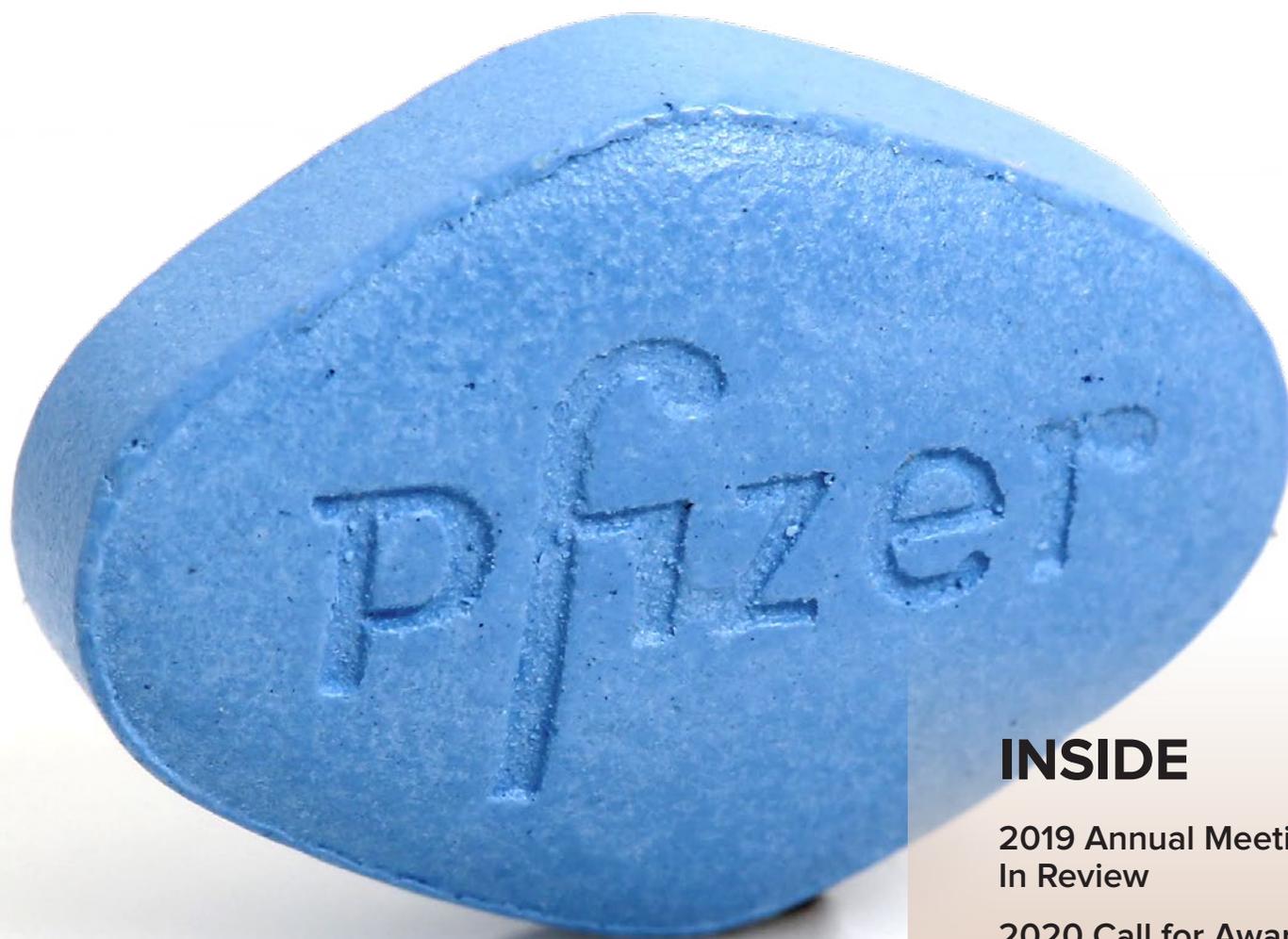




# THE Pharmacologist

A Publication by The American Society for  
Pharmacology and Experimental Therapeutics

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# Viagra from NO to Yes

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2019 Annual Meeting  
In Review

2020 Call for Award  
Nominations

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# Message from The President

Dear ASPET members,

I hope that you agree with me that the ASPET Annual Meeting at EB 2019 was outstanding! We're indebted to Mike Wood and the Program Committee for putting together such an engaging scientific program. It got off to a great start with a pharmacology-focused, all-society Tang lecture by Dr. Brian Druker, who talked about the discovery of the revolutionary anti-cancer drug imatinib. Two of our award lectures also had a drug discovery theme: Reynold Spector Award winner Dr. V. Craig Jordan talked about his lab's development of selective estrogen receptor modulators, which have had such an immense impact on breast cancer and women's health; and 2017 David Lehr Research Award winner Dr. Paul Insel presented his lab's promising efforts to develop drugs aimed at novel G protein-coupled receptor targets in pancreatic cancer. We had a joint symposium with the Chinese Pharmacological Society (CNPHARS), in which we learned not only about recent advances in understanding mechanisms that contribute to neurodegenerative diseases, but also how Chinese traditional medicines can be exploited to identify novel drugs for their treatment. This symposium was part of an ongoing relationship with CNPHARS, and it highlighted the possibilities for how the different approaches of Western and Chinese pharmacologists to the same problems can be used in synergistic ways to tackle Parkinson's and other neurodegenerative diseases.

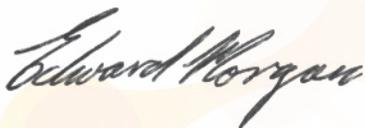
My biggest hopes going into EB were centered around the poster presentations and the joint ASPET-APS Presidential Symposium series, and I'm gratified that we are hearing very positive feedback from our members about both. The new schedule carved out a spot in the mornings for poster presentations that were unopposed by oral sessions and society business meetings. Anecdotally, our presenters found this to markedly improve traffic at their posters, and one could easily observe the increased interactions when walking through the poster area. This innovation, together with the continuation of the ASPET Datablitz, lent a great deal of buzz to the exhibition hall. The joint Presidential Symposium series was also a big success, attracting large audiences and garnering encouraging comments from members of both societies. You can read a detailed report on page 79 of this issue. As I mentioned in March, the series will be reprised at EB 2020 in San Diego on the topic of inflammation and oxidative stress. We look forward to fostering further relationships with the other EB societies to bring you additional, inventive EB programming.

As I look back on my almost-completed year in office, I'm struck by the great progress we've made in such a short time. We completed the move of our office to our spiffy new location in Rockville, MD, and we welcomed our first international chapter, the Canadian Society of Pharmacology and Therapeutics. We've completed a governance review, implemented the new ASPET Fellows program, and began implementation of our community engagement platform on our website. We've truly reimagined our annual meeting and we've reworked the highly successful Washington Fellows program to provide an even better experience for our budding science policy advocates. This was all highly dependent on our Executive Officer, Judy Siuciak, and our other amazing ASPET staff; as well as on the hard work of the ASPET committees and their chairs. My most sincere thanks to all of them. Finally, at the annual business meeting, we approved proposed changes in the by-laws to allow graduate student member and affiliate members to vote. These changes were voted on and approved by the full membership in May. Council recognizes that students are the future of our society, and we think that they should have a say in Society affairs moving forward.

Looking forward to July, when I step down as President and pass the gavel to Wayne Backes, I'm glad that I still have a year to serve you as Past-President. I get to continue to work with my great colleagues on Council, and to see more of the fruits of our work over the year. I thank Past Secretary-Treasurer John Tesmer, Councilor Carol Beck, and ASPET Representative to FASEB Brian Cox, for their time and dedication to ASPET as they step down from their positions. Special thanks goes to Past-President John Schuetz for his three years of thoughtful leadership that have played a large part in how we got to this excellent juncture in our history. I'm also looking forward to working with our new President Wayne Backes, and President-Elect Charles France to continue to improve the Society's benefits to our members and our impact on pharmacology. Mary-Ann Bjornsti and this year's Abel Award winner Namandjé Bumpus will also join us as Secretary-Treasurer-Elect and Councilor, and I know they will make outstanding contributions to Council.

Finally, because I deeply value all that ASPET has given and will continue to give me, giving back to the society has been one of the most gratifying aspects of my career. So with apologies to JFK, I urge you to "ask not what ASPET can do for you, ask what you can do for ASPET". You can volunteer to serve on one of our committees, or you can think of ASPET when you decide where to make your charitable donations. Crucially, you can publish in ASPET journals. At a time when the society depends greatly on our journal revenues for support of our programs, the increasing pressure for open access publishing threatens that revenue in the future. Therefore, the simplest way for us to secure our journals' future is for ASPET members to publish their best work in ASPET journals. If you value ASPET as I do, please give this serious consideration.

Warm regards,

A handwritten signature in black ink that reads "Eddie Morgan". The signature is written in a cursive, flowing style.

Eddie Morgan, PhD  
ASPET President



# 2019 Annual Meeting in Review

From April 6-9, 2019, over 10,000 scientists gathered in Orlando, FL to take part in Experimental Biology 2019. With excellent programming across pharmacology, physiology, biochemistry, molecular biology, pathology, and anatomy, EB 2019 provided attendees with an exciting atmosphere of collaboration, networking, and socializing. The opening Tang Prize Lecture was given by 2018 Tang Prize laureate in Biopharmaceutical Science, Dr. Brian Druker. His lecture was titled “Imatinib as a Paradigm of Cancer Therapies.” Read more about the Tang Prize lecture on page 82. Directly following the lecture, attendees socialized at the all-society EB Welcome Reception, which featured highlighted scientific posters across all disciplines, innovative outreach program posters, and time to mingle with friends and colleagues.



*EB 2019 attendees at the All-Society Welcome Reception*

ASPET's annual business meeting took place on Saturday, April 6 led by President Edward Morgan. Dr. Morgan updated members on the Society's current activities, programs, and initiatives. Highlights from his presentation included:

- The announcement of the [ASPET Fellows Program](#)
- The announcement of ASPET's first international chapter, the [Canadian Society of Pharmacology and Therapeutics](#)
- A review of ASPET bylaws regarding the voting status of graduate students and affiliate members

## ASPET Fellows Program



President Edward Morgan announced the new ASPET Fellows (FASPET) Program at the Annual Business Meeting on April 6, 2019. The new program will recognize ASPET's most distinguished members. Selection as a Fellow is an honor bestowed on ASPET members who have demonstrated excellence via their overall contributions to pharmacology and the Society. The 2019 inaugural class of fellows will be announced this summer. Learn more about the program at [www.aspet.org/FASPET](http://www.aspet.org/FASPET).

ASPET's Executive Officer Judy Siuciak provided a quick update on this year's meeting highlights and new initiatives, the ASPET office relocation, and the new ASPET member-only online community. Following Dr. Siuciak, Secretary/Treasurer Peggy Gnegy reported on ASPET's financial status, and Board of Publications Trustees Chair Mary Vore provided an update on ASPET's journals. Directly following the business agenda, Dr. Morgan recognized this year's scientific achievement award winners, travel award winners, Washington Fellows, and Mentoring Network participants.



*President-Elect Wayne Backes thanks President Edward Morgan for his service to ASPET*



*2019 ASPET Scientific Achievement Award Winners with President Edward Morgan (from left to right) V. Craig Jordan, Mary Vore, Palmer Taylor, Alexandra Newton, Namandjé Bumpus, Kathryn Meier, and Edward Morgan*



2019 Washington Fellows



2019 Mentoring Network Participants



2019 ASPET Postdoctoral Travel Award Winners



2019 Undergraduate Student Travel Award Winners



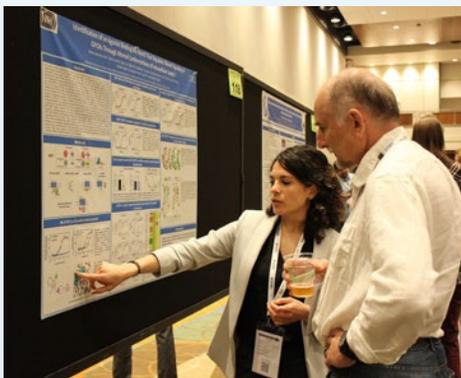
2019 ASPET Graduate Student/Post-Baccalaureate Travel Award Winners



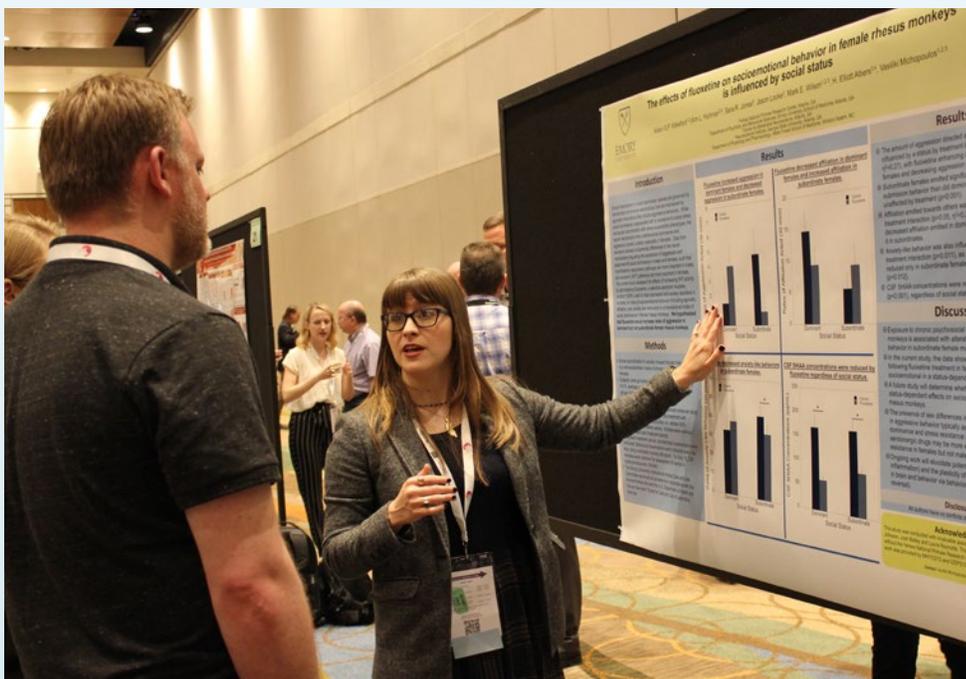
The ASPET booth in the exhibit hall recruited 30 new members, including 7 regular members, 1 affiliate member, 9 graduate student members, and 13 undergraduate student members. New members and members who helped recruit new members got to spin a wheel to win fun ASPET prizes. We also offered several items for sale in our store, including t-shirts and plush donkeys. If you didn't get a chance to purchase an ASPET product at the meeting, you can make purchases online at [www.aspet.org/store](http://www.aspet.org/store).

The ASPET member lounge offered a place for members to get their morning coffee, hold one-on-one meetings with colleagues, and relax between sessions. Several members took a break from sessions to complete a group puzzle, play games, catch up on work, and meet new friends in the lounge. This year in the lounge we featured ASPET's ten divisions. Members could learn more about each division and show their division pride by wearing division buttons.





Students and Postdocs competing in the poster competition



The 2019 Student/Postdoctoral Poster Competition gave undergraduate students, post-baccalaureates, graduate students, and postdocs an opportunity to present their work and compete for cash prizes. The competition provided a forum for students to talk about their work and network with senior members, colleagues, and friends. To find out the award winners, please turn to the division news section on page 125. Also at the poster competition, ASPET Academic Partners set up recruitment tables and provided attendees with information about their pharmacology programs.

The 2019 Dolores C. Shockley Competition took place at the Student/Postdoctoral Poster Competition. Dr. Shockley was the first African American woman to earn a PhD in pharmacology and the first to be appointed to chair a pharmacology department in the US. In the postbaccalaureate/graduate student category, prizes were awarded to **Reiya Hayden** (1st Place) from the University of Kentucky, **Chris Bolden** (2nd Place) from the University of Arkansas for Medical Sciences, and **Larry Rodriguez** (3rd Place) from the University of Southern California. In the postdoctoral category, prizes were awarded to **Stephanie Martinez** (1st Place) from Washington State University, **Sergio Dominguez Lopez** (2nd Place) from the Oklahoma Medical Research Foundation, and **Lillian Brady** (3rd Place) from Vanderbilt University.

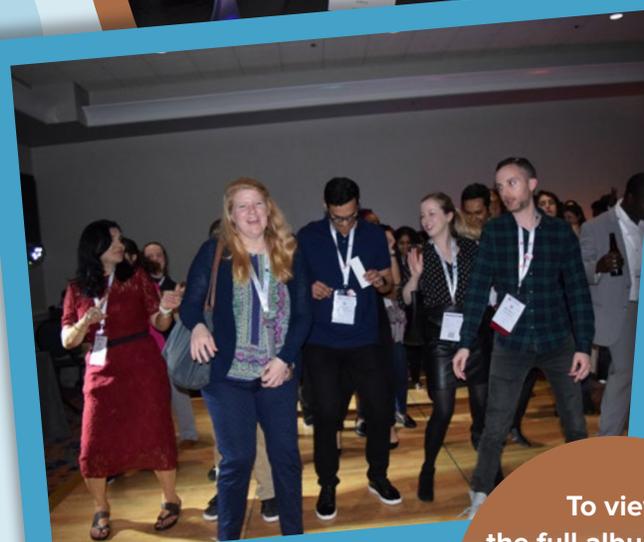


ASPET Academic Partners at the poster competition



Dolores C. Shockley poster winners

Following the poster competition,  
ASPET students and postdocs socialized at the  
**STUDENT/POSTDOC MIXER.**



To view  
the full album of EB  
2019 pictures, visit us  
online at:

[https://bit.ly/  
2Ww1svZ](https://bit.ly/2Ww1svZ)

# Annual Meeting Program Highlights

## ASPET-APS Joint Presidential Symposium Series “The Microbiome in Physiology and Pharmacology”

Submitted by Edward Morgan



Speakers at the ASPET-APS Presidential Symposium I: Gut Microbiome and Metabolic Disorders with the ASPET and APS presidents

This series was the first to feature joint ASPET-APS symposia at Experimental Biology, spurred by the fortuitous coincidence of the two societies electing presidents from the same institution. APS President Jeff Sands and I wanted to do something that would help our societies to exploit the many shared scientific interests of our members, and that hopefully would be a model for continued joint scientific programming not only between ASPET and APS but also with other EB societies. We chose the microbiome as an emerging area of EB-wide interest, and we are indebted to our symposium committee of Jen Pluznick, Laura McCabe, Julia Yue Cui, and Hyunyoung Jeong who put the

program together and co-chaired sessions II and III. The symposia were preceded on Saturday by a joint presidential workshop on *Microbiome Research: What You Need to Know*.

### **Sunday, Symposium I: Gut Microbiome and Metabolic Disorders**

*Co-chairs Eddie Morgan and Jeff Sands, Emory U.*

Rachel Perry of Yale University opened the session with her findings that hyperglycemia stimulates acetate production by the gut microbiota, which in turn enhances glucose-stimulated insulin secretion.

In humans, other short chain fatty acids may be more important. Marty Blaser from Rutgers University followed by describing his laboratory's work on the additive effects of antibiotics (with resultant depletion of the gut microbiome) and a high fat diet (HFD) on fat and lean body weight in mice. Short courses of antibiotics early in life had more profound effects than chronic exposure later in life, including accelerated development of diabetes, indicating that short-term changes in the microbiome cause long-term changes in metabolism and phenotype. Finally, Eugene Chang of the University of Chicago discussed the role of small intestinal microbiota, which are often neglected in microbiome studies. They are difficult to sample, less diverse, and more aerobic than colonic microbiota. Dr. Chang built a strong case for roles of specific jejunal bacteria in cholesterol and fatty acid absorption, making them possible targets for treating diabetes and obesity.

### **Monday, Symposium II: Gut Microbiota: A Chemical Factory**

*Co-chairs Hyunyoung Jeong, U. Illinois-Chicago and Jennifer Pluznick, Johns Hopkins U.*

Emma Allen-Vercoe of the University of Guelph's laboratory have developed bacterial culture systems that mimic the gut environment and can maintain microbial ecosystems in the laboratory. This system was used to study the microbial metabolomes in cultures from different fecal donors using  $^1\text{H}$  NMR. Donors were found to have very different profiles, and these data are being used to identify subsets of bacterial communities that can be used therapeutically to produce molecules such as tetrahydrobiopterin (BH4, for people deficient in BH4) or lack the production of deleterious molecules such as p-cresol. Matthew Redinbo of the University of North Carolina discussed his laboratory's progress in developing inhibitors of the bacterial  $\beta$ -glucuronidases, which are involved in intestinal toxicity of nonsteroidal anti-inflammatory drugs and irinotecan. One of the best compounds administered to tumor-bearing mice delayed diarrhea, reduced gastrointestinal pathology, and increased therapeutic efficacy of irinotecan. He also talked about activity-based proteomics as a potential diagnostic tool to detect bacterial  $\beta$ -glucuronidases in feces. Emily Balskus of Harvard University focused

on her lab's work to discover the elusive structure and biosynthesis of colibactin, a polyketide from *E. coli* that has been linked to colorectal cancer. They used painstaking genetic and biochemical approaches to determine that the molecule contains two electrophilic cyclopropyl rings that cause the characteristic DNA inter-strand crosslinks.

### **Tuesday, Symposium III: Microbiota in Action: The Gut and Beyond**

*Co-chairs Julia Cui, U. Washington and Laura McCabe, Michigan State U.*

Andrew Neish of Emory University described how commensal lactobacilli enhance the healing of colonic mucosa damaged with dextran sulfate sodium. The bacteria physically contact the wounded mucosa and stimulate epithelial cell migration by increasing levels of reactive oxygen species. In another project, they detected large changes in liver drug-metabolizing enzymes, glutathione metabolism, and redox pathways in conventionalized germ-free mice, which was largely due to the activation of the transcription factor nuclear factor erythroid-2 related factor 2 (Nrf2). Dominik Müller of the Max Delbrück Center in Berlin presented his work on the impact of a high salt diet (HSD) on the gut microbiome, since high salt is one of the greatest risk factors for hypertension and related pathologies in humans. HSD produced large changes in the microbiomes of cage-housed mice, but notably not in mice housed singly. Evidence was presented that murine or human lactobacilli could reverse the increase in Th17 T-cells and partially reverse the hypertension caused by HSD. In humans, HSD was found to cause a loss of lactobacilli in the feces as well as hypertension. Finally, Elaine Hsiao of UCLA discussed her work in mice showing that the well-known anti-epileptic effects of a ketogenic diet are dependent on the modulation of the gut microbiome. Specifically, *Akkermansia muciniphila* and *Parabacteroides sp.* play a crucial role. Together, these bacteria were able to reduce seizures in a genetic model of epilepsy, with or without a ketogenic diet.

A joint Presidential Symposium series on Inflammation and Oxidative Stress is being organized by ASPET President-Elect Wayne Backes and APS President Meredith Hay for EB 2020 in San Diego.

## The Heart of Pharmacology: A Fun-Filled Afternoon with the Young Scientists Committee, Orlando Science Center, and the Students of Edgewater High School

*Submitted by Sophia Kaska*

Excitement and curiosity filled the air as technology-track high schoolers from Edgewater High School entered the laboratory. Their teacher, Denise Hinds-Cruz, had not given them any information about this special activity. The students were greeted by members of the ASPET Young Scientists Committee (YSC), educators from the Orlando Science Center (OSC), and sheep hearts paired with dissection kits and laptops with 3D modeling software.

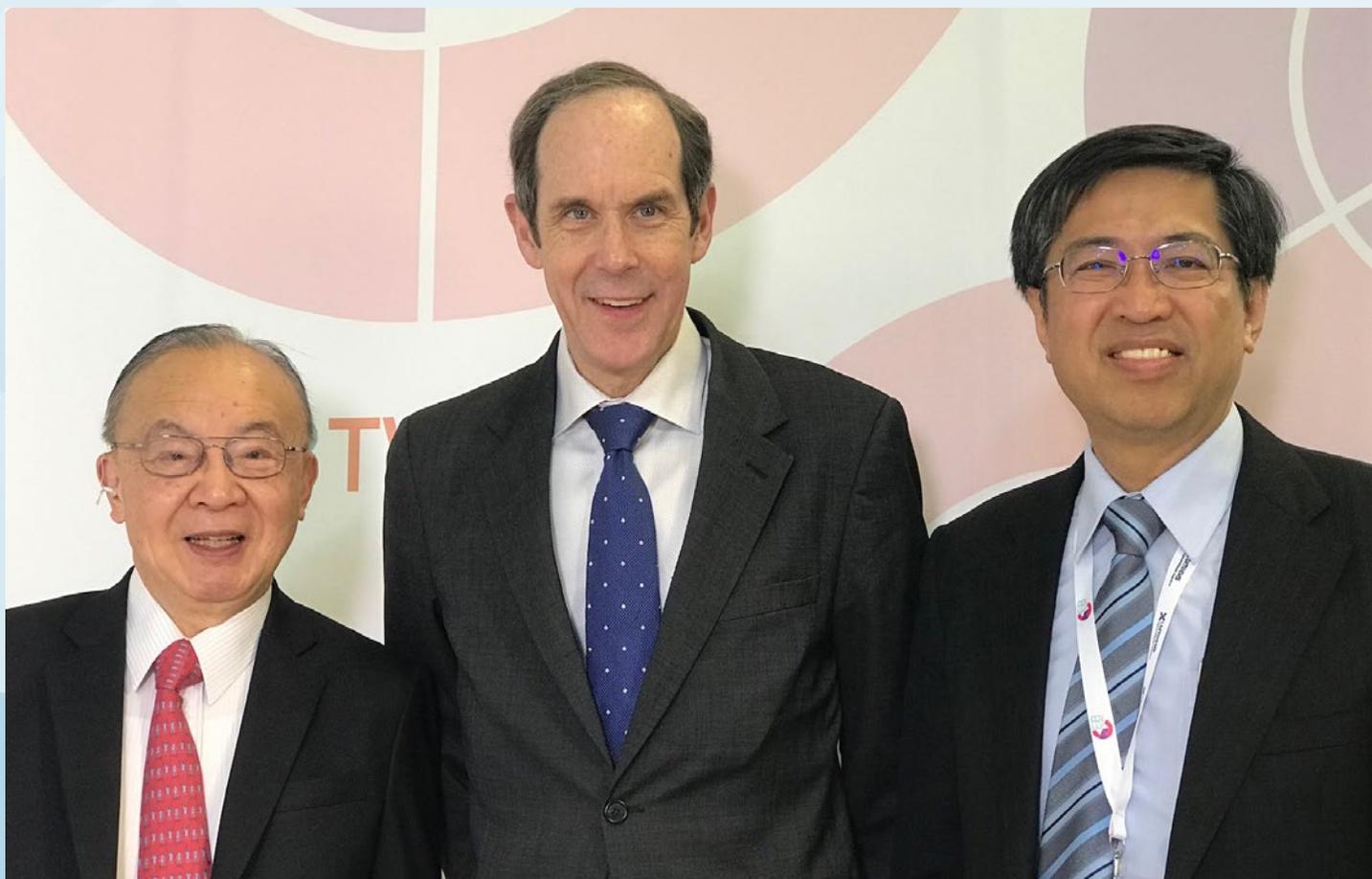
The day before the start of the ASPET Annual Meeting, the YSC typically hosts a science outreach event to introduce pharmacology and the careers available to undergraduate students. This year was the first time the YSC attempted to reach out to a younger generation: high schoolers. While the OSC educators led an interactive session on comparing sheep heart dissections with computer simulations, YSC chair Dr. Stephanie Davis, along with YSC members Dr. Gisela Camacho-Hernandez and Dr. Sophia Kaska engaged in conversations with students about college, career options, and pharmacology. Ms. Hinds-Cruz was beyond thrilled to have us there to interact with the students and provide them with an interactive dissection that they would not otherwise have done. She also provided us with valuable insight and perspective on the value of reaching out to high school students and how this could impact their career choice as this is a critical point in their lives in which they are actively making decisions about what they want to do with their future. This event was received with overall excitement and approval from the students and their teacher. The YSC will continue to hold outreach events associated with future ASPET meetings in order to provide opportunities to explore pharmacology for young future scientists.



*High school students participating in the ASPET YSC Outreach Event*

## EB Hosts Tang Prize Lecture to Explore New Cancer Therapies

*Submitted by the Tang Prize Foundation*



*Tang Prize Lecturer Brian Druker with Shu Chien and Jenn-Chuan Chern*

The evening of April 6th in Orlando, Florida saw more than three thousand people throng to the 2019 Experimental Biology (EB) Tang Prize Award Lecture, “Imatinib as a Paradigm of Cancer Therapies,” delivered by 2018 Tang Prize laureate in Biopharmaceutical Science, Dr. Brian Druker. Since 2015, the Tang Prize talk has been a staple event featured at EB, and as of 2018, it has been scheduled as the opening lecture preceding the official reception, drawing the attention of all who attend the conference. The five host societies of this year’s EB were the American Association of Anatomists (AAA), the American Society for Biochemistry and Molecular Biology (ASBMB), the American Physiological Society (APS), the American Society for Investigative Pathology (ASIP), and the American Society for Pharmacology and

Experimental Therapeutics (ASPET). Shawn Boynes, executive director of AAA and the chair of the 2019 EB Management Committee, stressed in his opening remarks that “together, we are working to expand awareness about the importance of basic science in understanding disease progression, prevention and eradication.” In addition to the Tang Prize Lecture, EB TV also conducted an interview with Dr. Druker and played the video in the convention center, in the hotels, and online, disseminating the latest developments in science and medicine to all corners of the world.

An amicable and compassionate physician and professor, Dr. Druker is credited with the successful clinical trial of imatinib (Gleevec®) on chronic myelogenous leukemia (CML). Lauded as the most successful example of targeted cancer therapies of

Photo courtesy of the Tang Prize Foundation



Photo courtesy of the Tang Prize Foundation

EB 2019 attendees at All Society Tang Prize Lecture

the 21st century, Gleevec has been on the market since 2001. It has benefited patients all over the world by increasing the 10-year survival rates to 90%. As a side note, the Chinese blockbuster, *Dying to Survive*, is seen by many as a cinematic rendition of the medical miracle Dr. Druker has performed. Treating every cancer sufferer like one of his family, he is happy to see that some of his patients continue to live a normal life for more than 20 years. In his lecture, Dr. Druker also mentioned that the success of imatinib has proven to scientists that they are on the right track, and more substantial progresses can be made by combining Gleevec with other treatments such as immunotherapies or radiotherapies.

As the director of the Knight Cancer Institute at Oregon Health & Science University, Dr. Druker harbors the vision of “a world freed from the burden of cancer.” He explained that the mission of the Institute is to “end cancer as we know it. Through innovative, collaborative research and education, we provide prevention, detection, and care—one person at a time.” Indeed, the intention to provide each patient with customized care shows how Dr. Druker and his team endeavor to help cancer patients with kindness and earnestness. He also notified us that following in the footsteps of Gleevec, four other drugs have been approved by the FDA to inhibit the activities of the Abl kinase, one of the oncogenes that drive the growth of cancer, and they have been very successful in targeting the genetic mutations in cancer cells.

Professor Shu Chien, director of the Institute of Engineering in Medicine at the University of California,

San Diego, chaired the lecture and hailed Dr. Druker’s talk as a concise introduction to the differences between traditional and new cancer therapies, making the significance of the latest technological development accessible to all. This event was marked with bursts of enthusiastic applause and a long queue of people staying on afterward for face-to-face interactions with Dr. Druker. Professor Chien noted that Dr. Druker was incredibly patient with every one of his fans, and his gentle smile never vanished even when greeted with a fusillade of questions and requests for autographs and photographs. Also present was Academia Sinica academician Wen-Chang Chang, who echoed Professor Chien’s observation about how successful the lecture was. Not only was the auditorium packed with people truly touched by Dr. Druker’s sincerity, but a group of around 20 high school students led by their teacher also attended the talk. They are faithful followers of EB’s Tang Prize Award lectures, travelling around the US to attend the inaugural 2015 speech given by Dr. James P. Allison in Boston, the 2016 lecture by Professor Tasuku Honjo in San Diego, the 2017 lecture by Dr. Emmanuelle Charpentier in Chicago, the 2018 lecture by Dr. Feng Zhang in San Diego, and the 2019 lecture by Dr. Druker in Orlando. Glowing with infectious excitement and passion, these students asked for Dr. Druker’s autograph on their copies of the book, *The Philadelphia Chromosome: A Genetic Mystery, a Lethal Cancer, and the Improbable Invention of a Lifesaving Treatment*, which features the important role imatinib plays in the treatment of Philadelphia chromosome, a specific genetic abnormality in CML cells.

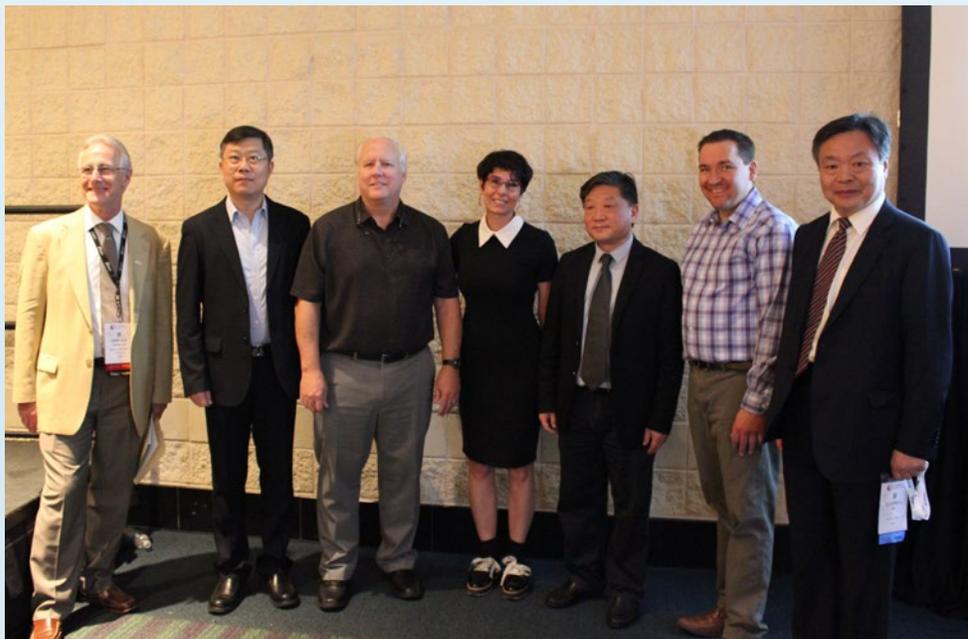
The Tang Prize Lecture series at EB is part of a ten-year collaboration in educational promotion between the two organizations. CEO of the Tang Prize Foundation Dr. Jenn-Chuan Chern believes that lectures like these provide a rare opportunity for scholars and students in biopharmaceutical science to get together and be updated on the most current innovations in scientific technologies. In addition, they are a suitable platform for promulgating the laureates’ contributions and for inspiring a younger generation of researchers, eventually turning the philosophy of the Tang Prize into reality.

Watch EB TV’s interview with Dr. Druker at <https://youtu.be/KXPduQxaPt0>.

## ASPET-CNPHARS Joint Symposium - Parkinson's and Alzheimer's Disease: Neuronal Mechanism and Therapeutic Strategies to Combat Neurodegenerative Diseases

Submitted by Habibeh Khoshbouei

In continuation of fostering the exchange of scientific knowledge and collaboration between Chinese and American pharmacologists, the 2019 ASPET-CNPHARS Symposium was co-sponsored by the Chinese Pharmacological Society and ASPET. The symposium was focused on presenting cutting-edge advances in neurodegenerative diseases such as Parkinson's and Alzheimer's diseases. Scientists from research laboratories in China and the US presented their research on developing effective therapies and development of relevant model systems for mechanistic studies. The symposium was co-chaired by Dr. Habibeh Khoshbouei from the University of Florida and Chinese Pharmacological Society Vice Present Wei Wei from Anhui Medical University. ASPET President Edward Morgan commemorated this collaboration by welcoming investigators from both societies and presented CNPHARS with a gift. Dr. Morgan highlighted the importance of joint scientific interactions and described how scientific collaborations facilitate interdisciplinary studies among life sciences and medicine across the world to revolutionize and promote advancement in human health. Dr. Guanhua Du, from the Institute of Materia Medica, Chinese Academy of Medical Sciences, shared pioneering research at his laboratory on how baicalein can inhibit the symptoms of Parkinson's disease. Dr. Mike Beckstead from Oklahoma Medical Research Foundation presented his work in a mouse model of progressive Parkinson's disease. His data support the notion that the physiology of dopamine



Speakers and chairs at the ASPET-CNPHARS Joint Symposium with the ASPET president

neurons is impaired long before disruption of somatodendritic morphology. Dr. Baiping Ma from the Beijing Institute of Radiation Medicine spoke about discovery and research of timosaponin BII as an anti-dementia drug. Dr. Ma shared the phase 2 clinical studies showing the effectiveness of timosaponin on improving the quality of life of Parkinson's disease patients. Dr. Randy Blakely, Director of the Brain Institute, Florida Atlantic University, described the discovery of a novel mechanism required for glial support of neuronal survival using the forward genetics approach in a *C. elegans* model system. The symposium highlighted the latest advances in understanding the cellular mechanisms of neurodegenerative diseases and diagnostic and pharmacological approaches, including traditional Chinese medicine.

## 2nd Annual ASPET Daily Datablitz

Submitted by Mike Jarvis and Mark Hernandez



The ASPET Daily Datablitz is a joint initiative by the ASPET Program and the Young Scientists Committees and sponsored by *Pharmacology Research & Perspectives (PR&P)*, an Open Access journal collaboration between ASPET, the British Pharmacological Society, and John Wiley & Sons, Inc.

Each day of the ASPET Annual Meeting at EB 2019 in Orlando, the Datablitz provided presenters and attendees with a fast-paced summary of selected posters, representing each of the ASPET divisions. Focused on early career researchers (ECRs), these sessions offered a great opportunity for ECRs to refine their presentation skills and provided attendees with well-constructed summaries of cutting-edge pharmacological research.

These highly energized sessions consisted of 10 individual 3-minute talks, challenging the speakers to be extremely concise and clear. Similar to a blockbuster movie trailer, presenters shared exciting bits of their data with the audience during the individual oral sessions before engaging in more in-depth scientific discussions with attendees at their posters. Many exciting areas of pharmacology research were covered including innovative pharmacology education paradigms, pharmacogenomics of drug metabolism, environmental toxicology, autophagy, neuro-immune interactions, and novel optogenetic and in vitro/in vivo modeling studies to name a few.

The Daily Datablitz sessions were very well-attended each day. They provided a venue for meeting attendees to learn about the vibrant and diverse science presented in the ASPET poster sessions and served as an excellent networking opportunity for both the presenters and the audience. PR&P was delighted to sponsor this year's sessions as it exemplifies the journal's commitment to advancing all areas of pharmacology research as well as fostering career growth opportunities for young scientists. During the Datablitz, PR&P announced a Call for Papers for an ECR Special Issue (see <https://bpspubsonlinelibrary.wiley.com/hub/journal/20521707/phdinitiative>). We congratulate the presenters for their dedication and hard work to make their talks succinct and enlightening. These sessions not only enhance the camaraderie among ASPET divisions, but also highlight innovative pharmacology research for other biological societies attending EB 2019.

## Debut of EB Career Central in Orlando

On April 6th ASPET helped successfully launch a new EB Career Central at Experimental Biology in Orlando.

Over 50% of attendees reported that they attended at least one of the **career development workshops** that were extended to longer lengths with varying formats, and moved into meeting rooms more conducive to learning. Each EB society developed workshops for this series that were of interest across multiple disciplines.

The ASPET contributed workshops were very popular. Over 200 young scientists attended our colloquium on ***Building Winning Career Connections: The Art of Self-Promotion***. Drs. Martha Davila-Garcia, Michael Jarvis, and Lakshmi Devi led the group through interactive activities learning how to create your own narrative, build your credibility, construct your network, optimize your CV/resume, and write a winning cover letter.

Every seat was filled at another ASPET career workshop: ***An Interactive Guide to Publishing, Reviewing, and Ethics Issues*** which was presented by the editors of ASPET's journals. Attendees gave nearly perfect scores to the ASPET career symposium titled ***The Need for Scientists in Regulation and Policy: Academia, Government, and Industry***. "Wonderful speakers" and "the content from each one beautifully melded into each other" were just a few of the comments from attendees.

Inside the EB exhibit hall, Career Central's new open layout provided a welcoming place for participants to browse the job listings boards, meet with an expert one-on-one for career advice, resume/CV critique, or to practice their poster presentation, as well as to learn about university doctoral programs.

The schedule in the new **micro-learning hub** was packed with presentations! From 9:00 am until 4:00 pm each day, attendees wandered into the hub to hear impactful 10 minute career presentations with take-away career tips and resources for learning more. Topics included career planning, marketing yourself, staying out of copyright trouble, finding funding, grant-writing, science communications skills, and so much more.

We welcome ideas for an expanded EB Career Central in 2020. Please send your ideas to [meetings@aspet.org](mailto:meetings@aspet.org).



# QUICK STATS at EB 2019

The ASPET Annual Meeting is the place to discover high quality, innovative science in pharmacology and experimental therapeutics

**62** educational and scientific sessions were presented over 4 days

**328** scientists shared their expertise in sessions

## MOST ATTENDED SESSIONS:

- John J. Abel Award in Pharmacology Lecture
- ASPET-APS Presidential Series on the Microbiome
- Julius Axelrod Award in Pharmacology Lecture
- Graduate Student - Postdoctoral Colloquium: Building Winning Career Connections: The Art of Self-Promotion
- David Lehr Research Award Lecture

## EB DRAWS SCIENTISTS FROM AROUND THE WORLD

ASPET attendees at EB represented

**46**

different countries.

Largest non-US contingents coming from Canada, Brazil, South Korea, China, Japan, Nigeria, and the United Kingdom

## CUTTING-EDGE SCIENCE IS PRESENTED IN PHARMACOLOGY

ABSTRACTS

**922**

**40**

### POSTERS

designated as Blue Ribbon picks by the Program Committee

YOUNG SCIENTISTS

gave rapid fire poster talks in the datablitz

**28**

**11**

**PHARMACOLOGY POSTERS** featured as Scientific Highlights at the EB-wide Welcome Reception



**92%**

of pharmacology attendees rated the meeting as well worth their investment of time and funds.

ASPET SESSIONS WERE RATED AN AVERAGE OF **4.6 OUT OF 5 STARS** ON THE MOBILE APP



# Thank you to our 2019 Annual Meeting Sponsors!

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# Call for 2020 Award Nominations

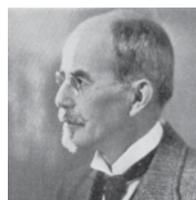
**ASPET is dedicated to recognizing the best research in, contributions to, and accomplishments in all areas of pharmacology. We encourage members to nominate deserving scientists to raise awareness of the outstanding work being done in our field.**

*ASPET is strongly committed to diversity. Nominations for members of underrepresented groups, women, and persons with disabilities are particularly encouraged.*

- **Who can submit a nomination?** You must be an ASPET member to submit nominations.
- **Who is eligible to receive awards?** Scientists from all over the world and at all career stages are eligible for ASPET's various awards. Learn more about the specific eligibility details for each award at <http://www.aspet.org/awards>.
- **How do I submit a nomination?** To nominate someone, visit: <http://www.aspet.org/awards>. Review the award criteria and nomination requirements. Access the Awards Portal and log in as a member to be routed to the nomination forms.
- **When are nominations due?** The deadline for nominations is Monday, September 16, 2019 at 5:00 PM EDT.
- **What happens after a nomination is submitted?** Each nomination is reviewed by the members of a designated committee. Scores and rankings are given, and compiled results are discussed by the committee, leading to the final selection of the 2020 awardee.

## ASPET SCIENTIFIC ACHIEVEMENT AWARDS

**Have you mentored a young investigator whose original research is outstanding? Nominate them for the**



### JOHN J. ABEL AWARD IN PHARMACOLOGY

This award is presented for original, outstanding research in the field of pharmacology and/or experimental therapeutics by a candidate who is younger than 45. This award, named after the founder of ASPET, was established in 1946 to stimulate fundamental research in pharmacology and experimental therapeutics by young investigators.

**Did your mentor have a profound impact on you and the pharmacology community? Nominate them for the**



### **JULIUS AXELROD AWARD IN PHARMACOLOGY**

This award is presented for significant contributions to understanding the biochemical mechanisms underlying the pharmacological actions of drugs and for contributions to mentoring other pharmacologists. This award was established in 1991 to honor the memory of the eminent American pharmacologist who shaped the fields of neuroscience, drug metabolism, and biochemistry and who served as a mentor for numerous eminent pharmacologists around the world.

**Do you know someone who is performing outstanding research in the pharmacology of biological receptors? Nominate them for the**



### **LOUIS S. GOODMAN AND ALFRED GILMAN AWARD IN RECEPTOR PHARMACOLOGY**

This award was established in 1980 to recognize and stimulate outstanding research in the pharmacology of biological receptors. Such research might provide a better understanding of the mechanisms of biological processes and potentially provide the basis for the discovery of drugs useful in the treatment of diseases.

**Do you have a colleague who has made a major impact on the pharmacological treatment of disease? Nominate them for the**



### **PHARMACIA- ASPET AWARD IN EXPERIMENTAL THERAPEUTICS**

This award recognizes and stimulates outstanding research in pharmacology and experimental therapeutics, basic laboratory,

or clinical research that has had, or potentially will have, a major impact on the pharmacological treatment of disease.

**Do you know someone who epitomizes high standards of ethical behavior, scientific scholarship, publication, and teaching? Nominate them for the**



### **OTTO KRAYER AWARD IN PHARMACOLOGY**

This award is presented to commemorate the enduring legacy of Otto Krayer's personal qualities: his ethical behavior, his commitment to teaching, his high standards of scientific scholarship, publication and editorship, his promotion of interdisciplinary research to reveal the actions of drugs or other chemicals, and his guidance and support of younger scientists. The award recognizes an individual whose character and career contributions to pharmacology are in accord with those exemplified by Dr. Krayer.

**Is the head of your department or lab at the height of their career, having made significant contributions to an area of pharmacology? Nominate them for the**



### **ROBERT R. RUFFOLO CAREER ACHIEVEMENT AWARD IN PHARMACOLOGY**

This award honors the scientific achievements of scientists who are at the height of their careers (typically mid-to late-career) and who have made significant contributions to any area of pharmacology. This award recognizes the contributions made to drug discovery and development by Dr. Ruffolo.

## ASPET DIVISION- SPONSORED AWARDS

ASPET is strongly committed to diversity. Nominations for members of underrepresented groups, women, and persons with disabilities are particularly encouraged.

### Awards for Established Scientists



*Sponsored by the ASPET Division for Behavioral Pharmacology*

The **P. B. Dews Lifetime Achievement Award for Research in Behavioral Pharmacology** recognizes outstanding lifetime achievements in research,

teaching, and professional service in the field of behavioral pharmacology. The award honors Dr. Peter Dews for his seminal contributions to the development of behavioral pharmacology as a discipline.



*Sponsored by the ASPET Division for Cardiovascular Pharmacology*

The **Paul M. Vanhoutte Distinguished Lectureship in Vascular Pharmacology** was established to honor Dr. Vanhoutte's

lifelong scientific contributions to our better understanding and appreciation of the importance of endothelial cells and vascular smooth muscle function in health and disease and for his mentoring of countless prominent endothelial and vascular biologists and pharmacologists.



*Sponsored by the ASPET Division for Drug Discovery and Development*

The **Scientific Achievement Award in Drug Discovery and Development** recognizes outstanding investigators who have made significant

contributions in drug discovery, translational and/or drug development science. This can include investigators who have developed technologies, methods or processes that have enhanced the process of drug discovery or enabled accelerated drug development. Contributions to any therapeutic area or therapeutic modality (small molecule, oligonucleotide, gene therapy, biologic or drug-device combination) will be considered.



*Sponsored by the ASPET Division for Drug Metabolism and Disposition*

The **Bernard B. Brodie Award in Drug Metabolism** recognizes outstanding original research contributions in drug metabolism and disposition, particularly

those having a major impact on future research in the field. This award was established to honor the fundamental contributions of Dr. Brodie in the field of drug metabolism and disposition.



*Sponsored by the ASPET Division for Pharmacology Education*

**Travel Awards for Pharmacology Educators** which defray costs to participate in the ASPET Annual Meeting at EB 2020 are available

for pharmacology educators at all career levels who are faculty members. Applicants must have significant teaching responsibilities in pharmacology: either graduate, undergraduate college classes, or professional schools.



*Sponsored by the ASPET Division for Toxicology*

The **Division for Toxicology Career Award** recognizes outstanding original research contributions to toxicology by an established investigator.



*Sponsored by the ASPET Division for Translational and Clinical Pharmacology*

The **Ray Fuller Lecture** was established to honor the achievements of Ray W. Fuller, PhD in applying an

improved understanding of the central nervous system to discover better treatments for the mentally ill. Dr. Fuller was one of the triad that discovered fluoxetine (Prozac), leading to an entire new approach to the therapy of depression. The division will select the awardee through the symposium proposal process. Outside nominations are not being accepted.

## Early Career Awards

Division-sponsored early career awards are intended for ASPET members who are past the postdoc or trainee career stage but still early in their careers (no more than 15 years after receiving their doctorate). Applications and nominations are welcome from members in academia, industry, government, or other organizational affiliations.



*Sponsored by the ASPET Division for Behavioral Pharmacology*

The **JH Woods Early Career Award in Behavioral Pharmacology**

recognizes outstanding original research by early career investigators in the area of behavioral pharmacology. Past participation in the Division for Behavioral Pharmacology and in other ASPET events will be considered when evaluating candidates.



*Sponsored by the ASPET Division for Cardiovascular Pharmacology*

The new **Division for Cardiovascular Pharmacology Early Career Award**

recognizes and honors independent investigators early in their careers working in any area of cardiovascular science.



*Sponsored by the ASPET Division for Molecular Pharmacology*

The new **Division for Molecular Pharmacology Early Career Award**

recognizes scholarly achievements by early career independent investigators in the area of molecular pharmacology.



*Sponsored by the ASPET Division for Neuropharmacology*

The **Division for Neuropharmacology Early Career Award**

recognizes and honors a young independent investigator who is working in any area of neuropharmacology.

Preference is given to candidates who hold an independent position. An independent position is considered to be one that is responsible for securing and administering their own budgets for research (traditionally a faculty position, or a team leader in a non-university setting).

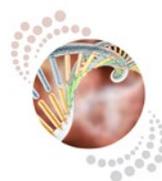


*Sponsored by the ASPET Division for Pharmacology Education*

**Travel Awards for Pharmacology Educators**

which defray costs to participate in the ASPET Annual Meeting at EB 2020 are available

for pharmacology educators who have relatively less experience as a pharmacology educator and/or junior faculty members (e.g., assistant professor). In addition to promoting participation in the ASPET meeting by pharmacology educators, this award is intended to foster career development in pharmacology education. Applicants must have significant teaching responsibilities in pharmacology, either graduate, undergraduate college classes, or professional schools.



*Sponsored by the ASPET Division for Toxicology*

The **Division for Toxicology Early Career Award**

recognizes excellent original research by early career investigators in the area of toxicology.



*Sponsored by the ASPET Division for Translational and Clinical Pharmacology*

The TCP division presents two **Early Career awards** to recognize excellence in translational and

clinical pharmacology research that comes from early career scientists. The purpose is to provide travel support to defray costs to participate at the ASPET Annual Meeting. Awardees will be invited to share with the TCP division their research and ideas pertinent to the division's mission.



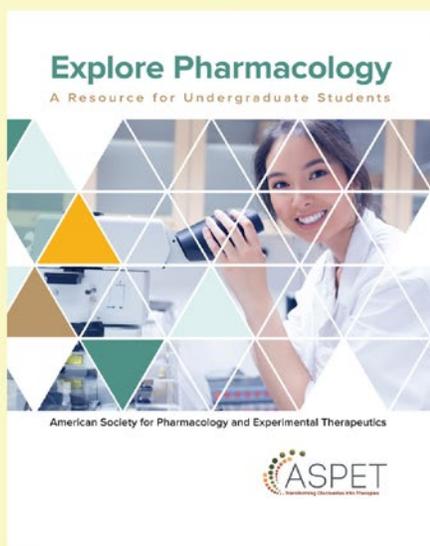
Are you an ASPET emeritus member in need of travel funding to attend the ASPET Annual Meeting at EB 2020? Apply online for the E. Leong Way Travel Award.



### E. LEONG WAY EMERITUS TRAVEL AWARD

The E. Leong Way award provides financial support to defray the expenses for an ASPET emeritus member to attend the ASPET Annual Meeting at EB. The award honors Edward Leong Way (1916-2017). Dr. Way, a former president of ASPET, is remembered for his contributions to drug metabolism research, opioid pharmacology, and a western understanding of Chinese traditional medicine, as well as the numerous scientists he mentored over 75 years of his professional life. Self-nominations are permitted.

## Promote Your Graduate Program in *Explore Pharmacology*



ASPET's Explore Pharmacology booklet provides students with a broad overview of the discipline of pharmacology. It describes the many employment opportunities that await students who pursue pharmacology and outlines the academic path that they are advised to follow. **The 2019 edition is due out this Fall and will be distributed to undergraduate students directly interested in graduate pharmacology programs.** Take advantage of this unique opportunity today!

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Visit [www.aspet.org/explorepharmacologyads](http://www.aspet.org/explorepharmacologyads) for print specifications and pricing information or contact Suzie Thompson, ASPET Marketing Director at [sthompson@aspnet.org](mailto:sthompson@aspnet.org).



# Viagra from NO to Yes

*Rebecca J. Anderson, PhD*

At the annual meeting of the American Urological Association in 1983, Giles Brindley gave a presentation that few in the audience would ever forget. The evening symposium on April 18 was co-sponsored by the Urodynamics Society and held in the ballroom of the Hilton Hotel in Las Vegas. Very little was known at that time about the physiology of penile erection or safe and effective drug treatments, so the symposium was well attended (1).

The unstated but strictly followed dress code in those days was business attire at medical conferences. But when Brindley, the first speaker, walked to the podium, he was wearing a blue track

suit (2, 3). The accomplished British neurophysiologist began his talk with a series of 35 mm slides showing photos of a human penis in various stages from flaccid to full erection (1, 2). Brindley explained that injection of vasoactive drugs into the penis could induce an erection, as shown in some of the photos (2). In an era before selfies, Brindley announced that all of those photos were of his own penis. Gasps and muffled whispers rippled through the audience (1).

Then, to emphasize the point, Brindley moved to his left, turned sideways, arched his back, and pulled up his sweatpants tight around his genitalia (1, 2). He said, "It is in fact phentolamine that I've injected into

my corpus cavernosum today, and the erection that's pushed aside by my trousers at the moment is in fact now virtually full" (3). The whispers were no longer muffled (1).

More than a hundred urologists—many having brought their spouses—witnessed this demonstration, but the bulge in Brindley's pants was hard to see by those sitting beyond the first few rows of the large ballroom. Later, he said it was at the session chairman's request, but for whatever reason, Brindley lowered his sweatpants to reveal his clearly erect penis (1, 2, 4). The audience was shocked into silence. Then, "all chaos broke out" when Brindley stepped down from the speakers' platform (pants still lowered), walked through the aisles, and invited the audience to feel how firm his penis was (1, 2, 4).



*Jimsonweed flower*

## Try, Try Again

Cultures throughout history have employed various means to facilitate erections on demand. Homer recommended the flowering jimsonweed. A 15th century European text claimed that witches caused impotence (by placing testicles of a cock under the bed) and said you could undo the hex by sprinkling the walls of your house with dog's blood and carrying around the bile of fish (3). Any efficacy from these remedies was pure coincidence.

The first report of an implanted device to treat impotence appeared in 1936. Nikolaj Bogoraz inserted human rib cartilage into the penises of impotent men (3, 5). This peculiar procedure derived from the observation that male walrus and some other

mammals have a permanent bonelike structure in their urethra that guarantees potency (3). Unfortunately for Bogoraz's patients, the cartilage implant could degrade over time, collapse on itself, and result in a permanently curved, nonfunctional penis (3, 5).

In the 1950s, investigators experimented with acrylic implants. This synthetic material could be molded and did not degrade, but few successes were reported (5).

Among the innovations spinning out of the space program in the 1960s was silicone rubber implants, and researchers determined that silicone was a satisfactory material for penile prostheses (5). Through trial and error, surgeons refined techniques and designs for implanted devices that performed physiologically and were not painful.

In 1973, F. Brantley Scott devised the first inflatable device made from silicone cylinders. In 1974, Michael Small and Hernan Carrion developed the first malleable silicone implant, subsequently called the Small-Carrion prosthesis. All of the currently available penile prostheses can be traced back to one of these two prototypes (5).

## Drugs Work, Too

Despite these clinical innovations, as recently as the 1980s, surprisingly little research regarding penile mechanics had been conducted. Scientists



*Ronald Virag*

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who studied sexual physiology received little respect from their colleagues and virtually no federal funding (3). The first significant advances resulted from serendipity and follow-up by a couple of astute researchers.

In 1982, Ronald Virag, a French cardiovascular surgeon, accidentally injected papaverine into the penile cavernosa of a patient during a surgical shunting procedure (6). The drug, a vascular smooth muscle relaxant, produced a fully rigid erection that lasted 2 hours.

Around the same time in London, Giles Brindley made a puzzling observation. Because electrical stimulation of pelvic nerves caused an erection,

conventional wisdom asserted that smooth muscle contraction in the penis mediated the response (7). By this logic, Brindley reasoned that  $\alpha$ -adrenergic blockers (which relax smooth muscle) would prevent an erection (7, 8). Instead, he found that phenoxybenzamine caused penile engorgement in 2 of 3 subjects.

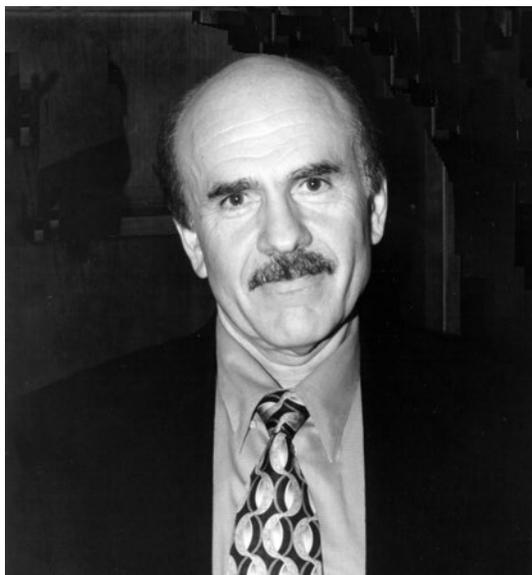
Virag and Brindley both followed up on their unexpected observations with a series of methodical, well designed studies. Their results greatly enhanced the medical community's understanding of the mechanisms involved in penile erection. Virag recruited a series of impotent men for his studies (6). But Brindley experimented on himself, because he wanted to fully experience and understand the consequences before exposing other subjects to the same procedures (4).

Brindley made dozens of injections in the cavernosal space of his penis with various specific agonists and antagonists (9). His results confirmed that only  $\alpha$ -adrenergic antagonists and direct smooth muscle relaxants mediated erection. Muscarinic receptors, for example, played no role, "despite many textbook statements that it is involved" (9).

Erections via drug-induced vasodilation seemed counterintuitive to Brindley, and he could only make educated guesses as to the mechanism. But he was satisfied that those drugs worked. He injected himself multiple times with  $\alpha$ -adrenergic blockers to optimize the dose and his injection technique (7).

Extending his studies to 4 potent and 11 impotent men, Brindley demonstrated that the  $\alpha$ -adrenergic blocker, phenoxybenzamine, "is of clear practical use, in that it causes prolonged full erection in some men with erectile impotence and allows them to have sexual intercourse" (7). He also made the insightful observation that when phenoxybenzamine or papaverine produced only a partial erection in impotent men, "sexual stimulation during this partial erection makes it complete" (9).

Brindley's unforgettable demonstration in Las Vegas revolutionized the treatment of impotence. Many of the attendees returned to their practices, confirmed Brindley's results, and began training impotent men to self-inject with papaverine or phentolamine. Without Brindley's "spectacular *tour de force*," they claimed, convincing the urology community to inject a drug to treat impotence "would have taken years if not decades to evolve" (1).



Louis Ignarro

Further insight regarding the physiology of penile erection came from Louis Ignarro, a pharmacologist, and Jacob Rajfer, a urologist, at UCLA. In 1988, they began a productive collaboration and found that sexual activity triggers release of the neurotransmitter, nitric oxide (NO), in the penis. NO increases production of cGMP, which relaxes vascular smooth muscle, dilates penile arteries, and enables erection (10). The enzyme, phosphodiesterase, rapidly degrades cGMP, and without sexual stimulation, the levels of cGMP remain very low, accounting for a flaccid penis.

## Heartaches, Headaches

In the mid-1980s, five families of phosphodiesterases (PDE) had been characterized (11). These enzymes broke down cAMP, cGMP, or both. PDE 5 was present in vascular smooth muscle and platelets and appeared to be the only PDE that selectively degraded cGMP.

In 1986, Pfizer established a project team to find a PDE 5-specific inhibitor (11). Such a drug, they thought, should prevent angina attacks by dilating coronary arteries. Inhibiting platelet aggregation should also be beneficial, preventing thromboembolic heart attacks and strokes.

At the time, nitrates were the primary treatment for alleviating acute angina attacks. Drugs like nitroglycerin generate NO, which diffuses into the blood vessels, increases cGMP levels, causes coronary vasodilation, and improves blood flow to an ischemic heart. But the effect is short-lived, and tolerance to



Nick Terrett

nitrates develops quickly. The Pfizer researchers thought that blocking the breakdown of cGMP with a PDE 5 inhibitor would produce a longer-lasting therapeutic benefit (11).

Over the next 3 years, the team at Pfizer's European Research Centre in Sandwich, England, synthesized and tested 1,500 compounds (3). In December 1989, they produced UK-92,480, which proved to be a potent and selective PDE 5 inhibitor in their laboratory tests and animal models (11). After preclinical safety testing, the first Phase 1 trial was conducted in England in 1991. It was a single-dose safety study of UK-92,480, now called sildenafil (3, 11).

The second Phase 1 trial, a multi-dose study, began in early 1992 with healthy volunteers in South Wales. Sildenafil had a short half-life and was given orally 3 times daily for 10 days. The results were not promising (12). The subjects reported muscle aches and backaches at the doses that the researchers predicted would be needed to treat angina (3, 12).

Nevertheless, the project team moved ahead with the next trial—the first and only trial in angina patients. Sildenafil produced some mild beneficial effects on blood pressure and cardiac output but not the significant improvement in angina that the team expected (3, 11).

In parallel, Ian Osterloh, a manager at one of Pfizer's Phase 1 clinical units, conducted a small trial to determine the interaction between sildenafil and nitrates. When the two drugs were given together, healthy volunteers experienced a profound drop in

blood pressure (12). This posed a significant risk to angina patients, who might be exposed to both drugs, accidentally or otherwise.

The disappointing clinical results—on both safety and efficacy—greatly dampened enthusiasm for the drug. David Brown, a Pfizer chemist, recalled, “People weren't coming to the project team meetings—they all smelled failure” (13). At their quarterly project review meeting in June 1993, Pfizer's executives threatened to terminate the angina program.

## Anything Else?

Days later, the team received some encouraging news. At the end of the multi-dose Phase 1 trial in Wales, the investigators asked the subjects an open question: Is there anything else you noticed during the trial? One Welsh miner put up his hand and said, “Well, I seemed to have more erections during the night than normal.” Some of the others smiled and said, “So did we” (13).

Reports of this sildenafil “side effect” did not come as a surprise to Peter Ellis and Nick Terrett, researchers in Pfizer's discovery lab at the Research Center in Sandwich. They were aware of the UCLA researchers' studies regarding the role of NO and cGMP in penile erection. In 1991, they had suggested that sildenafil, by inhibiting PDE 5 and increasing cGMP levels in the penis, might be useful in treating impotence (11).

Ellis and Terrett's scientific rationale, along with the Welsh miners' feedback, helped the Pfizer team to convince their senior managers to pursue this effect. They received executive approval for a pilot trial of sildenafil in impotent men. But designing the clinical protocol for this study posed several unique challenges.



Rigiscan instrument

First, they needed a way to measure the magnitude of each erection. Physicians had been using an instrument called RigiScan to differentiate patients with organic versus psychogenic impotence, by measuring penile rigidity while the patient slept. The Pfizer team decided that this measuring device would be suitable for their purposes as well (3).

Next, because NO release was mediated by nerve impulses that were activated by sexual stimulation, they knew that sildenafil would work only when subjects were sexually active. To get meaningful results, the team needed to standardize sexual stimulation. They decided that they would have the men view erotic videos and magazines while hooked up to the RigiScan device. However, laws in the UK at that time strictly regulated the use of sexually explicit materials. With some difficulty, the researchers managed to convince the British Home Office to grant a license for importing this material from Europe (3, 13).

Finally, the subjects needed to be in a quiet, relaxed setting—rather than the hubbub of a typical clinic. The investigators found a private hospital room in Bristol, England. The men took sildenafil 3 times daily for a week and then reported to the hospital for the RigiScan session (11). To ensure patient privacy, the sessions were scheduled in the evenings and on weekends (3).

Pfizer's management had authorized this trial reluctantly, and almost everyone thought that sildenafil wouldn't work (3). The erections in the Welsh miners had occurred after high doses, which also caused significant side effects. The dose chosen for this trial was much lower (to avoid adverse effects) and had never been associated with erections.

Despite everyone's concerns, the RigiScan measurements and feedback from the impotent men was very encouraging—they asked for more tablets. It confirmed that combining sildenafil with sexual stimulation was the key (3).

In all of the early studies, men took sildenafil 3 times a day (3). But to be practical as an impotence treatment, the drug needed to be reliably effective after a single dose—and work quickly.

In May 1994, the next Phase 2 trial, also conducted in Bristol, provided the proof the team needed. The double-blind, randomized, placebo-controlled crossover study enrolled 12 impotent men. A single dose of sildenafil induced erections while men were watching erotic videos. And the magnitude of the response

(measured by RigiScan) was dose dependent (15).

By this time, Pfizer researchers had found PDE 5 in human corpus cavernosal smooth muscle (11, 16). They also showed fairly conclusively that sildenafil's mechanism of action in treating impotence “involves the potentiation of the NO-stimulated cGMP signal mediating relaxation of cavernosal smooth muscle during sexual stimulation” (16). “Ok,” Peter Ellis said, “this could really be something worth having” (3). Pfizer accelerated the clinical trial timetable (11).

Concurrently with these trials, the National Institutes of Health issued a consensus statement. A review panel said that the term “impotence” was confusing and often led to “uninterpretable results in both clinical and basic science investigations” (17). They suggested a more precise term, “erectile dysfunction,” be used instead.

## Bedroom Data

The RigiScan device had provided quantitative data in a controlled environment, but the Pfizer team now faced another challenge. How could they show that the drug worked during unstructured activities—in the bedroom?

At the annual American Urological Association meeting in 1994, Ian Osterloh found a solution. He attended a poster session, where a urologist presented a sexual-function questionnaire that he was developing (3). Such a questionnaire might work for Pfizer's trials, if they could validate it.

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*The RigiScan device had provided quantitative data in a controlled environment, but the Pfizer team now faced another challenge. How could they show that the drug worked during unstructured activities—in the bedroom?*

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Back in Sandwich, Osterloh convened a team of internal and external experts. They wanted to develop relevant questions describing male sexual function that everyone could agree upon, regardless of culture and language (3, 19). The final product, called the International Index of Erectile Function (IIEF), consisted of 15 questions that seemed to be universally accepted and were grouped into 5 categories: erectile function, orgasmic function, sexual desire, intercourse

**Table 2** The IIEF-5 questionnaire<sup>a</sup>

Over the past six months:					
	Very low	Low	Moderate	High	Very high
1 How do you rate your <b>confidence</b> that you could get and keep an erection?	1	2	3	4	5
2 When you had erections with sexual stimulation, how often were your erections hard enough for penetration?	Almost never/never	A few times (much less than half the time)	Sometimes (about half the time)	Most times (much more than half the time)	Almost always/always
3 During sexual intercourse, <b>how often</b> were you able to maintain your erection after you had penetrated (entered) your partner?	1	2	3	4	5
	Almost never/never	A few times (much less than half the time)	Sometimes (about half the time)	Most time (much more than half the time)	Almost always/always
4 During sexual intercourse, <b>how difficult</b> was it to maintain your erection to completion of intercourse?	1	2	3	4	5
	Extremely difficult	Very difficult	Difficult	Slightly difficult	Not difficult
5 When you attempted sexual intercourse, how often was it satisfactory for you?	1	2	3	4	5
	Almost never/never	A few times (much less than half the time)	Sometimes (about half the time)	Most times (much more than half the time)	Almost always/always
	1	2	3	4	5

<sup>a</sup>The IIEF-5 score is the sum of the ordinal responses to the five items; thus, the score can range from 5 to 25.

Reprinted with permission from Springer Nature. See (18).

### IIEF-5 Questionnaire

satisfaction, and overall satisfaction (19).

The IIEF was pilot-tested on men with erectile dysfunction (ED) in the United Kingdom and Sweden and then linguistically validated in 12 countries in 10 languages. The questionnaire, and its simplified 5-question version, IIEF-5, have subsequently been accepted as the gold standard for assessing ED drugs in clinical trials, as well as for classifying ED severity and prevalence (11).

The first Phase 2 trial using the IIEF questionnaire began in September 1994, enrolling 351 ED patients in the UK, Sweden, and France. Men took one of three sildenafil doses or placebo daily at home for 4 weeks. In February 1995, Osterloh received the interim results, which showed “a beautiful dose-response on the IIEF questions in general and on the key question of whether sildenafil improved men’s erections” (3).

In December 1994, Pfizer started a second large Phase 2 trial in the UK, Norway, and France. This was an open-label dose-escalation trial, in which the men started with a 10 mg dose and were allowed to increase their daily dose stepwise if they were not helped by the lower dose. Most men settled on 100 mg as their preferred dose. They took the drug at home in conjunction with intercourse—on average, twice a week. After 16 weeks, they entered a “blind extension” of the trial and were randomized to either continue at their favored sildenafil dose or were given placebo. Those taking placebo rapidly returned to

their baseline erectile function—and many of them complained about it (3).

## We Want More

Typically, at the end of early clinical trials, patients are expected to return their unused tablets. But the Pfizer team was receiving many letters requesting additional drug supplies after trial completion. Some men were quite insistent. One said, “This is like throwing a drowning man a life preserver and then pulling the plug out of it” (3).

So, Pfizer launched open-label extension trials and allowed patients from the Phase 2 trials to enroll. The extension trials benefitted everyone. The patients could receive sildenafil for an additional year, and Pfizer collected data on the drug’s long-term effects.

## More Good News

All of the early clinical trials restricted enrollment to men whose ED was due to nonorganic (that is, psychological) causes. Then, in several small, specialized studies, RigiScan measurements showed that sildenafil was also effective in impotent men with diabetes and spinal cord injuries. In planning the pivotal Phase 3 trials, the team expanded enrollment to include the broadest possible range of ED patients. But Osterloh nearly left out radical prostatectomy patients, “because we thought—mistakenly, as it turned out—that there is no way that sildenafil is going to work for them” (3).

The Phase 3 trials began in late 1995 in the US, Canada, and Europe (20). Pierre Wicker, who managed Pfizer's American clinical trials, said, "We had more patients willing to participate than we could accept" (3). Those patients' responses confirmed and expanded the results of the earlier trials. Sildenafil was effective in more than 80% of the patients, regardless of the cause of their ED, and the erections reliably occurred about 25 minutes after taking the tablet (3, 20).

While the Phase 3 trials proceeded smoothly, some of the Phase 2 patients were nearing the end of their one-year open-label extensions. Again, Pfizer was deluged with letters, pleading for continued access to the drug. So, the Pfizer team added 3 more years to the open-label extension studies (3).

After clinical trials in more than 4,000 satisfied patients, the most commonly reported adverse events were headache and flushing (16% and 10%, respectively). In most cases, these effects were transient and mild (20, 21).

Because the Pfizer researchers had specifically designed sildenafil to dilate coronary arteries, a team of cardiologists carefully analyzed the data for signs of serious cardiovascular side effects. The incidence of heart attacks, strokes, and other cardiac events was no different between sildenafil- and placebo-treated patients (11, 21). Also, the patients did not experience hypotension or any adverse effects related to blood pressure, such as dizziness (3).

The broad range of patients recruited for the Phase 3 trials included many men with health problems (like hypertension and diabetes) that required drug

treatment. Fortunately, interactions between those drugs and sildenafil did not alter sildenafil's safety profile or vice versa (3).

There was one exception. As Osterloh had found in his drug-interaction study, the combination of nitrates and sildenafil causes a dangerously abrupt drop in blood pressure. For that reason, nitrates are one of the few contraindications for sildenafil (3, 11).

Another mechanism-related adverse effect of sildenafil was an effect on vision. As new families of PDEs were characterized, the Pfizer researchers systematically assessed sildenafil's effect on them. They found that sildenafil is a weak inhibitor of PDE 6, which is located exclusively in the retina and plays a role in phototransduction (11, 16, 22). Although the Pfizer team saw no eye toxicity in animals, they closely monitored the patients enrolled in the Phase 2 and 3 trials for effects on the eye. In addition, as a precaution, they excluded men with retinitis pigmentosa.

About 3% of the sildenafil-treated patients reported blue-tinged vision and an increased sensitivity to light, which seemed to correlate with inhibition of PDE 6 (1, 22). Fortunately, the men experienced no changes in color vision or visual function, even after long-term treatment. They might experience the visual effect when they took the drug, but it was always transient and did not affect their daily life (22).

A good indicator of sildenafil's efficacy and tolerability was that 90% of all patients in the clinical trials completed long-term treatment, and only 2% withdrew because of side effects (20, 21).

## The Little Blue Pill

After 8 years of research, the Pfizer team had conducted 21 clinical trials in 13 countries involving nearly 4,500 men. And thanks to the open-label extensions, they had long-term safety data from some men who had been taking the drug for 3 years. On September 29, 1997, Pfizer representatives simultaneously hand-delivered a CD-ROM containing all of the accumulated data to both the U.S. Food and Drug Administration (FDA) and the European Medicines Agency (3).

FDA approved Viagra® (sildenafil citrate) on March 27, 1998. Within hours, Osterloh and other key investigators held a press conference announcing Viagra, the first oral drug approved for



Viagra tablets

the treatment of ED. For the next 4 months, Pfizer's switchboard was flooded with phone calls from the press, the public, and physicians (3).

Print and broadcast coverage, including cover stories in *Time* magazine and *Business Week*, reached an estimated 140 million Americans—greater media attention than any other drug in history. At the same time, former presidential candidate Senator Bob Dole appeared on *Larry King Live*. Dole, a radical prostatectomy patient, had participated in the Viagra clinical trials. He endorsed Viagra, saying it was “a great drug” (3). Pfizer seized on this public announcement and engaged Dole in an ED public awareness initiative and its ads for Viagra.

Pfizer's marketing department had made several strategic decisions. The product would be a little blue, diamond-shaped pill. They also decided to use the recently proposed term “erectile dysfunction,” rather than impotence, “to remove the social stigma” (13). Among the wide range of marketing materials, they developed educational brochures specifically for doctors, because medical schools had not trained them on how to raise the delicate topics of sexual function and ED with their patients (3).

Pfizer also invested considerable effort in preparing its sales force, because they anticipated Viagra would probably elicit jokes and off-color comments (3). The training was aimed at helping the sales staff become more comfortable talking about ED and ensuring that those conversations remained professional (13). One Viagra sales representative, Jamie Reidy, said Pfizer conducted hours of workshops and sexual harassment training, “especially for the female reps who were going to be talking about erections all day long” (13).

Television advertising was also a challenge. At the time, media regulations prevented Pfizer from running its Viagra ad before 11:00 pm. Jennifer Doebler, Pfizer's marketing director, had to “go and talk to every single network and make the case why they had to let the ad run before 11, when [our] target audience was awake and watching” (13).

## A Blue Rocket

Prior to Viagra, less than 10% of ED patients had sought treatment. Those who did start treatment often stopped (3). Coincidentally, Viagra reached the market just as the baby boom generation was transitioning into middle age. More than any previous generation,

the boomers wanted to continue living youthfully and deflected aging labels. They invested heavily in their health, including treatment for ED, which affects more than half of all men aged 40-70 (3).

During the first 6 months of Viagra's availability, physicians wrote 5.3 million prescriptions for it—the most successful introduction ever for a US drug. Within 18 months, it had captured 90% of the market (3).

Every physician had stories to tell. Some extended office hours, including weekends, to accommodate the overwhelming demand. Some patients came in wearing a trench coat, hat, and sunglasses and refused to give their name. To avoid patient embarrassment, one doctor referred to it as Vitamin V. Another had a 90-year-old patient who unflinchingly came every 3 months for a urological checkup, despite being “absolutely fit as a fiddle.” He was simply coming to get another pack of Viagra samples (13).

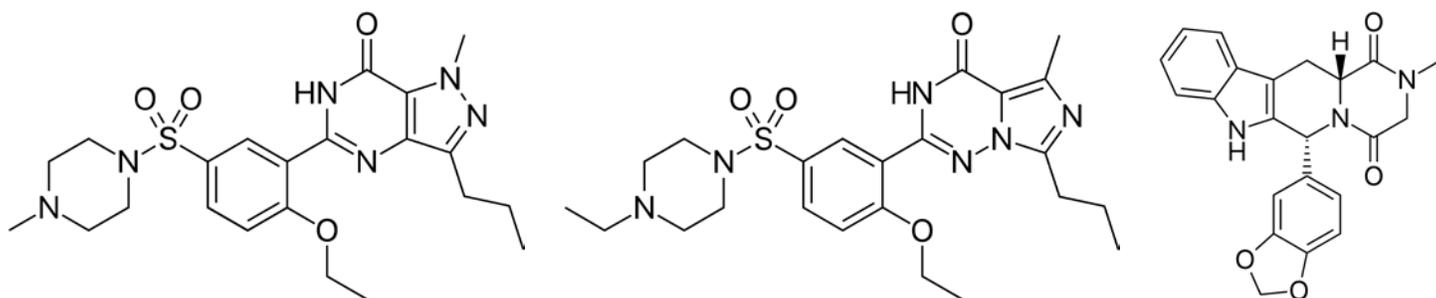
Viagra unquestionably benefitted men, but the reaction among women was mixed. There were those like the woman who threatened to call off her wedding unless her fiancé (a participant in the clinical trials) could continue getting experimental sildenafil after the trial ended (3). But there were also wives who said, “I thought we were done with that” (13).

## Changing Hearts and Minds

Before Viagra, the prevailing view among experts, including Masters and Johnson, was that virtually all cases of ED stemmed from psychological causes (3). The relationship between ED and depression is complex, but Viagra was effective in men who suffered from both. In fact, Viagra treatment not only alleviated ED but also often reduced the symptoms of depression (3).

Certainly, depression and anxiety are important factors. But the Viagra clinical trials confirmed that about 80% of ED cases are associated with underlying medical conditions like diabetes and hypertension, as well as physical damage from spinal cord injury or radical prostatectomy (3).

Urologists had conducted most of the Viagra clinical trials, because ED was considered a subspecialty of urology, and urologists administered treatment (i.e. surgical implants or penile drug injections). But the Viagra trials made it clear that physicians across the entire medical spectrum would be prescribing it. Many men who had avoided routine checkups were now visiting their doctors, asking for



Chemical structure of sildenafil, vardenafil, and tadalafil

Viagra. Within a year, primary care physicians were writing 60% of all Viagra prescriptions (3).

Often, those patients' ED was actually an early sign of an underlying and potentially serious health condition. Atherosclerosis, for example, is the most common cause of organic ED. The narrow vessels of the penis are more sensitive to blockage than the larger heart vessels, making ED one of the first symptoms of cardiovascular disease.

Other contributing conditions include diabetes, hypertension, alcohol, cigarette smoking, and some drugs (such as antidepressants, antihistamines, and opioids) (3). Viagra played a broad role in improving men's health, because it brought men to the doctor's office. Physicians could detect serious diseases earlier, and in many cases, treatment of those diseases alleviated ED without Viagra intervention.

Viagra does not affect sperm motility or morphology. It therefore assisted couples who wanted to start a family. It was especially helpful for young men with diabetes, spinal cord injury, or depression (3).

Viagra also tempted entrepreneurs. According to a recent FDA survey, 776 dietary supplement products contain undeclared but potent drugs. Sildenafil is the mystery drug most commonly missing from the label of over-the-counter products for sexual enhancement (23).

Another creative use was in US intelligence. Afghan warlords and tribal leaders expected to be paid for their cooperation, but cash and weapons were not always the best bribes. Showy gifts brought unwanted attention and might get the informant killed. Rather, the CIA sought to meet an informant's personal needs without leaving a visible trace (24). The long list of personalized incentives included surgical and dental services for the informant or his family. For older tribal leaders, intelligence operatives could dangle another enticement.

One CIA officer, for example, had tried in vain to win the cooperation of a 60-year-old Afghan chieftain, who had

extensive knowledge of the region but was cautious about engaging with the Americans. Finally, the intelligence operative pulled out 4 blue pills and said, "Take one of these. You'll love it." Four days later, the operative returned and the chieftain rushed up to him, beaming. "After that, we could do whatever we wanted in his area" (24).

## Culture Shift

*USA Today* called Viagra "the little blue tablet that triggered a sexual revolution" and said that "life... will never be the same" (25). "Erectile dysfunction" entered the mainstream, going from a taboo topic—unmentioned even in the bedroom—to a legitimate medical disorder (13). Research of sexual function intensified and yielded a better understanding of erectile physiology and the underlying causes of ED. Pharmaceutical researchers produced several new oral drugs: tadalafil (Cialis®) and vardenafil (Levitra®).

Viagra also launched a thousand bad jokes and became a recurring topic of late-night television monologues—just one more sign of the profound shift in our culture (13). Male sexuality is now openly discussed, flashy ads for ED drugs are commonplace, and diseases in men are detected earlier.

In 1998, pharmacologist Louis Ignarro received the Nobel Prize in Physiology or Medicine for his discovery of NO's role in human physiology, including its role in facilitating erections. He called Viagra, a logical extension of his research, "one of the most novel and long-needed drugs in history" (3).

Giles Brindley, now 93 years old, has had a long and distinguished career in neurophysiology, conducting innovative research of visual, genitourinary, and sexual function (4). He also excelled in mechanical engineering and produced neurosurgical devices for spinal cord injury patients. A beloved mentor, Brindley inspired many young researchers, arranged their

funding, and provided vital guidance (27). In 1965, he was elected a Fellow of the Royal Society, Britain's highest honor for scientists. He was also knighted for his work in bioengineering (4, 27).

Although his methods were often unconventional, Brindley's passion and attention to detail led to many major research contributions and therapeutic milestones—none more memorable or impactful than his demonstration in Las Vegas. It was summed up best by Alvaro Morales, a urologist at the Las Vegas meeting and who later conducted some of the Viagra clinical trials: “The field was thrown wide open...the physiology and pharmacology of the erectile process became understood. New drugs were developed... Humanity owes a great deal of gratitude to Giles Brindley's brilliant mind (and to his penis)” (1).

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*Gladly I think of the days  
When all my members were limber,  
All except one.  
Those days are certainly gone.  
Now all my members are stiff,  
All except one.  
—Goethe*

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Giles  
Brindley

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## Biosketch:



Rebecca J. Anderson holds a bachelor's in chemistry from Coe College and earned her doctorate in pharmacology from Georgetown University. She has 25 years of experience in pharmaceutical research and development and now works as a technical writer. Her most recent book is *Nevirapine and the Quest to End Pediatric AIDS*. Email [rebeccanderson@msn.com](mailto:rebeccanderson@msn.com).

## In the next issue of *The Pharmacologist*...

Dr. Anderson will share the story of heparin.

**Don't miss the September 2019 issue.**



# Science Policy News

## 2019 Fellows Visit Washington, D.C.



*2019 Washington Fellows and guides*

In late April and early May, the ten awardees of ASPET's Washington Fellows program arrived in Washington, D.C. for a two-day event where they trained in advocacy, heard from guest speakers on policy topics, and traveled to Capitol Hill to meet with lawmakers and staff. This year's class is the first to meet as a group in Washington, D.C. following a revamping of the program last year. The new program intends to streamline the format and provide better preparation to fellows, develop opportunities for networking, and create an experience that encourages deeper engagement with ASPET and the legislative process.

The fellows arrived on April 30th and jumped right into a day of programming. After receiving a review of their materials and schedules for the following day from ASPET's Government Affairs representative Tyler Lamb, the fellows heard from three invited speakers on issues connected to legislation and policy. Moutray McLaren, Chief of Staff to Rep. William Timmons (SC-4), discussed how to conduct successful hill meetings with staffers. McLaren began his political career under then Rep. Mick Mulvaney (SC-5) and took hundreds of meetings with constituents on issues related to health



*Fellows during the training session*

and budgetary policy. He encouraged the fellows to be aware that staffers are often overworked and unable to deeply research the particulars of a bill before a meeting. As he explained, a good way to ensure a successful meeting is to show up prepared and able to guide a staffer through the nuances of the legislation you're intending to support or advocate against.

Next, the fellows heard from Ben Krinsky, PhD, Associate Director for Legislative Affairs at the Federation of American Societies for Experimental Biology (FASEB), of which ASPET is a member. Dr. Krinsky gave an in-depth review of the budget and appropriations process to prepare the fellows for their advocacy on behalf of raising this year's budgetary caps and encouraging increased federal investment in biomedical research. As Dr. Krinsky explained, the appropriations process rarely follows regular order, and a complex interrelation of several fiscal measures—the need to raise the budget caps, the looming debt ceiling, the use of continuing resolutions—makes advocating for appropriations increases a sometimes confusing process, especially this year. Thanks to his patient and thorough explanation of the process, our fellows were well-

prepared to discuss research funding with their legislative offices.

Finally, Remy Brim, PhD, a former Senate staffer for Senator Elizabeth Warren (MA) and Senator Patty Murray (WA), and current Vice President of Government Affairs for the BGR Group addressed the group. Dr. Brim relayed her experiences with deciding to move from a career in science to a career in science policy, and gave advice on what opportunities are available to scientists looking to make a similar move. Scientists interested in policy have a variety of options available to them, from working on the Hill, to working for a regulatory agency, to working for one of the many advocacy or trade organizations in D.C. One point she emphasized repeatedly is that in moving to a new career track, scientists may have to start lower on the policy totem pole than they may feel is warranted, but that their academic training will give them a significant advantage in rapidly advancing in their careers.

To close out the day's programming, the fellows were introduced to the four volunteer guides that would help them navigate the Hill the next day. The four guides—Dr. Sophia Kaska, Dr. Michael Tranter, Dr. Lauren Haar, and Ryan Staudt—all former Washington Fellows, assisted fellows with the challenging task of engaging in advocacy on Capitol Hill for the first time. After introductions, the fellows checked into their rooms at The Fairmont and prepared for a group dinner at Rasika West End.

The next morning, the fellows and their guides met and traveled to Capitol Hill for their meetings. In addition to advocating for raising the budget caps and increasing federal funding of biomedical research, the fellows also educated staffers on the importance of animal models to scientific research. Over the course



*Fellows Angela Van and Nicholas Warren with their guide Dr. Sophia Kaska meeting with Sen. Feinstein's office*

of the day, the fellows attended thirty-four meetings. Collectively, they met with twenty-three Senate offices and eleven House offices from a combined thirteen states, nearly even split between Democrats and Republicans (eighteen vs. sixteen). The impact of their advocacy not only helped explain to staffers the importance of science, it also raised the profile of ASPET among legislative offices. At the end of the day, fellows gathered their luggage and headed to the airport to return home.

Next up, the fellows will use their newly gained knowledge and experiences to write op-ed articles for local publications on ASPET policy issues. The program will conclude in June. If you're interested in being a Washington Fellow, applications for the 2020 Fellows class will open in the fall. Please monitor communications from ASPET for details.



## THE WASHINGTON FELLOWS PROGRAM

Enables developing and early career scientists interested in science policy to learn about and become more engaged in public policy issues. Learn more at: <https://www.aspet.org/aspet/advocacy>



# Education News

## ASPET Names 2019 Individual Summer Undergraduate Research Fellows

The ASPET Summer Undergraduate Research Fellowship (SURF) program is designed to introduce undergraduate students to pharmacology research through a 10-week summer laboratory research experience. The goal of the program is to use authentic, mentored research experiences in pharmacology to heighten student interest in careers in research and related health care disciplines. ASPET offers both institutional and individual SURF awards. Institutions with funded fellowship programs are listed at <http://www.aspet.org/awards/SURF/institutional-Funded/>. The individual fellowships are designed to support students whose home campus lacks an institutional program or who seek more specialized training opportunities at a different university. ASPET congratulates the 5 students selected for 2019 individual fellowships:



### Nina Beltran

Nina Beltran, a student at the University of Texas at El Paso, will work with Dr. Katherine Serafine. Her research project will examine the impact of eating a high fat diet on the sensitivity of male and female rats to the behavioral effects of two

serotonergic drugs that produce serotonin syndrome.



### Nicholas Harris

Nicholas Harris will be working in the laboratory of Dr. Sarah Lindsey at Tulane University. The goal of his summer research project is to understand how trafficking of the prorenin receptor in endothelial cells impacts

vascular damage in Type II diabetes. He will use a combination of cell culture, an inducible and cell-specific knockout model, and ex vivo analysis of vascular reactivity and structure.



### Alexis Hall

Alexis Hall will be working in the laboratory of Dr. Brooks Pond at East Tennessee State University. Alexis will examine how a dehydrogenation product of nicotine found in electronic cigarette vapor, nicotyrine, affects the pharmacokinetics

of nicotine in a rodent model. Nicotyrine and nicotine levels will be extracted from brain and plasma and measured using high-performance liquid chromatography-tandem mass spectrometry.



### Ashley Hendricks

Ashley Hendricks, a student at Vanderbilt University, will be working in Dr. Erin Calipari's laboratory to elucidate the role of D1 and D2 medium spiny neurons in decision making and cue-reward processing. Ashley will selectively inhibit particular

neurons in mice using DREADD and run behavioral experiments to determine how these neurons contribute to addictive behaviors.



### Jennifer Tat

Jennifer Tat, a student at Vanderbilt University, will be working with Dr. Erin Calipari. Her project aims to understand what changes in the dopamine system occur in males and females following cocaine self-administration. The goal of this

project will be to link sex differences in basal dopamine system function and cocaine-induced neural plasticity to the development of addictive behaviors.

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*We wish the 2019 individual fellows as well as the fellows participating in the SURF institutional programs a productive and fun summer of research!*

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## Institutional Summer Undergraduate Research Fellowship (SURF) Program



### APPLICATIONS DUE OCTOBER 1, 2019 FOR 2020 AWARDS

ASPET's Summer Undergraduate Research Fellowship (SURF) program introduces undergraduate students to pharmacology research through a 10-week laboratory research experience. The goal of the program is to use authentic, mentored research experiences in pharmacology to heighten student interest in careers in research and related health care disciplines.

#### Who Should Apply

Groups of faculty from the same campus who conduct pharmacology-related research including, but not limited to, scientists representing departments of pharmacology, toxicology, pharmaceutical sciences, and/or biological chemistry are encouraged to apply for funding to establish a SURF program on their campus. If awarded,

institutional programs will be responsible for recruiting and selecting students to participate.

#### Program Overview

- A group of at least five ASPET regular or affiliate members in good standing from one institution may apply, with one ASPET member serving as the program director.
- Students are expected to receive at least a \$2,800 stipend for a minimum of ten weeks participation in the program. ASPET support for an undergraduate fellowship program is \$1800/student for at least 5 students per year of funding (\$9000 total/year). The application should include an institutional commitment for matching funds of at least \$1000/student from local resources.
- Student participants are expected to be current members of ASPET or to join no later than the start of their summer research experience.

Institutional awards are normally made for three years. For award terms and application instructions, please visit <https://www.aspet.org/awards/SURF>. For questions, please contact Catherine L. Fry, PhD at [cfry@aspnet.org](mailto:cfry@aspnet.org).

# AAMC-CFAS Meeting in Review

*Submitted by Joe Blumer and John Szarek*

The AAMC Council of Faculty and Academic Societies (AAMC-CFAS) meeting was held April 4-6, 2019 in Atlanta, GA. ASPET was represented by Joe Blumer (Medical University of South Carolina) as a junior society representative. CFAS provides a platform for faculty at academic medical centers to identify critical issues facing medical school faculty and academic societies and provide a voice for faculty in the creation and implementation of AAMC programs. A total of 135 medical school and academic society representatives and AAMC staff attended the 2019 annual meeting.

While many topics were addressed, major themes included sexual harassment in academic medicine; bioethics, health policy, and research advocacy; and changes in medical and biomedical education.

## Sexual Harassment

The opening plenary discussed sexual harassment in academic medicine. Dr. Vivian Pinn (former director, NIH Office of Research on Women's Health) presented a recent report from the National Academy of Sciences, Engineering, and Medicine on the prevalence of sexual harassment and strategies to overcome and prevent it. While the full report can be found at <http://sites.nationalacademies.org/shstudy/index.htm>, a take-home message is that focusing on legal compliance is necessary but not sufficient to reduce sexual harassment; the climate and culture at our institutions must be changed. Esther Choo (Oregon Health and Science University) suggested that sexual harassment should be treated like an infectious disease with an emphasis on prevention, early detection, and measurement of progress until the problem is mitigated rather than solely relying on legal outcomes. There should also be awareness of the long-term sequelae of sexual harassment, which include decreased productivity, avoidance of interactions with others, and long-term impacts on career development and advancement.

## Bioethics, Health Policy, and Research Advocacy

The second plenary discussed hot topics in bioethics, health policy, and biomedical research.

Discussion points included the creation of synthetic genomes, "DIY" genetics, and CRISPR/gene editing in humans. Questions regarding experimental vs. health-related reasons for gene editing as well as obtaining informed consent, the environmental and health impacts of genetically modified organisms, and machine learning/artificial intelligence were also discussed. Public trust in science appears to be worsening due to the perception that science is done for political-economic agendas. Faculty members were encouraged to learn the differences between politics vs. policy and to advocate for health policies that improve the health of the population.

Dr. Ross McKinney, AAMC Chief Scientific Officer, addressed improving public trust in scientific research. He suggested that over-hyping results (e.g., "curing" cancer based on relatively small studies) only serves to reduce credibility. Furthermore, there should be an effort to improve reproducibility and transparency in research design and analysis and to avoid confirmation bias. Increased visibility of retracted papers and incidents of research misconduct only serve to undermine our credibility as scientists. Conflicts of interest have raised multiple levels of concern, including an emerging issue of "academic espionage" in which foreign governments seek to exploit U.S.-funded research (in some cases potential sharing of confidential grant applications). This undermines the rich history of immigrants in U.S.-funded research and discovery and erodes trust in rules regarding intellectual property and collaboration.

Through CFAS, the AAMC has distributed several advocacy sign-on letters that bring societies like ASPET together to have a unified voice on important issues, including the AAMC Ad Hoc Group for Medical Research's FY2020 NIH Funding Recommendation Endorsement, among others ([www.aamc.org/adhocgroup](http://www.aamc.org/adhocgroup)). Bipartisan support for increasing NIH funding is steadfast with four consecutive years of NIH budget increases. For FY2020, the AAMC recommendation is for at least \$41.6 billion (a \$2.5 billion increase) for NIH. There is concern regarding potential budget caps on NIH growth; since about

20% of NIH funds are available for new projects each year, even a small drop inhibits funding for new grant applications, which stifles innovation.

### Education

Education was another point of emphasis in both plenary and breakout sessions. Within undergraduate medical education, there is an increasing emphasis on fostering curiosity, standardizing learning outcomes, individualizing the learning process, promoting multiple forms of integration, and fostering development of a future physician's professional identity. Institutions have many content experts, but few true educators, so there is a need to educate the educators.

In a workshop on revitalizing and invigorating PhD education, there was discussion of how and why academic medical centers are transforming education in order to prepare trainees for successful employment. The job market for PhD researchers is fairly stable and can absorb the current rate of trainees with an unemployment rate of ~2%, with 15-20% of PhDs accepting academic faculty positions. Given these data, there does not appear to be a broad effort to reduce the number of PhD trainees. However, there should be an effort to continue to expand the professional skill set for trainees to meet the diverse demands of today's biomedical workforce, which is reflected in Keith Yamamoto's

PhD "hub" with career option "spokes" model (<https://www.ibiology.org/biomedical-workforce/graduate-education>). Unanswered questions include: 1) How do we modernize graduate student curricula to include diversity in the PhD workforce? Do some course components and/or research experiences get eliminated to make room for this new material, and if so, which ones? 2) How can we incorporate multi-disciplinary training in PhD education? 3) Is there adequate mentoring of PhD students in non-academic vocations, and if not, who assumes this role?

CFAS appears to be responding to prior feedback from basic scientists as evidenced by conference programming with either broad interest to both clinical and basic scientists or to basic scientists in particular. We should, therefore, continue to engage with CFAS to ensure our voice and concerns as pharmacologists are heard by the AAMC and the general public. As your representatives to CFAS, we are keen to advocate for the concerns of ASPET members at CFAS meetings. As your representatives to CFAS, we are keen to advocate for the concerns of ASPET members at CFAS meetings. Please email either Joe Blumer ([blumerjb@musc.edu](mailto:blumerjb@musc.edu)) or John Szarek ([jszarek@som.geisinger.edu](mailto:jszarek@som.geisinger.edu)) with issues you would like us to raise at the next CFAS meeting. Visit the CFAS website for more information and resources: <https://www.aamc.org/members/cfas>.

## Check out the Wall of ASPET Presidents in the Emory Department of Pharmacology and Chemical Biology



The department recently renovated their conference room and created a wall to honor their faculty who have served as ASPET presidents. Emory has had five presidents.

How does your institution compare?



# Meeting News

## ASPET-JPS Lecture at the 92nd Annual Meeting of the Japanese Pharmacological Society

*Submitted by Lorraine J. Gudas*



*Osaka, Japan*

The large port city of Osaka, with a population of almost 3 million, was the host city for the 92nd Annual Meeting of the Japanese Pharmacological Society (JPS). Osaka is a commercial city known for its street food (okonomiyaki, kushikatsu, etc.) and active night life. A famous landmark in Osaka is the Osaka Castle, which played a large part during the Azuchi-Momoyama period (16th century) in the unification of Japan. The conference was held at the Osaka International Convention Center from March 14-16, 2019. At the same time, Osaka was hosting the 2019 Grand Sumo Tournament at the Osaka Prefectural Gymnasium. This vibrant city was a stimulating setting for pharmacologists to listen to talks and participate in poster sessions focused on, in the words of the JPS president, Dr. Yoshikatsu Kanai, “future pharmacology in international, inter-disciplinary, and industry-academic-government collaboration.” The meeting’s theme, “Concerto on Science and Innovation toward a New Horizon of Pharmacology,” was chosen to stimulate Japanese pharmacologists to further develop

by “collaboration with various fields of life sciences.” Because pharmacology bridges and integrates multiple research approaches, this theme was appropriate and captured the exciting and positive interactions among a large number of pharmacologists from countries around world. ASPET views partnering with other national societies, such as the JPS, as a high priority. In addition to sessions featuring cutting-edge drug discovery and novel disease treatments, Dr. Kanai also wanted this JPS meeting to include sessions on “diversity and pharmacological education,” so that promising young researchers can “find their future in pharmacology.”

It was my great honor to give the ASPET-JPS lecture at the 92d Annual Meeting of the JPS. My talk, “Combining Pharmacology and Genetics to Study and Treat Human Diseases,” was focused on two areas of my laboratory’s research: first, the role of cancer stem cells in the development of head and neck squamous cell carcinoma (HNSCC) and our use of a highly selective, synthetic retinoid agonist of the



Lorraine Gudas receives a certificate of appreciation from the JPS for speaking at the ASPET-JPS Lecture

retinoic acid receptor gamma in the prevention and treatment of HNSCC, and second, our recent findings that in adult mice, a diet deficient in vitamin A (retinol) causes hyperglycemia and pancreatic beta-cell loss. Following up on this discovery, we found that obesity results in depletion of vitamin A in organs such as the liver, pancreas, lung, and kidney. This organ specific deficit in vitamin A occurs even though these models provide vitamin A in the diet and the mice have normal vitamin A levels in their blood. Thus, our recent results suggest that obesity profoundly changes the storage and utilization of vitamin A in the body, and that this could have a major impact on numerous diseases

associated with aging, such as diabetes, heart disease, hepatic steatosis, and cancer. Dr. Matsamitsu Iino (Cell and Molecular Pharmacology, Nihon University School of Medicine, and former president of the JPS) was the chair for my lecture. It was exciting to present my research in front of Japanese pharmacologists because Japan has produced many outstanding research publications in the area of retinoid pharmacology over the past two decades.

Among the many interesting symposia at the conference was the 22nd Japanese-Korean Pharmacology Joint Seminar, which featured many fascinating presentations, alternating talks by Korean and Japanese pharmacologists. In addition, the Young Investigator Outstanding Oral Presentation Award Sessions showcased the research of talented, poised, up-and-coming Japanese pharmacologists. Dr. Mitsuhiro Yoshioka, president of the Japanese Pharmacological Society, introduced the plenary lecture by Dr. Shuh Narumiya (Kyoto University Graduate School of Medicine), in which he traced his career from his early work with Dr. John Vane at the Wellcome Research Labs in England to his most recent, and most creative, work on prostanoid receptors. Dr. Shizuo Akira (Osaka University) spoke on the endoribonuclease Regnase-1 and its key role in inflammatory and immune responses. Dr. Narumiya summed up the mood of the meeting at the end of his abstract for his lecture where he wrote: "The joy of pharmacology never ceases."

We look forward to the next annual meeting of the JPS where the collaborations of scientists, young and established, from diverse countries and disciplines will share their newest discoveries.

## ASPET will be exhibiting at the following meetings this fall:



### AACR-NCI-EORTC MOLECULAR TARGETS AND CANCER THERAPEUTICS CONFERENCE

Boston, MA

October 26-30, 2019

<https://www.aacr.org/Meetings/Pages/MeetingDetail.aspx?EventItemID=184>



### ANNUAL BIOMEDICAL RESEARCH CONFERENCE FOR MINORITY STUDENTS (ABRCMS)

Anaheim, CA

November 13-16, 2019

<http://www.abrcms.org/>



### HEALTH PROFESSIONS WEEK

Online Virtual Meeting  
November 16-21, 2019

<https://explorehealthcareers.org/hpw/>



### PHARMACOLOGY 2019

Edinburgh, UK  
December 15-17, 2019

<https://www.bps.ac.uk/news-events/events/2019/pharmacology-2019>



# Journals News

## ArticleExpress—A New Way to Correct Page Proofs

In late May, ASPET's journals implemented a new service for authors called ArticleExpress. Developed by the SheridanGroup, which provides copyediting and typesetting services for the Society's journals, ArticleExpress allows authors to make alterations to their page proofs in an HTML environment. Instead of adding comments and notes to a PDF file or marking up a hard copy and scanning it, authors can enter changes directly into their article on screen.

This author correction system enables insertions, deletions, and formatting changes. It also allows authors to add footnotes, citations, and references and to make changes to tables and figures. ArticleExpress's user-friendly WYSIWYG HTML

environment does not require knowledge of any software or HTML coding.

All changes are tracked and vetted by production editors. As in the past, requests for large changes will be referred to the ASPET journals department and the journal's editor for approval.

ArticleExpress is expected to make correcting page proofs easier and less time consuming for authors. It may also reduce production times and allow the copyedited and formatted version of an article to go online faster. A small number of journals are already working with this system. ASPET is pleased to provide this new service to the Society's authors.

## New Editorial Board Members

*Drug Metabolism and Disposition* welcomed five new Editorial Board members this year:



**Eric Chan,**  
*Department of Pharmacy,  
University of Singapore*



**Aarti Sawant-Basak,**  
*Clinical Pharmacology,  
Pfizer*



**Rommel Tirona,**  
*Department of Physiology & Pharmacology,  
University of Western Ontario*



**Bhagwat Prasad,**  
*Department of Pharmaceutics,  
University of Washington*



**Michael Zientek,**  
*Global Drug Metabolism and Pharmacokinetics,  
Takeda Pharmaceuticals*

*Pharmacological Reviews* added four new associate editors to its board:



**Habibeh Khoshbouei**,  
*Department of Neuroscience, College of Medicine, University of Florida*



**Amin Rostami-Hodjegan**, *Centre for Applied Pharmacokinetic Research, University of Manchester, and Certara.*



**Nancy Rusch**,  
*Department of Pharmacology and Toxicology, College of Medicine, University of Arkansas for Medical Sciences*



**Hyunyoung (Young) Jeong**, *Department of Pharmacy Practice and Department of Biopharmaceutical Sciences, University of Illinois at Chicago*

The Board of Publications Trustees appreciates the time, work, and commitment given to the Society's journals by all of its editorial boards and is grateful for these newest members.

## ***Molecular Pharmacology* Highlighted Trainee Authors**

Congratulations to Tosifa Memon and Jinxin Victor Pei for being selected as the Highlighted Trainee Authors for the April and May 2019 issues, respectively.

Dr. Memon is a post-doctoral trainee with the College of Pharmacy, University of Utah. Her mentor is Dr. Christopher A. Reilly. Dr. Pei is a post-doctoral trainee with the University of Adelaide. His mentor is Dr. Andrea Yool. Read about their areas of research, current projects, and the anticipated impact of their work at <https://bit.ly/2yX1YeH>.

All trainee authors who publish in *Molecular Pharmacology* are eligible for this honor and may be



*Tosifa Memon*



*Jinxin Victor Pei*

nominated by the corresponding author of their paper or be self-nominated. Nominations should be submitted immediately after manuscript acceptance.



# Membership News

## New Members

### REGULAR MEMBERS

Jamie Alan, DPh, Michigan State Univ  
 Francois Alhenc-Gelas, INSERM, France  
 Christopher M. Barbieri, Bristol-Myers Squibb, NJ  
 Marie Gabrielle L. Bedia, Eternus Global Company Ltd,  
 Philippines  
 Bruce E. Blough, RTI International, NC  
 Jay Breaux, JB Life Sciences, NC  
 Tim Corson, Indiana Univ Sch of Medicine  
 James Costello, Univ of Colorado Anschutz Med  
 Campus  
 Aditya J. Desai, Merck Res Labs, CA  
 Isaac L. Downs, U.S. Army Med Res Inst of Infectious  
 Diseases, MD  
 Boris Farber, Noigel, LLC, NY  
 Justin F. Fraser, Univ of Kentucky Med Coll  
 Jian Gao, Second Affiliated Hosp of Dalian Med Univ,  
 China  
 Nicholas A. Geisse, NanoSurface Biomedical, Inc., WA  
 Jennifer Grant, Univ of Wisconsin-Stout  
 Ali A. Habashi, Idaho State Univ  
 Peng Hsiao, Ferring Res Institute, CA  
 Rong Huang, Purdue Univ, IN  
 Suree Jianmongkol, Chulalongkorn Univ, Thailand  
 Daniel R. Kennedy, Western New England Univ, MA  
 Rafaat H. Khalil, Florida A&M Univ, FL  
 David Kinder, Ohio Northern Univ College of Pharmacy  
 Ilya Kleyn, Noigel, NY  
 Hesham Korashy, Qatar Univ College of Pharmacy,  
 Qatar  
 Ke Lan, Sichuan Univ, China  
 Mohammed G. Magaji, Ahmadu Bello Univ, Nigeria  
 Sanju Narayanan, RTI International, NC  
 Leslie C. Newman, Ohio State Univ College of  
 Pharmacy, OH

Omonike A. Olaleye, Texas Southern Univ  
 Eric Ortlund, Emory Univ Sch of Medicine, GA  
 Sreenivasulu Naidu N. Pattipati, California Hlth Sci Univ  
 Michela Piedepalumbo, Temple Univ, PA  
 Thomas E. Prinszano, Univ of Kansas  
 Ricardo Rodriguez-Millan, Nova Southeastern Univ,  
 Coll of Pharmacy, PR  
 Becky Roof, NIH, MD  
 Jessica K. Sawyer, Duke Univ, NC  
 Paul Shapiro, Univ of Maryland  
 Yoshiyuki Shirasaka, Tokyo Univ of Pharmacy & Life  
 Sciences, Japan  
 Rommel G. Tirona, Univ of Western Ontario, Canada  
 George Tonn, G Tonn Consulting LLC, CA  
 Rupa L. Tuan, Univ of California, San Francisco, CA  
 Chinenye J. Ugwah-Oguejiofor, Usmanu Danfodiyo  
 Univ Sokoto, Nigeria  
 Mathieu Vinken, Vrije Univ Brussel, Belgium  
 Jun Wang, Univ of Arizona  
 KeWei Wang, Qingdao Univ Sch of Pharmacy, China  
 Ru Yan, Univ of Macau, China  
 Lan Zhang, Univ of Louisville, KY

### POSTDOCTORAL MEMBERS

Iyabo M. Adebisi, Usmanu Danfodiyo Univ, Nigeria  
 Su Youn Baek, Kyungpook National Univ, South Korea  
 Amber C. Chevalier, North Dakota State Univ, ND  
 Yen-Jun Chuang, Univ of Georgia  
 Franziska M. Heydenreich, Stanford Univ, CA  
 Theodore Lemuel Mathuram, Nova Southeastern Univ, FL  
 Nshunge Musheshe, Groningen Res Inst of Pharmacy,  
 Andrew J. Robles, Univ of Texas Health San Antonio, TX  
 Kelly Smart, Yale Univ, CT  
 Xin Xu, Augusta Univ, GA

## AFFILIATE MEMBERS

Krista A. Cope, Erlanger Health System, TN  
 Ryan O'Connell, Ironwood Pharmaceuticals, MA  
 Yazawa Suzuki, Drug Admin & Control Authority of Ethiopia  
 Aprajita S. Yadav, MyoKardia Inc., CA

## GRADUATE STUDENTS

Salah Abdo, Cairo Univ, Egypt  
 Jaylene M. Alvarez, Univ of Puerto Rico  
 Jeremy C. Burton, Univ of Georgia  
 Moises M. Bustamante-Pozo, Univ of California, San Diego  
 Alejandra Bagues Carot, Iowa State Univ  
 Alejandra Garate Carrillo, Univ of California, San Diego  
 Mingqing Chen, Ohio State Univ  
 Neha M. Chitre, Mercer Univ Atlanta  
 Dawn Henderlong, Michigan State Univ  
 Jeanne Ishimwe, Univ of Mississippi Med Center  
 Carsten Ginsel, Kiel Univ, Germany  
 Margaret Jameson, Univ of Wisconsin - Madison  
 Irem Karaomerlioglu, Turkish Medicines & Med Devices Agency  
 Manvir Kaur, Texas Southern Univ  
 You Li, Univ of the Pacific, CA  
 Sireesha Manne, Iowa State Univ  
 Jacob McPherson, Univ of Houston, TX  
 Shuhan Meng, Univ of Louisville, KY  
 Eman D. Mohammed, I, Drum Tower Hospital, China  
 Alyssa Nease, Iowa State Univ

Collins C. Onyenaka, Texas Southern Univ  
 Aboagyewaah Oppong-Damoah, Mercer Univ, GA  
 Oladayo A. Oyebanji, Wright State Univ, OH  
 Piyush Padhi, Iowa State Univ  
 Yam N. Paudel, Monash Univ Malaysia, Nepal  
 Jahnvi Polina, Southern Illinois Univ  
 Sema G. Quadir, Boston Univ, MA  
 Kerry A. Smith, Univ Wisconsin Madison  
 LaShaundra Taylor, Florida A&M Univ  
 Hannah R. Turbeville, Univ of Mississippi Med Center  
 Tao Wang, Univ of Kansas Med Center  
 Xuesong Wang, Leiden Univ, Netherlands

## POST-BACCALAUREATE

Shayda Abazari, Stanford Sch of Medicine, CA  
 Isabella Blanco, Univ of Virginia  
 Ping Chen, The Univ of Kansas Med Center  
 Sinibaldo R. Romero Arocha, Mayo Clinic, MN

## UNDERGRADUATE STUDENTS

Amy Brown, Tennessee Tech Univ  
 Nicholas A. Fruit, Univ of Wisconsin Eau Claire  
 Alexis Hall, Samford Univ, TN  
 Ryan J. Hecksel, Univ of Arizona  
 Ashley Hendricks, Vanderbilt Univ, TN  
 Haley Kenner, Univ of Arizona  
 Jennifer Tat, Vanderbilt Univ, TN  
 Troy Weinstein, Univ of Arizona



# AMENDMENTS TO ASPET BYLAWS

The ASPET Council recently discussed the voting status of Graduate Student and Affiliate members. Graduate students represent the next generation of pharmacologists, and Affiliate members represent the increasingly diverse array of careers in the profession. Council felt strongly about giving these members a greater voice in the Society, and at the 2019 Annual Business Meeting in Orlando, the membership in attendance voted to send the proposed bylaws changes out to the full membership for a vote. Members have voted to approve the following bylaws:

**ITEM 5. Affiliate Members.** Any qualified person who is engaged in the study of problems in pharmacology but does not meet requirements for Regular Membership may be eligible for Affiliate Membership. Affiliate Members may later be proposed for Regular Membership, upon meeting the requirements.

**ITEM 6. Student Members.** Persons who are enrolled in undergraduate, post-baccalaureate, graduate, or professional degree programs, and who have an interest in pharmacology, are eligible for Student Membership. Students enrolled in graduate or professional degree programs shall be voting members; Post-baccalaureate and Undergraduate Members shall be non-voting. Upon completion of their research doctoral degree, Student Members must upgrade to another membership category.

## ASPET 25 YEAR MEMBERS

Thank you to the following members who have devoted 25 years to ASPET and the growth of our discipline\*



Mahmoud S. Ahmed, PhD  
Othman A. Al-Shabanah, PhD  
Suleiman W. Bahouth, PhD  
Edward C. Burgard, PhD  
Judith A. Cole, PhD  
Bryan F. Cox, PhD  
David L. Crandall, PhD  
Arthur M. Edelman, PhD

David H. Farb, PhD  
Edward Hawrot, PhD  
William T. Jackson, PhD  
Jeffrey R. Jasper, PhD  
Mary J. Kreek, MD  
Rachel E. Laskey, PhD  
Alejandro M. Mayer, PhD  
John R. McCullough, PhD

Kathryn E. Meier, PhD  
Kamala D. Murugaiah, PhD  
Kenny J. Simansky, PhD  
Robert P. Soltis, PhD  
Reza Tabrizchi, PhD  
Roseann L. Vorce, PhD  
Harvey L. Wiener, PhD

## ASPET 50 YEAR MEMBERS

Thank you to the following members who have devoted 50 years to ASPET and the growth of our discipline\*



M. W. Anders, PhD  
Charles D. Barnes, PhD  
Allen Barnett, PhD  
Arthur L. Bassett, PhD  
J. T. Bigger, MD  
Saul S. Bloomfield, MD  
Yi-Han Chang, PhD  
Tzu S. Chiang, MD, PhD  
Frank R. Ciofalo, PhD  
Robert Clark, PhD  
Naranjan S. Dhalla, PhD  
Samarendra N. Dutta, MD, PhD  
Arnold J. Eisenfeld, MD  
Robert M. Epstein, MD  
Herbert W. Felsenfeld, MD, PhD  
Gregory B. Fink, PhD  
James W. Flesher, PhD

Edward D. Frohlich, MD  
Richard A. Gillis, PhD  
Alan M. Goldberg, PhD  
Charles W. Gorodetzky, MD, PhD  
Richard D. Green, PhD  
Robert Z. Gussin, PhD  
Jordan L. Holtzman, MD, PhD  
Henry I. Jacoby, PhD  
Donald R. Jasinski, MD  
Yee S. Kim, PhD  
Jai D. Kohli, MD, PhD  
Roberto Levi, MD  
John J. McCormack, PhD  
Shakil Mohammed, MD, PhD  
Robert Y. Moore, MD, PhD  
Charles Y. Pak, MD  
Popat N. Patil, PhD

Arthur Raines, PhD  
Robert Rosenstein, PhD  
Lawrence F. Sancilio, PhD  
Manfred Schach Von Wittenau, PhD  
John B. Schenkman, PhD  
Robert J. Schlueter, PhD  
Sorell L. Schwartz, PhD  
Louis Shuster, PhD  
Paula H. Stern, PhD  
Robert I. Taber, PhD  
Jose M. Trifaro, MD  
Lubos Triner, MD, PhD  
Joan Vernikos, PhD  
Nathan Watzman, PhD  
Benjamin Weiss, PhD  
John T. Wilson, MD

\*Note: As of December 31, 2019

## A Tribute to Gavril W. Pasternak

*Submitted by Kelly Standifer, Dennis Paul, Ying-Xian, Grace Rossi, and Steven Childers*

It is with great sadness and loss that we report the passing of the distinguished scientist and long-time ASPET member, Professor Gavril W. Pasternak, MD, PhD on February 22, 2019, at the age of 71 after a brief battle with pancreatic cancer. In recognition of the impact of his scientific career, "Gav" was honored with the 2012 ASPET Julius Axelrod Award in Pharmacology.

Dr. Pasternak was a graduate of Johns Hopkins University (BS chemistry, MD, and PhD). During his undergraduate years at Hopkins, Gav's primary interest was playing lacrosse, but his lifelong passion with opioids began when he joined the laboratory of Dr. Solomon Snyder for his PhD work. Those were exciting days with Sol's group, which was one of the labs who first identified opioid receptors by radioligand binding. Gav joined Candace Pert as the first students to work on opioids in Sol's lab, and he began with isolating brain extracts to identify potential endogenous opioids, called morphine-like factors in those days. Of course, Hans Kosterlitz, John Hughes, and their colleagues at the University of Aberdeen were the first to purify enkephalins, so Gav switched his focus to characterizing pharmacological and biochemical properties of opioid receptors. He was the first to show that sodium distinguished agonist and antagonist binding to opioid receptors by selectively decreasing affinities for agonists, a finding that would provide one of the foundations for exploring opioid receptor crystal structure decades later. But his lifelong interest in mu receptor subtypes began with a serendipitous finding. In characterizing the actions of novel irreversible alkylating ligands, which he hoped could be used as long-acting agonists and antagonists at opioid receptors, he found that the alkylating antagonist naloxonazine only reacted with a subset of mu receptors. From that finding, he deduced that mu receptors must exist as multiple discernible subtypes. This was more than simply an academic interest for Gav. From his clinical work, he knew the enormous variation in the response of patients to analgesic drugs, and he theorized that multiple mu receptor subtypes not only provided the opportunity to design novel analgesics



with fewer side effects, but could also individualize pain therapy with different patients. From these early beginnings ultimately came his pioneering work on alternative RNA splice variants of mu receptors.

Following completion of his neurology residency at Johns Hopkins in 1979, Gavril joined the Neurology Department of Memorial Sloan-Kettering Cancer Center, where he was the model of the classic clinician/scientist until his passing. From the development of receptor binding assays to the recognition of splice variants of mu opioid receptors that may explain individual differences in response to opioid drugs, Dr. Pasternak devoted his career to contributing to our understanding of how opioids produce analgesia and their undesired effects. In recent years he was awarded several patents for the development of novel opioid analgesics that do not produce many of the adverse effects of morphine. Among the many NIH grants that funded these endeavors, Dr. Pasternak was especially

proud of the Research Scientist Development, MERIT, Senior Scientist awards and most recently, a UG3 grant from NIDA to develop ‘...a new class of potent, safer analgesics’ that target one type of mu receptor splice variants identified in his lab.

In addition to his Julius Axelrod Award, he has been recognized with many other scientific awards for his work in the fields of pain including the John J. Bonica (International Association for the Study of Pain), Raymond W. Houde (Eastern Pain Association), Frederick W. L. Kerr Basic Science Research Awards (American Pain Society), the Founders Award (International Narcotics Research Conference), 2018 Award in Excellence in Pharmacology/Toxicology awards (PhRMA Foundation), and the Harrington Scholar-Innovator Award for being a physician-scientist innovator.

Gavril believed that mentoring was an important aspect of research and teaching, and his lab always included a cadre of summer students (high school and college), graduate and medical students, postdoctoral fellows, residents, and visiting professors from all over the world. Gav’s irreplaceable enthusiasm for science was contagious. Most of his mentees produced at least one paper and presented their work with Gav at a national or international meeting; all of them received thoughtful guidance and attention geared toward helping them identify and achieve their career goals.

What many did not know about Gav was that he was a two-time U.S. Lacrosse Man of the Year awardee (NY Metro Division), and he continued to play in lacrosse tournaments through age 70. Gav’s passion for lacrosse and mentoring young talent were combined when he co-founded the Doc’s NYC Lacrosse program in 1996 so that children in NYC had a place to play lacrosse in their home town. Because few NYC public schools offered lacrosse as a team sport in high school, Gav suggested that a public-private partnership might help fund lacrosse teams in inner city public schools. In 2006, the non-profit organization CityLax partnered with the NYC Board of Education to make that happen. This enabled a diverse group of kids from all over NYC to play from elementary age through high school and to become eligible for college scholarships.

Gavril was predeceased by his beloved wife Sandra and daughter Katie Pasternak. The condolences of the ASPET community are with his daughter Anna Pasternak and son David Avram Pasternak. He is also survived by his academic family of undergraduate and graduate students, post-doctoral fellows, visiting scientists, collaborators, colleagues, and friends.

You can add a note of remembrance at: <https://www.legacy.com/obituaries/berkshire/obituary.aspx?n=gavril-william-pasternak&pid=191661024&fhid=2086>

## IN SYMPATHY

*ASPET notes with sympathy the passing of the following members.*

Paul Greengard  
Gavril W. Pasternak  
Jeremy G. Richman

Raymond W. Ruddon  
Paul Talalay  
William Schumacher

## A Tribute to William A. Schumacher

Submitted by Pancras Wong



It is with great sadness that I inform you of the passing of William A. Schumacher, PhD, a long time ASPET member. Dr. Schumacher passed away on January 19, 2019.

Dr. Schumacher received his BS in biology from the University of California, Irvine, and his PhD in pharmacology from the University of Minnesota, Minneapolis. He then completed a post-doc training in the laboratory of Dr. Benedict Lucchesi at the University of Michigan, Ann Arbor.

Dr. Schumacher joined the E.R. Squibb & Sons Company in 1984 to conduct research in cardiovascular drug discovery. During these years at E.R. Squibb & Sons and later at the Bristol-Myers Squibb Company, Bill was a key pharmacologist

to deliver 17 early clinical candidates: 3 in heart failure, 12 in thrombosis, and 2 in asthma. He also made important contributions to the development of Plavix (clopidogrel, an oral P2Y<sub>12</sub> platelet antagonist), Eliquis (apixaban, an oral factor Xa inhibitor) and Sprycel (dasatinib, a tyrosine kinase inhibitor). Plavix, Eliquis, and Sprycel are highly successful blockbuster drugs and make a significant difference for millions of patients across the globe. Dr. Schumacher retired from the Bristol-Myers Squibb Company in 2016.

Over the course of his career, Dr. Schumacher made important and original contributions in advancing drug discovery research in thrombosis and heart failure. He was recognized both internally and externally as an expert in cardiovascular research. As a result of his outstanding work at the Bristol-Myers Squibb Company, he was awarded multiple times for his contributions to the drug discovery programs. Externally, Dr. Schumacher was honored as a fellow of the American Heart Association.

Dr. Schumacher had been a long time member of the American Heart Association, ASPET, and the International Society on Thrombosis and Haemostasis. In addition to publishing over 90 peer-reviewed articles, he was a contributor to the peer-review process.

To his colleagues and co-workers, Dr. Schumacher was not just an outstanding scientist; he was also a great collaborator, a loving manager, and a dear friend. On a more personal level, he was an exceptional and generous person. He was trustworthy, never selfish, and always supportive. The world has lost a top pharmacologist, and we have lost a best friend. He will be greatly missed.

Please see his obituary at <http://www.startribune.com/obituaries/detail/0000294674/?fullname=william-anthony-schumacher>.



# Members in the News

## Achievements, Awards, Promotions, and Scientific Breakthroughs

Richard Neubig, MD, PhD

*Michigan State University*



Richard Neubig, MD, PhD, is Professor and Chair of the Department of Pharmacology and Toxicology at Michigan State University. In April of this year, Dr. Rick Neubig published a new book entitled “*Cellular Signal Transduction in Toxicology and Pharmacology: Data Collection, Analysis, and*

*Interpretation*” which he co-edited with Dr. Jonathan Boyd from West Virginia University.

Dr. Neubig is a Past-President of ASPET and was the founding Chair of the Molecular Pharmacology Division. He received his BS in chemistry at the University of Michigan, and MD, PhD from Harvard Medical School and the Harvard-MIT Program in Health Sciences and Technology. He then did a residency in internal medicine at the University of Michigan before joining the pharmacology faculty there. In 2013, he moved to Michigan State University as Chair of the Pharmacology and Toxicology Department. His research is on GPCR signaling and academic drug discovery.

Dr. Neubig has been a member of ASPET since 1987 and is a member of the Divisions for **Molecular Pharmacology, Cardiovascular Pharmacology, Drug Discovery and Development.**

Samba Reddy, PhD, RPh

*Texas A&M College of Medicine*



*Award presentation to Dr. Reddy by Drs. Ulhas Naik (president), Satya Kunapuli (chair) and Gauthami Jalagadugula (secretary)*

Samba Reddy, PhD, RPh, received the Mario Toppo Distinguished Scientist Award from the Association of Scientists of Indian Origin in America (ASIOA) for his groundbreaking research on neurosteroid replacement therapy. ASIOA is a national-level scientific organization of Indian-Americans, the largest ethnic group in medicine, engineering, and biomedical research fields. He received this distinction on April 10, 2019 in Orlando, Florida.

Dr. Reddy is a professor of neuroscience and experimental therapeutics at the Texas A&M College of Medicine. The prestigious award recognizes his scientific work and its impact on clinical care of brain disorders. During his acceptance speech, he discussed his breakthrough neurosteroid-replacement therapy for menstrual disorders of

catamenial epilepsy, premenstrual syndrome, and post-partum depression. Recently, the neurosteroid allopregnanolone (brexanolone) was approved by the FDA for clinical use in post-partum depression. His translational research has led to significant advances in the field, including multiple drug molecules advancing into clinical stage. Reddy's outstanding contributions to the field of neurosteroids have been continuously funded by the National Institutes of Health (NIH) for over 14 years.

Dr. Reddy has been a member of ASPET since 1999 and is a member of the **Divisions for Neuropharmacology, Drug Discovery and Development, and Translational and Clinical Pharmacology.**

## Boris Farber, PhD, DSc

*Noigel, LLC.; TRIZ Biopharma International, LLC.; QuaziVita International Corporation*



Boris Farber, PhD, DSc, is the CEO of Noigel, TRIZ Biopharma International, and QuaziVita International Corporation. Dr. Farber was selected as Man of the Year by the International Association of Top Professionals (IAOTP) and is the proud recipient of the Leonardo Da Vinci Medal and Diploma

for his contributions to international development and promotion of his inventions. Dr. Farber and his colleagues' article "*Creation of new medical drugs based on TRIZ and computer mathematical modeling*" received outstanding recognition in 2018 by the European Academy of Natural Sciences.

After meeting Genrich Altshuller, creator of TRIZ (Theory of Inventive Problem Solving), in childhood, Dr. Farber has been developing inventions for many years, including self-adjusted and self-organized dynamical systems in many areas of his research in bioengineering, biotechnology, and pharmacology based on TRIZ.

He applied TRIZ as a tool to understand the Da Vinci legacy and wrote a script of a movie about Leonardo Da Vinci. This is especially important now

when the world is preparing to celebrate the 500th anniversary of the death of a great genius.

Dr. Farber joined ASPET earlier this year and is a member of the **Divisions for Molecular Pharmacology, Divisions for Cancer Pharmacology, Cardiovascular Pharmacology, Drug Discovery and Development, Pharmacology Education, and Toxicology.**

## Ting-Chao Chou PhD

*PD Science, LLC*



Ting-Chao Chou, PhD, is the founder and president of PD Science LLC. Dr. Chou was recently inducted into the honorable Society of Scholars at John Hopkins University (JHU). The induction ceremony and dinner took place at the Peabody Institute Library at JHU, in Baltimore MD

on April 8, 2019, and was hosted by the university president and provost.

In 1976, Dr. Chou introduced the pharmacodynamics/biodynamics general theory and the median-effect equation of the mass-action law, as the unified theory for BD/PD. This new paradigm allowed the generation of dose-effect curves by automated computer simulation, forming the basis for Econo-Green biomedical research and development. Dr. Chou also co-developed the Combination Index Theorem, PD, CalcuSyn, and CompuSyn software. His 1984 theoretical paper with JHU's Paul Talalay introducing the CI theory/method has been cited nearly 6,000 times in more than 1,190 biomedical journals worldwide.

Born in Taiwan, Dr. Chou received his PhD in pharmacology from Yale University and completed his postdoctoral fellowship at Johns Hopkins University. He joined Memorial Sloan-Kettering Cancer Center (MSKCC) and became a member and professor of pharmacology at Cornell University Graduate School of Medical Sciences in 1988. He is an honorary professor of the Chinese Academy of Medical Sciences and a visiting professor of five universities. He retired from MSKCC in 2013.

Dr. Chou has been an ASPET member since 2006 and is a member of the **Divisions for Molecular Pharmacology, Divisions for Cancer Pharmacology, Drug Discovery and Development, Pharmacology Education, Toxicology, and Translational and Clinical Pharmacology.**

## Santosh Kumar, PhD

*University of Tennessee Health  
Science Center*



Santosh Kumar, PhD, Associate Professor at the University of Tennessee Health Science Center has been appointed Assistant Dean of Scholarly Integration and Collaboration, effective July 2019. During the past year, Dr Kumar received the Phi Delta Chi Professor-of-the-Year

Award, The UT Alumni Outstanding Teacher Award, the Student Government Association Executive Council (SGAEC) Excellence-in-Teaching-Award, and the Distinguished-Service-Award from SNIP. Dr. Kumar's research program is at the intersection of HIV and drugs of abuse. Alcohol drinking and tobacco smoking are highly prevalent in HIV-infected individuals. His group proposes that alcohol and tobacco exacerbate HIV pathogenesis and neuropathogenesis via exosomal and cytochrome P450 (CYP) pathway. His group is the first one to show a potential role of the CYP pathway in the context of drugs of abuse and HIV pathogenesis. This provides a novel target to treat HIV-infected drug abusers effectively.

Dr. Kumar has been a member of ASPET since 2003 and is a member of the **Divisions for Neuropharmacology, Drug Metabolism and Disposition, and Toxicology.**

## Stephanie M. Davis, PhD

*University of Kentucky*



Stephanie M. Davis, PhD will be joining the 2019-2020 Class of Executive Branch AAAS Science and Technology Policy Fellows. She will be the first Fellow serving in the NIH National Institute of Aging, Office of Small Business Research. Her appointment will start in September 2019, with

an option to renew for an additional year. Dr. Davis received her undergraduate training in Biochemistry & Molecular Biology at Florida Southern College in 2012 and graduated with her PhD in Molecular Pharmacology from the University of South Florida in 2016. Currently, she is a postdoctoral scholar at the University of Kentucky where she conducts basic and clinical research focused on targeting the post-stroke peripheral inflammatory response.

Dr. Davis has been a member of ASPET since 2016 and is a member of the **Divisions for Neuropharmacology, Cardiovascular Pharmacology, Molecular Pharmacology, and Translational and Clinical Pharmacology.** She currently serves as the 2018-2020 Chair for the Young Scientists Committee.

## Luisa Torres, PhD

*Intelispark*



Luisa Torres, PhD has been selected as a AAAS Mass Media Fellow. She will spend the summer of 2019 at National Public Radio (NPR) in Washington, DC writing science news in NPR's blogs "The Salt", "Goats and Soda", and "Shots". She has recently left her postdoctoral appointment at Cornell University to

become a Senior Consultant and Life Science Proposal Development Specialist at Intelispark in Ithaca, NY. While at Cornell, Dr Torres was studying the effects of *Toxoplasma gondii* infections on the development of signs of Alzheimer's disease in the mouse brain. She was also studying the effect of perfluorinated compounds on the mouse immune system. She has a PhD in molecular and cellular pharmacology from Stony Brook University where she was advised by Dr. Stella Tsirka. Dr. Torres currently serves as Communications Officer for the ASPET NEU division and is the editor of the ASPET NEU blog.

Dr. Torres has been a member of ASPET since 2017 and is a member of the **Divisions for Neuropharmacology, Behavioral Pharmacology, and Drug Discovery and Development.**

## Kirti Kandhwal Chahal, MS

*University of California San Diego*



Kirti K. Chahal, MS, is an exchange graduate student from Guru Jambheshwar University of Science and Technology, Hisar India, and she is currently completing her research studies at the University of California, San Diego (UCSD). Ms. Chahal was recently awarded

(March 2019) a Cancer Systems Biology Training Program Award, sponsored by The Cancer Cell Map Initiative. This award is given to graduate students and postdoctoral fellows at University of California, San Francisco or UCSD wishing to develop and apply systems biology approaches to address compelling biomedical questions in cancer.

Ms. Chahal's project is aimed at understanding SMO signaling and trafficking from a systems biology perspective, by characterizing the spatiotemporally resolved interactome of this receptor in cells using APEX2 proximity biotinylation coupled to mass spectrometry, and by integrating findings into an executable interactive network.

Ms. Chahal has been a member of ASPET since 2016 and is a member of the **Divisions of Molecular Pharmacology, Behavioral Pharmacology, Cancer Pharmacology, Drug Discovery and Development, Drug Metabolism and Disposition, Neuropharmacology, and Toxicology.**

## Larry Rodriguez, BS

*University of Southern California  
School of Pharmacy*



Larry Rodriguez, BS, is a 4th year PhD candidate at the University of Southern California School of Pharmacy and a proud ASPET student member in the Molecular Pharmacology Division. He is also a first generation Latino American PhD student. Mr. Rodriguez was awarded a renewal of

a highly competitive pre-doctoral fellowship from the American Foundation for Pharmaceutical Education (AFPE) for 2019-2020.

Mr. Rodriguez started his academic career at Dodge City Community College in Kansas and then transferred to Kansas State University as a Biochemistry/Chemistry double major. He graduated in May 2015 and soon after began his graduate studies in the Department of Pharmacology and Pharmaceutical Sciences at the USC School of Pharmacy. Under the tutelage of Dr. Daryl Davies, Mr. Rodriguez is currently investigating the molecular mechanisms behind alcohol addiction and has since discovered a novel interaction between two receptors that play a crucial role in alcohol consumption.

Mr. Rodriguez has been a member of ASPET since 2018 and is a member of the **Divisions for Molecular Pharmacology, Behavioral Pharmacology, Drug Discovery and Development, and Neuropharmacology.**



# Division News

## 2019 Division Award Winners



### DIVISION FOR BEHAVIORAL PHARMACOLOGY



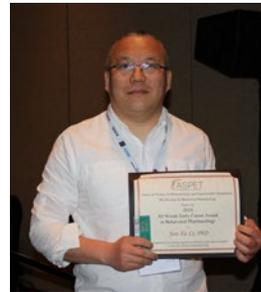
#### Student/ Postdoctoral Poster Competition

In the undergraduate category, prizes were awarded

to **Natalie Henderson** (1st place) from Florida State University and **Ethan Hardin** (2nd place) from the University of Texas at El Paso.

In the postbaccalaureate/graduate student category, prizes were awarded to **Laura Erwin** (1st place) from the Louisiana State University Health Science Center, **Kendall Woodlief** (2nd place) from Wake Forest School of Medicine, and **Robert Seaman** (3rd place) from the University of Texas Health Science Center at San Antonio.

In the postdoctoral category, prizes were awarded to **Vanessa Minervini** (1st place) from the University of Texas Health Science Center at San Antonio, **Mark Nilges** (2nd place) from Louisiana State University Health Science Center, and **Alison Wakeford** (3rd place) from Yerkes National Primate Research Center, Emory University.



#### JH Woods Early Career Award in Behavioral Pharmacology

The JH Woods Early Career Award in Behavioral Pharmacology was established to recognize outstanding original research by early career investigators in the area of behavioral pharmacology. This year's awardee was **Jun-Xu Li**, PhD from the University at Buffalo.



### DIVISION FOR CANCER PHARMACOLOGY



#### Student/ Postdoctoral Poster Competition

In the undergraduate category, prizes were awarded

to **Evan Kania** (1st place) from Ohio State University College of Pharmacy and **Maryam Mansoura** (2nd place) from the University of Georgia.

In the postbaccalaureate/graduate student category, prizes were awarded to **Shuhan Meng** (1st place) from the University of Louisville and **Jason Anderson** (2nd place) from Ohio State University.

In the postdoctoral category, the top prize was awarded to **Khalid Garman** (1st place) from the National Institutes of Health and Georgetown University.



## DIVISION FOR CARDIOVASCULAR PHARMACOLOGY



### Student/ Postdoctoral Poster Competition

In the undergraduate category, prizes

were awarded to **Vladyslava Rybka** (1st place) from Georgetown University and **Tesneem Othman** (2nd place) from Chicago State University, College of Pharmacy.

In the postbaccalaureate/graduate student category, prizes were awarded to **Ankit Gilani** (1st place) from New York Medical College, **Lockhart Jamieson** (2nd place) from the University of Alberta, and **Arash Tehrani** (3rd place) from the University of British Columbia.

In the postdoctoral category, prizes were awarded to **Safaa Hammoud** (1st place) from Beirut Arab University and **Simon Comerma Steffensen** (2nd place) from Aarhus University, Denmark/Central University of Venezuela, Maracay.

### CVP Trainee Showcase (Oral Sessions)

In the graduate student category, prizes were awarded to **Lisa Green** (1st place) from the University of Cincinnati, **Shuchi Guo** (2nd place) from Temple University, and **Reem Atawia** (3rd place) from Augusta University.

In the postdoctoral category, prizes were awarded to **Claudio de Lucia** (1st place) from Temple University, Lewis Katz School of Medicine and **Yujing Li** (2nd place) from the University of Arizona College of Medicine-Phoenix.



### Benedict Lucchesi Young Scientist Travel Award in Cardiac Pharmacology

The Benedict R. Lucchesi Young Scientist Travel

Award in Cardiac Pharmacology was established to honor Dr. Lucchesi's lifelong scientific contributions to our better understanding and appreciation of the pharmacological treatment and prevention of cardiovascular disease, and for his mentoring of countless prominent cardiovascular pharmacologists in translational approaches. This year's awardee was **Aaron J. Trask**, PhD, FAHA, FCVS from the Research Institute at Nationwide Children's Hospital and the Ohio State University College of Medicine.



## DIVISION FOR DRUG DISCOVERY AND DEVELOPMENT



### Student/ Postdoctoral Poster Competition

In the postbaccalaureate/graduate student category, prizes were awarded to **Amanda**

**Davis** (1st place) from the University of Michigan, **Anh Phan** (2nd place) from Loyola University Chicago, and **Samantha McClenahan** (3rd place) from the University of Arkansas for Medical Sciences.

In the postdoctoral category, prizes were awarded to **Gisela Camacho-Hernandez** (1st place) from the University of California San Diego, **Scott Barnett** (2nd place) from the Medical College of Wisconsin, and **Nayaab Khan** (3rd place) from the Research Triangle Institute International.



### Scientific Achievement Award in Drug Discovery and Development

The Scientific Achievement Award in Drug Discovery and Development

recognizes outstanding investigators who have made significant contributions in drug discovery, translational, and/or drug development science. This year's awardee was **Craig W. Lindsley**, PhD from Vanderbilt University.



## DIVISION FOR DRUG METABOLISM AND DISPOSITION



### Student/ Postdoctoral Poster Competition

In the postbaccalaureate/graduate student category, prizes were awarded to

**Mingqing Chen** (1st place) from Ohio State University, **Lindsay Henderson** (2nd place) from the University of Washington, and **Irina Teslenko** (3rd



place) from Washington State University.

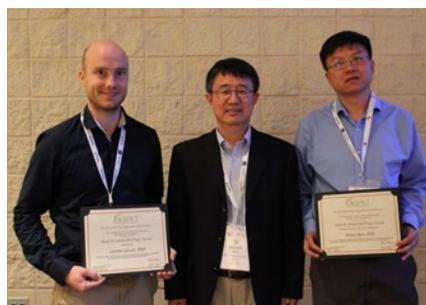
In the postdoctoral category, prizes were awarded to **Simone Brixius-Anderko** (1st place) from the University of Michigan, **Stephanie Martinez** (2nd place) from Washington State University, and **Herana Seneviratne** (3rd place) from Johns Hopkins University School of Medicine.



### Richard Okita Early Career Award in Drug Metabolism and Disposition

The Richard Okita Early Career Award in Drug Metabolism and Disposition was established

to recognize excellent original research by early career investigators in the area of drug metabolism and disposition. This year's awardee was **Lauren M. Aleksunes**, PharmD, PhD from Rutgers University.



*James R. Gillette Best Paper Award Winners Carsten Ginsel and Hong Shen with Division for Drug Metabolism and Disposition Chair Xinxin Ding*

### James R. Gillette Best Paper Award

*Submitted by Michael Espiritu and Aarti Sawant-Basak*

Throughout the years the Division for Drug Metabolism and Disposition has had the pleasure of presenting

the James R. Gillette Best Paper Award for two outstanding papers: one for the best paper of the year in drug metabolism and one for the best paper of the year in pharmacokinetics and transporters. Our 2018 award winners recently presented their work at the 2019 ASPET Annual Meeting held in Orlando, FL and received a cash award and certificate of recognition for their scientific achievements. The Gillette Award honors the late NIH pharmacologist James R. Gillette, PhD (<http://dmd.aspetjournals.org/cgi/reprint/31/12/1474.pdf>), who was a scholar, scientist, philosopher, and mentor of pharmacologists worldwide. During his career, Dr. Gillette published more than 300 papers and book chapters and co-edited seven books. He was considered a visionary and significant contributor to the field of drug metabolism and pharmacokinetics.

### The 2018 Gillette Best Paper Award winner for Drug Metabolism is Carsten Ginsel from the Institute of Pharmaceutical Chemistry in Kiel, Germany.

The 2018 Gillette award in the category of drug metabolism was presented to Carsten Ginsel for the paper "The Involvement of the Mitochondrial Amidoxime Reducing Component (mARC) in the Reductive Metabolism of Hydroxamic Acids" authored by Carsten Ginsel, Birte Plitzko, Danilo Froerip, Diana A. Stolfa, Manfred Jung, Christian Kubitzka, Axel J. Scheidig, Antje Havemeyer, and Bernd Clement. This study demonstrated that the mitochondrial amidoxime reducing component, or mARC enzyme, is responsible for the reduction of hydroxamic acids. Since hydroxamic acids are often found both in drug candidates and toxic metabolites of drugs, understanding the clearance of these compounds is paramount to their successful use as therapeutics.

This study also highlights the importance of including the mitochondrial fraction when characterizing the metabolism of hydroxamic acids or related compounds. The authors investigated the reduction of four hydroxamic acid containing compounds: benzhydroxamic acid, bufexamac, vorinostat, and the toxic metabolite N-hydroxyphenacetin. Experiments were carried out to determine the metabolites and rate of metabolite formation in either porcine subcellular fractions, with reconstituted mARC enzyme, or in HEK-293 cells. The authors found that for all N-unsubstituted hydroxamic acids N-reductive activity was enhanced in the mitochondrial fractions in comparison to all other fractions. The authors also conducted siRNA experiments which resulted in a significant loss of N-reduction when the mARC proteins were silenced, providing further evidence that mARC is responsible for the reduction of hydroxamic acids. Interestingly, it was also reported that N-hydroxyphenacetin, the toxic metabolite of phenacetin, was not metabolized by the mARC proteins, likely due to the steric bulk of the N-phenyl substitution, which is supported by the known toxicity of this metabolite in humans. This is the first report on the involvement of mARC enzymes in the reductive metabolism of hydroxamic acids and highlights the importance of these enzymes in removing toxic N-hydroxy metabolites.

#### **The 2018 Gillette Best Paper Award winner for Pharmacokinetics and Transporters is Hong Shen from Bristol-Myers Squibb**

The 2018 Gillette award in the pharmacokinetics and transporters category was given to Hong Shen for the paper "Discovery and Validation of Pyridoxic Acid and Homovanillic Acid as Novel Endogenous Plasma Biomarkers of Organic Anion Transporter (OAT) 1 and OAT3 in Cynomolgus Monkeys" authored by Hong Shen, David M. Nelson, Regina V. Oliveira, Yueping Zhang, Colleen A. Mcnaney, Xiaomei Gu, Weiqi Chen, Ching Su, Michael D. Reily, Petia A. Shipkova, Jinping Gan, Yurong Lai, Punit Marathe, and W. Griffith Humphreys. This study demonstrated that both pyridoxic acid and homovanillic acid can be used as biomarkers for the renal transporters OAT1 and OAT3, which have been known to be involved in several clinically relevant drug-drug interactions. This study further demonstrated the utility of cynomolgus

monkeys as a model organism for studying these transporters as changes in AUC of the OAT1/3 substrate furosemide correlated well with human data when probenecid was used as an inhibitor. The authors used an LC-MS/MS based metabolomics method for identifying potential endogenous biomarkers of OAT1/3 and validated the use of 29 of these biomarkers using targeted LC-MS/MS. Both pyridoxic acid and homovanillic acid were found to have characteristics of clinically useful biomarkers and both were confirmed to be substrates for OAT1/3 using stable cell lines constitutively expressing these transporters. These studies led the authors to conclude that both pyridoxic acid and homovanillic acid could serve as clinically relevant endogenous biomarkers for OAT1/3 activity in humans.



## **DIVISION FOR MOLECULAR PHARMACOLOGY**



### **Student/ Postdoctoral Poster Competition**

In the post baccalaureate/ graduate student category, prizes

were awarded to **Michael Ippolito** (1st place) from Thomas Jefferson University and **Sumit Bandekar** (2nd place) from the University of Michigan.

In the postdoctoral category, the top prize was awarded to **Kathryn Luderman** (1st place) from the National Institutes of Health/NINDS.

### **Postdoctoral Scientist Award Competition (Oral Sessions)**

In the postdoctoral category, the top prize was awarded to **Marta Sanchez Soto** (1st place) from the National Institutes of Health/NINDS.



## DIVISION FOR NEUROPHARMACOLOGY



### Student/ Postdoctoral Poster Competition

In the postbaccalaureate/graduate student category, prizes were awarded to

**Joshua Lorenz-Guertin** (1st place) from the University of Pittsburgh, **Deborah Luessen** (2nd place) from Wake Forest School of Medicine, and

**Kaitlyn Thompson** (3rd place) from Stony Brook University.

In the postdoctoral category, prizes were awarded to

**Marta Sanchez Soto**

(1st place) from the National Institutes of Health/NINDS, **Katherine Holleran** (2nd place) from Wake Forest School of Medicine, and **Lillian Brady** (3rd place) from Vanderbilt University.



### Postdoctoral Scientist Award Competition (Oral Sessions)

In the Postdoctoral category, prizes were awarded to **Moriah**

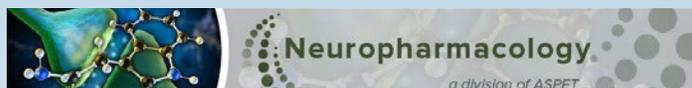
**Jacobson** (1st place) from Uniformed Services University, **Sean Collins** (2nd place) from the University of Cincinnati, and **Heidi Villalba** (3rd place) from Texas Tech University Health Sciences Center.



### Early Career Award

The Division for Neuropharmacology Early Career Award was established to honor a young independent investigator working in neuropharmacology.

The winner of this award was **Michelle Mazei-Robison**, PhD, from Michigan State University.



## Graduate Students and Postdoc Members of the NEU Division

**Are you interested in getting more involved in ASPET and making connections with leaders in academia, government, and industry?**

The Neuropharmacology (NEU) Division is recruiting young scientists to be regional coordinators for its communications and outreach activities to work closely with NEU Communications Officer Luisa Torres. You will be interviewing other ASPET members about their scientific breakthroughs to produce blog posts for the ASPET NEU blog.

### BENEFITS

- ▶ **1.** Network with key leaders in academia, government, and industry and learn more about the diverse career possibilities for pharmacologists.
- ▶ **2.** Enhance your career profile by learning to write about science for the lay public.
- ▶ **3.** Take an active role in shaping the division and the society in a way that will best serve the next generation of pharmacologists.
- ▶ **4.** Be recognized by the division at the annual ASPET meeting

**If you are interested in this opportunity, please contact Communications Officer Luisa Torres ([luisa@intelispark.com](mailto:luisa@intelispark.com)) for more information.**



## DIVISION FOR TOXICOLOGY



### Student/ Postdoctoral Poster Competition

In the undergraduate category, the top prize was awarded to

**Storm Lotomau** (1st place) from Pacific University.

In the postbaccalaureate/graduate student category, prizes were awarded to **Ludwik Gorczyca** (1st place) from Rutgers University, **Robert Freeborn** (2nd place) from Michigan State University, and **Siannah Miller** (3rd place) from the University of Arizona.

In the postdoctoral category, the top prize was awarded to **Souvarish Sarkar** (1st place) from Brigham and Women's Hospital, Harvard Medical School.

### Career Award

The winner of the 2019 Career Award was **Gary O. Rankin**, PhD from the Joan C. Edwards School of Medicine at Marshall University.

### Early Career Award

The winner of the 2019 Early Career Award was **Cheryl E. Rockwell**, PhD from Michigan State University.



## DIVISION FOR TRANSLATIONAL AND CLINICAL PHARMACOLOGY



### Student/ Postdoctoral Poster Competition

In the undergraduate student category, prizes were awarded

to **Ryan Grabau** (1st place) from the University of South Florida Heart Institute and **Darby Peter** (2nd place) from the University of Wisconsin, Madison.

In the postbaccalaureate/graduate student category, prizes were awarded to **Lishann Ingram** (1st place) from the University of Georgia and **Rachel Fenske** (2nd place) from the University of Wisconsin, Madison.

In the postdoctoral category, prizes were awarded to **Thomas Flanagan** (1st place) from Louisiana State University Health Science Center and **Lan Zhang** (2nd place) from the University of Louisville.

### Young Investigator Awards Platform Session (Oral Sessions)

The top prize was awarded to **Swetha Thiyagarajan** (1st place) from North Dakota State University.



### Early Career Awards

The TCP Early Career Awards recognize research excellence in translational and clinical pharmacology that comes from

early career scientists. The two awardees in 2019 were **Nariman Balenga**, PhD from the University of Maryland School of Medicine and **Ross Corriden**, PhD from Merck.



## DIVISION FOR PHARMACOLOGY EDUCATION



### Travel Award for Pharmacology Educators

The winners of the Travel Award for Pharmacology Educators were **Gagani**

**Athauda**, MD from Florida International University, **Ashley Guillory**, PhD from University of Texas Medical Branch, and **Arun Ram**, MD from Eastern Virginia Medical School.



### Division for Pharmacology Education Inducts Two New Fellows into the Academy of Pharmacology Educators

The Academy of Pharmacology Educators was established in 2010 to recognize individuals who have made exemplary contributions to pharmacology education in one or more of the following areas: student-teacher interaction, innovative contributions, scholarly endeavors, professional development, and service. Two new fellows were inducted into the Academy during the Division for Pharmacology Education's Annual Division Meeting at EB 2019 on Monday, April 8, 2019. More information about the Academy, including application instructions and a roster of inductees, can be found here: <http://www.aspet.org/Education/Academy>.

**Dr. Gagani Athauda** received her MD in 2002 from Riga Stradiņš University, Latvia. She is currently an associate professor at the Herbert Wertheim College of Medicine (HWCOM), Florida International University where she serves as vice chair of the Department of Cellular Biology and Pharmacology. She is a pharmacology educator for courses in the first three years of medical school, and is the course

director of the year 1 pharmacology course and year 2 gastrointestinal systems course. She has been honored with multiple teaching awards, including the "Excellence in Teaching Award" from HWCOM (2015 and 2019), the "Faculty Awards for Excellence in Teaching Award" from the Florida International University, Miami (2015), the "Healthcare Educators Award" from "Figure 1," an organizational network for social learning for healthcare professionals based in Ontario, Canada (2016), and the "Pharmacology Educator Travel Award" from ASPET (2019). She was inducted into the Florida Epsilon Chapter of Alpha Omega Alpha (AOA) Honor Medical Society honoring gifted teaching (2017). Dr. Athauda has been recognized for excellence in mentoring medical students from HWCOM and received the "Mentor of the Year Students Choice Award" (2015). She has published her educational research in *Medical Science Educator* and *MedEdPORTAL* and has presented her work at meetings both nationally and internationally. She has been a member of ASPET and a primary member of the Division for Pharmacology Education (DPE) since 2014. She is a member of the DPE executive committee and is the DPE Secretary/Treasurer-Elect for 2019-2020.

**Dr. Robert J. Theobald, Jr.**, received his PhD in 1975 and completed a postdoctoral fellowship at the University of Pittsburgh. A member of the pharmacology department at ATSU-KCOM since 1976, he served as chairman from 1989-2015, and is currently a professor. He is much involved in pharmacology education at the national level, in ASPET's Division of Pharmacology Education, the National Board of Osteopathic Medical Examiners, the Association of Medical School Pharmacology Chairs, and other organizations, in which he's held several leadership positions. His research has long involved study of lower urinary tract function and has been funded by NIH and other national funding organizations, but he recently turned to investigating drug effects on cognitive behavior. He has been a member of ASPET since 1984.

The Division for Pharmacology Education considers it a privilege to add these educator-scholars to the roster of the Academy of Pharmacology Educators and is greatly appreciative of their many contributions to the discipline.

# 2019 Division Mixers

*ASPET members attend division-sponsored mixers at EB 2019 to network and socialize with friends and colleagues.*



To view the full album of EB 2019 pictures, visit us online at: <https://bit.ly/2Ww1svZ>