of all candidates. Interested students can also complete the patent bar exam while in school, which is a requirement for almost everyone wanting to practice IP in a legal environment. Last, Margaret emphasizes learning IP terms, such as "prior art," "patent litigation," and "patent prosecution," before applying for jobs. She recommends reading IP pamphlets or websites to become comfortable with the language since candidates are expected to speak knowledgeably about the field during interviews.

Margaret entered graduate school as one of a few students interested in a non-academic career path. She remembers the frustration she felt with "the academic bubble" while in school, but in retrospect, she feels that CAMB prepared her well. "I loved CAMB," she says. "I didn't love being a grad student." She credits the CAMB administration with preventing students from "falling through the cracks," and with organizing informative events that prepared her for a career outside academia. Margaret, like other alumni, also speaks very highly of the CAMB holiday parties. Contact Margaret to learn more about IP careers at **MFleetwood@tech.uchicago.edu**

Getting to Know Your Program Chair:

Valder Arruda, GTV

Lindsey Weed

Valder Arruda, M.D., Ph.D.
Associate Professor of Pediatrics and GTV Program Chair

Dr. Valder Arruda began his career in Sao Paulo, Brazil as a clinician specializing in hematology and hemotherapy. His first job was to organize a hemophilia treatment center at the University of Campinas to attract and treat a greater number of patients. After almost a decade of clinical training, he received his Ph.D. in molecular biology studying the molecular basis of factor VIII deficiencies, which are responsible for 80% of hemophilia A cases. At the time, sequencing evidence had identified a number of novel factor VIII mutations in hemophilic patients. Dr. Arruda came to the realization that if you wanted to cure a factor VIII deficiency molecularly, you would need to replace the gene. While at a hemophilia conference, he noticed a section on gene therapy and says, "I became very attracted to the idea. I thought it was something that I'd like to learn a little bit more about. That's when I came to work in Dr. Kathy High's lab as a postdoc."

What was originally supposed to be two years in the United States turned into an invitation to join the Penn faculty. "I struggled with the decision to stay at Penn or return to Brazil, but came to the conclusion that as a clinician performing research in gene therapy, there are very few times you see things migrate from the bench into humans. It spoke very highly about the institution for me, and if it wasn't for that I wouldn't have stayed."

Dr. Arruda recently succeeded Dr. Dave Weiner as the Program Chair for GTV. He had been involved in the program for many years when he was asked to be Vice Chair in 2015. This gave him time to observe an admission season before becoming nominated and elected to the Chair position in 2016. His responsibilities include organizing GTV faculty committees to oversee the program's activities, such as the student seminar series and the invited speaker seminar series, and managing the required student courses. He and his support team try to make these classes accessible to faculty that want to teach and provide feedback to the directors of the course. In his own words, "I facilitate conversations with people. This way everybody contributes a bit to who they think should be invited to speak or how to reorganize some of the aspects students don't seem to like about a course. It's a very dynamic thing."

When asked what his best advice is for students progressing through the program, he exclaims without hesitation, "Abuse all the resources Penn has! Take advantage of them! In a small geographic area there are a lot of opportunities within your reach. The nature of Penn is to collaborate." His hope for this year is greater attendance at the GTV student and invited speaker seminar series. "These talks are intended to open your mind a bit, even if the research being discussed isn't applicable to your own. As you progress in your career, you find yourself having to learn about many different areas. Even a basic understanding of a subject can aid you in conversing with someone that is an expert so you can better understand what it is you want to accomplish and how you want to do it."

SPECIAL INTEREST

Broadening the Penn Medicine Community: A Profile on Vice Dean Eve Higginbotham and the Office of Inclusion and Diversity

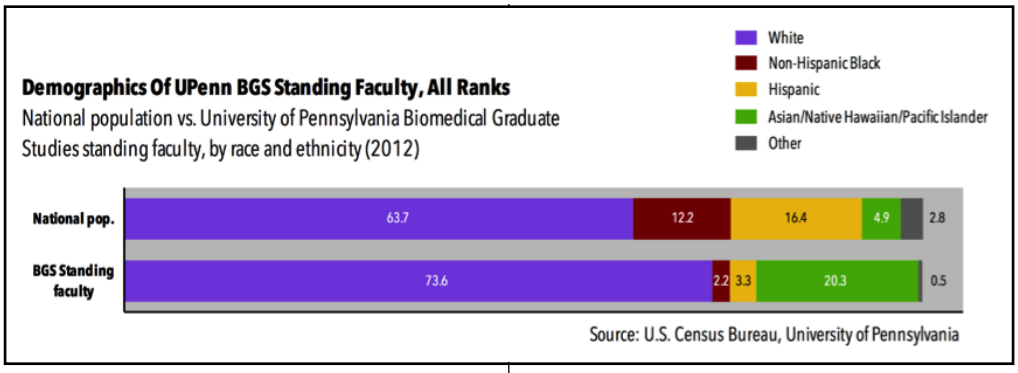
Francesca Tuazon

Launched in August 2013, the Office of Inclusion and Diversity is a relatively new addition to Penn Medicine that supports, evaluates, and generates programs that promote diversity within our research community. Prior to the generation of this office, initiatives and programs to broaden access in the medical school and biomedical graduate studies, from graduate students to faculty, were handled by separate entities. There was a need for an executive-level office to direct a more cohesive and coordinated effort. The Office of Inclusion and Diversity (OID) is a product Penn Medicine's five-year Strategic Plan, "Shaping the Future of Medicine," which incorporates goals set by President Gutmann's Action Plan for Faculty Diversity and Excellence. Overall, the OID represents an administrative commitment to fostering innovation at Penn through inclusion and diversity.

Eve Higginbotham, M.S., M.D. is the Vice Dean for Inclusion and Diversity and, alongside four other staff members, comprises the OID. Interestingly, Dr. Higginbotham made the conscious decision to put 'Inclusion' first when naming the OID, thinking "rather than call this 'Diversity and Inclusion,' let's call it 'Inclusion and Diversity' to emphasize the *environment* so that any of our efforts to bring in different perspectives will be sustained; so everyone wants to stay at Penn [and] it's not about specific groups or a specific gender…, but it's everyone including [different] cultures." To Dr. Higginbotham, inclusion at Penn must span a "broad landscape" that embraces people of all ethnicities, genders, religions, disabilities, sexual orientation, historical traditions (like first-time college graduates), and socioeconomic, veteran, and immigrant statuses. This is a refreshing view from a compassionate leader: "Being an African-American woman in academia, I [have] experience! I can't say that... I'm a trained diversity professional, but I've lived the life. I know what it's like to not only go through the process of building a scientific career (as well as a career in medicine) at many different levels, but I also… know what challenges are ahead." One of Dr. Higginbotham's first initiatives was to evaluate Penn Medicine's attitude toward promoting diversity, which she describes as

"ready and receptive, but not proactive." She believes the OID can provide the direction necessary and notes that "leadership really does make a difference in…galvanizing an organization to embrace change." Now, after creating the OID, Larry Jameson (Dean of the School of Medicine) has incorporated "Inclusion and Diversity" as one of the Core Values of Penn Medicine, which reaffirmed to Dr. Higginbotham "that what we [in the OID] were trying to build was important to the institution."

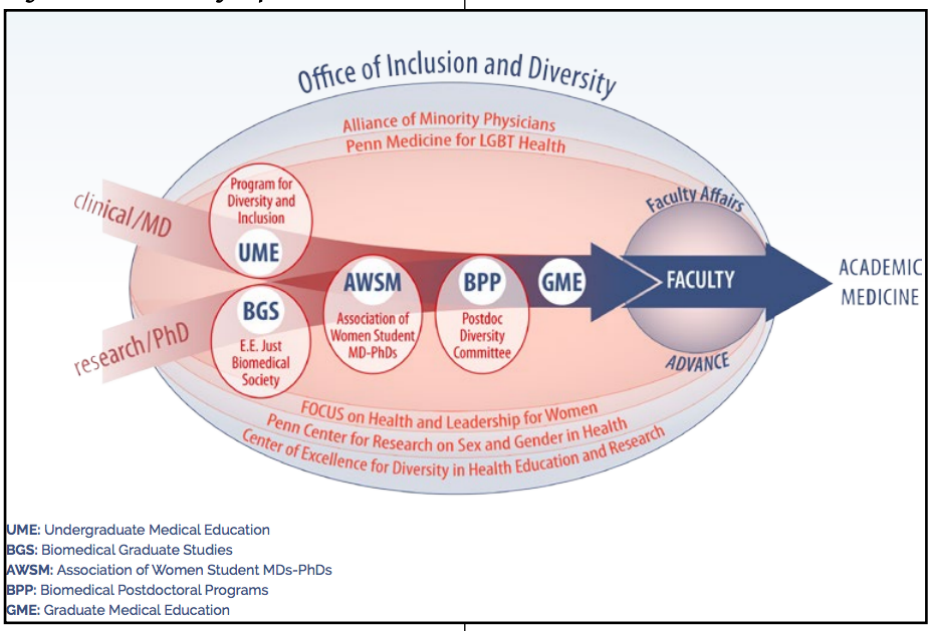
Figure 1. Demographic of UPenn BGS Standing Faculty Compared to National Population[2]



Evaluating the status of diversity in Penn Medicine

First, the OID began collecting and analyzing data to raise awareness of current unintentional discrimination and to, hopefully, measure progress against it in the future. The OID has analyzed potential gender differences in salary and space allocation in basic science departments and found that while there is no gender bias in salary, there may be a male basis in allocating research space[4]. This has started a dialogue about ensuring gender equity with the goal of measuring progress since this analysis will be updated and disseminated every two years. The OID has also compiled and tracked the demographics of standing faculty since 2009 and reports the improved representation of women, all minorities, and historically underrepresented minorities in medicine (URM, defined as African American, Latino, and Native American)[1]. While representation of URM has improved, URM populations remain grossly underrepresented when compared to the demographics of the national population; although Latinos comprise over 16% of the national population and African Americans 12%, at most only 7% of Penn faculty belong to *either* demographic (Fig. 1).

Figure 2. OID Faculty Pipeline[1]



Setting the foundation for a diverse faculty

The three goals of the OID are to Recruit, Retain, and Reaffirm and these goals are primarily aimed at generating a more diverse body of faculty. The emphasis on diversity at the faculty-level stems from the importance of having role models. As described by Iris Bohnet (the director of the Women and Public Policy Program at the Harvard Kennedy School) to the Harvard Business Review[3], "Being surrounded by role models who look like you can affect what you think is possible for people like you." To this end, the OID is working to improve the recruitment process to attract diverse and talented candidates. First, the OID has streamlined the hiring process not only to make it more efficient, but also to enable Penn to be "nimble" during the recruitment process, which makes it more competitive when recruiting exceptional candidates. Second, the OID is exploring ways to make the recruitment process more objective to "mitigate any influence of bias." Though these explorations are still underway, the OID is less focused on implementing diversity training (which has little evidence of success[3]) and instead favors an approach based on fostering a bias- free environment. However, how the characteristics of an inclusive environment are translated into objective metrics for recruitment remains under consideration.

Retaining talent: the OID's vision for graduate students

The crux of the OID mission is to foster an inclusive environment that makes people (students, faculty, staff) want to *stay* at Penn. This desire is reflected in the second goal of the OID, Retain. This, of course, applies to retaining talented faculty, but it is also particularly focuses on the student experience. The ultimate goal is to bring talented individuals to Penn as Ph.D. or M.D. students and to provide such a supportive community that these individuals have no desire to leave – they would stay throughout their career trajectory to eventually become faculty. This concept, dubbed the Faculty Pipeline is graphically represented in Fig. 2 and remains one of Dr. Higginbotham's proudest achievements at the OID. As previously discussed, separate entities that promote diversity already existed at Penn before the creation of the OID. However, Dr. Higginbotham envisions the OID as a partner that will "leverage what's here and maybe try to fill in the gaps" in a coordinated effort to build a supportive community with longevity.

Engaging with the efforts of the OID

First and foremost, the OID website (http://www.med.upenn.edu/inclusion-and- diversity/) is a valuable resource. The OID cosponsors events, workshops, and seminars, has opportunities for funding, and publishes an annual report. In addition to the data described in this article and displayed in Fig. 2, the annual reports also include data on BGS matriculation demographics. Students are encouraged to explore this report, and future ones, on their own! Second, the OID launched the Diversity Engagement Survey in 2015, which was emailed to all of Penn Medicine, including BGS. The OID relies on this survey to gauge the climate and culture at Penn and urges all graduate students to participate. Finally, Dr. Higginbotham stresses that OID is open to all concerns, feedback, and suggestions and encourages students interested in engaging further to contact the OID through its website.

Works Cited:

1. http://www.med.upenn.edu/inclusion-and-diversity/assets/user-content/documents/OID_ANNUAL_REPORT_FINAL_2016.pdf

2. Graph courtest of Seleeke Flingai, which used US Census data on population demographics and self-reported BGS data from 2012 (and is consistent with demographic data collected by the OID[1]): http://www.upenn.edu/almanac/volumes/v60/n16/pdf/minorityequity2013.pdf

3. http://hbr.org/2016/07/designing-a-bias-free-organization