A Publication by The American Society for Pharmacology and Experimental Therapeutics

THE Pharmacologist

Vol. 60 • Number 2 • June 2018

The Evolution of the Home Pregnancy Test

Inside:

ASPET
Transforming Discoveries into Therapies

The Pharmacologist is published and distributed by the American Society for Pharmacology and Experimental Therapeutics.

Contents

Effective July 5, 2018

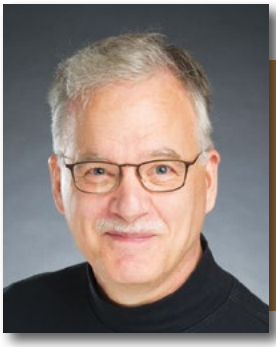
ASPET's new office address is:

1801 Rockville Pike, Suite 210
Rockville, MD 20852-1633

(Please update your records)

The Pharmacologist (ISSN 0031-7004) is published quarterly in March, June, September, and December by the American Society for Pharmacology and Experimental Therapeutics, 9650 Rockville Pike, Suite E220, Bethesda, MD 20814-3995. Annual subscription rates: $25.00 for ASPET members; $50.00 for U.S. nonmembers and institutions; $75.00 for nonmembers and institutions outside the U.S. Single copy: $25.00. Periodicals postage paid at Bethesda, MD. GST number for Canadian subscribers: BN:13489 2330 RT.

Postmaster: Send address changes to: *The Pharmacologist,* ASPET, 9650 Rockville Pike, Suite E220, Bethesda, MD 20814-3995.



Message from The President

Dear ASPET members,

It is hard to believe that my one-year stint as president of the American Society for Pharmacology and Experimental Therapeutics will end in a few weeks' time. Service to this society has been both a challenging and gratifying experience. To meet the society's challenges, I have had the privilege and opportunity to meet and work with some outstanding people, have learned many lessons, and am energized to continue to do what I can in support of fellow pharmacologists.

I owe a special thanks to our ASPET staff members, who are outstanding and do so much behind the scenes to enable our Society to operate smoothly. Their service has been exemplary, especially considering the major challenge of relocating the ASPET office to a new home in July 2018. Imagine the challenge of cleaning house after 60 years of occupancy! To accomplish this and seamlessly maintain normal operations, our executive officer, Dr. Judy Siuciak, has a terrific team that works together to produce our journals (overseen by Rich Dodenhoff), organize our meetings and workshops (overseen by Melissa Huston), education efforts toward our young scientists (overseen by Dr. Catherine Fry), marketing (overseen by Suzie Thompson), finances (overseen by Matthew Hilliker), spearhead science policy (by Tyler Lamb), and provide a personal touch for our members via membership and subscriptions (by Yennifer Hernandez). Thanks to every member of the ASPET staff for all you do on our behalf.

In my last letter, I highlighted the "ASPET datablitz" which was an incredible innovation developed by the Program Committee and the Young Scientists Committee and featured for the first time at EB 2018. Initially, I plugged this innovation because I expected that it would draw attention to posters, but in my opinion, it did more than that. It was an event unto itself. Previously I likened it to a movie "trailer," but in reality, the ASPET datablitz was like "the Voice" or "American Idol" for young scientists. We viewed poised young scientists exuding enthusiasm for their discoveries on a small stage in front of a rapt audience. I think this was an ASPET meeting highlight for me. To be eligible to participate, you must be a graduate student, postdoc, postbac, or undergraduate ASPET member, and submit your research to an ASPET topic category. Next year I encourage you to submit your abstract in order to be considered.

In an earlier letter, I described a pilot program that Council approved. Representatives from university pharmacology programs staffed tables and provided information describing pharmacology research programs of interest to both undergraduates interested in doctoral programs as well as graduate students looking for postdoctoral fellowships. I am happy to report that this nascent program looks like it got off to a fine start at EB 2018. Hopefully this event will grow in the future. It is our desire that opportunities like this will cultivate the next generation of pharmacologists.

I have been the beneficiary of the esprit de corps in the work accomplished by ASPET volunteers, i.e., those among us who contribute their ideas, energy, and time to make the world of pharmacology a better place for all of us. To our Council members, division chairs and officers, committee chairs and members, thank you for your good work and willingness to give back. Time is at a premium these days,

yet these ASPET members find time to contribute. I have enjoyed participating in ASPET committees with you because I can interact with colleagues whom I would not normally have had the opportunity to work with. The projects we have worked on often required brainstorming, and quite often yielded creative solutions—this kind of problem solving is often a satisfying process for most scientists. Teaming up with my counterparts from different institutions helped me to feel that, with our common goals, I was connected with a larger family of pharmacologists. Thank you for your service.

Two dedicated ASPET leaders are leaving Council and deserve special recognition for their dedicated service: Drs. Charles France and David Sibley. Charles France served as ASPET's secretary/treasurer and prior to that was a councilor for three years. As he completes his term at the end of this month, I know that Charles has been an exemplary steward of our assets by consistently encouraging us to focus our resources on fostering the development of our prime asset: our next generation, the young scientists. Jin Zhang will assume the role of secretary/treasurer-elect in July, and I am sure she will do an outstanding job, too.

Dr. David Sibley will step down from Council having completed his one-year term as past-President. Dave has a long record of service to ASPET (with stints on the BPT, editor of *Pharmacological Reviews*, as ASPET secretary/treasurer, etc.), and we are grateful. This past year the presidential team (including Dave, Eddie Morgan, and me) has been the fortunate beneficiary of his collective knowledge and experience during our weekly teleconferences. In addition, he has been a crucial liaison for our division chairs, helping facilitate communication with Council. Heartfelt thanks to Dave for all his efforts on behalf of ASPET.

Another highlight of my term was the opportunity to see the further evolution and progression of our science policy efforts with the Science Policy Committee (SPC) chaired by Dr. Ken Thummel and facilitated by Tyler Lamb, ASPET's senior manager of government affairs and science policy. Through the efforts of the SPC, ASPET has published a number of policy positions related to increasing the NIH budget and science funding, scheduling of fentanyl analogs, and other topics. One area of interest to our young scientists was ASPET weighing in to congressional committee members on the repeal of the income exclusion for graduate tuition waivers in the Tax Cuts and Jobs Act (H.R. 1). Through our efforts and the efforts of other scientific societies, this was ultimately not included.

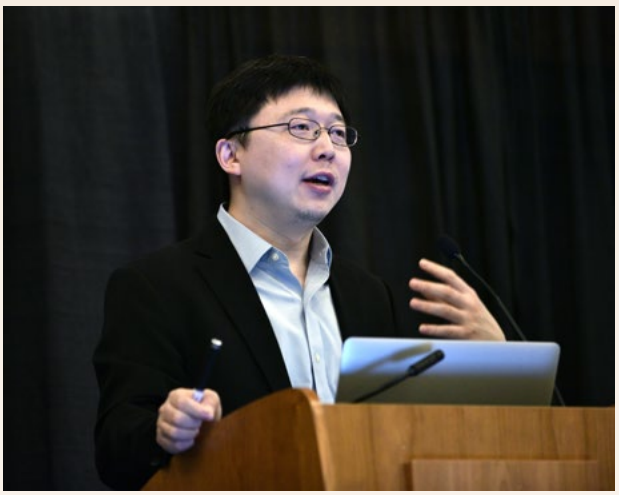
I am extremely pleased that my successor, Dr. Eddie Morgan, is so well qualified to lead ASPET over the next year having served as editor of *Drug Metabolism and Disposition*, as well as secretary/treasurer of ASPET. If you have not had a chance, please check out Eddie's interview on EBTV where he discusses the strategic plan, next year's annual meeting, the incredible scientific value of the EB annual meeting, etc. It has been an honor to work with Eddie in his capacity as president-elect this year, and I look forward to continuing to support him in my role this coming year as past president of ASPET.

Thanks to each of you for the privilege of serving.

Best wishes,

John D. Schuetz, PhD
President, ASPET

2018 Annual Meeting in Review



Tang Prize Lecturer Feng Zhang

From April 21-25, 2018, over 11,000 scientists gathered in San Diego, CA to take part in Experimental Biology 2018. The meeting included an excellent scientific program from all five host societies (ASPET, ASBMB, APS, ASIP, and AAA) as well as great networking and social events. In the spirit of collaboration, EB held an opening Tang Prize Lecture by Feng Zhang, which focused on "Harnessing Nature's Diversity for Gene Editing and Beyond." Directly following the lecture, attendees socialized at the all-society EB Welcome Reception. For the first time this year, the reception included highlighted posters from each society as well as posters discussing innovative outreach programs, which garnered enthusiasm for the start of the conference.

EB 2018 attendees at All Society Tang Prize Lecture

EB 2018 attendees at the All-Society Welcome Reception

ASPET's business meeting took place on Saturday, April 21 led by President John Schuetz. Dr. Schuetz updated members on the Society's current activities, programs, and initiatives. Highlights from his presentation included:

- Recent accomplishments on ASPET's Strategic Plan
- The announcement of ASPET's new post-baccalaureate membership category
- A review of the recent ASPET/Chinese Pharmacological Society Joint Meeting
- Information about the upcoming 18th World Congress of Basic and Clinical Pharmacology in Kyoto, Japan

ASPET's Executive Officer Judy Siuciak provided a quick update on this year's meeting highlights and new initiatives, improved member communications, and information on ASPET's impending office relocation. Following Dr. Siuciak, Secretary/Treasurer John Tesmer 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. Schuetz recognized this year's scientific achievement award winners, travel award winners, and Mentoring Network participants.

Top: President-Elect Edward Morgan thanks President John Schuetz for his service to ASPET. Bottom: 2018 ASPET Scientific Achievement Award Winners with President John Schuetz (from left to right) Raymond Dingledine, Mark Currie, Robert Balster, John Schuetz, Kirill Martemyanov, Joseph Beavo, Marc Caron, and Paul Hollenberg.

Top: 2018 Bernard B. Brodie Award in Drug Metabolism Winner David J. Waxman (right) with Betty Sue Masters. Center, Left: 2018 Mentoring Network Participants. Center, Right: 2018 Undergraduate Student Travel Award Winners. Bottom, Left: 2018 ASPET Graduate Student/Post-Baccalaureate Travel Award Winners. Bottom, Right: 2018 ASPET Postdoctoral Travel Award Winners

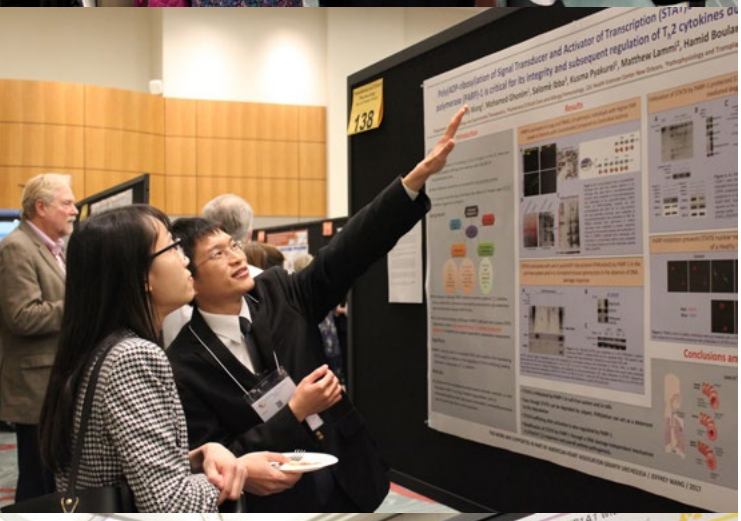
The ASPET booth in the exhibit hall recruited 30 new members, including 6 regular members, 2 postdoc members, 12 graduate student members, and 10 undergraduate student members. We also offered several items for sale in our store, including a new infant/toddler t-shirt design. If you didn't get a chance to purchase an ASPET product at the meeting, you can make purchases online at www.aspet.org/store.

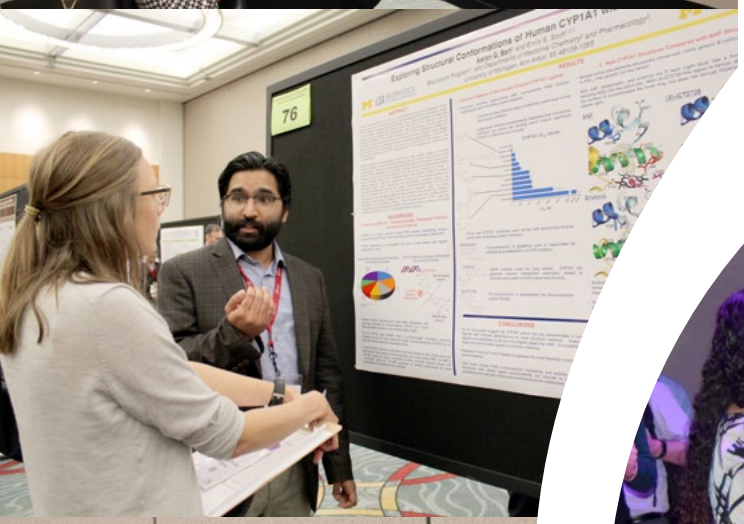
The ASPET member lounge offered a place for members to get their morning coffee, hold one-on-one meetings with colleagues, and relax between sessions. Several members took a break from sessions to complete a group puzzle, play games, catch up on work, and meet new friends in the lounge. "Ask the Editors" sessions as well as the ASPET Young Scientists Committee's photo booth were also hosted in the lounge.

The 2018 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 young scientists 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 126.

Members take a break from sessions in the member lounge.

The 2018 Dolores C. Shockley Competition also 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 **Ashleigh Matthews** (1st) from the University of Michigan, **Yadira Pérez-Páramo** (2nd) from Washington State University and **Aleena Arakaki** (3rd) from the University of California, San Diego. In the postdoctoral category, prizes were awarded to **Natalie Scholpa** (1st) from the University of Arizona and **Patrick Garcia** (2nd) from the University of Alabama, Birmingham.





NEW THIS YEAR, six academic partners hosted recruitment tables at the poster competition to discuss their programs with event attendees.

Following the poster competition, ASPET students and postdocs socialized at the Student/Postdoc Mixer.

Left, Top 3: Student and Postdoctoral Poster Competition. Left, Bottom: Recruitment table at the Student and Postdoctoral Poster Competition. Bottom, Right: ASPET Student/Postdoc Mixer

To view the full album of EB 2018 pictures, visit us online at:
https://bit.ly/2JCshsb

Annual Meeting Program Highlights

ASPET Presidential Symposium: Deadly Liaisons – Squeezing the Life out of Cancer

Submitted by John Schuetz

Speakers at the ASPET Presidential symposium

The Presidential Symposium was held on Sunday, April 22 and entitled, **"Deadly Liaisons: Squeezing the Life Out of Cancer"** and I was delighted to have Dr. Mary-Ann Bjornsti, the Chair of the Division for Cancer Pharmacology, as my Co-chair. This symposium was developed to provide a state-of-the-art overview of cancer pharmacology by international leaders in their respective fields. Topics included: using genomics to elucidate the determinants of anticancer drug toxicity and efficacy; discovering druggable pathways in novel, clinically relevant models of pediatric CNS cancer, medulloblastoma; how deciphering the mechanism of action of a natural product, taxol, revealed a breakthrough in cancer therapy; and discovering small molecules that disrupt protein interactions, which cancers depend upon.

First, we had Bill Evans discussing his lab's use of genome-wide strategies to elucidate the importance of both inherited and somatic genome variation in determining the efficacy and toxicity of leukemia chemotherapy with the goal of using this information to not just predict response in leukemia patients, but to minimize toxicity. Martine Roussel, whose lab focuses on identifying genes within key signaling pathways and epigenetic modifiers that govern the formation of medulloblastoma, a malignant cerebellar tumor of childhood, discussed the development of novel animal models of medulloblastoma and demonstrated how these models are key to developing new therapeutics for this most frequent and deadly CNS disease in pediatric patients. Susan Horwitz, an outstanding researcher in experimental therapeutics, discussed her lab's seminal 1979 discovery which revealed how the small molecule, taxol, impacted the dynamics of microtubules. This discovery laid the groundwork for the development of paclitaxel as a frontline therapy for many common solid tumors, including ovarian, breast, and lung carcinomas. Kip Guy discussed how a novel small molecule targeting a drug protein-protein interaction impacting the ubiquitin-ligase pathway provided important insights into potential novel approaches to targeting metastases. In all, this symposium provided a contemporary survey of the landscape of how technology and new approaches can really drive new insights into cancer biology by providing opportunities for therapeutic development into the molecular drivers of carcinogenesis or tumor genesis.

Next year's Presidential Symposium will focus on the microbiome and will be chaired by President-Elect Dr. Edward Morgan. The symposium will be held at the ASPET Annual Meeting at EB 2019 in Orlando, FL.

Journals Workshop at ASPET's Annual Meeting

Submitted by Rich Dodenhoff

Speakers at the Hear It from the Editors *workshop*

Building on past success, ASPET's journals sponsored a *Hear It from the Editors* workshop at the annual meeting on Wednesday morning. Dr. Mary Vore, chair of the Board of Publications Trustees and a workshop co-chair, set the format by explaining that the session was all about the attendees. At least one editor and/or associate editor from ASPET's journals was at each of the tables to facilitate discussion and help participants work through questions after each brief presentation. Participants were encouraged to ask whatever they wanted about the publication process.

The workshop focused on three areas: the manuscript decision process, being a manuscript reviewer, and avoiding ethics and copyright problems.

Dr. Ken Tew, the editor of *JPET*, explained what happens once a manuscript is submitted to a journal. His informative slides showed exactly what goes on "behind the curtain" as a paper moves through ASPET's online peer review system. Attendees could better understand the process, see what goes into a decision, and learn about problems to avoid. Attendees then worked through five questions about issues that often arise for authors.

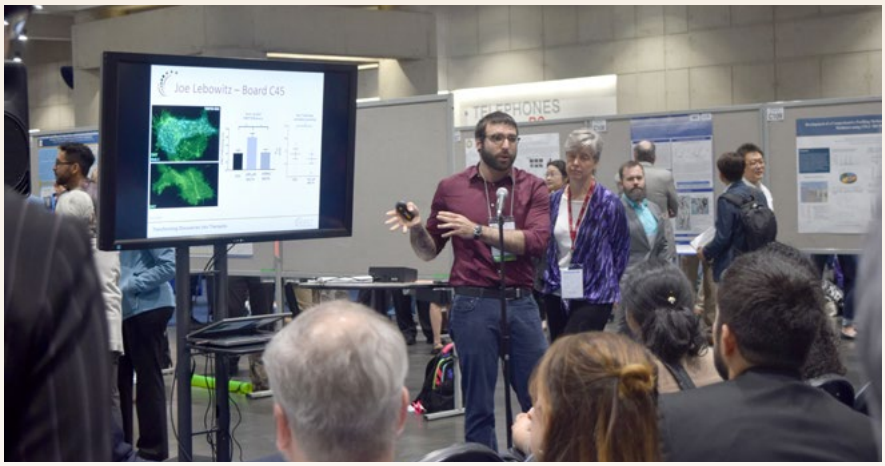
Dr. Kathryn Meier and Dr. Jeffrey Stevens, editors of *Molecular Pharmacology* and *Drug Metabolism and Disposition*, respectively, addressed how to serve as a reviewer. They provided three challenging but typical peer review scenarios for discussion by participants that addressed what to say in a review and how to say it. The scenarios were based on real manuscripts, and the actual outcome was given.

Rich Dodenhoff, ASPET's journals director and the co-chair for the session, provided information on ethics such as who should and should not be listed as an author, what constitutes an unpublished work, image manipulation, and copyright. The presentation included resources on these topics that are available to anyone. Attendees were given several questions on these topics to address with the facilitators.

Those who attended the session are encouraged to submit feedback via the meeting app or by email to journals@aspet.org. Comments will be used to plan the workshop for next year's meeting. The session is intended to serve primarily younger researchers by providing them with practical information that they can use when submitting manuscripts, but input from everyone is welcome.

ASPET Daily Datablitz

Submitted by Amreen Mughal, Carol Paronis, and Mark Hernandez



Poster presenters at the daily datablitz sessions

ASPET's inaugural datablitz sessions at EB 2018 represent a joint initiative by the ASPET Program Committee and the Young Scientists Committee as a timely and unique opportunity for young trainees to hone their presentation skills for a broader scientific audience. Each datablitz session included ten individual condensed talks, challenging the speakers to be extremely concise, yet powerful and engaging. This innovative series served many purposes during EB 2018, including giving young scientists the opportunity to summarize their research in a short duration "elevator pitch" format, improving participation at the poster sessions, and serving as a networking event. The three-day series had ten participants per day, representing each of the ASPET divisions. Participants were selected based on their abstracts, and were required to submit a maximum of three slides to session facilitators a month before the meeting. There was a great deal of excitement in preparation for the oral presentations as many participants made updates and revisions to their slides until the day before the scheduled datablitz. In each 4 minute presentation, graduate students and postdocs briefly summarized their research, attracting an audience during the session and increasing participation during poster presentations. Impressively, the session served its purpose by encouraging scientific discussions. Many participants got beneficial feedback that will help them in their future research and also in career development. Several trainees felt that their participation, in addition to the poster session at a national conference like EB, would have a great impact on their career path and future trajectory.

Not infrequently, we limit ourselves as scientists to our particular interests; however, in the current cutting-edge research era, there is a continuous need to expand our horizons. This session served to enhance cross-divisional talks during EB and improved diversity in science and research. The datablitz session did not include time for questions; instead, the audience was encouraged to visit individual posters to learn more about the presenters' research. Both audience and participants learned about each other's research during this inaugural datablitz. In conclusion, this event provided an excellent platform for trainees during the meeting with high possibilities of increased participation during future EB meetings that can help the next generation of scientists in their career development.

University Startups: From Invention to Commercialization

Submitted by Harshini Neelakantan

Attendees participate in a real world case study discussion

Members of the Young Scientists Committee (YSC) of ASPET, Drs. Harshini Neelakantan, Karen Tonsfeldt, and Sadiq Umar, conceptualized, developed, organized, and chaired a unique symposium at Experimental Biology 2018 to introduce ASPET trainees to the fundamental concepts guiding effective translation of academic scientific discoveries into commercially viable therapeutic technologies. This symposium titled *University Startups: From Invention to Commercialization* was a perfect and timely addition to the ASPET program this year, as the ecosystem of university spin-off biotech ventures is largely growing in popularity across the nation. During this interactive symposium workshop, trainees were provided a blueprint of the therapeutics technology commercialization life cycle, concepts which were then introduced and discussed by biotech industry professionals during their talks, as well as applied to a real-world case study during the breakout session.

Dr. Tom Parry, Principal at Skyline Biopharma, LLC initiated the didactic session by discussing a high-level overview of the drug development and therapeutics technology commercialization process, emphasizing the importance of early evaluation of market potential, target product profile, competitive advantage, financial strategies, and commercialization/regulatory path for a novel technology. Dr. Louis Lieto, patent attorney with the Wilson Sonsini Goodrich & Rosati, P.C. introduced the know-hows of public disclosure of inventions, intellectual property (IP) and patent protection of discoveries, and the role of the university technology transfer office in IP and licensing processes. Dr. Kara Bortone, Director of Venture Sourcing and Development at JLabs (J&J Innovation) reviewed JLabs' incubator model and discussed varied resources and benefits for early-stage startups and entrepreneurs within the model, including business development opportunities with potential corporate strategic partners. Dr. Hugh Rosen, a professor at The Scripps Research Institute culminated the didactic session by narrating his journey as an academic founder of a biotech company that was a spin-off around an invention discovered in his own lab. His talk was a great illustration of the hard work and perseverance it takes to translate innovative bench science into a viable therapeutic product commercialized for changing human lives.

Following the talks, trainees were extended the opportunity to network with the speakers and other key opinion leaders from industry (Drs. Donald Button, Dennis Marshall, Pamela Hornby, and Felix Kim) during a breakout session that focused on discussing a real-world case study on a clinical-stage biotechnology company. Representative trainees from the breakout groups then presented their solutions/strategies for open discussions and feedback. This symposium workshop succeeded in bridging trainees from across ASPET divisions and has set the foundation for continued innovative future symposia.

Surmounting the Insurmountable: Obstacles in Drug Discovery and Development – Real World Case Studies

Submitted by Kan He, Paul Hollenberg, and Thomas Woolf

Speakers at the Surmounting the Insurmountable symposium

We were pleased to welcome the second installment of the ASPET session titled Surmounting the Insurmountable to our Annual Meeting at EB 2018. The session focused on real-world case studies, and was organized as part of ASPET's BIG IDEAS Initiative by Kan He, President of Biotranex, LLC, and Paul F. Hollenberg, Professor Emeritus, University of Michigan. Four speakers focused on the obstacles that invariably pop up in drug discovery and development, and they shared case studies from the real world to highlight experienced scientists' challenges when things go wrong at any stage of the process. The session's real-world examples provided a unique forum for student, academic, government, and industrial scientists to learn directly from researchers who are or have been involved in just such situations. The goal of this session was to provide actual examples to share with biomedical scientists emphasizing the need to think critically and creatively when unexpected and challenging roadblocks occur in drug discovery and development.

Speakers included:

- Margaret Bradbury - Challenges and Solutions in the Approval of Austedo, the First Deuterium-Substituted Small Molecule
- Francis Lee - Discovery and Development Challenges of Dasatinib for the Treatment of Chronic Myelogenous Leukemia and Beyond
- Sandeep Dutta - Modeling and Simulation that Resulted in the Progression of Evolucumab
- Francis Wolenski - Fasiglifam (TAK-875) Alters Bile Acid Homeostasis in Rats and Dogs: A Potential Cause of Drug Induced Liver Injury

Planning for next year's session is beginning. The session committee strongly encourages you to send suggestions for topics and/or presenters with an interesting case study that shows how complex bringing successful drugs to the market can be when faced with "surmounting the insurmountable" in drug discovery and development. Contact: Kan He at khe@biotranex.com or Paul Hollenberg at phollen@umich.edu.

TCP Trainee Mentoring and Career Development Session

Submitted by Naeem Patil

Session presenter Jeffrey Paul

The ASPET Division for Translational and Clinical Pharmacology (TCP) conducted its fourth special *Trainee Mentoring and Career Development* session with the goal of discussing with experts relevant topics and the career skills needed. This year's presenter was Jeffrey Paul, PhD, who presented the purpose of personalizing pharmacotherapy, which is to choose the right drug, at the right dose, for the right patient. One increasingly familiar approach to this is precision medicine, which is molecular targeting in cancer patients. Other examples were discussed, such as dealing with varying sensitivities of race/ethnicity, sex, age, and genetics to particular drug classes. Groupings of individuals are made based on their biology (age, sex, race, gender) and environmental influences (diet, activity level, microbiome, socioeconomic status).

There was an interesting and spirited discussion involving how drug labels are created and adverse events are monitored for various vulnerable groups including women, the elderly, and various racial/ethnic groups. Dr. Paul presented the case of the popular sleep aid Ambien, where the FDA reduced the dose in women 22 years after the initial approval, based on their PK/PD and reports of driving accidents.

Of particular interest to the attendees were the technical skills needed for personalized pharmacotherapy during drug development and after a drug is launched. In general, during the drug discovery phase scientific teams combine technical expertise in disease biology, pharmacology, genomics, biomarkers, and informatics. Post-approval, knowledge of epidemiology, real world data, statistics, analytics, and understanding of demography and social/advocacy groups become important skill sets.

The TCP Division has received much positive feedback as attendance at this event (including the free lunch) has been quite popular. TCP intends to continue this session at future ASPET Annual Meetings.

FUN STATS AT EB 2018

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

56 educational and scientific sessions were presented over 5 days

320 scientists shared their expertise in sessions

MOST ATTENDED SESSIONS:

ASPET sessions were rated an average of

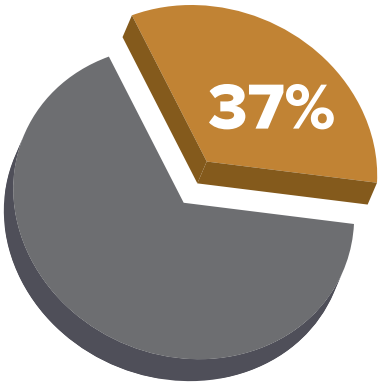
4.7 OUT OF 5 STARS

on the mobile app

EB draws cutting-edge science from around the world!

ASPET attendees at EB represented **41** different countries.

26% of first authors on pharmacology abstracts were from outside the United States.



ASPET welcomes new scientists with an interest in pharmacology! **37%** of pharmacology attendees were at their first EB meeting.

TOP 3
ASPET ITEMS PURCHASED IN THE BOOTH:

1. "Genius" toddler/ baby t-shirt

2. "Experiment. Fail. Learn. Repeat." t-shirt

3. Einstein quote t-shirt

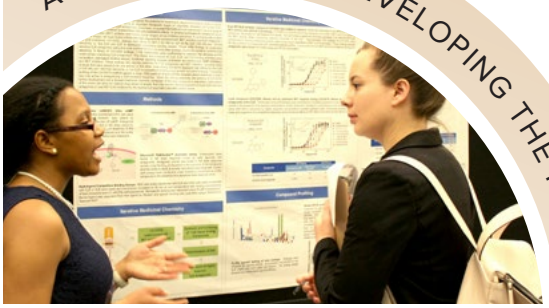
Young scientists were the first authors on **72%** of pharmacology abstracts

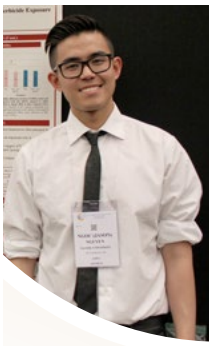
141 young scientists competed in the Student/Postdoc Poster Competition winning **$12,900** in prizes

17% of young scientists submitting abstracts to ASPET were given an opportunity for an oral presentation

114 Travel Awards were given to young scientists

ATTRACTING AND DEVELOPING THE NEXT GENERATION





Call for 2019 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.

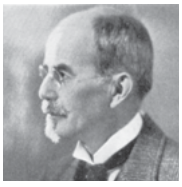
ASPET is strongly committed to diversity. Nominations for members of underrepresented groups, women, and persons with disabilities are particularly encouraged.

- **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 Friday, September 14, 2018 at 5:00 PM EDT.
- **What happens after a nomination is submitted?** Each nomination is reviewed by the members of the award's designated award committee. Scores and rankings are given, and compiled results are discussed by the committee, leading to the final selection of the 2019 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.

Are you an investigator looking for extended funding for research directed toward improving human health? Apply for the

DAVID LEHR RESEARCH AWARD

This award is intended to extend funding for preclinical or clinical research directed toward improving human health. This award is made possible by an endowment to ASPET from Mrs. Lisa Lehr in honor of her husband, the late Dr. David Lehr, former chair of the Department of Pharmacology of New York Medical College. It includes two years of funding at $50,000 per year.

Do you know a clinical pharmacologist who excels in research and/or teaching? Nominate them for the

REYNOLD SPECTOR AWARD IN CLINICAL PHARMACOLOGY

This award recognizes excellence in research and/or teaching in clinical pharmacology. It was established in recognition of Dr. Spector's dedication and contributions to clinical pharmacology and is made possible by the generosity of Dr. Reynold and Mrs. Michiko Spector.

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.

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 an ASPET emeritus member in need of travel funding to attend the ASPET Annual Meeting at EB 2019? Nominate them for the

E. LEONG WAY EMERITUS TRAVEL AWARD

The E. Leong Way award, originally established in 1988, is being relaunched in 2019 to provide 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.

ASPET DIVISION-SPONSORED AWARDS

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.

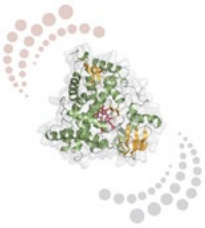
ASPET is strongly committed to diversity. Nominations for members of underrepresented groups, women, and persons with disabilities are particularly encouraged.

Sponsored by the ASPET Division for Behavioral Pharmacology

This new award has been established to recognize 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. The awardee will be invited to deliver a talk at a future ASPET Annual Meeting.

Sponsored by the ASPET Division for Cardiovascular 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.



Sponsored by the ASPET Division for Drug Metabolism and Disposition

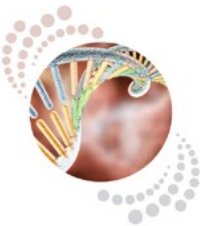
This achievement award is established to recognize excellent original research by early career investigators in the area of drug metabolism and disposition. The awardee will deliver a talk at the ASPET Annual Meeting at EB 2019 and will be invited to publish a review article in *Drug Metabolism and Disposition.*

Sponsored by the ASPET Division for Neuropharmacology

This 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 to defray costs to participate in the ASPET Annual Meeting at EB 2019 are available for pharmacology educators who are 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

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

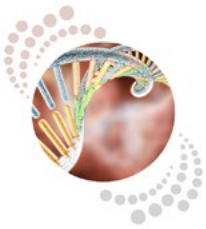
Sponsored by the ASPET Division for Translational and Clinical Pharmacology

The TCP division presents two 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. In addition to this career development opportunity, awardees will give short talks during an Early Career Showcase, which will help in networking with TCP members.

OTHER DIVISION-SPONSORED AWARDS

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. The awardee will deliver a talk at the ASPET Annual Meeting at EB 2019.



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 Pharmacology Education

Travel Awards for Pharmacology Educators to defray costs to participate in the ASPET Annual Meeting at EB 2019 are available for pharmacology educators at all career levels who are faculty members (e.g., assistant professor). Applicants must have significant teaching responsibilities in pharmacology: either graduate, undergraduate college classes, or professional schools.

EXERCISE YOUR MEMBERSHIP BENEFITS!

Nominate someone who has made an impression on you. What better way to give long-deserved kudos to our everyday unsung heroes! Only ASPET members may nominate candidates for awards, so please make sure your membership is up to date.

ASPET Office Relocation

After 60 years on the FASEB campus in Bethesda, MD, ASPET will be moving to a new location.

60 years of history, during this period:

- Staff grew from 1 to 17
- 6 Executive Officers
- 60 Presidents
- Membership grew from 800 to 4800+ in 69 countries

We look forward to serving our members for many more years to come from our new office location!

Please update your records:

ASPET
1801 Rockville Pike
Suite 210
Rockville, MD 20852-1633

The Evolution of the HOME PREGNANCY TEST

Rebecca J. Anderson, PhD

In 2015, the Smithsonian Institution purchased, at auction, a little plastic box containing a test tube and an eyedropper for $11,875 *(1)*. The Smithsonian's curator of medicine and science called the 50-year-old artifact "revolutionary," because it symbolized a major shift in diagnostics. The little kit allowed women to test their own urine and determine for themselves whether or not they were pregnant *(2)*.

Ancient Urine

The concept of using urine to diagnose pregnancy dates back to at least 1350 BCE. An ancient Egyptian papyrus described a test that involved having women urinate on wheat and barley seeds for several days *(3)*. If the barley seeds sprouted, the woman was pregnant with a boy. If the wheat seeds grew, it meant a girl. If neither sprouted, the woman was not pregnant.

In 1963, scientists demonstrated that the Egyptian procedure, though simple and lacking scientific precision, was 70% accurate *(3)*. Urine from pregnant women did promote growth of the seeds, whereas the urine of men and non-pregnant women did not.

In the centuries that followed, healers and other practitioners increasingly asserted their diagnostic expertise. They claimed they alone could perform the complicated and often mysterious, ritualistic procedures. In the Middle Ages, for example, physicians made various diagnoses by visually inspecting urine. Clear pale lemon-yellow urine with a cloud on its surface indicated pregnancy *(3)*. Other practitioners mixed urine with wine or sulfur and assessed the precipitates *(3, 4)*. None of those methods proved reliable.

In the 18th and 19th centuries, some physicians suggested that pregnant women secreted certain substances into their urine. Those substances, which were visible only under a microscope, were probably bacteria or crystalline materials *(4)*. In the 1890s, Ernest Starling coined "hormone" as the name for secreted chemical messengers *(3)*.

The Rabbit Died

In the 1920s, scientists identified a specific hormone, human chorionic gonadotropin (hCG), which they found only in pregnant women *(3)*. In 1927, two German gynecologists, Selmar Aschheim and Bernhard Zondek, injected urine from pregnant women into immature female mice. The injection induced an estrous response in the mice despite their immaturity. No such reaction occurred after injection of urine from non-pregnant women *(3, 5)*. Aschheim and Zondek concluded that the urine of pregnant women contained a substance that resembled pituitary hormones *(3, 5, 6)*.

From this observation, the "A-Z test" was standardized and adopted as a routine, though somewhat cumbersome, test for pregnancy. Five immature female mice were injected with a woman's urine twice daily for 3 days, and then their ovaries were examined. Enlarged and congested mouse ovaries indicated that the woman was pregnant *(6)*.

Maurice Friedman, who had earned PhD and MD degrees from the University of Chicago, improved on the A-Z test, although he admitted it was "something of an accident" *(7)*. In 1928, Friedman joined the University of Pennsylvania Medical School, where he taught and conducted research in reproductive physiology *(8)*. He was interested in the "peculiar and special mechanism of ovulation in the rabbit" *(7)*.

Female rabbits have an almost constant supply of ripe ovarian follicles, but the follicles are discharged only after mating with a male. The prevailing view was that rabbit ovulation was a neural reflex, but Friedman (using transplanted ovaries with no innervation) demonstrated that a hormonal mechanism was involved. To prove the point, he needed a source of suitable hormones for his next experiments. "I really wanted to use hog pituitaries but…my greatly restricted research funds forced [me] to seek some other material" *(7)*.

At about the same time, he read the reports of Aschheim and Zondek, indicating that the urine of pregnant women contained something that resembled pituitary hormones. At first, he was skeptical, "because at that time bizarre claims were being made in the European literature" *(7)*. But due to his limited research funds, "I had little choice in the matter" *(7)*. Coincidently, his lab was next door to the Obstetrics Division of the hospital, and he prevailed upon his good friend, Max Lapham, a resident in obstetrics, for urine specimens *(7)*.

Friedman injected urine from pregnant women into a series of female rabbits and examined their ovaries 24-48 hours later *(9)*. The rabbits' ovaries developed corpora lutea and corpora hemorrhagicum—ovulatory changes that occur after mating and presumably were due to hormones in the urine *(8)*. The best results came from rabbits that had delivered a litter within the previous few weeks *(9)*. Friedman thought his method was "sufficiently accurate for clinical use" and made no further attempts to optimize it *(7)*. In fact, ovulation was so consistent that a single postpartum rabbit could be used to determine a woman's pregnancy. Friedman said, "The only more reliable test is to wait nine months" *(8)*.

In 1932, Friedman recommended that "the postpartum rabbit be given a trial in the bioassay of gonad-stimulating extracts" *(10)*. He admitted that this rabbit test was no great discovery—merely a modification of the A-Z test. But within a few years, many clinicians adopted Friedman's test because of its "regularity, rapidity, and ease" of use *(7, 10, 11)*.

At Mount Sinai Hospital in New York, for example, Frank Spielman used Friedman's test to assist with diagnosing 635 difficult cases. Spielman not only

could diagnose normal pregnancies but also detected ectopic gestation and incomplete abortions *(11)*. He concluded, "The Friedman test is worthy of universal adoption" because the method gives "results as good as those obtained with mice" *(1)*. The rabbit test was also faster and used fewer animals.

"The rabbit died" became a euphemism for a pregnancy diagnosis. In fact, the rabbits (and mice) always died because they had to be dissected to examine the size and condition of their ovaries *(5)*.

African clawed frog, Xenopus laevis

Leap Frog

An even faster bioassay was developed by F. A. E. Crew using the African clawed frog, *Xenopus laevis* *(12)*. Crew's assay was an application of research conducted by Lancelot Hogben, Crew's deputy at the Animal Breeding Research Department of the University of Edinburgh *(6)*.

Hogben was a talented endocrinology researcher and cofounder of the Society for Experimental Biology, but he also held strong socialist views and considered himself a "scientific humanist." He railed against the then-popular eugenics movement and was imprisoned in Britain as a conscientious objector during World War I—after working with a Red Cross ambulance unit in France *(6)*.

In addition to his work in Edinburgh, Hogben briefly held appointments in London and Montreal before accepting a lucrative professorship at the University of Cape Town, South Africa *(6)*. He continued his studies of comparative endocrinology, most of which used *Xenopus*, a species plentiful in South Africa. Among his findings was that injection of ox anterior pituitary extracts induced ovulation in the female frogs.

Hogben became increasingly troubled by the racism and worsening political climate in South Africa. After three years, he returned to London, where he accepted the chair in social biology at the London School of Economics.

In his basement laboratory, Hogben set up a colony of *Xenopus* and, along with his colleague Charles Bellerby, optimized the conditions for maintaining healthy frogs in captivity *(6)*. Among other things, their research showed that in the absence of males, the females do not lay eggs spontaneously *(5, 12)*. However, isolated female *Xenopus* could be induced to lay eggs when challenged with an appropriate stimulus, such as urine containing gonadotropins.

Hogben was more interested in reproductive physiology research than assay development. But he sent some frogs to Crew, his former boss in Edinburgh, and encouraged him to investigate their suitability for pregnancy testing *(6)*. Crew's method involved injecting a woman's urine into the frog's dorsal lymph sac. If the woman was pregnant, the female frogs laid eggs 8-12 hours later, a response that could be observed without dissection of the animals *(6)*. Initially, Crew and other research groups used this *Xenopus* method only for experimental studies in their laboratories *(12)*.

In 1937, Crew compared the features of the A-Z mouse test, the Friedman rabbit test, and the *Xenopus* test. He called the frog method the "Hogben test," acknowledging Hogben's seminal studies *(12)*. Each of the three bioassays had advantages and disadvantages, but Crew concluded that they all were trustworthy. The A-Z test gave results in 5 days, the Friedman test took 1-2 days, and the Hogben test took less than 15 hours *(12)*.

Crew's lab, as well as commercial laboratories, offered their services to doctors and hospitals for animal-based pregnancy testing. Over the next 2 decades, they each performed tens of thousands of tests *(6)*. As the bioassays became more widely available, popular books on prenatal care and childbirth began encouraging women to visit a doctor's office and take advantage of the tests to confirm their pregnancy *(3)*. Unfortunately, all of these bioassays

were labor-intensive and relied on trained technicians to care for the animals, dose them, and assess the signs of ovulation.

From Animals to Test Tubes

In 1960, Leif Wide and Carl Gemzeill developed a hemagglutination inhibition test for pregnancy *(3, 13)*. In 1966, A. Rees Midgley published the first radioimmunoassay for gonadotropins *(14)*. These tests were faster and less expensive than the animal assays, but they could not distinguish between hCG and the closely related gonadotropin, luteinizing hormone (LH) *(3)*.

Although by the 1960s hCG was well established as a hormone associated with pregnancy, little else was known about it. The National Institutes of Health (NIH) was one of the few places in the US conducting reproductive endocrinology research *(3)*. Among those NIH researchers were Judith Vaitukaitis and Glenn Braunstein.

Judith Vaitukaitis. © In the public domain

They had both been medical residents in Boston and arrived at NIH's National Cancer Institute in 1970 to begin research in the Reproductive Research Branch under Griff Ross *(3)*. Vaitukaitis worked as an NIH postdoctoral fellow. Braunstein held a commission as a Clinical Associate in the US Public Health Service, which fulfilled his military obligation. The alternative for him was Vietnam.

Using various techniques, researchers at NIH and elsewhere determined that hCG consists of two subunits. The alpha-subunit of hCG is identical to the corresponding subunit of LH, which explained why antibodies raised to the intact hCG hormone cross-reacted with LH in the early immunoassays.

In 1970-1971, Vaitukaitis worked long hours in 10B09, a small lab in NIH's Building 10, studying hCG *(3)*. She immunized rabbits with each hCG subunit, harvested the subunit-selective antibodies, and studied their characteristics and biological function. Most of her research focused on the beta-subunit of hCG because it was structurally and immunologically distinct from the other gonadotropins.

In 1972, Vaitukaitis injected five rabbits with 10 µg of the isolated beta-subunit, and then five rabbits with 50 µg. SB6, the first rabbit to receive the 50 µg injection and the sixth rabbit in the experiment, was the first rabbit to produce an hCG-selective antibody *(15)*.

Vaitukaitis and Ross showed that the SB6 antiserum bound only to hCG—unlike antibodies raised to the intact hormone, which were non-selective *(15)*. "SB6 became the classic antiserum," Viatukaitis said. "[It] had the best relative specificity…and we provided it all over the place" *(3)*.

Choriocarcinoma and Beyond

Years earlier at the National Cancer Institute, Roy Hertz had investigated experimental treatments for choriocarcinoma, a tumor that secretes hCG. He and his colleague Min Chiu Li monitored hCG in the patients' urine to track how well the chemotherapy drugs were working. In groundbreaking research, they persisted with methotrexate treatment until the patients' hCG was undetectable. The tumors dramatically shrank—the first time that any solid tumor had responded to chemotherapy. But Li's assay did not distinguish between hCG and closely related gonadotropins.

Citing Vaitukaitis's work, Braunstein asked Griff Ross whether they could develop a radioimmunoassay that was specific for hCG. In Ross's lab, Vaitukaitis and Braunstein proceeded to purify the antibody and developed a quantitative method for detecting hCG in blood. They did not have to look far for blood samples. Taking advantage of the clinical resources at NIH, they assayed samples taken from patients during routine blood draws. In some of those blood samples, their new assay detected measurable levels of hCG *(3)*.

They also assayed frozen serial samples that Ross had collected from women with choriocarcinoma. In some women who had undergone chemotherapy treatment and had supposedly been cured, Vaitukaitus and Braunstein were still able to detect small amounts of hCG *(15)*.

They knew that their radioimmunoassay, because of its specificity and sensitivity, would be quickly adopted by commercial firms *(3)*. Its value in monitoring cancer chemotherapy efficacy alone justified a patent. Before publishing their research in 1972, they met with NIH's patent lawyers *(3)*.

"We wanted to protect the public from getting gouged with being charged for these tests," Vaitukaitis said, "but the legal counsel would not at that time allow patenting" *(3)*. Their work had been conducted using public funds, the lawyers said, and the results belonged in the public domain. NIH did not patent the assay.

Margaret Crane. © Reprinted with permission from Ashley Gilbertson/VII/Redux

At first, the new radioimmunoassay was used by clinicians who were treating and monitoring patients with hCG-secreting tumors. According to Vaitukaitis, "We were doing assays for people all over the place. We felt ethically that we had to because it wasn't available anyplace else. So, we used to give out a lot of antiserums to research labs and show them how to set up the assays" *(3)*.

Although most of their data was collected from cancer patients, Vaitukaitis and Braunstein noted in their 1972 paper that "the sensitivity of the assay will permit earlier diagnosis of pregnancy" than the commercially available alternatives *(15)*.

A Lightbulb Moment

Technicians in clinical chemistry labs were already using immunoassays to conduct the routine pregnancy tests ordered by doctors *(3)*. But now, commercial developers drew on the work of Vaitukaitis and Braunstein to devise assays with greater sensitivity.

Some of those developers also offered urine-pregnancy testing services. Among them was Organon Pharmaceuticals. One day, Margaret Crane visited Organon's commercial laboratory in West Orange, NJ, and noticed row upon row of test tubes suspended over a mirrored surface. She asked a scientist and was told they were pregnancy tests: "Each test tube contained reagents which when combined with a pregnant woman's urine, would display a red ring at the base of the test tube, as reflected in the mirror" *(1)*.

All of the pregnancy testing up to that time required doctors to send their patients' urine samples to a local clinical chemistry lab or ship them to a commercial lab like Organon's. Technicians conducted the assay and returned the results to the doctors. The doctors then notified their patients by telephone or mail. The entire process took up to 2 weeks *(2)*.

"I thought how simple [the assay] was," Crane said. "A woman should be able to do that herself" *(1)*. She knew many women wondered whether they might be pregnant, but for social, legal, or religious reasons, they remained silent—and worried.

Unmarried women often avoided pregnancy testing because they did not want their doctor to know they were sexually active *(16)*. In 26 states, obtaining birth control was illegal *(17)*. In the workplace, bosses had the right to lay off women who became pregnant. Abortion was generally illegal in the US, and Crane knew a number of women who had gone through great soul-searching and, for some, the dangerous process of seeking and getting an abortion *(17)*.

Doing Homework

Organon had hired freelancer Margaret "Meg" Crane in 1967 to design a new line of cosmetics packaging *(1)*. The 26-year-old graphic designer was not a scientist and had no particular chemistry background *(2)*. After her visit to the testing labs, Crane returned to her home in New York and made a few attempts at designing a self-contained urine test that women could do at home. Her attempts failed.

Then one day, she absentmindedly glanced at a little plastic box on her desk. It held paperclips. The rectangular container, she instantly realized, was the right size and shape for holding the components of the urine test.

In place of the mirror, she cut a piece of Mylar to fit at an angle at the base of the box. Above that, she placed a shelf with holes to hold a test tube and an eyedropper *(1)*. A woman would collect a urine sample using the box's lid and then squeeze a few drops of it into the test tube. By peering through the transparent wall of the box, she could watch the bottom of the test tube as reflected by the Mylar mirror. A red ring would magically appear if she was pregnant *(17)*.

Crane took her model to work, but her managers were not interested. Organon marketed its pregnancy testing services to doctors, and Crane's product would eliminate the doctors' need for such services *(17)*. Some managers objected on moral grounds, fearing that women who did their own tests would be more likely to seek abortions, and that would bring the wrath of church hierarchies on the company. Others simply said women had no right to test themselves for pregnancy *(1)*.

Disappointed but not discouraged, Crane returned to the office that she shared with a secretary, tucked away her prototype, and resumed sketching lipstick cases and cosmetics bottles *(17)*. Although no one told her, the idea of a home pregnancy test remained on the minds of Organon's executives *(1)*.

A few months later, Organon's Vice President visited AZKO, the parent company in the Netherlands, and pitched the concept to his bosses. The Dutch executives approved and gave him a small budget to conduct a marketing assessment *(1)*. The project moved forward, despite the American managers' objections. Those skeptics became more supportive when they saw the favorable sales projections *(1)*.

Others simply said women had no right to test themselves for pregnancy.

In January 1968, Crane learned that a strategy meeting had been scheduled to discuss the design of Organon's new home pregnancy kit. She had not been invited, but she decided to attend anyway *(17)*.

On the conference room table, her boss and a group of freelance product designers had lined up their proposed models. Crane entered the room and slid her jury-rigged prototype in line with the others. She took a seat at the table and glanced at her boss, challenging him to throw her out. He didn't *(17)*.

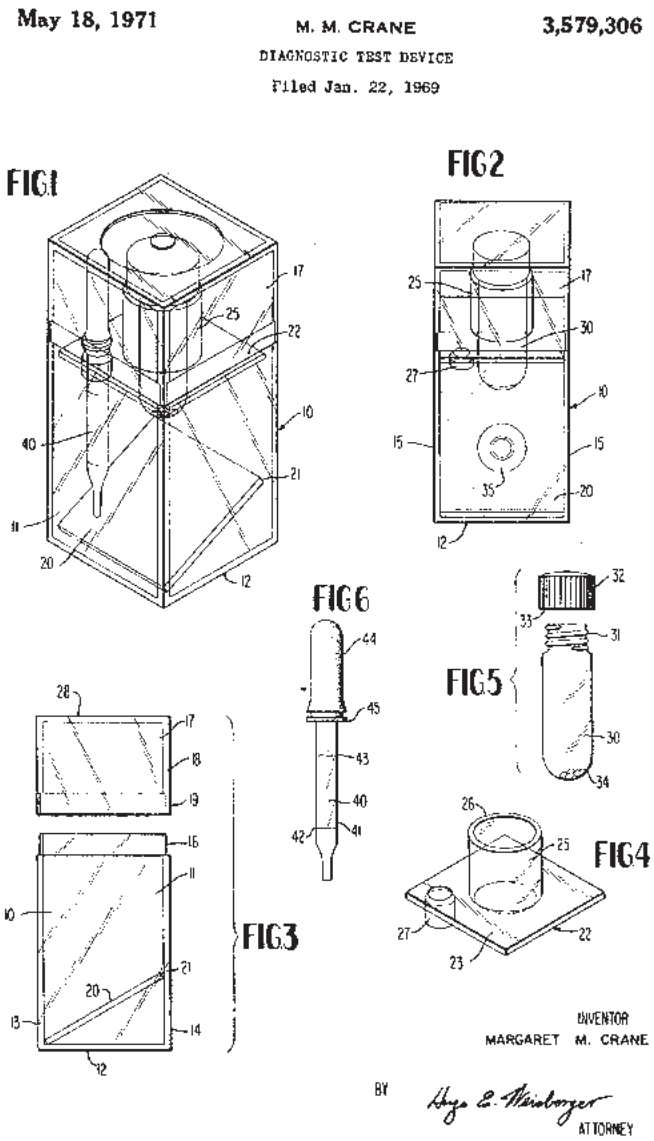
The competing models—all designed by men—had little flowers around the edges or purple diamonds. One had a tassel on the top *(2, 17)*. To Crane, they didn't look scientific. "If I were a customer," she said, "I'd worry about how accurate they could be" *(2)*.

Then, Ira Sturtevant entered the room. He had been hired to manage the marketing plan. After inspecting the prototypes, he picked up Crane's model and said, "This is what we're using, isn't it?" *(17)*.

Her boss replied, "No. That's just something Meg did for talking purposes" *(17)*. He claimed it would be too expensive to manufacture. That was not true, and in the end, Crane's model was chosen over the others. It was the only design that allowed customers to reliably conduct the assay and view the results *(17)*.

In 1969, Organon applied for a patent on the kit design and listed Crane as the inventor *(18)*. In a little ceremony with the company's lawyers and executives, Crane signed over her patent rights to Organon for $1 *(1, 4, 17)*.

In 1970, Crane and Sturtevant joined forces to form Ponzi & Weill, Inc., a design consulting firm, and Organon hired them to manage the product's market launch in Canada *(1, 2, 17)*. When the kit (labeled "Predictor") appeared on Canadian store shelves in 1971, the slogan was, "Every woman has the right to know whether or not she is pregnant" *(17)*.



Patent for home pregnancy test (US3,579,306) by Margaret Crane. © In the public domain

The Predictor kit was an immediate hit in Canada, but it triggered a vigorous debate in the US. The US Public Health Service opposed the product because they feared that teenaged girls would be the main customers *(17)*. The Texas Medical Association warned that if women diagnosed their pregnancy without seeing a doctor, they would neglect prenatal care. Some doctors questioned the ability of women to accurately administer home tests, especially when they were "in a state of emotional anxiety" *(17)*.

Changing Times

Organon licensed its patented product to several companies for marketing in the US *(2)*. All of these companies based their home pregnancy products on the kit design and antigen-antibody reaction described in the Crane-Organon patent *(16, 18)*.

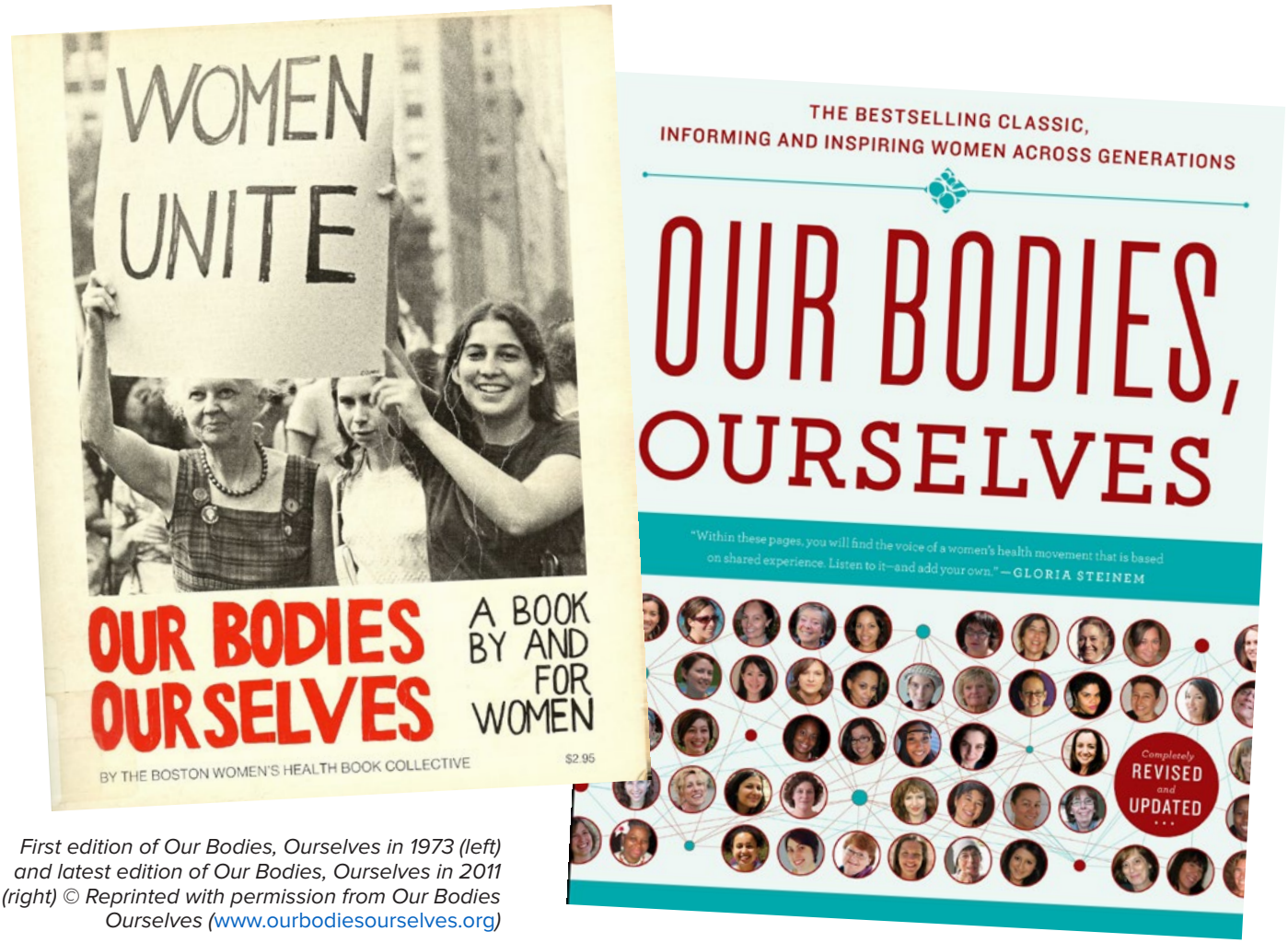
The reagents were contained in two pellets or tablets, which were placed in the test tube. The first contained a freeze-dried, predetermined quantity of sheep red blood cells sensitized with hCG. The other contained a freeze-dried, predetermined quantity of rabbit hCG antiserum. The woman added distilled water and a few drops of her urine to the test tube. If hCG was present in the urine, the antibodies bound to it and the sheep cells fell out of solution forming a distinctive red ring in the bottom of the tube. If there was no hCG in the urine, the rabbit antibody agglutinated to the sheep cells and formed a dense clump *(16, 18)*.

Warner/Chilcott, a division of Warner-Lambert Company, sponsored clinical trials with its in-licensed product. Howard McQuarrie in Utah and Veasy Butram, Jr. in Texas enrolled 379 women who used the kit in their homes. Their test results were 97% accurate in identifying pregnancy, and that was comparable to the results obtained by trained laboratory technicians *(16)*.

Warner/Chilcott's product e.p.t. (for "early pregnancy test") was the first home pregnancy test approved by the US Food and Drug Administration. It appeared on US store shelves in early 1978 *(16)*. Later that year, e.p.t. received competition from "Answer" marketed by Diagnostic Testing, Inc., a subsidiary of Carter-Wallace; "ACU-TEST" marketed by J. B. Williams, Inc., a subsidiary of Nabisco; and "Predictor" marketed by Whitehall Laboratories, a subsidiary of American Home Products *(16)*.

Women had no difficulty following the package's instructions, despite the multiple, time-consuming steps *(16)*. The label on the box included a warning, "Keep refrigerated" *(2)*. One woman recalled, "I had to refrigerate the urine. The test could not be disturbed. You had to put it where it would not feel any vibration" *(19)*. And women had to wait two hours for the ring or clump to appear in the tube.

Though clunky, the Predictor and e.p.t. kits were groundbreaking. For the first time, women could find out whether they were pregnant in the privacy of their own bathrooms. And, just as noteworthy,



First edition of Our Bodies, Ourselves in 1973 (left) and latest edition of Our Bodies, Ourselves in 2011 (right) © Reprinted with permission from Our Bodies Ourselves (www.ourbodiesourselves.org)

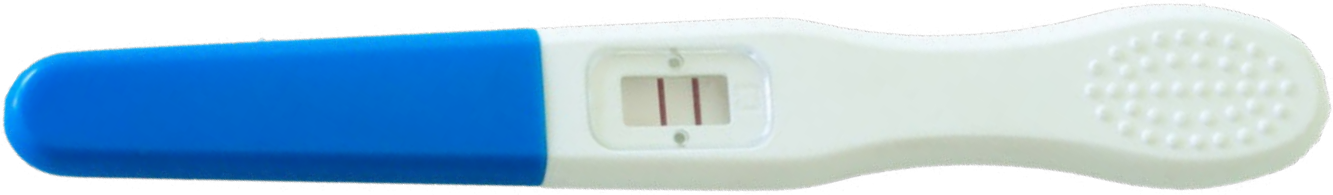
they were taking an active role in their healthcare *(4, 16)*. As Cari Romm explained, "The home pregnancy test wasn't just about knowing; it was about taking charge, a sentiment that fit in nicely with the ethos of the time" *(4)*.

In 1972, Title IX of the US Civil Rights Law ensured equal participation and benefits to women regarding education and all activities receiving federal financial assistance. In 1973, *Our Bodies, Ourselves* was first published—a book in which women frankly addressed topics that had been regarded as taboo (postpartum depression, abortion, birth control, and sexual orientation), as well as pregnancy, childbirth, and menopause. Also in 1973, the US Supreme Court declared abortion legal in Roe v. Wade. Women's liberation groups felt more emboldened to assert women's rights.

"The home pregnancy test wasn't just about knowing; it was about taking charge, a sentiment that fit in nicely with the ethos of the time"

Home pregnancy tests were heavily advertised in women's magazines, but in preparing the ads, marketers struggled to find ways to describe their product. They avoided technical terms such as "hCG," but other details such as "urine stream" were necessary and difficult to sugar coat.

The ads emphasized the products' benefits: For $10, any woman could answer her question about pregnancy in the privacy of her own bathroom without involving husbands, boyfriends, bosses, or doctors *(17)*. One ad for e.p.t. called it "a private little revolution that any woman can easily buy at her drugstore" *(3, 4)*. A Predictor ad boldly asked, "Pregnant? The sooner you know, the better" *(3)*.



Home pregnancy test

Concerns about enabling promiscuous behavior proved to be unfounded. Rather than teenaged girls, the kits appealed primarily to college coeds and married women who eagerly wanted to start a family *(17)*.

Still, some doctors remained skeptical. One wrote to the *American Journal of Public Health* saying that untrained women might use the tests incorrectly and do more harm than good. The journal's editors firmly backed the home pregnancy test and replied that incorrect temperature and blood glucose measurements might be even more dangerous, but patients routinely performed those tests at home. "Not everyone needs carpenters to hammer in their nails" *(20)*.

The Thin Blue Line

The popularity of home pregnancy testing prompted competition among manufacturers to simplify the test procedure and streamline the packaging. A wide range of home pregnancy products flooded the market. Some, like the original, were "cup kits." Others used test strips or dip sticks.

In 1988, Unilever introduced the first one-step test, a sleek plastic stick that was simply exposed to "mid-stream" urine. A blue stripe slowly appeared to indicate pregnancy *(19)*. In 2003, battery-operated devices were introduced, and some replaced the thin blue line with a digital readout *(3)*.

Digital electronics allowed designers to become more creative. They proposed a variety of cutesy, cheery images (such as a baby's smiling face, a swollen belly, or even a single wriggling sperm) that would appear in a small display window to indicate pregnancy *(4)*. But as Marcel Wanders, a product designer, warned, "You can't put too much meaning into it" because for some women the news was neither cheery nor cute *(4)*. Ultimately, designers settled for unpretentious indicators, such as the colored stripe or a simple digital message: "pregnant" or "not pregnant" *(3)*.

Eco-friendly Privacy

The largest distributors of home pregnancy kits have always been drugstores and pharmacies. But many manufacturers are now focusing on online marketing, which not only is more convenient for customers but also provides another layer of privacy.

In December 2017, the FDA approved "Lia," an even more empowering innovation in product design. Lia contains no glass fibers, plastic, electronics, or batteries. The special paper construction (similar to multi-ply toilet paper) is the first flushable and biodegradable pregnancy test. The inventors, echoing Margaret Crane's perspective, said that they specifically created Lia "for women who value privacy, empowering users to choose how to share their results" *(21, 22)*.

The global market for home pregnancy and fertility tests is currently valued at $1 billion and continues to grow. Over half of those sales are in North America, where one-third of all women have used a home pregnancy test *(19)*. It is estimated that 80% of American women now learn they are pregnant from a kit they purchased and used themselves *(17)*.

Witnessing the phenomenal success of the home pregnancy test, Meg Crane thought that its humble beginnings should be preserved. She dug through her closet and retrieved her original prototype, along with one of the original Canadian commercial products and accompanying advertising copy that she and Sturtevant had devised.

In June 2015, Bonhams in New York auctioned the collection as Lot 37. The most prized item in the lot was the little plastic prototype that Crane had patented *(1, 17)*. The Smithsonian outbid everyone else, offering $2000 over the pre-sale estimate. The historic object now resides at The National Museum of American History *(2)*.

Looking back on the evolution of her idea, from paperclip container to biodegradable dipsticks, Margaret Crane could not be happier. "People come up to me, women and a surprising number of men, to thank me," she says. "I'm very pleased about that" *(17)*.

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.

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

Dr. Anderson will share the story of Percy Julian: Physostigmine to Prednisone

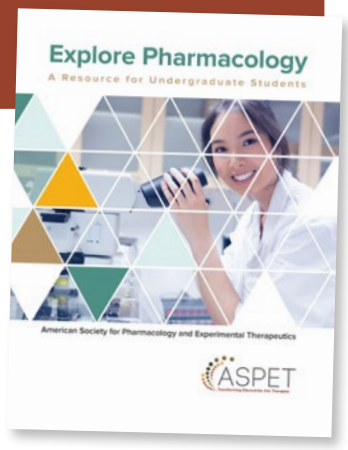
References

1. Bonhams (2015) Lot 37, Original Predictor home pregnancy test prototype, 1968; available from: http://www.bonhams.com/auctions/22407/lot/37/
2. Catlin R (September 21, 2015) The unknown designer of the first home pregnancy test is finally getting her due. *Smithsonian.com*; available from: https://www.smithsonianmag.com/smithsonian-institution/unknown-designer-first-home-pregnancy-test-getting-her-due-180956684/
3. Leavitt S A (December 2003) A thin blue line: The history of the pregnancy test kit. Office of NIH History; available from: https://history.nih.gov/exhibits/thinblueline/introduction.html
4. Romm C (June 17, 2015) Before there were home pregnancy tests. *The Atlantic*; available from: https://www.theatlantic.com/health/archive/2015/06/history-home-pregnancy-test/396077/
5. Yong E (May 4, 2017) How a frog became the first mainstream pregnancy test. *The Atlantic*; available from: https://www.theatlantic.com/science/archive/2017/05/how-a-frog-became-the-first-mainstream-pregnancy-test/525285/
6. Gurdon JB and Hopwood N (2000) The introduction of *Xenopus laevis* into developmental biology: of empire, pregnancy testing and ribosomal genes. *Int J Dev Biol* **44**: 43-50.
7. Friedman MH (1976) The development of the rabbit test for pregnancy. *Am J Obstet Gynecol* **126(6)**: 728-729.
8. Howe M (March 10, 1991) Dr. Maurice Friedman, 87, dies; created rabbit pregnancy test. *New York Times*; available from: http://www.nytimes.com/1991/03/10/obituaries/dr-maurice-friedman-87-dies-created-rabbit-pregnancy-test.html
9. Friedman MH (1939) The assay of gonadotropic extracts in the post-partum rabbit. *Endocrinology* **24(5)**: 617-625.
10. Friedman MH (1932) On the mechanism of ovulation in the rabbit. IV. Quantitative observations on the action of extracts of urine of pregnancy. *J Pharmacol Exp Ther* **45(1)**: 7-18.
11. Spielman F (1934) The Friedman pregnancy test. *Am J Obstet Gynecol* **27(3)**: 448-450.
12. Crew F A E (1939) Biological pregnancy diagnosis tests: A comparison of the rabbit, the mouse, and the "clawed toad" (*Xenopus laevis*) as the experimental animal. *BMJ* **1(4084)**: 766-770.
13. Wide L and Gemzell CA (1960) An immunological pregnancy test. *Acta Endocrinologica* **35**: 261-267.
14. Midgley AR (1966) Radioimmunoassay: A method for human chorionic gonadotropin and human luteinizing hormone. *Endocrinology* **79(1)**: 10-18.
15. Vaitukaitis JL, Braunstein GD, and Ross GT (1972) A radioimmunoassay which specifically measures human chorionic gonadotropin in the presence of human luteinizing hormone. *Am J Obstet Gynecol* **113(6)**: 751-758.
16. Digest (1979) Home pregnancy test simple to use, reasonably accurate, especially if result is positive. *Family Planning Perspectives* **11(3)**: 190-191.
17. Kennedy P (July 31, 2016) The pregnancy test scandal. *New York Times*; available from: https://www.nytimes.com/2016/07/31/opinion/sunday/could-women-be-trusted-with-their-own-pregnancy-tests.html
18. Crane MM (May 18, 1971) Diagnostic test device. US Patent 3,579,306.
19. Kennedy P (July 29, 2012) Who made that home pregnancy test? *New York Times Magazine*; available from: http://www.nytimes.com/2012/07/29/magazine/who-made-that-home-pregnancy-test.html
20. Entwistle PA (1976) Do-it-yourself pregnancy tests: the tip of the iceberg? *Am J Pub Health* **66(11)**: 1108-1109; available from: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC1653504/
21. Duffy S (December 5, 2017) First flushable pregnancy test cleared for OTC use. *MPR*; available from: http://www.empr.com/news/pregnancy-test-lia-biodegradable-flushable/article/712019/
22. Gibbs C (December 11, 2017) Flushable pregnancy test receives FDA clearance. *New York Daily News*; available from: http://www.nydailynews.com/life-style/flushable-pregnancy-test-receives-fda-approval-article-1.3691585

Strategic Plan Update

In 2017, ASPET Council announced the strategic plan which highlights the approaches that the Council sees as necessary to keep pharmacology at the cutting edge of biomedical research. The new strategy was designed to enhance the core functions of the Society in a way that is consistent with ASPET's vision and mission. The plan identified six overarching goals and ASPET's leadership and staff have made great strides in this first year toward implementing some of the identified strategies toward achieving these goals.

Promoting Pharmacology and ASPET



- Updated Explore Pharmacology Booklet
- Created "What is Pharmacology?" Video
- Initiated Plans for Online ASPET Community

Attracting and Developing the Next Generation

- Health Professions Week – High School and Undergraduate Student Outreach
- Mentoring Network
- Summer Undergraduate Research Fellowship Program (SURF)

Reimagining the Annual Meeting Experience

- Daily Poster Datablitz Sessions at EB 2018
- Restructured Symposia Sessions for EB 2019
- Expanded Marketing and Website Features

Enhancing ASPET Journals

- Greater Discoverability Through Indexing by BenchSci and Meta
- Increased Visibility With TrendMD and Kudos

BenchSci

Advocating for Critical Science Policies

- Action Alerts
- Washington Fellows Program
- Expanded Coalition Engagement

Strengthening ASPET

- Financial Analysis by Task Force
- ASPET Office Move

Science Policy News

Washington Fellow Jared Tur on the House-side steps of the U.S. Capitol

#ASPETontheHill

The 2018 Washington Fellows program is underway and our class of 10 fellows have already begun their visits. The mission of the ASPET Washington Fellows Program is to enable developing and early career scientists interested in science policy to learn about and become more engaged in public policy issues. Fellows will develop an understanding of how public policy decisions made in Washington help shape and impact science policy, such as funding for the National Institutes of Health and other science agencies. Fellows will also learn how to advocate effectively on Capitol Hill and in their home districts. This year, the fellows are advocating for the importance of federally funded research, for the necessity and efficacy of animal research, and for the relaxation of regulation that inhibits research on controlled substances. To date, four fellows have completed their visits to Capitol Hill. Collectively, they've visited over twenty congressional offices covering seven states. The remaining six are scheduled to complete their visits by early June. At the conclusion of the program, they will write an op-ed about their experiences advocating for science policy for publication in a news format of their choosing.

Top: Washington Fellow Sean Moran outside the office of Sen. Chris Murphy (CT). Bottom: Rep. Mike Doyle (PA-14) and Washington Fellow Ryan Stoudt

For those interested in next year's program, keep an eye out for a call for applications, scheduled to go out in late summer of this year. If you have any other questions about the Washington Fellows program, please contact Tyler Lamb at tlamb@aspet.org.

Legislative Happenings

In science policy news, at the federal level the appropriations process for FY 19 is already underway. March saw the close of the FY 18 process, with the National Institutes of Health (NIH) receiving an increase of approximately $3 billion, and the National Science Foundation receiving an increase of approximately $295 million. The health care and science policy community is eager to build on this success for the next fiscal year by securing similarly sized appropriations for both agencies. ASPET and our colleagues are calling for NIH to be funded at $39.3 billion and for NSF to be funded at $8.5 billion. While these increases would be substantial, they still will not represent a return to the funding baseline established prior to the budget control caps being implemented in 2011.

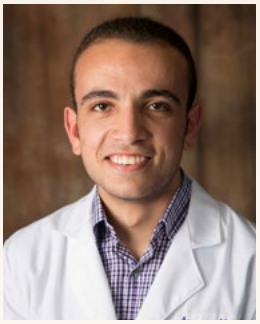
There is reason to be hopeful that these targets will be met or even exceeded. Appropriations committee members in both houses on both sides of the aisle have reiterated their commitment to research funding, both in the media and to ASPET directly. Additionally, the House Agriculture Appropriations subcommittee increased funding in the agriculture bill slightly during a markup recently. These modest increases are a positive indicator that the Department of Health and Human Services' funding will hold at current levels or receive a similarly modest bump. Another key factor to consider: legislators are wary of budget cuts during an election year. The key challenge for research funding will likely begin in FY 20 due to the projected deficits from the recent tax cut bill. As one House legislator put it to ASPET earlier this month, "FY 2020 will be less about increasing funding than protecting what you already have."

At the state level, ASPET joined with the National Association for Biomedical Research (NABR), Johns Hopkins University (JHU), the University of Maryland (UMD), and several other science policy organizations to support S.B. 675, a bill that would require research institutions in the state of Maryland to adopt out dogs and cats that were used for research purposes. Several states without large research institutions have already passed these bills, as animal rights organizations are targeting those states to build momentum for pushing through similar legislation in states with a heavier research presence. Though ASPET originally opposed the bill, once it was amended to remove an onerous requirement that those institutions report the results of their program to the state, ASPET endorsed the bill as a codification of existing programs at JHU and UMD. Thanks to the efforts of NABR, JHU, UMD, the American Physiological Society and ASPET, these institutions will now be able to continue their adoption programs with minimal impact to animal research.

Education News

ASPET Names 2018 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 3 students selected for 2018 individual fellowships:



Arsany Abouda

Lipscomb University

Arsany Abouda, student at Lipscomb University, will work with Dr. Klarissa Jackson as part of the 2018 Pharmaceutical Sciences Summer Research Program. Arsany's project will focus on examining the metabolism and toxicity of tyrosine kinase inhibitors in primary human hepatocytes to identify individual factors that contribute to hepatotoxicity.

Storm Lotomau

Pacific University

Storm Lotomau, a student at Pacific University, will work with Dr. Brendan Stamper. The goal of Storm's research project is to determine the structural features necessary for polyphenols to produce protective effects in the liver. Using a series of polyphenolic compounds, Storm will generate structure-activity relationships to investigate mechanistic details concerning the antioxidant response and prevention of drug-induced liver injury.

Christina Sanders

Vanderbilt University

Christina Sanders, a student at Vanderbilt University, will be working in Dr. Erin Calipari's laboratory to understand factors that contribute to addiction vulnerability in females. By combining operant conditioning with histological analysis, she will study how D1 and D2 cells change over the estrous cycle and how this influences drug seeking behavior.

We wish the 2018 individual fellows, as well as the fellows participating in the SURF institutional programs, a productive and fun summer of research!

Institutional Summer Undergraduate Research Fellowship (SURF) Program

APPLICATIONS DUE OCTOBER 1, 2018 FOR 2019 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.
- Program Directors are expected to sponsor SURF Fellows for student membership in ASPET at the onset 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@aspet.org.

Science Outreach: #instaMETSA – Science Stories in Pictures

Submitted by Tom Wilkie

SCIENCE OUTREACH AT EB 2018

The inaugural science outreach poster session at Experimental Biology 2018 in San Diego was the best poster session I ever had the pleasure to attend. 57 posters at the EB 2018 outreach session told stories of amazing scientific discovery made possible by the young students who committed to their projects and took their work seriously. Engaged audiences crowded around posters from all five EB host societies (**ASPET, ASBMB, APS, ASIP, and AAA**). Every story I saw inspired hope and pride in the scientific approach

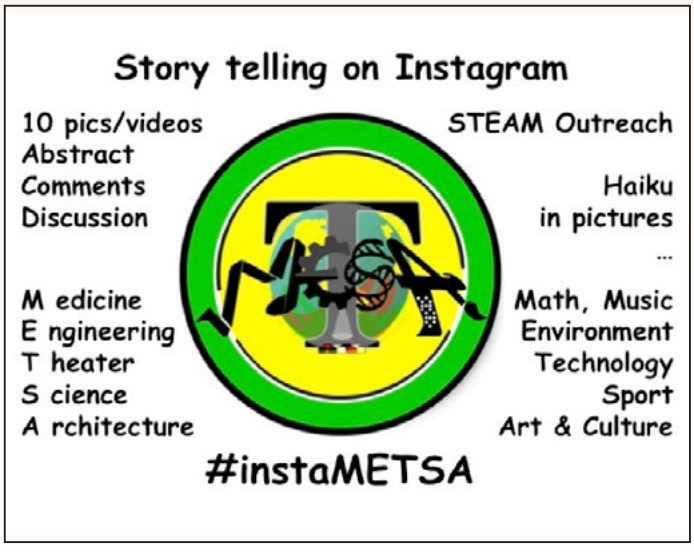
Hillcrest High School biomedical research students pictured with Dr. Tom Wilkie at EB 2018 during the science outreach poster session

and the people who strive to improve the human condition on our small blue planet.

Some notable posters I had the pleasure to briefly view include the story of Falcon Biomanufacturing, presented by Matthew Koci in a partnership between North Carolina State University and Bertie Early College High School. Matthew and high school students from rural northeast North Carolina formed a "mini-biotech company" to clone and express avian cytokines, which are not commercially available, for his laboratory's studies on avian microflora and pathogen response. Brian Hoffmann, from the Medical College of Wisconsin, and his undergraduate colleagues identified non-caloric food sweeteners that persist in the blood and damage vascular endothelial cells in culture, opening a new research project of interest to everyone who consumes diet drinks. Wendy Pacheco welcomed future scientists in an outreach program engaging Puerto Rican high school students. The Art of Science Communication (www.asbmb.org/outreach/training), presented by the ASBMB Public Outreach Committee, described an online course for STEM professionals who present science to non-expert audiences. The San Diego Fleet Science Center highlighted "Two scientists walk into a bar …". The scientists enter a bar with their own beer coasters to take questions and talk about their science. I'd like to hear the stories they leave with.

#instaMETSA

From the University of Texas Southwestern Medical Center, I offer **#instaMETSA** – science stories on Instagram. The target audiences of our outreach program are science and arts students in high school – younger and older students are also welcome. The activities are to assemble and share stories of discovery, experimentation, method, and mechanism – any creative process that can be described in pictures or videos, and a few words. The storyboards are drawn from current science fair projects, school newspaper stories, edible gardens, art projects, theater staging, how to run the pick and roll (complete with angles, arcs, and timing) – anything a student is driven to learn and share.



We scientists tell stories in pictures. Telling a good story takes practice, feedback, and revision. Young people have stories to share of their experiences in music, math, engineering, environment, technology, theater, science, sports, and arts – aka 'METSA'. Sport is where I first learned to value teamwork. Good hands at the bench can develop in childhood sports and arts. METSA aims to attract talented youth from a broad reach of interests. The idea is for students to discover other students having fun doing amazing science, art, literature, and theater projects, all essential skills of great scientists.

METSA (aka STEAM) offers an outreach platform for students and teachers in public, private, or home school; in city, suburban, or rural schools. We post a simple explanation of a scientific hypothesis and how to test it. The goal is for students to drive their own interests and networks, articulate hypotheses, test them in the classroom or laboratory, and identify and share their best work. We welcome all interested students, be they African-American, Hispanic, Native American, Caucasian, Asian, or recent immigrants. Because we communicate via social media, students and educators can reach far and wide.

#instaMETSA is useful for young scientists to describe their discoveries in a title, abstract, and figures (still or video) in 10 panels. Instagram features include comments and messaging functions, allowing public and private discussion. Revised posts can replace earlier drafts. Through instaMETSA, trainees and mentors share their discoveries, discussions, and revisions in small private groups, campus-wide, across America, or around the world.

One of the inspirational outreach programs we joined is the Emory-Tibet Science Initiative (ETSI). The **ETSI** program explores the interface between science and philosophy with Tibetan Buddhist monks and nuns. This program is entering its 5th year of classes in physics, neuroscience, biology, the philosophy of science, and a class on the scientific approach initiated by my son,

Jordan, with the Biology Director, Arri Eisen, for the young monks in residence at Drepung Monastery. I will be teaching in the biology group this year. I look forward to the #instaMETSA postings this summer from Drepung, Gaden, and Sera Monasteries, and constructive discourse with students in outreach programs in Atlanta, Dallas, and across America.

Monks participating in the Emory-Tibet Science Initiative program.

The Cancer Discovery (CanDisc) Team

Two years ago, Havish Kantheti, an undergraduate at the University of Texas at Dallas, came to my lab wanting to develop his skills in bioinformatics for a career in personalized medicine. His drive and enthusiasm helped attract young people to the project from local high school, undergraduate, and post-baccalaureate programs. We formed the Cancer Discovery (CanDisc) Team to explore public databases, identify candidate disease drivers, and examine potential therapeutics. We use social media tools to work via the internet, thus limiting commuting – an important feature for high school and neighboring college students. #instaMETSA is an offshoot of our work in CanDisc.

Research in our laboratory will test the hypotheses articulated by CanDisc. Researchers are recruited from volunteers in the Dallas-Fort Worth metroplex and outreach programs at UT Southwestern, the Science Teacher Access to Resources at Southwestern **(STARS)**, the Dallas Mayor's Intern Fellows high school programs, Summer Undergraduate Research Fellows **(SURF),** and the Physician Scientist Training Program **(PSTP)** for undergraduate visiting scholars. Graduate students, postdocs, researchers, and principal investigators at UT Southwestern gain outreach experience through their contributions as researchers and mentors in these outreach programs. In my lab, the CanDisc Tools facilitate discovery, communication, and organization of the research projects.

We invite others to use, modify, and improve the CanDisc approach, and we look forward to hearing from you (thomas.wilkie@utsouthwestern.edu).

Here are some useful tools we were taught by today's tech-savvy students:

WHATSAPP is an app for cell phones and laptop computers for individuals and small groups to have video-conference discussions about data. The video application on WhatsApp allows researchers to view specific data on their computer screens at dispersed locations. The phone app allows researchers to talk while viewing data. The texting function facilitates setting meeting times and follow-up.

INSTAGRAM allows 10 photos or videos to comprise a story-board of figures outlining preliminary findings within small research groups. An abstract can accompany each post. Feedback and discussion is featured in a public comments section, or by private messaging.

SLACK is a chat room-type platform that brings the entire CanDisc Team together in one virtual location. We post group and individual messages, our best early ideas, papers of interest, and our manuscripts in preparation.

SKYPE is used for CanDisc Team meetings.

GOOGLE DOCS organizes the workflow.

BIOARCHIVE posts of our completed work will enhance the educational experience for our young researchers prior to journal submission. We encourage open dialogue with our colleagues to facilitate early training.

Journals News

DMD Special Section on Transporters in Drug Disposition and Pharmacokinetic Prediction

Studies in recent decades have provided convincing evidence that many ATP-binding cassette (ABC) and solute carrier (SLC) transporters play pivotal roles in the absorption, distribution, metabolism, and elimination of drugs and xenobiotics. The special section of the *DMD* May 2018 issue contains over 20 original manuscripts, perspectives, and reviews that highlight the most recent advances in several of the transporter research areas, including basic biology and function of transporters, expression of drug transporters in organ and tissue barriers, the mechanisms underlying regulation of transporter expression, transporter-mediated drug disposition in animal models, and the development and utilization of new technologies in drug transporter study as well as pharmacokinetic modeling and simulation to assess transporter involvement in drug disposition and drug-drug interactions.

Many thanks to Qingcheng Mao, Yurong Lai, and Joanne Wang who served as guest editors for the special section by gathering this exceptional collection of papers.

The articles are available at https://bit.ly/2IGTt8b.

With Thanks to Our Top Reviewers

In her presentation during ASPET's Annual Business Meeting in San Diego, Mary Vore, Board of Publications Trustees chair, thanked the many people who served on editorial boards and acted as reviewers for the Society's journals over the past year. Particular thanks were given to those who completed the most reviews for each ASPET journal: David S. Riddick for *DMD*, Vladimir Beljanski for *JPET*, David A. Gewirtz for *Molecular Pharmacology*, and Gerald W. Zamponi for *Pharmacological Reviews*. The exceptional commitment of these reviewers is greatly appreciated.

New Associate Editors



The Journal of Pharmacology and Experimental Therapeutics recently welcomed Susan K. Wood as a new associate editor. Dr. Wood is an assistant professor in the Pharmacology, Physiology, and Neuroscience Department at the University of South Carolina School of Medicine.

David Riddick and Ai-Ming Yu are new associate editors for *Drug Metabolism and Disposition*. Dr. Riddick is an associate professor with the Department of Pharmacology and Toxicology at the University of Toronto. Dr. Yu is a professor with the UC Davis School of Medicine's Department of Biochemistry and Molecular Medicine.

Also joining *DMD* are Matthew Cerny and Joanne Wang who are new members of the Editorial Board. Dr. Cerny is a senior principal scientist with the Pfizer, Inc. Pharmacokinetics, Dynamics, and Metabolism Department. Dr. Wang is a professor in the Department of Pharmaceutics at the University of Washington School of Pharmacy.

The Board of Publications Trustees thanks these new editorial board members for their commitment to ASPET's journals.

Molecular Pharmacology Highlighted Trainee Authors





Since the December 2017 issue of *The Pharmacologist*, *Molecular Pharmacology* has honored five additional trainee authors: Renee Bouley, Thomas Maxwell Kaiser, Anita K. Nivedha, Shane Hellyer, and Andrew N. Keller.

The Highlighted Trainee Author program was launched last fall to spotlight the work of a young researcher selected from each issue of the journal. Dr. Adriano Marchese, a member of the *MOL* Editorial and Advisory Board, manages the selection process. Trainee authors may be nominated by a corresponding author or self-nominated.

To learn about each honoree's areas of research, current projects, the anticipated impact of their research, and interests outside the lab, visit https://bit.ly/2yX1YeH.

New Feature: Note Added in Proof

For several years, the *Fast Forward* (manuscript) version of accepted articles posted on ASPET's journals have carried the warning "This article has not been copyedited and formatted. The final version may differ from this version." Changes sometimes get made to manuscripts between acceptance and posting of the formatted version to fix an error. For the sake of greater transparency, the journals have begun using a "Note Added in Proof" to point out substantive changes between those two versions. These include, among other things, the addition or deletion of an author name, a revised figure or table, and the addition of funding information. Some of these changes require approval of the editor. Corrections to grammar, punctuation, and typographical errors will not be called out. Notes added in proof will serve all who use and cite the *Fast Forward* version of ASPET's content.

Membership News

New Members

AFFILIATE MEMBERS

Leo Kim, Cytokinetics Inc., CA

POSTDOCTORAL MEMBERS

Monicah Bwayi, St Jude Children's Res Hospital, TN
Rajeshwary Ghosh, Univ of South Dakota
Eric Gonzalez, NIH Natl Ctr for Advancing Translational Sci, MD
Kevin M. Harlen, Montana Molecular, MT
Eric L. Harvey, Scripps Res Inst, CA
Yu-Jing Li, Univ of Arizona
Wesley Moy, Trifoil Imaging, CA
Anita K. Nivedha, Beckman Res Inst of the City of Hope Natl Med Ctr, CA
Priyanka Prathipati, Univ of Texas HSC at Houston
Andrii Puzyrenko, All Saints Univ Sch of Med, Dominica
Cristina Salmeron Salvador, Univ of California San Diego

REGULAR MEMBERS

Hydar Ali, Univ of Pennsylvania Sch of Dental Med, PA
Piyush Bajaj, Takeda Pharma America, MA
Shyam Sundhar Bale, APER, MA
Rachel Bar-Shavit, Hadassah-Hebrew Univ Med Ctr, Jerusalem
Aynun N. Begum, InnoSense LLC, CA
Luc Boueau, Univ de Moncton, NB
Kristopher Bough, National Inst on Drug Abuse, MD
Terry L. Bowlin, Microbiotix, Inc., MA
Richard Britten, Eastern Virginia Med Sch
Murat Cirit, MIT, MA
Wladyslawa A. Daniel, Inst of Pharmacology, Polish Academy of Sciences
Aditi Das, Univ of Illinois Urbana-Champaign
Danita Eatman, Morehouse Sch of Med, GA
Hafeez M. Faridi, Chicago State Univ, IL
Ryan S. Funk, Univ of Kansas Med Ctr
Brandon T. Gufford, Indiana Univ Sch of Med
Jeff Heard, Beacon Discovery, CA
Keli Hu, Ohio State Univ
Yiding Hu, Sanofi, MA
Mehrak Javadi Paydar, Scripps, CA
Apurva Javkhedkar, Bristol Myers Squibb, MA
Lijuan Jiang, Enanta Pharmaceuticals, Inc., MA
Keon Wook Kang, Col of Pharmacy, Seoul National Univ, South Korea
Yeon A Kim, Gyeongsang National Univ Changwon Hospital, South Korea
Hiroyuki Kusuhara, Univ of Tokyo, Grad Sch Pharma Sci, Japan
Li Ma, Donald & Barbara Zucker Sch of Med at Hofstra/Northwell, NY
Maureen T. O'Brien, Charles River Labs, MD
Frank Park, Univ of Tennessee HSC
Jean Regard, Novartis, MA
Terrilyn A. Richardson, Northeast Ohio Medical Univ
Arthur Roberts, Univ of Georgia
Joseph A. Roche, Wayne State Univ, MI
Christopher Q. Rogers, Univ of South Florida
Ravi P. Sahu, Wright State Univ, OH
Horacio U. Saragovi, McGill Univ - Lady Davis Inst - Jewish Gen Hosp, QC
Mohd Shahid, Chicago State Univ, IL

Mohammad R. Siddiqui, Northwestern Univ - Galter Hlth Sci Lib, IL
Rakesh Singh, Arkansas Col of Osteopathic Med
Rammohan Subramanian, Management & Science Univ, Shah Alam, Malaysia
Thomas R. Sutter, Univ of Memphis, TN
Mohammad Tabrizifard, Merck, CA
Robert G. Thorne, Univ of Wisconsin-Madison
Ronald Tjalkens, Colorado State Univ
Robert C. van Waardenburg, Univ of Alabama at Birmingham
Sathish Venkatachalem, North Dakota State Univ
Robert Yasuda, Georgetown Univ, DC
Rekha Yesudas, AT Still Univ Kirksville Coll of Osteopathic Med, MO
Peng Zhang, Univ of Houston, TX

GRADUATE STUDENTS

Maryam Abunnaja, Univ of Toledo, OH
Moudi M. Alasmari, MCPHS, MA
Suyesha Bhandari B C, Southern Illinois Univ Edwardsville
Riya P. Bhavsar, Long Island Univ, NY
Trisha A. Blair, Univ of the West Indies, Jamaica
Mengbing Chen, Western Univ, CA
Terri Clister, Johns Hopkins Univ, MD
Michael Cozart, Univ of Arkansas for Med Sci
Ivelisse Cruz Torres, Univ of Colorado
Neel Deferm, KU Leuven, Belgium
Hilda C. Delgado De la Herran, CICESE, Mexico
Chiara Evans, Albany Col of Pharmacy & Hlth, NY
Kristina Gill, Harrison Sch of Pharmacy, AL
Omar N. Issa, Univ of Toledo, Col of Pharmacy & Pharmaceutical Sciences, OHMarguerite E. Johnson, Drexel Univ, PA
Jacklyn Skye Kelty, Univ of California Davis
Mostafa K. Khater, Augusta Univ, GA
Victor O. Kolawole, Univ of Abuja, Nigeria
Nitish S. Kunte, North Dakota State Univ
Mangesh S. Kurade, Long Island Univ, NY
Mark Lampert, Univ of California, San Diego
Razia Sultana Mohammad, Univ of Houston, TX
Mehaben Patel, Long Island Univ, NY
Steven W. Plouffe, Univ of California San Diego
Sahith Rajalingam, Long Island Univ, NY
John T. Rodgers, Washington State Univ
Valerie Sapp, Univ of California, San Diego
Armaan H. Siddiquee, Long Island Univ, NY
Ashok Silwal, Southern Illinois Univ Edwardsville
Sreedhar Reddy Suthe, Texas Tech Univ HSC
Olivia Travis, Univ of Mississippi
Jessica Waninger, Univ of Michigan Ann Arbor

UNDERGRADUATE STUDENTS

Allison Barton, Univ of Wisconsin
Nina M. Beltran, Univ of Texas at El Paso
Lucas Brandt, Univ of Wisconsin-Eau Claire
Laura R. Inbody, Univ of Findlay, OH
Lindsey Lanzillotta, Univ of Cincinnati, OH
Dominique M. Lund, Univ of Arizona
Dylan R. Rothbauer, Univ of Wisconsin-Eau Claire
Christie Sanders, Vanderbilt Univ, CO
Emily N. Schulz, Univ of Wisconsin-Eau Claire
Angela F. Smith, AZ
Aaron Tryhus, Univ of Wisconsin

ASPET 50 Year Members

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

Edson X. Albuquerque
Hermann Bader, MD
Joseph R. Bianchine, PhD
Joseph L. Borowitz, PhD
Charles R. Craig, PhD
Richard A. Deitrich, PhD
James V. Dingell, PhD
Donald W. DuCharme, PhD
Andrew G. Ebert, PhD
Mahlon D. Fairchild, PhD
Peter Goldman, MD
Allen W. Gomoll, PhD
Arthur P. Grollman, MD
Martin Helrich, MD
Lorenz M. Hofmann, PhD
Jerry B. Hook, PhD
Carl C. Hug, Jr., MD/PhD
David G. Johns, MD/PhD
Gordon E. Johnson, PhD
Kinya Kuriyama, MD/PhD
Gerald S. Marks, DPhil
Norton H. Neff, PhD
Thomas E. Nelson, PhD
Ronald Okun, MD
John J. O'Neill, PhD
William A. Pettinger, MD
Peter E. Pool, MD
Ernest Reit, PhD
Eugene Roberts, PhD
Raymond W. Ruddon, MD/PhD
Charles O. Rutledge, PhD
Bernard P. Salafsky, PhD
F. H. Schneider, PhD
F. W. Sunderman, Jr, MD
C. Dennis D. Thron, MD
Tsui H. Tsai, PhD
Alan VanPoznak, MD
Elliot S. Vesell, MD
Wolfgang H. Vogel, PhD
Lavern J. Weber, PhD
Ira Weinstein, PhD
George B. Weiss, PhD

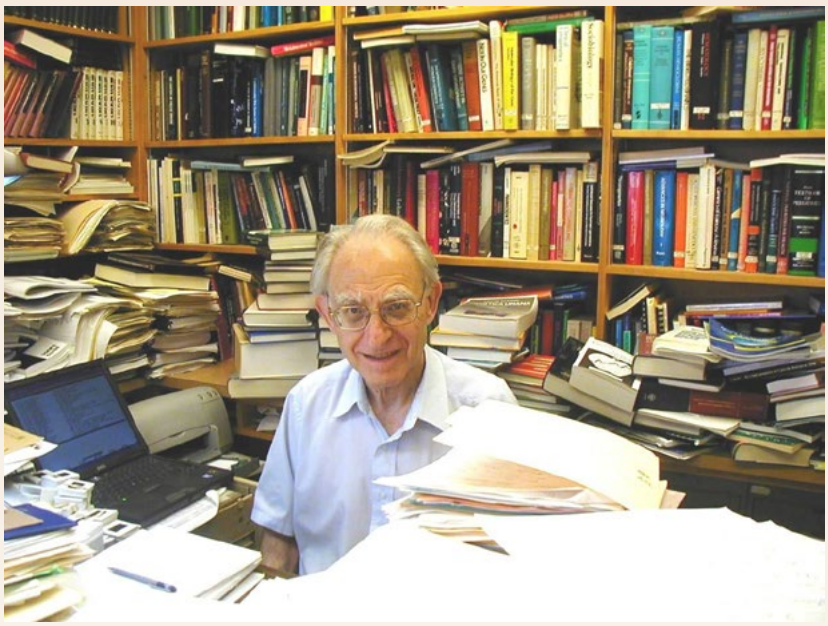
ASPET 25 Year Members

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

Mary E. Abood, PhD
Vincent J. Aloyo, PhD
Chris Bode, PhD
Victoria J. Christiansen, PhD
Patricia C. Contreras, PhD
Susanna Cotecchia, MD
Shaaban F. ElNaggar, PhD
Ronald B. Emeson, PhD
Annette E. Fleckenstein, PhD
Manasses C. Fonteles, MD/PhD
Dale G. Hoyt, PhD
Steven W. Johnson, MD, PhD
John E. Koerner, PhD
Dennis R. Koop, PhD
Edouard Kouassi, PhD
Lawrence H. Lash, PhD
Stephen B. Liggett, MD
Gerald Litwack, PhD
Kenneth W. Locke, PhD
Ronald J. Lukas, PhD
Kevin R. Lynch, PhD
Jaime L. Masferrer, PhD
Paul I. Nadler, MD
Mark A. Osinski, PhD
Michael J. Owens, PhD
Patangi K. Rangachari, PhD
Peter J. Rice, PhD
David S. Riddick, PhD
Jan S. Rosenbaum, PhD
Ramzi Sabra, MD
John F. Schmedtje, Jr., MD
Debra A. Schwinn, MD
Russell J. Sheldon, PhD
Craig K. Svensson, PhD
Akira Tomiyama, PhD
Parminder J. Vig, PhD
John L. Wallace, PhD
Stephanie W. Watts, PhD
R. C. Webb, PhD
Linda L. Werling, PhD

A Tribute to Arno Motulsky (1923 – 2018)

Submitted by Palmer Taylor and Paul A. Insel



Arno Motulsky, MD, an internationally recognized leader in medical genetics, who created the field of (and coined the term) pharmacogenetics in 1963, passed away at age 94 in January 2018. Dr. Motulsky was one of several European emigrants prior to WWII (including Otto Krayer, Alex Karczmar, and Steven Mayer) who were major contributors to the development of American pharmacology during the past century. In 1939 Motulsky was one of 900 Jewish refugees on the boat *St. Louis* that was refused entry into the United States and Cuba and had to return to Europe. Motulsky was arrested in Belgium and after a series of transfers, was sent to the Gurs internment camp in Vichy France. He was able to leave France in June 1941 (ten days before his 18th birthday) for Portugal, from where he was permitted to come to the United States. He became an American citizen, joined the U.S. Army, attended Yale University and then medical school at the University of Illinois, and performed subsequent military service at Walter Reed Hospital in Washington, DC. His pre-medical and medical education fashioned his interest in human genetics. In 1953, he accepted a position at the University of Washington, and by 1957, Motulsky led a division and the first NIH training program in genetics. In his early research efforts, he explored genetic explanations for differences in patients' responses to drugs.

In addition to being a founder of pharmacogenetics, through his work in medical genetics and collaborations with the late Werner Kalow in Toronto, and other pharmacologists in the United States, such as Bert LaDu and Wendell Weber at the University of Michigan, Motulsky was a continuing spokesperson for the role of heredity in disease states and individual responses to medications. With applications of human and prokaryotic and eukaryotic gene sequencing, this sub-discipline of pharmacology expanded and has transformed over the past 20 years into pharmacogenomics.

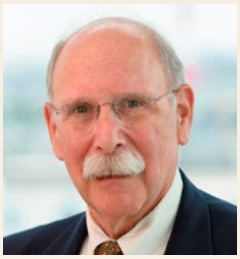
Arno's son, Harvey Motulsky, MD, was a post-doctoral fellow in pharmacology, then a member of the pharmacology faculty at the University of California, San Diego, and the founder of the company GraphPad Software, widely used by graduate students, fellows, and faculty in pharmacology (and other scientific disciplines) in learning and applying graphical and statistical methods to dose-response relationships, pre-clinical pharmacological analyses and clinical outcomes. Harvey is also the author of *Intuitive Biostatistics*, now in its 4th edition. Harvey has been a member of ASPET since 1995 and serves as a statistics editor for *Molecular Pharmacology*.

Those interested in learning more about Arno Motulsky can read more about his life from these resources:

1. Motulsky AG and King M-C (2016) The great adventure of an American human geneticist. *Annu Rev Genet* 17(1): 1–15.
2. Denise G (2018) Arno Motulsky, a founder of medical genetics, dies at 94. *New York Times*, Jan. 29, available from: https://nyti.ms/2GviktX
3. Jarvik GI (2018). Arno G. Motulsky (1923–2018): A founder of medical genetics, creator of pharmacogenetics, and former ASHG president. *Am. J Hum Genet* 102: 335–339.

Members in the News

Achievements, Awards, Promotions, and Scientific Breakthroughs



Gavril W. Pasternak, MD, PhD

Memorial Sloan Kettering Cancer Center

Gavril W. Pasternak, MD, PhD, received the 2018 PhRMA Foundation Award in Excellence in Pharmacology/Toxicology by the Board of Directors of the PhRMA Foundation at the ASPET Annual Meeting at Experimental Biology on April 21, 2018. The award honors "a distinguished career of scientific and/or academic achievements."

Dr. Pasternak has been a leader in the opioid field for over 40 years. He holds the Anne Burnett Tandy Chair of Neurology at Memorial Sloan Kettering Cancer Center and is Professor of Neurology & Neuroscience, Pharmacology and Psychiatry at the Weill Cornell Medical College. While in the Snyder laboratory at Johns Hopkins in the 1970's, he was part of the original team that identified and characterized the opiate receptor. During that time, he discovered the "sodium effect" and was the first to propose a role of sodium ions in the inter-conversion of agonist and antagonist receptor conformations, a discovery that now extends to almost all G-protein coupled receptors. After moving to Memorial Sloan Kettering, he focused upon subtypes of opiate receptors, synthesizing antagonists that separated opioid analgesia from side-effects, such as respiratory depression and constipation. Following the discovery of the mu opioid receptor gene *Oprm1*, his group identified a vast array of mu receptor splice variants that have played a major role in understanding opioid action and the variable responses of patients to different mu opioid drugs. In addition to the traditional GPCR variants, he identified two sets of truncated isoforms and established their pharmacological relevance both in vitro and in vivo. As with the sodium effect, the importance of the GPCR splicing and truncated isoforms may extend beyond the opioid field to GPCRs in general.

His discoveries have markedly altered our understanding of how opiates act and have led to novel, potent analgesics targeting novel receptor targets with greatly reduced side effects. He synthesized a series of compounds targeting one of the truncated isoforms that yielded new opiate drugs up to 100-fold more potent than morphine with a broader spectrum of analgesic activity that includes neuropathic pain and that lack respiratory depression, physical dependence, and reward behavior.

Dr. Pasternak has been a member of ASPET since 1981 and is a member of the **Divisions for Neuropharmacology** and **Molecular Pharmacology.**

Craig W. Lindsley, PhD

Vanderbilt University School of Arts & Sciences

Craig W. Lindsley, PhD, was promoted from Professor to University Professor of Pharmacology, Chemistry and Biochemistry at Vanderbilt University School of Arts & Sciences. On April 24, 2018, he received the Sato International Memorial Award for his significant contributions to pharmacology, therapeutics, and the pharmaceutical sciences. On February 9, 2018, he was elected Chair of the AAAS Pharmaceutical Sciences Section. He will also be honored as the 22nd Smissman Memorial Lecturer in September 2018.

Dr. Lindsley pioneered the development of allosteric ligands for Akt, $mGlu_5$ and M_1 while at Merck & Co, providing critical proof-of-concept compounds that validated the mechanism of allosteric modulation and clinical candidates. Together with Jeffrey Conn at the Vanderbilt Center for Neuroscience Drug Discovery, Dr. Lindsley has pioneered the concept of GPCR allosteric modulation, developing key proof of concept compounds and clinical candidates. He holds over 85 issued US patents and has published over 400 manuscripts and another 180 published patent applications. As co-founder and co-director of the Vanderbilt Center for Neuroscience Drug Discovery, Dr. Lindsley has raised over $160 million in licensing and research support from NIH, Foundations, and companies. In 2016, and without an industry partner, he oversaw IND-enabling studies of a novel M_1 PAM that was awarded an open IND. In mid-2017, the Phase I trial (SAD and MAD) was initiated at Vanderbilt.

Dr. Lindsley has been a member of ASPET since 2009 and is a member of the **Divisions for Molecular Pharmacology, Drug Discovery and Development,** and **Neuropharmacology.**

Edilberto A. Raynes, MD, PhD

Tennessee State University College of Health Sciences

Edilberto A. Raynes, MD, PhD, associate professor at Tennessee State University College of Health Sciences Department of Physical Therapy, was elected to serve as a faculty senator for the academic year (2018- 2020). In August 2017, he was recognized as a Distinguished Faculty Scholar by the Center for Innovation in Research and Teaching at Grand Canyon University. He also was the recipient of Tennessee State University's Blue and White Distinguished Teaching Award.

Dr. Raynes obtained his doctor of medicine degree from the University of the City of Manila in 1991 and was a practicing pediatrician prior to migrating to the United States. He earned his PhD in public health with a concentration on epidemiology from Walden University in Minneapolis in 2013. He has been a Health Disparity Fellow from the University of North Texas at Fort Worth, a fellow of the Texas' Steps Toward Academic Research (STAR) program, as well as a Fellow in a Minority Serving Institution from the American Evaluation Association. Now at Tennessee State University in Nashville, Tennessee, Dr. Raynes is a member of the Institutional Research Board. He has participated in various committees such as Tenure and Promotion, Faculty Search, Academic Integrity, and Academic Discipline, among others. He has been a manuscript reviewer, book reviewer, abstract reviewer, and an advisory board member. In addition to his teaching and service responsibilities, he has several publications in peer reviewed journals in the field of public health, infectious disease, physical therapy, substance abuse, and others.

Dr. Raynes has been a member of ASPET since 2015 and is a member of the **Divisions for Pharmacology Education, Behavioral Pharmacology, Cardiovascular Pharmacology, Drug Discovery and Development, Drug Metabolism and Disposition, Molecular Pharmacology, Neuropharmacology,** and **Translational and Clinical Pharmacology.**

Sandeep Bansal, MD

University of Illinois College of Medicine at Urbana Research

Sandeep Bansal, MD, is currently an associate professor and course director of pharmacology at the University of Illinois College of Medicine at Urbana Research. In May 2018, he was promoted to professor and will join Texas Christian University and the University of North Texas Health Science Center School of Medicine as a professor of medical education to direct pharmacology content in the medical curriculum. In January 2018, he co-authored the book *Learning Pharmacology through Clinical Cases* which was published by Thieme. His book substantiates his educational philosophy to provide a relevant context to learn therapeutics in an integrated and active learning style.

Dr. Bansal has extensive experience using innovative pedagogies such as flipped classroom, problem-based and team-based learning, and case-based integrated teaching. He strongly believes classroom time should be used for the application of knowledge instead of the simple transfer of information.

Dr. Bansal has been a member of ASPET since 2006 and is a member of the **Divisions for Translational and Clinical Pharmacology, Behavioral Pharmacology, Cancer Pharmacology, Cardiovascular Pharmacology, Drug Discovery and Development, Drug Metabolism and Disposition, Molecular Pharmacology, Neuropharmacology,** and **Pharmacology Education.**

Simon G. Comerma Steffensen, DVM

Aarhus University, Denmark

Simon G. Comerma Steffensen, DVM, a postdoctoral researcher at Aarhus University, received the award for best preclinical poster presentation at the International Society for Sexual Medicine (ISSM) and the European Society for Sexual Medicine (ESSM) annual meeting in Lisbon, Portugal earlier this year. The pre-clinical prize was given by *Nature Reviews in Urology*. The title of his poster was "Functional effects of the monoamine reuptake inhibitor, IPED2015, in both cerebral and erectile tissue in vitro."

Comerma Steffensen finished his PhD in cardiovascular pharmacology in 2016 at Aarhus University where he worked with KCa channels and dopamine signaling in an endothelial dysfunction model. He also worked with a Saniona spin off company called Initiator Pharma based on part of his PhD results about compound IPED2015.

Dr. Comerma Steffensen has been a member of ASPET since 2016 and is a member of the **Divisions for Cardiovascular Pharmacology, Behavioral Pharmacology, Cancer Pharmacology, Drug Discovery and Development, Drug Metabolism and Disposition, Molecular Pharmacology, Neuropharmacology, Pharmacology Education, Toxicology,** and **Translational and Clinical Pharmacology.**

Eric A. Wold

The University of Texas Medical Branch

Eric A. Wold received the Ruth L. Kirschstein National Research Service Award (NRSA) Predoctoral Fellowship on March 1, 2018.

Wold received his BS degree with honors in biotechnology from the University of Houston and is currently pursuing a PhD in the Pharmacology and Toxicology Graduate Program at the University of Texas Medical Branch.

Under the mentorship of professors Jia Zhou and Kathryn A. Cunningham, Wold's work aims to discover small molecule allosteric modulators of the serotonin 5-HT2C receptor for the treatment of substance use disorders. As a student working within the Center for Addiction Research, he utilizes medicinal chemistry to further understand the neuropharmacological mechanisms by which drugs of abuse elicit their effects and to illuminate effective therapeutic strategies.

Wold has been a member of ASPET since 2013 and is a member of the **Divisions for Neuropharmacology** and **Drug Discovery and Development.**

Share your achievements, awards, promotions, and scientific breakthroughs with fellow ASPET members. Send your news to your division's communications officer:

BEHAVIORAL PHARMACOLOGY:
Brenda M. Gannon, PhD at GannonB@uthscsa.edu

CANCER PHARMACOLOGY:
Markos Leggas, PhD at mark.leggas@uky.edu

CARDIOVASCULAR PHARMACOLOGY:
David B. Averill, PhD at daverill@tcmc.edu

DRUG DISCOVERY AND DEVELOPMENT:
Przemyslaw Radwanski, PharmD at Przemyslaw.Radwanski@osumc.edu

DRUG METABOLISM AND DISPOSITION:
Aarti Sawant-Basak, PhD at aarti.sawant@pfizer.com or Lindsay M. Henderson at lmhender@uw.edu

MOLECULAR PHARMACOLOGY:
Kathryn E. Livingston, PhD at kathrynlivingston@gmail.com or Amy E. Moritz, PhD at amy.moritz@nih.gov

NEUROPHARMACOLOGY:
Luisa Torres, PhD at lft9@cornell.edu

PHARMACOLOGY EDUCATION:
Catherine M. Davis, PhD at cdavis91@jhmi.edu

TOXICOLOGY:
Alison H. Harrill, PhD at harrill.alison@gmail.com

TRANSLATIONAL & CLINICAL PHARMACOLOGY:
Naeem K. Patil, PhD at naeem.patil@vanderbilt.edu

Division News

2018 Division Award Winners

DIVISION FOR BEHAVIORAL PHARMACOLOGY

Student/Postdoctoral Poster Competition

In the Undergraduate category, prizes were awarded to **Caroline Hernandez-Casner** (1st) from the University of Texas, El Paso and **Karen Jimenez** (2nd) from the University of Texas Health Science Center, San Antonio.

In the Postbaccalaureate/Graduate Student category, prizes were awarded to **Lakeisha Lewter** (1st) from the University at Buffalo, **Laura Erwin** (2nd) from the Louisiana State University Health Science Center, and **Julie Finnell** (3rd) from the University of South Carolina.

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

DIVISION FOR CANCER PHARMACOLOGY

Student/Postdoctoral Poster Competition

In the Undergraduate category, prizes were awarded to **Remi Looi-Somoye** (1st) from the University of Bath and **Janine DeBlasi** (2nd) from the University of South Florida.

In the Postbaccalaureate/Graduate Student category, prizes were awarded to **An-Angela Van** (1st) from the University of California, San Diego, **Jia Cui** (2nd) from the University of Alabama, Birmingham, and **Joseph Jilek** (3rd) from the University of California, Davis.

In the Postdoctoral category, prizes were awarded to **Rebecca Crawford** (1st) from St. Jude Children's Research Hospital and **Jin Lee** (2nd) from the University of California, San Diego.

DIVISION FOR CARDIOVASCULAR PHARMACOLOGY

Student/Postdoctoral Poster Competition

In the Undergraduate category, prizes were awarded to **Sabina London** (1st) from the University of Pennsylvania and **Lindsey Lanzillotta** (2nd) from the University of Cincinnati.

In the Postbaccalaureate/Graduate Student category, prizes were awarded to **Robert Cameron** (1st) from the University of Arizona, **Lisa Green** (2nd) from the University of Cincinnati, and **Korin Leffler** (3rd) from East Carolina University, Brody School of Medicine.

In the Postdoctoral category, prizes were awarded to **Arsalan Syed** (1st) from the University of California, Davis, **Yin Cai** (2nd) from the The University of Hong Kong, and **Amanda Miller** (3rd) from the Pennsylvania State University College of Medicine.

CVP Trainee Showcase (Oral Sessions)

In the Postbaccalaureate/Graduate Student category, prizes were awarded to **Maria Paz Prada** (1st) from University of California, Davis, **Shrinidh Joshi** (2nd) from North Dakota State University, and **Amreen Mughal** (3rd) from the University of Vermont.

In the Postdoctoral category, prizes were awarded to **Benard Ogola** (1st) from Tulane School of Medicine, **Cameron Brand** (2nd) from the University of California San Diego, and **Takeshi Suetomi** (3rd) from the University of California San Diego.

Paul M. Vanhoutte Distinguished Lectureship in Vascular Pharmacology

Virginia M. Miller, PhD from the Mayo Graduate School of Medicine, and Thomas Michel, MD, PhD, from Harvard Medical School (HMS) and Brigham and Women's Hospital (BWH), are the co-recipients of the 2018 Paul M. Vanhoutte Distinguished Lectureship in Vascular Pharmacology.

The ASPET Division for Cardiovascular Pharmacology awards the Vanhoutte Lectureship 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. Drs. Miller and Michel were presented with their awards at EB 2018 in San Diego.

DIVISION FOR DRUG DISCOVERY AND DEVELOPMENT

Student/Postdoctoral Poster Competition

In the Undergraduate category, prizes were awarded to **Nilay Shah** (1st) from The Scripps Research Institute.

In the Postbaccalaureate/Graduate Student category, prizes were awarded to **Samantha McClenahan** (1st) from the University of Arkansas for Medical Sciences, **Amer Al-khouja** (2nd) from the Johns Hopkins University School of Medicine, and **Sean Naughton** (3rd) from Augusta University.

In the Postdoctoral category, prizes were awarded to **Adrian Campbell** (1st) from the University of Michigan, **Alicja Urbaniak** (2nd) from the University of Arkansas for Medical Sciences, and **Ronik Khachatoorian** (3rd) from the University of California, Los Angeles.

DIVISION FOR DRUG METABOLISM AND DISPOSITION

Student/Postdoctoral Poster Competition

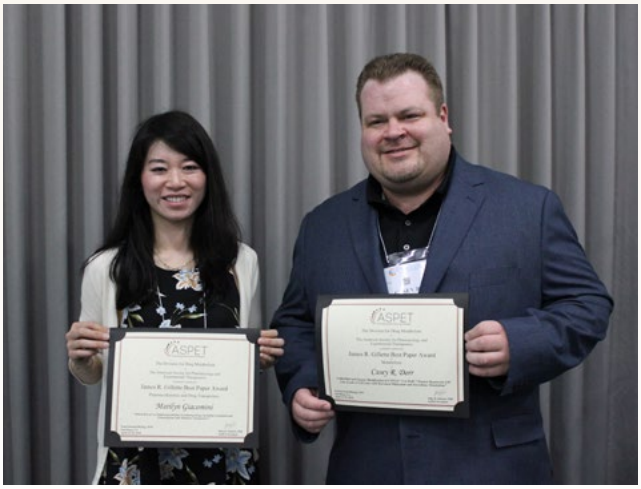
In the Postbaccalaureate/Graduate Student category, prizes were awarded to **Aaron Bart** (1st) from the University of Michigan, **Sara Shum** (2nd) from the University of Washington, and **Yadira Pérez-Páramo** (3rd) from Washington State University.

In the Postdoctoral category, prizes were awarded to **Herana Seneviratne** (1st) from the Johns Hopkins University School of Medicine, **Patrick Garcia** (2nd) from the University of Alabama, Birmingham, and **Kyoung-Jae Won** (3rd) from the University of Illinois, Chicago.

James R. Gillette Best Paper Award

Submitted by Lindsay M. Henderson and Aarti Sawant-Basak

Each year, the Division for Drug Metabolism and Disposition presents 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 2017 award winners recently presented their work at the 2018 ASPET Annual Meeting held in San Diego, CA, 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.



Marilyn Giacomini (left), winner of the 2017 Gillette Best Paper Award for Drug Metabolism, and Casey Dorr (right), winner of the 2017 Gillette Best Paper Award for Pharmacokinetics and Transporters

The 2017 Gillette Best Paper Award winner for Drug Metabolism is Dr. Dorr from the Minneapolis Medical Research Foundation, MN.

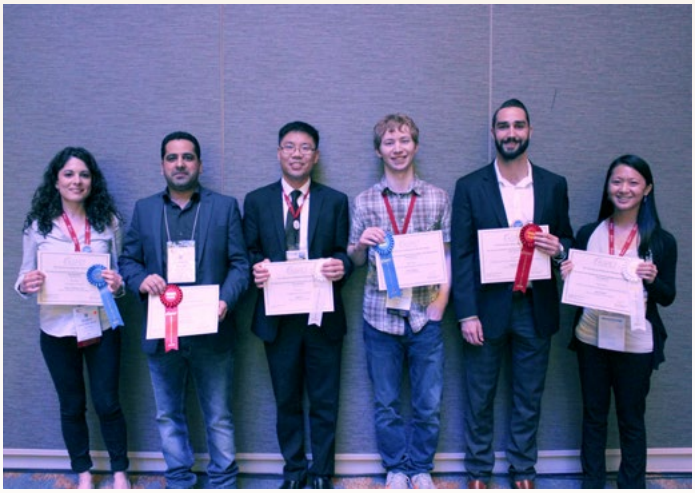
The 2017 Gillette award in the category of drug metabolism was presented to Dr. Casey R. Dorr for the paper "CRISPR/Cas9 Genetic Modification of *CYP3A5 *3* in HuH-7 Human Hepatocyte Cell Line Leads to Cell Lines with Increased Midazolam and Tacrolimus Metabolism," authored by Casey R. Dorr, Rory P. Remmel, Amutha Muthusamy, James Fisher, Branden S. Moriarity, Kazuto Yasuda, Baolin Wu, Weihua Guan, Erin G. Schuetz, William S. Oetting, Pamala A. Jacobson, and Ajay K. Israni. This study, available at https://doi.org/10.1124/dmd.117.076307, showed successful CRISPR/Cas9 bioengineering of a human liver cell line, HuH-7, to create the following *CYP3A5* variants: **1/*1* double deletion, **1/*3* single deletion, or **1/*3* point mutation. The HuH-7 liver carcinoma cells were fully characterized and confirmed to express *CYP3A4* and *CYP3A5* mRNA by RT-PCR. Engineered cell lines were characterized for CYP3A5 transcripts and protein abundance using qRT-PCR and immunoblotting, respectively, and then functional assays on drug metabolism were performed. The newly engineered cell lines expressing elevated *CYP3A5* mRNA demonstrated a higher rate of turnover of probe CYP3A5 substrates, tacrolimus and midazolam (MDZ), in comparison to that observed for the native cell line. The genetically modified cell lines also produced the expected MDZ metabolites (1-OH MDZ and 4-OH MDZ). This study was the first report of genomic *CYP3A5* bioengineering in human cell lines and functional analysis of associated drug metabolism phenotypes.

The 2017 Gillette Best Paper Award winner for Pharmacokinetics and Transporters is Dr. Giacomini from Gilead Sciences, Inc., Foster City, CA.

The 2017 Gillette award in the Pharmacokinetics and Transporters category was given to Dr. Marilyn M. Giacomini for the paper "Interaction of 2,4-Diaminopyrimidine–Containing Drugs Including Fedratinib and Trimethoprim with Thiamine Transporters," authored by Marilyn M. Giacomini, Jia Hao, Xiaomin Liang, Jayaraman Chandrasekhar, Jolyn Twelves, J. Andrew Whitney, Eve-Irene Lepist, and Adrian S. Ray. The article is available at https://doi.org/10.1124/dmd.116.073338. Fedratinib, a Janus kinase inhibitor (JAKi) myelofibrosis medication, had compelling Phase II and III data, but was issued a clinical hold in 2013 after a few treated patients were found to suffer from Wernicke's encephalopathy, a serious neurological disorder, due to coincident thiamine deficiency. Giacomini et al. elucidated the mechanism of fedratinib-mediated inhibition of thiamine uptake and found that the drug inhibited both thiamine transporter (THTR) 1 and 2 in human colorectal epithelial adenocarcinoma (Caco-2) THTR-overexpressing cells. Then the authors investigated the structural basis for THTR inhibition and determined that only JAKi containing a 2,4-diaminopyrimidine exhibited inhibitory effects on THTR. Further studies were conducted with other drugs containing the 2,4-core to investigate their inhibitory potential of THTR, resulting in the finding that trimethoprim also decreased thiamine uptake via inhibition of THTR1 and 2. This paper established that some JAKi medications are capable of inhibiting thiamine transport, suggesting that drug interactions with vitamin transporters may require increased attention, especially in vulnerable populations.

DIVISION FOR MOLECULAR PHARMACOLOGY

Student/Postdoctoral Poster Competition



In the Undergraduate category, prizes were awarded to **Julia Chini** (1st) from the University of Wisconsin, Madison and **Caleb Kim** (2nd) from the University of Arizona.

In the Postbaccalaureate/Graduate Student category, prizes were awarded to **Isaac Fisher** (1st) from the University of Rochester, **Timothy Baffi** (2nd) from the University of California, San Diego, and **Amy Chinn** (3rd) from the University of California, San Diego.

In the Postdoctoral category, prizes were awarded to **Marta Sanchez Soto** (1st) from the National Institutes of Health/NINDS, **Mumtaz Anwar** (2nd) from the University of Illinois, Chicago, and **Wei Lei** (3rd) from the University of Arizona, Tucson.

Postdoctoral Scientist Award Competition (Oral Sessions)

In the Postdoctoral category, prizes were awarded to **Yun Young Yim** (1st) from Vanderbilt University, **Eric Greenwald** (2nd) from the University of California, San Diego, and **Manish Jain** (3rd) from the University of Texas Medical Branch.

DIVISION FOR NEUROPHARMACOLOGY

Student/Postdoctoral Poster Competition

In the Undergraduate category, a prize was awarded to **Paul Nguyen** (1st) from the University of Arizona.

In the Postbaccalaureate/Graduate Student category, prizes were awarded to **Joshua Lorenz-Guertin** (1st) from the University of Pittsburgh, **Deborah Luessen** (2nd) from the Wake Forest School of Medicine, and **Blair Willette** (3rd) from the National Institutes of Health/NINDS.

In the Postdoctoral category, prizes were awarded to **Natalie Scholpa** (1st) from the University of Arizona, **Dean Kirson** (2nd) from The Scripps Research Institute and **Kathryn Luderman** (3rd) from the National Institutes of Health/NINDS.

Postdoctoral Scientist Award Competition (Oral Sessions)

In the Postdoctoral category, prizes were awarded to **Ram Kandasamy** (1st) from the University of Michigan, **Lindsay Lueptow** (2nd) from the Icahn School of Medicine at Mount Sinai, and **Max Joffe** (3rd) from Vanderbilt University.

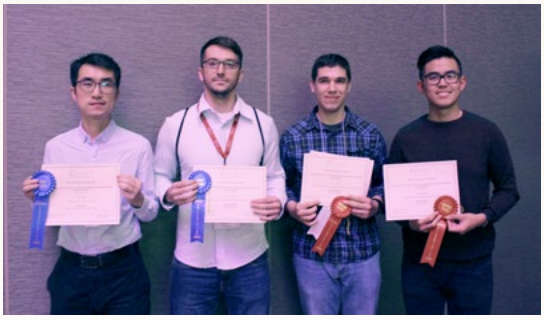
Early Career Independent Investigator Award

The winner of this award was **Richard Daneman**, PhD, from the University of California, San Diego.

Dr. Daneman (left) was presented with the Early Career Independent Investigator Award during the ASPET Annual Meeting at EB 2018 by Dr. John Traynor.

DIVISION FOR TOXICOLOGY

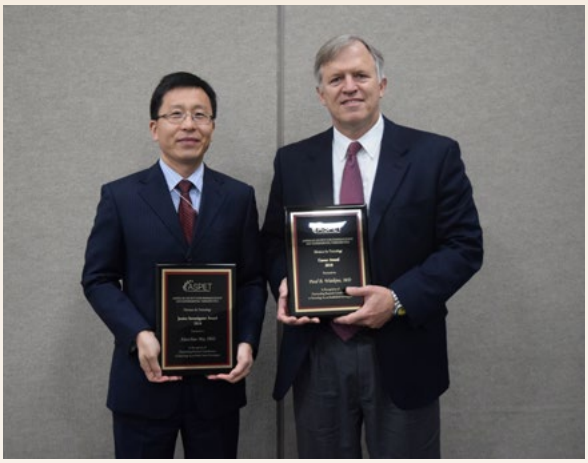
Student/Postdoctoral Poster Competition



In the Undergraduate category, prizes were awarded to **Sammi Chung** (1st) from Fordham University and **Ngoc Nguyen** (2nd) from Pacific University.

In the Postbaccalaureate/Graduate Student category, prizes were awarded to **Emir Malovic** (1st) from Iowa State University, **Grant Glatfelter** (2nd) from the Universityat Buffalo, and **Anthony Jones** (3rd) from the University at Buffalo.

In the Postdoctoral category, prizes were awarded to **Jiang Ma** (1st) from the The Chinese University of Hong Kong and **Naveen Neradugomma** (2nd) from the University of Washington.



Career Award

The winner of the 2018 Career Award was **Paul B. Watkins**, MD from the University of North Carolina.

Junior Investigator Award

The winner of the 2018 Junior Investigator Award was **Xiaochao Ma**, PhD from the University of Pittsburgh.

DIVISION FOR TRANSLATIONAL AND CLINICAL PHARMACOLOGY

Student/Postdoctoral Poster Competition

In the Postbaccalaureate/Graduate Student category, prizes were awarded to **Fengyuan Li** (1st) from the University of Louisville, **Jeffrey Wang** (2nd) from the Louisiana State University Health Science Center, New Orleans, and **Essie Komla** (3rd) from Virginia Commonwealth University.

In the Postdoctoral category, prizes were awarded to **Yunhuan Liu** (1st) from the University of Louisville and **Lu Liu** (2nd) from New York Medical College.

TCP Young Investigator Awards Platform Session (Oral Sessions)

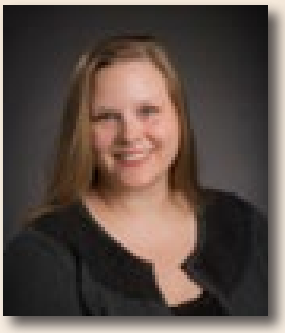
In the Undergraduate Student category, prizes were awarded to **Carolyn Stine** (1st) from the University of Arizona and **Justin Doherty** (2nd) from the University of South Florida Health, Byrd Alzheimer's Institute.

In the Graduate Student category, prizes were awarded to **Tiffanie Hargraves** (1st) from the University of Arizona and **Tamara Escajadillo** (2nd) from the University of California, San Diego.

In the Postdoctoral category, prizes were awarded to **Kristin Luther** (1st) from Cedars-Sinai Heart Institute and **Mohamed Ghonim** (2nd) from Louisiana State University, School of Medicine.

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 2018 were Brandi M. Wynne, PhD, Instructor of Medicine, Emory University School of Medicine, and Bhagwat Prasad, PhD, Assistant Professor, Department of Pharmaceutics at the University of Washington. Both are at an early stage of their careers having completed their post-doctoral training and now have independent labs with external funding for their research. They presented to the TCP Division research pertinent to the division's mission for the annual Early Career Showcase on Monday April 23rd at the ASPET Annual Meeting at EB 2018 in San Diego.



Brandi M. Wynne, PhD
Emory University School of Medicine

Brandi M. Wynne, PhD, presented her research on kidney epithelial cells illustrating the concept that inflammation underlies hypertension. Her talk was titled “Interleukin-6 and the Mineralocorticoid Receptor: Old Targets in a New Pathway.” She described how interleukin-6 increases sodium absorption leading to hypertension. Her laboratory uses systems pharmacology in mice such as tail cuff plethysmography to measure blood pressure combined with in vitro models of distal nephron epithelial cell to determine the molecular signaling pathways involved.

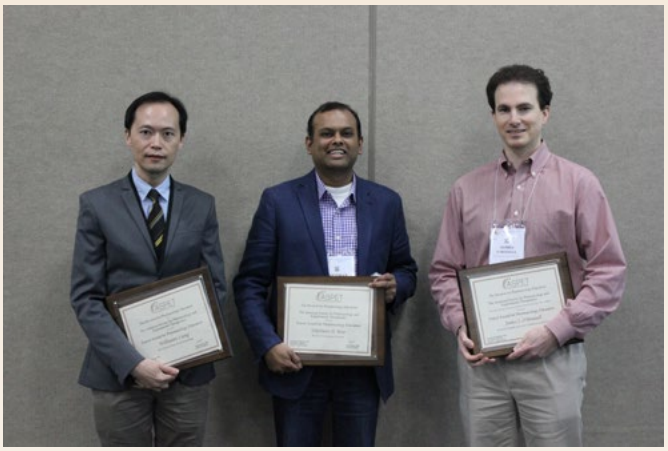
Bhagwat Prasad, PhD
University of Washington

Bhagwat Prasad, PhD, shared his interest in the mechanisms of age-dependent variability in xenobiotic disposition and response. His talk was titled “Genetic and Non-genetic Factors Affecting UGT2B17, An Important Androgen and Drug Metabolizing Enzyme: Applications in Precision Medicine.” He used this to illustrate examples of where he has applied quantitative LC-MS/MS proteomics and metabolomics for understanding the activity and abundance of enzymes and transporters in human tissue. This is very critical for the disposition of drugs in vulnerable populations, such as pediatric patients.

They gave excellent 15 minute podium presentations and received recognition and an award to defray the cost of travel to the meeting. In addition, TCP benefitted from increasing its breadth of research diversity and networking with early career colleagues. We look forward to running this successful program again in 2019.

DIVISION FOR PHARMACOLOGY EDUCATION

Travel Award for Pharmacology Educators



The winners of the Travel Award for Pharmacology Educators were **Willmann Liang**, PhD, from the Chinese University of Hong Kong, **Diptiman D. Bose**, PhD, from Western New England University, and **James J. O’Donnell**, PhD, from Rosalind Franklin University of Medicine and Science.

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 Meeting at EB 2018 on Monday, April 23 in San Diego, CA. More information about the Academy, including application instructions and a roster of inductees, can be found here: http://www.aspet.org/Education/Academy/.

Raeann Carrier, PhD

West Virginia School of Osteopathic Medicine

Dr. Raeann Carrier is the Director of the Office of the National Boards and Exam Center and tenured assistant professor of pharmacology at the West Virginia School of Osteopathic Medicine (WVSOM). She earned her PhD in pharmacology from the Ohio State University in 2008. In 2009, Dr. Carrier joined the National Board of Osteopathic Medical Educators (NBOME) National Faculty and she still serves as a pharmacology subject matter expert. Her work with the NBOME includes writing, reviewing, editing, and developing content for COMLEX-USA Level 1 and the new Foundational Biomedical Comprehensive Osteopathic Medical Achievement Test (COMAT) exam. This opportunity exposed her to student assessment from the creation of a single exam item to the development of whole licensure exams, including post-test analysis. Dr. Carrier has implemented similar processes for institutional exam review with the Item Writing Group and the Test Assessment Subcommittee – two faculty committees devoted to the quality of WVSOM's in-house examinations. Dr. Carrier created the "Just Say Know to Drugs!" pharmacology camp, a one-week day camp exposing high school campers to the science of pharmacology in fun, interactive ways. Since 2013, Dr. Carrier has mentored first year osteopathic medical students who have an interest in community service and teaching in the implementation of this camp. She has been a member of ASPET since 2006 and a primary member of the Division for Pharmacology Education (DPE) since 2010.

Mark Hernandez, PhD

University of Missouri-Columbia

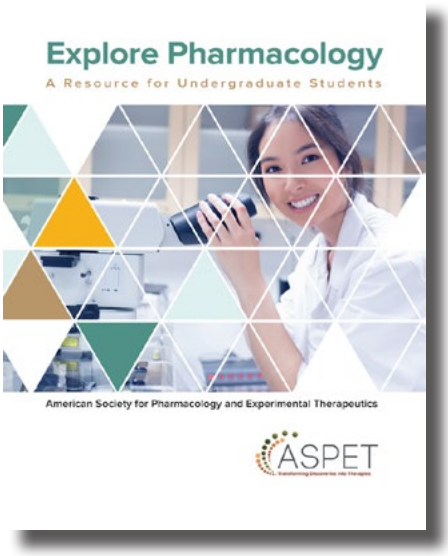
Dr. Mark Hernandez graduated from McArthur High School in Hollywood, Florida, and completed a bachelor of science from Barry University in Miami Shores. He then went on to pursue a master of science degree in physiology-medicine, followed by the doctor of philosophy degree, both at the University of Missouri-Columbia campus. Dr. Hernandez also completed the Master Educator Training Program, with an emphasis in pharmacology, at Ross University located in the Caribbean Island of Dominica. Dr. Hernandez has been actively involved in medical education for the past 11 years, and his goals as an educator are for the student learners to develop a strong foundation on which to build a rational approach to the use of drugs in clinical practice and to evaluate new drugs in the context of evidence-based medical practice. He has used different innovative methods such as simulation to accomplish this while teaching pharmacology and also to actively engage the students. Dr. Hernandez currently serves as associate professor of physiology and pharmacology at the Alabama College of Osteopathic Medicine (ACOM), where he is also a member of the founding faculty. Dr. Hernandez is an active member of the International Association of Medical Science Educators (IAMSE) and the National Faculty for the NBOME exam. He has been a member of ASPET and a primary member of the Division for Pharmacology Education (DPE) since 2008.

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.

2018 Division Mixers

ASPET members attend division-sponsored mixers at EB 2018 to network and socialize with friends and colleagues.

Check out more pictures from the division mixers at https://bit.ly/2JCshsb.



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 2018 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!

Directly Reach Students Interested in Pharmacology

Through mailings and distribution at national meetings

Benefits of Advertising

Your ad will also be highlighted on ASPET's Departments and Training Programs in Pharmacology webpage as a featured graduate program.

Deadlines

Space and materials deadline is Friday, August 10, 2018.

Reserve Your Ad Now

Contact Suzie Thompson at **sthompson@aspet.org** or call **(301) 634-7069** to reserve your ad.

Visit **www.aspet.org/explorepharmacologyads** for print specifications and pricing information or contact Suzie Thompson, ASPET Marketing Director at **sthompson@aspet.org**.