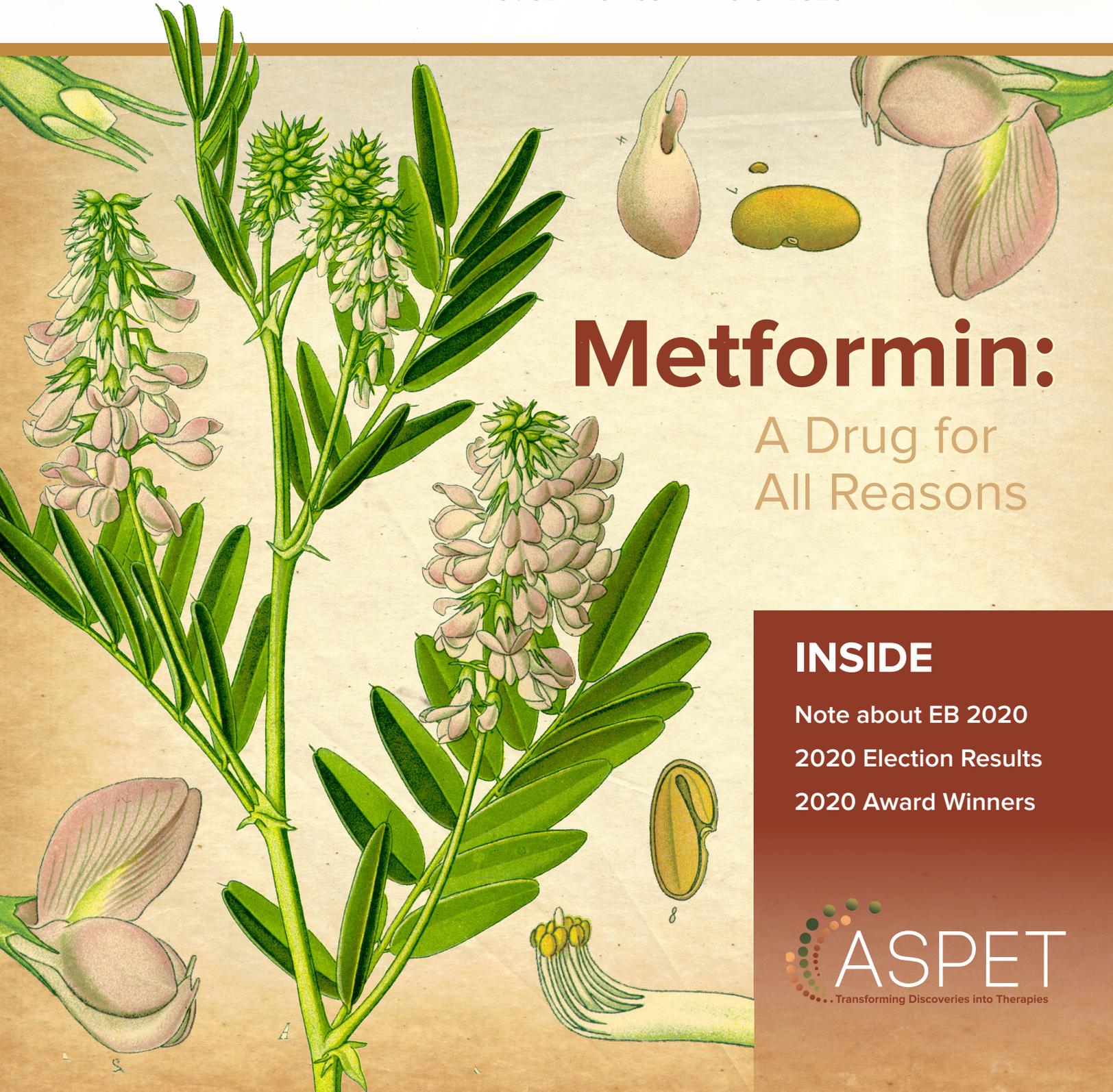




THE Pharmacologist

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Metformin:

A Drug for
All Reasons

INSIDE

Note about EB 2020
2020 Election Results
2020 Award Winners

 ASPET

Transforming Discoveries into Therapies

Contents

- 1** Note About the 2020 Annual Meeting
- 2** Message from the President
- 4** 2020 Election Results
- 5** 2020 Award Winners
- 9** ASPETConnect
- 11** 2020 Annual Meeting Program
- 28** Feature Story: Metformin: A Drug
For All Reasons
- 39** Science Policy News
- 44** Education News
- 46** Journals News
- 49** Membership News
Obituaries: Henry Strobel
- 56** Members in the News
- 59** Meeting News
- 63** Division News
- 76** AMSPC News

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Note About the 2020 Annual Meeting

The ASPET Annual Meeting at Experimental Biology (EB) 2020, set to take place April 4-7 in San Diego, California, has been cancelled.

As we have previously communicated via email, on our website, and on social media, the EB leadership closely monitored the spread of COVID-19 (coronavirus disease). Based on the latest guidance from public health officials, the travel bans implemented by institutions, and the state of emergency declared in California, it became clear to us that cancelling was the right course of action to ensure the safety and well-being of our members, attendees, staff, partners, and our communities.

ASPET has many steps to take over the coming months, including assessing the financial impact of this drastic, but necessary, cancellation of our largest event. While we recognize our decision to cancel as the right one, the Society's contracts with our many vendors and host hotel require that we work in coordination with our legal counsel and insurance provider to mitigate the financial loss to our organization and its members. Unfortunately, it may still be significant, and we ask for your patience as we work through the process.

The decision to cancel the ASPET Annual Meeting at EB was extremely difficult and although we are disappointed that we will not be seeing all of you in San Diego this year, we want to thank you for your understanding and support. We also want to express our sincere thanks to the entire ASPET community, our Experimental Biology partners, exhibitors, vendors, and our volunteer members who dedicated so much time and work into preparing this meeting.

Please save the date for the ASPET Annual Meeting at EB 2021 scheduled for May 1-4, 2021, in Indianapolis, IN, where we look forward to seeing all of our friends and colleagues exploring the latest research in pharmacology research.

The content in this issue of The Pharmacologist has not been modified as it was already finalized and in production when the decision to cancel the meeting was made.

All references to the annual meeting and associated events and activities are no longer in effect due to the cancellation of EB 2020.



Message from The President

Dear Members of ASPET,

After returning from the holiday break, ASPET Staff and Council have been continuing preparations for EB 2020. The Program Committee, with input from the divisions, has put together an informative and exciting conference. On April 3rd, just prior to the beginning of the conference, there will be “**Give a Day of Service to San Diego**” sponsored by the Division for Behavioral Pharmacology, but all are welcome to participate. We will be helping at Father Joe’s Villages, with numerous volunteer activities including home construction, painting, cleaning, and food service. If you are interested in participating, please contact Charles France (france@uthscsa.edu) who has been coordinating this project for many years.

On Friday afternoon and Saturday, there will be a **Colloquium on G Protein-Coupled Receptors**. This two-day symposium requires a separate registration. More information can be found on the [ASPET Colloquium webpage](#).

In addition to our regular scientific programming, the topic of the second **ASPET-APS Presidential Symposium Series** will be “Inflammation and Oxidative Stress,” which are contributing factors to almost every chronic human disease and targets for their drug therapies. The series will begin with a workshop on CRISPR-Cas and miRNAs on Saturday afternoon, and continue with sessions the following mornings titled (1) “CV and Renal inflammation,” (2) “Inflammation and Drug Metabolism,” and (3) “CNS Inflammation: Pain and Cognition.” ASPET and the Japanese Pharmacological Society will also continue our joint lecture series with Dr. Yoshikatsu Kanai, who will speak on “Nutrient Transporters in Molecular Target Drug Discovery.”

I would like to congratulate the winners of the ASPET Scientific Awards. They will be recognized at the **ASPET business meeting** which kicks off EB 2020 on Saturday at 4:30 PM. In addition to the recognition of the winners of the scientific awards, the business meeting will keep you up-to-date on the issues affecting ASPET, and we encourage your attendance. After the business meeting will be the **Tang Prize Lecture** given by Tony Hunter on tyrosine kinase inhibitors, followed by the **EB Welcome reception**.

Several of the popular activities will be continued this year, including the Diversity and Inclusion Breakfast (RSVP required), the unopposed poster sessions, the DataBlitz sessions, and poster bingo. The **Guppy Tank**, a new initiative modeled after ABC’s Shark Tank, will have graduate students and postdocs communicating and giving pitches about the commercial value of their research in front of a live audience.

For early career researchers, there are several programs of interest. In particular, EB Career Central for individuals looking for career advice, the ASPET Student/Postdoctoral Colloquium, the Poster Competition, and the Journals Workshop. More details about these and other EB 2020 symposia can be found on the [ASPET/EB 2020 program page](#).

Over the last year, we have been implementing and testing **ASPETConnect**, and I am pleased to announce that ASPET committees are now active on the community. **ASPETConnect** will be launching to all members at EB 2020. Be sure to stop by the ASPET member lounge to learn more about ASPET’s new online community, create your online profile, and be entered in a raffle for prizes. ASPET will also be offering professional headshots for members to upload to the community. All members are encouraged to visit and participate in **ASPETConnect**.

Discussions on **Open Access** are continuing, and we are monitoring progression of the Plan S initiative. One of our concerns is that much of the operating revenue for the Society is generated by our journals, and that Open Access would require us to change our operating paradigm. The current strategy of ASPET and

many other scientific societies is to advocate for an inclusive process that recognizes our concerns before any decisions are made.

Finally, I would also like to congratulate the winners of the ASPET elections with Margaret Gnegy as the incoming President-elect, Carol Beck as Secretary-Treasurer elect, and Randy Hall as our new Councilor. Their terms will begin on July 1. Each of these individuals has had a history of service to ASPET, and we appreciate their continued commitment to our society. A more complete listing of the ASPET Division Winners can be found in this issue of *The Pharmacologist*.

We are looking forward to seeing you at EB 2020.

Best regards,



Wayne L. Backes, Ph.D.
ASPET President



2020 Election Results

The 2020 ASPET election closed on February 7, 2020 with the highest voter turnout in years. This was the first year that graduate student members and affiliate members were eligible to vote. Congratulations to newly-elected Council members Dr. Margaret E. Gnegy, Dr. Carol L. Beck, and Dr. Randy A. Hall, who will begin their terms on July 1, 2020.



President-Elect

Margaret E. Gnegy, PhD

Professor of Pharmacology, University of Michigan Medical School



Secretary/Treasurer-Elect

Carol L. Beck, PharmD, PhD

Associate Professor, Department of Pharmacology & Experimental Therapeutics, Sidney Kimmel Medical College; Associate Dean for Curriculum; Program Director, MS-Pharmacology, Jefferson College of Life Sciences, Thomas Jefferson University



Councilor

Randy A. Hall, PhD

Professor, Department of Pharmacology & Chemical Biology, Emory University School of Medicine



2020 Award Winners

ASPET awards recognize accomplishments in all areas of pharmacology and experimental therapeutics. It is our honor to announce this distinguished group of Scientific Achievement Award winners for 2020.

ASPET will present the awards on Saturday, April 4, 2020 at 4:30 pm at the Business Meeting and Awards Presentation during the ASPET Annual Meeting at Experimental Biology 2020 in San Diego at the San Diego Convention Center on the Mezzanine Level in Room 16AB. Please join us to celebrate these inspirational awardees.

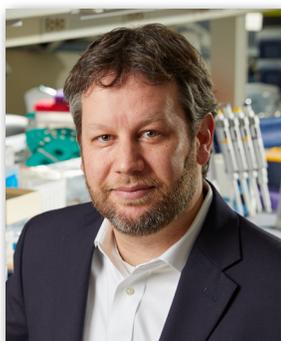


John J. Abel Award in Pharmacology

The John J. Abel Award in Pharmacology is named after the founder of ASPET. It was established

in 1946 to stimulate fundamental research in pharmacology and experimental therapeutics by young investigators.

Andrew Goodman, PhD
Yale University



Dr. Andrew Goodman is being recognized for his outstanding contributions to the study of the impact of the microbiome on drug metabolism through the fearless use of cutting edge, high throughput genetic and chemical methods. He was nominated by Dr.

Namandjé Bumpus from Johns

Hopkins University School of Medicine.

Dr. Goodman is the C.N.H. Long Professor of Microbial Pathogenesis at Yale University. He received his BA degree in ecology from Princeton University, his PhD in microbiology from Harvard Medical School, and conducted postdoctoral research at Washington University in St. Louis. He started his own research group at Yale in 2011, where his lab combines microbial genetics, gnotobiotics, metabolomics, and pharmacokinetic modeling to understand microbiome-drug interactions. Dr. Goodman is innovative and fearless in his approach to science. By working between the fields of microbiology

and pharmacology, the Goodman lab has developed new approaches to dissect the role of the microbiome in drug metabolism at the level of animal models, bacterial communities, species, enzymes, and drug metabolites.



Julius Axelrod Award in Pharmacology

The Julius Axelrod Award in Pharmacology 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. 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.

P. Jeffrey Conn, PhD
Vanderbilt Center for Neuroscience Drug Discovery



Dr. P. Jeffrey Conn is being recognized for his commitment to academic mentoring of trainees and his cutting-edge research in an academic setting in developing therapies for psychiatric diseases. He was nominated by Dr. Craig Lindsley, also from the Vanderbilt Center for Neuroscience Drug Discovery.

Dr. Conn is the Lee E. Limbird Professor of Pharmacology at Vanderbilt University and Director of the Vanderbilt Center for Neuroscience Drug Discovery. He received his PhD degree from Vanderbilt in 1986 and pursued postdoctoral studies at Yale University before joining the faculty at Emory University in 1988. Dr. Conn served as head of the Department of Neuroscience at Merck and Company. He then moved to Vanderbilt University and founded the Vanderbilt Center for Neuroscience Drug Discovery, where he has advanced multiple drug candidates into development for neurological and psychiatric indications. His research is focused on understanding the pathophysiology changes that contribute to serious brain disorders, including Parkinson's disease, schizophrenia, depression, and using this understanding to develop novel therapeutic strategies for treatment of these devastating disorders. Dr. Conn served as editor of *Molecular Pharmacology* and has been an ASPET member since 1992.



Dohlman and Dr. Bryan Roth, both also from the University of North Carolina at Chapel Hill.

Dr. Kenakin received his PhD in pharmacology from the University of Alberta and pursued postdoctoral studies at University College in London. In 1978 he joined Burroughs Wellcome (later

GlaxoSmithKline) before moving to the University of North Carolina at Chapel Hill in 2011, where he serves as a pharmacology professor in the School of Medicine. He has advanced receptor theory by applying mathematical models of drug-receptor interactions to generate a thermodynamically complete depiction of the cubic ternary complex model, including the first description of protean agonism. He has contributed to education by authoring 12 books on pharmacology, including *A Pharmacology Primer* (Elsevier), now in its 5th edition. While at GSK he contributed to therapeutics, including the development of a novel allosteric HIV-1 entry inhibitor (aplaviroc). That effort grew out of his pioneering 1989 publication proposing a molecular mechanism for biased agonism and subsequent work delineating the theory and pharmacological relevance of receptor allosterism. Dr. Kenakin has been an ASPET member since 1983.



Goodman and Gilman Award in Receptor Pharmacology

The Louis S. Goodman and Alfred Gilman Award in Receptor Pharmacology was established in 1980 to recognize and stimulate outstanding research in pharmacology of biological receptors.

Such research might provide a better understanding of the mechanisms of biological processes and potentially provide the basis for the discovery of drugs useful in the treatment of diseases.

Terrence P. Kenakin, PhD University of North Carolina at Chapel Hill

Dr. Terrence Kenakin is being recognized for his significant contributions to the development of the field of quantitative receptor pharmacology, which has resulted in major impacts in basic science and drug discovery. He was nominated by Dr. Henrik G.



Otto Kraye Award in Pharmacology

The Kraye Award commemorates the enduring legacy of Otto Kraye's personal qualities: his ethical behavior; his commitment to teaching; his high standards of scientific scholarship, publication, and editorship; his promotion of interdisciplinary research to reveal the actions of drugs or other chemicals; and his guidance and support of younger scientists.

S.J. Enna, PhD, FASPET
University of Kansas Medical Center



Dr. S.J. Enna is being recognized for his outstanding scientific contributions to the field of GABA receptor pharmacology, his commitment to the mentorship of young scientists, and his leadership in advancing the discipline of pharmacology. He was nominated by Dr. Joseph Coyle

from McLean Hospital and Harvard Medical School.

After a PhD in pharmacology from the University of Missouri, Dr. Enna completed postdoctoral training at the University of Texas Southwestern Medical School, at F. Hoffmann La Roche in Basel, and Johns Hopkins University School of Medicine. Following a decade on the faculty at the University of Texas Medical School-Houston, he spent six years as Scientific Director of Nova Pharmaceuticals. He is now at the University of Kansas Medical School serving as the associate dean for research and graduate education, professor of physiology and pharmacology, and served for 12 years as chair of pharmacology. Dr. Enna is currently on the Executive Committee of the International Union of Basic and Clinical Pharmacology (IUPHAR) and served for four years as the IUPHAR president.

An ASPET member since 1977, he served ASPET in many roles after receiving the ASPET John J. Abel Award in 1980, most notably as ASPET president and as editor of *The Journal of Pharmacology and Experimental Therapeutics*. He was named a fellow of ASPET in 2019.



Pharmacia-ASPET Award for Experimental Therapeutics

The Pharmacia-ASPET Award for Experimental Therapeutics 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.

Daniela Salvemini, PhD
Saint Louis University School of Medicine



Dr. Daniela Salvemini is being recognized for her outstanding contributions to the field of the molecular and cellular basis of neuropathic pain. Her highly translational approach has resulted in the development of multiple novel therapies that have entered clinical trials. She was nominated by Dr. Kenneth

Jacobson, from the National Institute of Diabetes and Digestive and Kidney Diseases, NIH.

Dr. Salvemini received her BSc in pharmacology from Kings College, London, her PhD in pharmacology from the University of London, and pursued postdoctoral studies at the William Harvey Research Institute in London and Monsanto in Saint Louis. After 15 years in industry, Dr. Salvemini moved to Saint Louis University, where she is professor and interim chair of the Department of Pharmacology and Physiology, director of the Henry and Amelia Nasrallah Center for Neuroscience, fellow of the Saint Louis Academy of Science and fellow of the National Academy of Inventors. She is a founder of BioIntervene, which is developing A3 adenosine receptor agonists for neuropathic pain treatment. She has published over 190 peer-reviewed articles and over 30 book chapters and holds 10 U.S. patents. Dr. Salvemini's scientific innovations and discoveries have opened new research fields in the area of pain and inflammation and led to the development of novel medicines having potential to treat millions who are in desperate need. She has been an ASPET member since 1996.



Robert R. Ruffolo Career Achievement Award in Pharmacology

The Ruffolo Award was established in 2011 in recognition of the contributions made to drug discovery and development by Dr. Robert R. Ruffolo. The award recognizes the scientific achievements of scientists who are at the height of their careers and who have made significant contributions to pharmacology.

Joan Heller Brown, PhD
University of California, San Diego



Dr. Joan Heller Brown is being recognized for her fundamental contributions to the identification and understanding of G protein-coupled receptor signal transduction pathways and their roles in physiology and disease. She was nominated by Dr. Alan Saltiel from

University of California, San Diego and Dr. Susan Band Horowitz from Albert Einstein College of Medicine.

Dr. Heller Brown graduated from Cornell University and obtained her PhD in pharmacology at Albert Einstein College of Medicine. Her seminal early papers on GPCR signaling demonstrated that dopamine receptors are the target of antipsychotic drugs, that muscarinic receptors inhibit adenylate cyclase, and that phospholipase C and CaM kinase II activation mediate cardiac hypertrophy. Her current work focuses on the role of RhoA signaling pathways in cancer and of CaMKII in cardiac inflammation and heart failure development. She has been consistently funded by NIH, published 250 scholarly articles, authored chapters in 7 editions of Goodman and Gilman, and served as editor of *Molecular Pharmacology*. Dr. Heller Brown has been an ASPET member since 1978.



E. Leong Way Emeritus Travel Award

The E. Leong Way Emeritus Travel Award provides financial support to defray the expenses for an ASPET emeritus member to attend the ASPET Annual Meeting at EB. The award honors Edward Leong Way (1916-2017), a former president of ASPET 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.

Lynn Wecker, PhD, FASPET
University of South Florida Morsani
College of Medicine



Dr. Lynn Wecker is being recognized for her strong contributions to ASPET including serving as president and creating the ASPET Mentoring Network, as well as her contributions to understanding the role of dietary choline in neurotransmission and

nicotinic acetylcholine receptor pharmacology.

She received her PhD in pharmacology from the University of Florida and pursued postdoctoral studies at Vanderbilt University. She moved to the University of South Florida in 1990, where she served as chair of the Department of Pharmacology and Molecular Therapeutics. When she retired in 2019, she was given the title of Distinguished University Professor Emeritus at the University of South Florida. Dr. Wecker's research focused on the regulation of neuronal nicotinic receptors in the brain and demonstrated serine site-specific phosphorylation plays a role in receptor formation, maturation, and expression.

Dr. Wecker mentored many students, postdoctoral scientists and faculty throughout her career and was instrumental in creating and initiating the [ASPET Mentoring Network](#). An ASPET member since 1980, she served ASPET in many roles, most notably as program committee chair, secretary/treasurer, and president. She was named a fellow of ASPET in 2019.



ASPETConnect



ASPETConnect, ASPET's member-only online community, will be launching this April at the ASPET Annual Meeting at Experimental Biology 2020. This new community will allow members the ability to network, communicate, and collaborate with fellow ASPET colleagues from anywhere, at any time. As a member, you get

access to discussion forums where you can connect with subject matter experts, get or give advice on career matters, or work with your committee or division members.

Have a question or discussion topic? Post it on the community and allow members to provide their input. Want to see what other members are discussing? Visit your division community and scroll through the discussions.



Discussions:

Get involved in the following discussions and communities later this year:

- Division specific discussions in the division communities
- Requests for expertise
- Online Ask the editor session
- Annual Meeting discussions
- Journal clubs
- Grassroots advocacy efforts

Membership Directory:

Search for colleagues by name, company, location, division, or research focus. Click into member profiles, add members as a contact, and send them a private message.

Unique Profile Pages:

Your unique profile page gives you the ability to control what members see about you. Update a profile picture, add your bio, education, and job history. Add your research focus, any ASPET positions you hold, and link to your other social media accounts. Once you fill out your profile, you can set your privacy settings to give or restrict access to specific pieces of your information.

Customizable Notifications:

When you join a new community, you can customize how you receive notifications about new content and discussions being posted to the community. Set your notifications so that you receive real time, daily, or weekly notifications directly to your email inbox. Keep track of discussions that interest you by setting up your notifications and respond to discussion posts directly from your email.

Online Library:

Important documents for ASPET members and committees are hosted on ASPETConnect. ASPET

Visit the ASPET Member Lounge

at the ASPET Annual Meeting at EB 2020 to learn more about ASPETConnect, get help logging in, get a professional photo taken to upload to your profile, and participate in a raffle drawing for prizes!

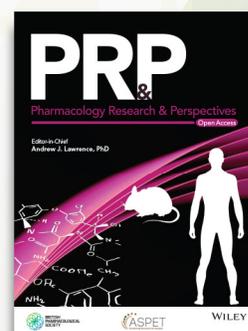
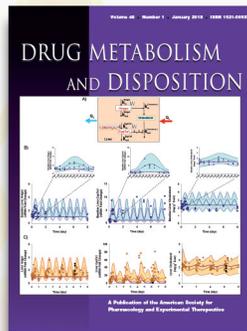
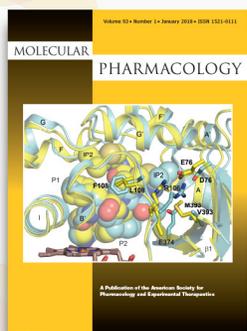
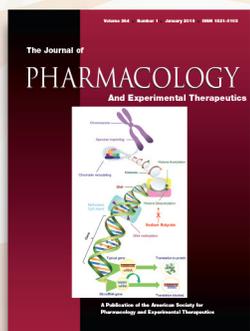


business meeting minutes, committee documents, reimbursement forms, etc. may be directly accessed from your community libraries.

Communicate with Leaders:

ASPET's council, division chairs, committee leaders, and staff are all on ASPETConnect. If you have questions, ideas, feedback, or want to get more involved, be sure to connect with society leaders to get the conversation started.

Submit Your Next Paper to an ASPET Journal



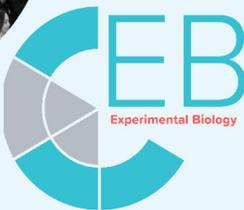
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April 4 – 7 • San Diego, California

ASPET 2020 Annual Meeting

at Experimental Biology



ASPET Annual Meeting Program

Plan to attend the ASPET Annual Meeting at Experimental Biology, **April 4-7, 2020** in San Diego, California! Join 1,600 scientists passionate about pharmacology as ASPET intersects with 10,000 other life scientists.

Visit the ASPET [website](#) to explore the full Annual Meeting Program

All ASPET events will be held at the San Diego Convention Center (SDCC) and the adjacent Marriott Marquis.

Check the EB 2020 Mobile app for the final schedule. *Schedule subject to change.*

Friday, April 3, 2020

Session/Event	Location at SDCC	Time
Give a Day of Service to San Diego at EB 2020 <i>See page 229</i>	Father Joe's Villages	8:00 am - 3:00 pm
Colloquium on G Protein Coupled Receptors: Evolving Insights from Pharmacology to Physiology (separate fee - day 1 of 2) <i>Chairs: T. Handel, P. Insel, and J. Pluznick</i>	Room 16 AB	2:00 pm - 7:00 pm

Saturday, April 4, 2020

Session/Event	Location at SDCC	Time
Colloquium on G Protein Coupled Receptors: Evolving Insights from Pharmacology to Physiology (separate fee - day 2 of 2) <i>Chairs: T. Handel, P. Insel, and J. Pluznick</i>	Room 16 AB	8:00 am - 12:30 pm
Challenges of Academic Drug Discovery in Cancer <i>Chairs: M. Leggas and M. Arkin</i>	Room 15 A	11:00 am - 1:00 pm
Teaching Institute: Preparing the Next Generation of Scientists to be Best Practice Educators <i>Chair: N. Kwiek</i>	Room 14 B	11:00 am - 1:00 pm
The NLRP3 Inflammasome as a Pharmacological Target in Cardiovascular Disease <i>Chairs: J. H. Brown and S. Miyamoto</i>	Room 15 B	11:00 am - 1:00 pm
Yin-Yang of the Prostaglandin-E2 Receptors: Novel Therapeutic Approaches <i>Chair: T. Ganesh</i>	Room 17 A	11:00 am - 1:00 pm

Saturday, April 4, 2020 *continued*

ASPET – APS Joint Presidential Symposium Series on Inflammation and Oxidative Stress: Workshop on CRISPR-Cas and miRNAs in the Study of Drug Metabolism, Cancer, and Other Diseases <i>Chairs: A. Moutal and W. Xie</i>	Ballroom 20 A	1:00 pm - 3:00 pm
Brain Microglia and Astrocytes in Health and Disease <i>Chair: A. Bhattacharya</i>	Room 15 B	2:00 pm - 4:00 pm
G Protein Signaling in Regulation of Metabolism and Diabetes <i>Chairs: A. Marchese and V. Slepak</i>	Room 17 A	2:00 pm - 4:00 pm
Student-Postdoctoral Colloquium: Strategies for Dealing with Conflict and Difficult Conversations <i>Facilitator: S. Milgram</i>	Marriott Marquis, San Diego Ballroom Salon B	2:00 pm - 4:00 pm
ASPET Business Meeting and Awards Presentation	Room 16 AB	4:30 pm - 6:00 pm
<i>Keynote: Tony Hunter</i> Tang Prize Lecture <i>Tyrosine Phosphorylation - From Discovery to Drug Development and Beyond</i>	Ballroom 20 BCD	6:00 pm - 7:00 pm
All Society EB Welcome Reception <i>Including Scientific Highlights Posters</i>	Sails Pavilion	7:00 pm - 8:30 pm

Sunday, April 5, 2020

Session/Event	Location at SDCC	Time
Diversity and Inclusion Breakfast: Being Heard and Telling Your Story To Claim Your Place – Strategies for Success (RSVP Required) <i>Facilitator: A. Núñez</i>	Room 14 B	7:30 am - 9:30 am
NIH Funding and Other Translational Research Opportunities <i>Chairs: R. Roof and S. Koduri</i>	Room 15 B	8:00 am - 10:00 am
Novel and Integrated Intestine-liver Crosstalk on Hepatic Xenobiotic Metabolism <i>Chairs: G. Guo and H. Wang</i>	Room 15 A	8:00 am - 10:00 am
Updating the Opioid Crisis: Novel Approaches to Reducing Opioid Abuse and Overdose <i>Chairs: G. Collins and S. Withey</i>	Room 16 AB	8:00 am - 10:00 am
Utilizing Educational Tools to Enhance Student Learning in the Health Sciences <i>Chairs: K. Brandl and G. Athauda</i>	Room 17 A	8:00 am - 10:00 am

Lectures
 Networking Opportunity

Sunday, April 5, 2020 *continued*

ASPET - APS Joint Presidential Symposium: Inflammation and Oxidative Stress: CV and Renal Inflammation in Health and Disease <i>Chairs: C. Banek and J. Imig</i>	Ballroom 20A	8:30 am - 10:00 am
ASPET Poster Presentations <i>Discover the latest with more than 300 pharmacology poster presentations</i>	Exhibit Hall A-C	10:00 am - 12:00 pm
ASPET Daily Datablitz <i>Sponsored by Pharmacology Research & Perspectives Fast-paced overview of the most exciting poster science of the day</i>	 ASPET Poster Discussion Area, Booth #822	10:30 am - 11:00 am
Young Scientists Town Hall	ASPET Poster Discussion Area, Booth #822	12:00 pm - 1:00 pm
Networking in the Exhibit Hall <i>Visit with exhibitors, grab lunch, explore Career Central</i>	Exhibit Hall A-C	12:00 pm - 1:00 pm
Undergraduate Networking and Career Development Luncheon (RSVP Required)	Room 14 B	12:15 pm - 2:00 pm

 Lectures
  Networking Opportunity

EB Career Central

Take the next step in your career with the help of Experimental Biology's Career Central!



- **Micro-learning Hubs**
Quick 10 minute nuggets of professional development
- **Career Development Workshops**
Longer form workshops on specialized topics
- **Job Listings**
View the latest openings
- **NIH Funding Conversations**
Meet with program directors
- **Resume/CV Critiques**
During personalized appointments
- **Poster Presentations**
Practice with a mentor
- **Doctoral Program Outreach**
Learn about university programs and speak with their reps

For more information, visit: <http://bit.ly/2qp7eo7>

Sunday, April 5, 2020 *continued*

Goodman and Gilman Award in Receptor Pharmacology Lecture <i>Keynote: Terrence P. Kenakin</i> <i>GPCRs as Pharmacology's 'Low Hanging Fruit': A Perfect Storm in Pharmacology Leads to a Renaissance of Therapeutic Application for Nature's Prototypic Allosteric Protein</i>	Room 16 AB	1:00 pm - 1:45 pm
Axelrod Award in Pharmacology Lecture: Protein Kinase C Out of Tune <i>Keynote: Alexandra C. Newton</i> <i>Protein Kinase C Out of Tune: Deregulated Signaling in Disease</i>	Room 16 AB	2:00 pm - 2:45 pm
Axelrod Symposium: Protein Kinases in Tune <i>Chair: Alexandra C. Newton</i>	Room 16 AB	3:00 pm - 5:00 pm
Behavioral Pharmacology of Biased Agonists <i>Chair: W. Fantegrossi</i>	Room 17 A	3:00 pm - 5:00 pm
Cardiometabolic Diseases: At the Crossroads of Adipose Tissue and Cardiac Health <i>Chairs: M. Tranter and A. Mughal</i>	Room 15 B	3:00 pm - 5:00 pm
Cross Talk in Metabolism of Xenobiotics and Endogenous Substrates <i>Chairs: A. Pandey and X. Ding</i>	Room 15 A	3:00 pm - 5:00 pm
Journals Workshop: An Interactive Guide to Publishing, Reviewing, and Ethics Issues <i>Chairs: E. Scott and R. Dodenhoff</i>	Room 14 B	3:00 pm - 5:00 pm
ASPET Student/Postdoc Poster Competition <i>Including display tables for university graduate programs</i>	Ballroom 20 BC	6:00 pm - 8:30 pm
ASPET Student/Postdoc Mixer	San Diego Marriott Marquis & Marina Marina Ballroom Salon E	8:30 pm - 11:00 pm

Lectures
 Networking Opportunity



Over 900 pharmacology posters! Where to start?
Look for high-scoring posters designated with this blue ribbon as "Program Committee Picks."
Spend a half hour at the ASPET Daily Datablitz at 10:30 am on Sunday, Monday, and Tuesday for highlights of 10 exciting posters of the day with a quick 3-minute synopsis of each.

Attending EB? Be sure to read the EB Code of Conduct

Experimental Biology (EB) is committed to providing a friendly, safe, and welcoming environment for all event participants. It is EB's policy that all forms of discrimination and harassment, sexual or otherwise, are prohibited in any EB events or activities.

EB participants (participants include sponsors, exhibitors, staff, attendees, venue employees and employees from other support suppliers) are expected to help us ensure a safe and positive conference experience for everyone and to abide by this Code of Conduct while attending EB.

- Exercise consideration and respect in your speech and actions.
- Refrain from demeaning, discriminatory, or harassing behavior and speech.
- Be mindful of your surroundings and of your fellow participants.

Experimental Biology is pleased to announce that it will provide ombuds services at EB 2020, April 4-7, San Diego. This action is taken to support the Conference Code of Conduct and Anti-harassment Policy.

The ombuds will serve as an independent, neutral, off-the-record, and confidential resource for conference attendees to discuss any concerns they may have concerning conference-related behaviors and activities. The ombuds will be able to provide information confidentially and will provide a safe way for people to discuss their concerns in a confidential way to explore options for any further action.

In addition to serving as a resource to assist individuals attending the conference, the ombuds—without breaching the confidentiality of any communications by people using the services—will provide Experimental Biology management with feedback on the nature of issues raised at the conference and any insights or observations about systemic issues relating to the conference.

The ombuds will be available by phone or email from April 2-8, 2020. For questions please contact management@experimentalbiology.org

Read the full code of conduct here: <https://experimentalbiology.org/2020/About/Policies.aspx#FAQLink262>

New Photography & Video Recording Policy

At EB 2020, we will be following a new photography and video recording policy that will give presenters and exhibitors a chance to choose whether to allow photos or video to be taken of their poster, presentation, or exhibit booth. Everyone at EB is committed to honoring the rights of copyright owners and to respectful sharing of scientific research and data, and this updated policy is a great way to give presenters and exhibitors more agency over their research. All attendees at EB are expected to adhere to this policy.

To help with the process, EB has provided presenters with a digital graphic to incorporate into their slides/poster or to print and display. Hard copies will also be available on the poster floor.



Red camera with an X: Photography/recording/sharing/remixing/derivative works of the material are prohibited. All rights are reserved.



CCBY-NC-SA icon/Camera with a Checkmark: Photography/recording of the material is permitted. Sharing and remixing are permitted with appropriate attribution as stated in CCBY-NC-SA 4.0 International, subject to commercial patents and trademarks, when applicable.



In the absence of the display of one of the graphics above, all forms of recording are prohibited.

For more information, please visit <https://www.aspet.org/eb2020-policies>

Monday, April 6, 2020

Session/Event	Location at SDCC	Time
46 Years of GPCR Pharmacology and Mentoring in the Field of Pain Research; A Tribute to G. W. Pasternak <i>Chairs: J. Clark and K. Standifer</i>	Room 16 B	8:00 am - 10:00 am
Experimental Approaches for the Treatment of Infectious Disease <i>Chairs: R. Corriden and E. Anderson</i>	Room 15 A	8:00 am - 10:00 am
Immune Mechanisms in Pathogenic Responses to Particles, Nanomaterials, and Nanomedicines <i>Chairs: Q. Ma and K. Pollard</i>	Room 15 B	8:00 am - 10:00 am
The Use of Chemogenetic Tools to Analyze Behavior in Non-human Primates <i>Chairs: K. Grant and V. Cuzon Carlson</i>	Room 17 A	8:00 am - 10:00 am
ASPET - APS Joint Presidential Symposium on Inflammation and Oxidative Stress: Inflammation and Drug Disposition <i>Chairs: R. Ghose and M. Piquette-Miller</i>	Ballroom 20 A	8:30 am - 10:00 am
ASPET Poster Presentations <i>Discover the latest with more than 300 pharmacology poster presentations</i>	Exhibit Hall A-C	10:00 am - 12:00 pm
ASPET Daily Datablitz <i>Sponsored by Pharmacology Research & Perspectives Fast-paced overview of the most exciting poster science of the day</i>	 ASPET Poster Discussion Area, Booth #822	10:30 am - 11:00 am
Networking in the Exhibit Hall <i>Visit with exhibitors, grab lunch, explore Career Central</i>	Exhibit Hall A-C	12:00 pm - 1:00 pm
John J. Abel Award in Pharmacology Lecture <i>Keynote: Andrew Goodman Drug Metabolism by the Human Gut Microbiome</i>	Room 16 A	1:00 pm - 1:45 pm

 Lectures  Networking Opportunity

ASPET Welcomes Our Guest Societies!

- Academic Drug Discovery Consortium
- Behavioral Pharmacology Society
- Catecholamine Society
- Global GI Club
- International Transmembrane Transporter Society
- Japanese Pharmacological Society

Monday, April 6, 2020 *continued*

“Guppy Tank” Translational Science Pitch Showcase <i>Chairs: R. Staudt and H. Neelakantan</i>	Room 16 B	2:00 pm - 3:30 pm
Drug Discovery from Bench to Artificial Intelligence: Treating the Rare and Ignored <i>Chairs: K. Garman and K. Pennypacker</i>	Room 15 B	2:00 pm - 3:30 pm
New Tools in ADME Prediction: Quantitative Omics, Liquid Biopsies, and Modeling <i>Chairs: B. Prasad and A. Rowland</i>	Room 15 A	2:00 pm - 3:30 pm
Teaching Blitz <i>Chair: M. Hernandez</i>	Room 17 A	2:00 pm - 3:30 pm
Networking Break <i>Visit exhibitors, explore Career Central, or relax in the ASPET Member Lounge</i>	Exhibit Hall A-C	3:30 pm – 4:00 pm
Scientific Achievement Award in Drug Discovery and Development Lecture <i>Keynote: Johnathan Baell</i> <i>Hypnos, Medusa and Shapeshifters: Whether from HTS or an in Silico Screen, Whether a Natural Product or FDA-approved Drug, Is Your Bioactive Compound Really What You think It Is?</i>	Room 15 B	4:00 pm - 4:50 pm
P.B. Dews Lifetime Achievement Award for Research in Behavioral Pharmacology Lecture <i>Keynote: Linda A. Dykstra</i> <i>Dews '55: Lessons Learned; Insights Shared</i>	Room 16 B	4:00 pm - 5:00 pm
Division for Cardiovascular Pharmacology Trainee Showcase featuring the Cardiovascular Pharmacology Early Career Awardee <i>Chairs: C. de Lucia, N. Prodan and L. Green</i>	Room 16 A	4:00 pm - 5:25 pm
Division for Cancer Pharmacology – Young Investigators Symposium <i>Chairs: A. Thorburn and J. Yalowich</i>	Room 17 A	4:00 pm - 6:00 pm
Division for Translational and Clinical Pharmacology – Young Investigator Awards Platform and Early Career Faculty Showcase <i>Chair: F. Kim</i>	Room 15 A	4:00 pm - 6:00 pm
Notable Platform Presentations in Drug Discovery and Development <i>Chairs: T. Parry, B. Sjogren and D. Button</i>	Room 15 B	4:50 pm - 6:00 pm
Behavioral Pharmacology Postdoctoral Award Competition <i>Chairs: J. Li and S. Wood</i>	Room 16 B	5:00 pm - 6:00 pm

Lectures
 Networking Opportunity

▶ Register for EB

It's not too late to join us! Register now at <http://bit.ly/32fRv8h>

Monday, April 6, 2020 *continued*

Paul M. Vanhoutte Distinguished Lectureship in Vascular Pharmacology <i>Keynote: Jan Danser</i> <i>Angiotensinogen siRNA: A New Tool to Combat Hypertension</i>	Room 16 A	5:25 pm - 6:20 pm
Annual Division Meetings for: Behavioral Pharmacology Cancer Pharmacology Drug Discovery and Development Translational and Clinical Pharmacology	Room 16 B Room 17 A Room 15 B Room 15 A	6:00 pm - 6:30 pm
Annual Division for Meeting and Awards Presentation for: Cardiovascular Pharmacology	Room 16 A	6:20 pm - 6:30 pm
Division Mixers for: Behavioral Pharmacology and Neuropharmacology Cancer Pharmacology, Drug Discovery and Development, and Translational and Clinical Pharmacology Cardiovascular Pharmacology	Marriott Marquis San Diego: Grand Ballroom 12 Grand Ballroom 11 Grand Ballroom 13	6:30 pm - 8:30 pm

Lectures
 Networking Opportunity

Give a Day of Service to San Diego at EB 2020

Join us for a day of volunteer service on Friday, April 3, from 8:00 am – 3:00 pm.

Since 2009, ASPET members attending Experimental Biology have given a day of volunteer service in the local communities where we convene. Volunteer activities have ranged from home construction to painting, cleaning, stocking shelves, food preparation and service, and building maintenance. The ASPET Division for Behavioral Pharmacology will again sponsor this volunteer opportunity.

At EB 2020, we return for a fifth time to Father Joe's Villages, whose mission is to prevent and end homelessness. We will be doing whatever we can to help the dedicated people at Father Joe's provide assistance to San Diegans.

If you plan to join us, please contact Charles P. France at france@uthscsa.edu or 210-567-6969 (voice) at your earliest convenience. Space is limited and further details will be provided to those who volunteer.

Special thanks to the ASPET Division for Behavioral Pharmacology and Dr. France for coordinating this volunteer activity.



Tuesday, April 7, 2020

Session/Event	Location at SDCC	Time
Development of Cannabinoids for Clinical Use - CNS Hazards and Therapeutic Effects <i>Chairs: M. Delatte and Z. Cooper</i>	Room 16 B	8:00 am - 10:00 am
Heavy Traffic: Targeting Diseases through Chemokine Receptor Antagonism <i>Chairs: S. Davis and S. Rajagopal</i>	 Room 16 A	8:00 am - 10:00 am
Precision Medicine Strategies for Treating Cardiovascular Disease <i>Chairs: E. Gross and H. Patel</i>	Room 15 B	8:00 am - 10:00 am
Targeting Autophagy in Cancer <i>Chairs: A. Thorburn and R. Perera</i>	Room 15 A	8:00 am - 10:00 am
ASPET - APS Joint Presidential Symposium on Inflammation and Oxidative Stress: Central Nervous System Inflammation: Pain and Cognition <i>Chairs: T. Vanderah and A. Kavelaars</i>	Ballroom 20 A	8:30 am - 10:00 am
ASPET Poster Presentations <i>Discover the latest with more than 300 pharmacology poster presentations</i>	Exhibit Hall A-C	10:00 am - 12:00 pm
ASPET Daily Datablitz <i>Sponsored by Pharmacology Research & Perspectives Fast-paced overview of the most exciting poster science of the day</i>	 ASPET Poster Discussion Area, Booth #822	10:30 am - 11:00 am
Networking in the Exhibit Hall <i>Visit with exhibitors, grab lunch, explore Career Central</i>	Exhibit Hall A-C	12:00 pm - 1:00 pm
ASPET - JPS Lecture <i>Keynote: Yoshikatsu Kanai Nutrient Transporters in Molecular Target Drug Discovery</i>	Room 16 A	1:00 pm - 1:45 pm
#DiversiSci <i>Chairs: J. Reuben and L. Johnson</i>	Room 17 A	2:00 pm - 3:30 pm
ADME in Neonates and Infants: Therapeutics, Toxicity, and Development of New Drugs <i>Chairs: X. Zhong and P. Annaert</i>	Room 16 B	2:00 pm - 3:30 pm
Emerging Approaches to Drug Metabolism <i>Chairs: K. He and M. Cerny</i>	Room 15 B	2:00 pm - 3:30 pm
G Protein Signaling in Neuropsychiatric Disorders <i>Chairs: V. Zachariou and Q. Wang</i>	Room 16 A	2:00 pm - 3:30 pm
Recent Progress in Drugging the "Undruggable" RAS Oncogene <i>Chairs: C. Canman and K. Bryant</i>	Room 15 A	2:00 pm - 3:30 pm
Networking Break <i>Visit exhibitors, explore Career Central, or relax in the ASPET Member Lounge</i>	Exhibit Hall A-D	3:30 pm – 4:00 pm

 Lectures  Networking Opportunity

Tuesday, April 7, 2020 *continued*

Bernard B. Brodie Award in Drug Metabolism and Disposition Lecture <i>Keynote: Kathleen M. Giacomini</i> <i>The Human Solute Carrier Superfamily: What Have We Learned From Genetic Variation?</i>	Room 16 B	4:00 pm - 4:50 pm
Methodologies for Integrating Basic and Clinical Sciences in Pharmacology Education <i>Chair: D. Peffley</i>	Room 17 A	4:00 pm - 5:30 pm
Division for Molecular Pharmacology Postdoctoral Award Competition and Keynote Address <i>Chairs: A. Lyon and K. Martemyanov</i>	Room 16 A	4:00 pm - 6:00 pm
Division for Neuropharmacology Early Career Award Lecture and Postdoctoral Fellow Showcase <i>Chairs: K. Standifer and S. Bhalla</i>	Room 15 B	4:00 pm - 6:00 pm
Highlights and Advances in Toxicology <i>Chair: B. S. Cummings</i>	Room 15 A	4:00 pm - 6:00 pm
Division for Drug Metabolism and Disposition Gillette Awards and Junior Investigator Platform Session <i>Chairs: A. Yu and R. Foti</i>	Room 16 B	4:50 pm - 6:00 pm
Annual Division Meeting for: Pharmacology Education	Room 17 A	5:30 pm - 6:30 pm
Annual Division Meetings for: Drug Metabolism and Disposition Molecular Pharmacology Neuropharmacology Toxicology	Room 16 B Room 16 A Room 15 B Room 15 A	6:00 pm - 6:30 pm
Division Mixers for: Molecular Pharmacology Drug Metabolism and Disposition, Pharmacology Education, and Toxicology	Marriott Marquis San Diego: Grand Ballroom 12 Grand Ballroom 13	6:30 pm - 8:30 pm

Lectures Networking Opportunity

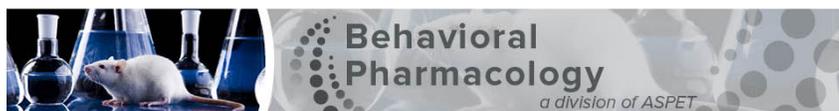


ASPET Booth #819

Visit the ASPET booth in the Experimental Biology exhibit hall. Bring someone who is not yet a member of ASPET for your chance to spin the wheel and win prizes. Items for sale at "Shop ASPET" include t-shirts and plush donkeys. Plus, pick up a complimentary hand sanitizer and your division button.

Division Specific Meetings and Activities

Explore the online division filter to see a full schedule of sessions of interest to your division at EB 2020.
<https://www.aspet.org/aspnet/meetings-awards/meetingsannual-meeting/aspnet-annual-meeting-at-eb-2020/program/program-by-division>



Monday, April 6	4:00 pm - 5:00 pm	P.B. Dews Lifetime Achievement Award for Research in Behavioral Pharmacology Lecture	SDCC Room 16 B
Monday, April 6	5:00 pm - 6:00 pm	Behavioral Pharmacology Postdoctoral Award Competition	SDCC Room 16 B
Monday, April 6	6:00 pm - 6:30 pm	Annual Division Meeting – Division for Behavioral Pharmacology	SDCC Room 16 B
Monday, April 6	6:30 pm - 8:30 pm	Joint Mixer: Divisions for Behavioral Pharmacology and Neuropharmacology	Marriott Marquis Grand Ballroom 12



Monday, April 6	4:00 pm - 6:00 pm	Division for Cancer Pharmacology – Young Investigators Symposium	SDCC Room 17 A
Monday, April 6	6:00 pm - 6:30 pm	Annual Division Meeting – Division for Cancer Pharmacology	SDCC Room 17 A
Monday, April 6	6:30 pm - 8:30 pm	Joint Mixer: Divisions for Cancer Pharmacology, Drug Discovery and Development, and Translational and Clinical Pharmacology	Marriott Marquis Grand Ballroom 11



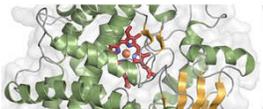
Monday, April 6	4:00 pm - 5:25 pm	Division for Cardiovascular Pharmacology Trainee Showcase featuring the Cardiovascular Pharmacology Early Career Awardee	SDCC Room 16 A
Monday, April 6	5:25 pm - 6:20 pm	Paul M. Vanhoutte Distinguished Lectureship in Vascular Pharmacology	SDCC Room 16 A
Monday, April 6	6:20 pm - 6:30 pm	Annual Division Meeting - Division for Cardiovascular Pharmacology	SDCC Room 16 A
Monday, April 6	6:30 pm - 8:30 pm	Mixer: Division for Cardiovascular Pharmacology	Marriott Marquis Grand Ballroom 13



Drug Discovery and Development

a division of ASPET

Monday, April 6	4:00 pm - 4:50 pm	Scientific Achievement Award in Drug Discovery and Development Lecture	SDCC Room 15 B
Monday, April 6	4:50 pm - 6:00 pm	Notable Platform Presentations in Drug Discovery and Development	SDCC Room 15 B
Monday, April 6	6:00 pm - 6:30 pm	Annual Division Meeting – Division for Drug Discovery and Development	SDCC Room 15 B
Monday, April 6	6:30 pm - 8:30 pm	Joint Mixer: Divisions for Drug Discovery and Development, Cancer Pharmacology, and Translational and Clinical Pharmacology	Marriott Marquis Grand Ballroom 11



Drug Metabolism & Disposition

a division of ASPET

Tuesday, April 7	4:00 pm - 4:50 pm	Bernard B. Brodie Award in Drug Metabolism and Disposition Lecture	SDCC Room 16 B
Tuesday, April 7	4:50 pm - 6:00 pm	Division for Drug Metabolism and Disposition Gillette Awards and Junior Investigator Platform Session	SDCC Room 16 B
Tuesday, April 7	6:00 pm - 6:30 pm	Annual Division Meeting – Division for Drug Metabolism and Disposition	SDCC Room 16 B
Tuesday, April 7	6:30 pm - 8:30 pm	Joint Mixer: Divisions for Drug Metabolism and Disposition, Pharmacology Education, and Toxicology	Marriott Marquis Grand Ballroom 13



Molecular Pharmacology

a division of ASPET

Friday, April 3 - Saturday, April 4	see schedule	Colloquium on G Protein-Coupled Receptors: Evolving Insights from Pharmacology to Physiology (separate fee)	SDCC Room 16 AB
Tuesday, April 7	4:00 pm - 6:00 pm	Division for Molecular Pharmacology Postdoctoral Award Competition and Keynote Address	SDCC Room 16 A
Tuesday, April 7	6:00 pm - 6:30 pm	Annual Division Meeting – Division for Molecular Pharmacology	SDCC Room 16 A
Tuesday, April 7	6:30 pm - 8:30 pm	Mixer: Division for Molecular Pharmacology	Marriott Marquis Grand Ballroom 12

► **Find Your Division Home at ASPET** Be sure to attend division-specific meetings and mixers for a chance to network with those who have similar interests to you – check the program for more in-depth scheduling. Don't forget to wear your division badge!





Neuropharmacology

a division of ASPET

Monday, April 6	6:30 pm - 8:30 pm	Joint Mixer: Divisions for Neuropharmacology and Behavioral Pharmacology	Marriott Marquis Grand Ballroom 12
Tuesday, April 7	4:00 pm - 6:00 pm	Division for Neuropharmacology Early Career Award Lecture and Postdoctoral Fellow Showcase	SDCC Room 15 B
Tuesday, April 7	6:00 pm - 6:30 pm	Annual Division Meeting – Division for Neuropharmacology	SDCC Room 15 B



Pharmacology Education

a division of ASPET

Tuesday, April 7	4:00 pm - 5:30 pm	Symposium: Methodologies for Integrating Basic and Clinical Sciences in Pharmacology Education	SDCC Room 17 A
Tuesday, April 7	5:30 pm - 6:30 pm	Annual Division Meeting – Division for Pharmacology Education	SDCC Room 17 A
Tuesday, April 7	6:30 pm - 8:30 pm	Joint Mixer: Divisions for Pharmacology Education, Drug Metabolism and Disposition, and Toxicology	Marriott Marquis Grand Ballroom 13



Toxicology

a division of ASPET

Tuesday, April 7	4:00 pm - 6:00 pm	Highlights and Advances in Toxicology	SDCC Room 15 A
Tuesday, April 7	6:00 pm - 6:30 pm	Annual Division Meeting – Division for Toxicology	SDCC Room 15 A
Tuesday, April 7	6:30 pm - 8:30 pm	Joint Mixer: Divisions for Toxicology, Drug Metabolism and Disposition, and Pharmacology Education	Marriott Marquis Grand Ballroom 13



Translational & Clinical Pharmacology

a division of ASPET

Monday, April 6	4:00 pm - 6:00 pm	Division for Translational and Clinical Pharmacology – Young Investigator Awards Platform and Early Career Faculty Showcase	SDCC Room 15 A
Monday, April 6	6:00 pm - 6:30 pm	Annual Division Meeting – Division for Translational and Clinical Pharmacology	SDCC Room 15 A
Monday, April 6	6:30 pm - 8:30 pm	Joint Mixer: Divisions for Translational and Clinical Pharmacology, Cancer Pharmacology, and Drug Discovery and Development	Marriott Marquis Grand Ballroom 11

ASPET Meetings

The following are **invitation-only meetings**. Schedule is subject to change.

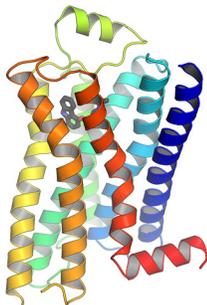
Thursday, April 2, 2020		
1:00 pm – 4:00 pm	Finance Committee Meeting	Marriott Marquis Rancho Santa Fe 1-2
5:00 pm – 9:00 pm	Council Meeting	Marriott Marquis Rancho Santa Fe 1-2
Friday, April 3, 2020		
7:30 am – 1:00 pm	Council Meeting	Marriott Marquis Rancho Santa Fe 1-2
11:00 am – 7:00 pm	Mentoring Network: Coaching for Career Development (mentors)	Marriott Marquis Torrey Pines 3
2:00 pm – 7:00 pm	Mentoring Network: Coaching for Career Development (mentees)	Marriott Marquis Torrey Pines 3
6:30 pm – 9:00 pm	Council Dinner	Refer to invitation for location
Saturday, April 4, 2020		
8:30 am – 12:00 pm	Mentoring Network: Coaching for Career Development (mentors and mentees)	Marriott Marquis Torrey Pines 3
12:00 pm – 1:30 pm	Mentoring Network Lunch	Marriott Marquis Rancho Santa Fe 2-3
1:00 pm – 2:00 pm	Science Policy Committee Meeting	Marriott Marquis Torrey Pines 2
1:00 pm – 2:00 pm	Division Communication Officers Meeting	Marriott Marquis Rancho Santa Fe 1
4:30 pm – 6:00 pm	ASPET Business Meeting and Awards Presentation (<i>all welcome</i>)	SDCC Room 16 AB
8:30 pm – 10:00 pm	President's Reception (<i>by invitation only</i>)	Refer to invitation for location
Sunday, April 5, 2020		
7:00 am – 8:00 am	Executive Committee – Div. for Drug Metabolism and Disposition	Marriott Marquis Rancho Santa Fe 3
7:00 am – 8:00 am	Executive Committee – Div. for Translational and Clinical Pharmacology	Marriott Marquis Rancho Santa Fe 1
7:00 am – 8:00 am	Fellows Review Committee Meeting	Marriott Marquis Torrey Pines 2
7:30 am – 9:30 am	JPET Editorial Board Meeting	Marriott Marquis Rancho Santa Fe 2
7:30 am – 9:30 am	Diversity and Inclusion Breakfast (RSVP required)	SDCC Room 14 B
12:00 pm – 1:00 pm	Executive Committee – Div. for Cancer Pharmacology	Marriott Marquis Torrey Pines 2
12:00 pm – 1:00 pm	Executive Committee – Div. for Behavioral Pharmacology	Marriott Marquis Rancho Santa Fe 1
12:00 pm – 1:00 pm	Executive Committee – Div. for Cardiovascular Pharmacology	Marriott Marquis Rancho Santa Fe 3
12:00 pm – 2:00 pm	Board of Publications Trustees Meeting	Marriott Marquis Rancho Santa Fe 2
12:15 pm – 2:00 pm	Undergraduate Networking and Career Development Luncheon (RSVP required)	SDCC Room 14 B
7:30 pm – 10:00 pm	Board of Publications Trustees Joint Editorial Boards Dinner	Marriott Marquis Ballroom Salon B

Monday, April 6, 2020		
7:00 am – 8:00 am	Mentoring and Career Development Committee Meeting	Marriott Marquis Torrey Pines 3
7:00 am – 8:00 am	Nominating Committee Meeting	Marriott Marquis Rancho Santa Fe 3
7:00 am – 8:00 am	Executive Committee – Div. for Toxicology	Marriott Marquis Torrey Pines 2
7:30 am – 9:30 am	<i>Molecular Pharmacology</i> Editorial Board Meeting	Marriott Marquis Rancho Santa Fe 1-2
12:00 pm – 1:00 pm	Executive Committee – Div. for Drug Discovery and Development	Marriott Marquis Torrey Pines 2
12:00 pm – 1:00 pm	Executive Committee – Div. for Molecular Pharmacology	Marriott Marquis Rancho Santa Fe 3
12:00 pm – 1:00 pm	Young Scientists Committee Meeting	Marriott Marquis Torrey Pines 3
12:00 pm – 2:00 pm	<i>Pharmacological Reviews</i> Editorial Board Meeting	Marriott Marquis Rancho Santa Fe 2
2:00 pm – 4:00 pm	<i>Pharmacology Research & Perspectives (PR&P)</i> Editorial Board	Marriott Marquis Rancho Santa Fe 3
6:30 pm – 9:00 pm	Past President's Dinner	Refer to invitation for location
Tuesday, April 7, 2020		
7:00 am – 8:00 am	Executive Committee – Div. for Neuropharmacology	Marriott Marquis Rancho Santa Fe 3
7:00 am – 8:00 am	Executive Committee – Div. for Pharmacology Education	Marriott Marquis Torrey Pines 3
7:30 am – 9:30 am	<i>Drug Metabolism and Disposition</i> Editorial Board Meeting	Marriott Marquis Rancho Santa Fe 1-2
12:00 pm - 1:00 pm	Council of Division Chairs Meeting	Marriott Marquis Torrey Pines 2
3:00 pm – 5:00 pm	<i>Pharmacology Research & Perspectives</i> Management Committee Meeting	Marriott Marquis Torrey Pines 2
Wednesday, April 8, 2020		
7:30 am – 12:00 pm	Program Committee Meeting	(Room TBD)

Thank you for being an ASPET member!



Be sure to visit the ASPET member lounge in Room 17B on the mezzanine level of the San Diego Convention Center. You can learn more about ASPETConnect, get your professional photo taken, and participate in a raffle to win prizes!



**Colloquium on G Protein-Coupled Receptors:
Evolving Insights from Pharmacology to Physiology**

**Friday, April 3 - Saturday, April 4, 2020
San Diego, CA**

This is a satellite meeting to Experimental Biology 2020.  *Separate registration fee required.*

Tremendous scientific advancements over the last decade indicate that GPCR physiology and pharmacology is much more complex than originally thought and that it may be possible to exploit this complexity to treat a wide variety of diseases.

This colloquium will expose scientists to recent discoveries and multidisciplinary approaches used to study GPCRs and provide opportunities for establishing collaborations that bridge complementary interests.

This line up of speakers has made exciting discoveries in GPCR research that range from molecular to systems biology, basic research to translational studies, and pharmacology to physiology.



Nobel Laureate Keynote Lecture

Brian Kobilka, Stanford University

“Structural Insights into the Dynamic Process of G protein-Coupled Receptor Activation”

GPCR Colloquium Sponsors

Gold Sponsor

- ASPET Division for Molecular Pharmacology

Silver Sponsors

- American Physiological Society
- American Society for Biochemistry and Molecular Biology

Bronze Sponsors

- Arena Pharmaceuticals, Inc.
- Multispan, Inc.
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- Abalone Bio, Inc.
- Journal of Biological Chemistry
- ASPET Division for Drug Discovery and Development
- ASPET Division for Neuropharmacology

American Society for Pharmacology and Experimental Therapeutics

Great Lakes Chapter

32nd Annual Meeting, June 12, 2020



Neuropharmacology of Pain and Addiction

Northwestern University

Feinberg School of Medicine

Simpson Querrey Auditorium

303 E Superior St. Chicago, IL 60611

- **Poster Session** (8:30 – 10:30 AM) (we encourage posters from all areas of pharmacology)
- **Vendor Exhibit** (8:30 AM – 12:00 PM)
- **Young Investigator Symposium** (10:30 – 12:00 PM)
- **Lunch & Learn Career Workshop** (12:15 – 1:30 PM)
- **Symposium** (1:30 – 4:45 PM)

Speakers:

Michael Salter (*Keynote speaker*) (Hospital for Sick Children & University of Toronto)

David Hackos (Genentech, S San Francisco)

Anne-Marie Malfait (Rush University)

Mary Eileen Dolan (University of Chicago)

Marwan Baliki (Northwestern University)

- **Poster Awards & Business Meeting** (4:45 – 5:30 PM)

Abstract Deadline: June 1, 2020

<https://www.aspet.org/glc/>

Metformin: A Drug for All Reasons

Rebecca J. Anderson, PhD

Ask anyone in drug development. They'll all say the same thing: As you accumulate data on a new investigational drug, its efficacy becomes less and less impressive. And its side effects become more problematic. You can count on it.

But once in a very great while, you might get lucky and find an exception. With the passage of time, this exceptional drug gains efficacy, exhibits less toxicity, and treats a wider range of disorders than first claimed (1). One such drug is metformin.

Herbal Ancestry

One of the herbs listed in Nicholas Culpeper's *Complete Herbal* (1652) was *Galega officinalis* (2-4). This perennial plant with white, blue, or purple flowers is variously known as goat's rue, French lilac, Spanish sainfoin, and false indigo (2-5). Medieval alchemists claimed it was good for snake bites, worms, miasma, epilepsy, and plague, among other things (2-4). In 1772, John Hill was the first to recommend the herb for thirst and frequent urination—symptoms that probably indicated diabetes (1, 3).

Extracts of *G. officinalis* continued to be used to treat diabetes until the 1930s, particularly in France (2, 4). In fact, modern herbal pharmacopoeias still cite the herb as a diabetes remedy. However, it has been designated as a poisonous plant in the US and is listed in the U.S. Food and Drug Administration's (FDA) Poisonous Plant Database (2, 4).

The herb's toxicity stems from its high content of guanidine, which was first isolated from *G. officinalis* in the mid-1800s (1-3). Adolph Strecker then became the first to synthesize it. In 1918, C.K. Watanabe at Yale University reported that guanidine lowered blood glucose when injected into rabbits (3, 4). But it was too toxic for clinical use (4).



An illustration of *G. officinalis*

In the public domain

In 1914, Georges Tanret at the University of Paris extracted another compound, galegine, from *G. officinalis* (4). In 1925, chemists elucidated its chemical structure, which is an analog of guanidine, and successfully synthesized it (2, 4). Tanret's own research was interrupted by World War I, but in 1927, he and colleagues reported that galegine lowered blood glucose in rabbits and dogs. In Munich, Helmut Müller and Helmuth Reinwein were the first to show that galegine also lowered blood glucose in diabetic patients (4).

At Schering-Kahlbaum AB (a chemical company in Berlin), Erich Frank was synthesizing analogs of guanidine and stumbled upon a byproduct, Synthalin A, that seemed to be more promising than galegine. It consisted of two guanidine molecules linked together with a long aliphatic chain. Synthalin A was briefly marketed in Europe, but unfortunately it caused serious adverse effects on digestive, liver, and kidney function and was withdrawn from clinical use (4). Synthalin B, a slightly longer analog of Synthalin A, was then introduced in Europe for mild cases of diabetes.

By the 1930s, though, only a few clinical centers, primarily in Germany, were still prescribing guanidine analogs (2-4). Galegine and Synthalin B had fallen out of favor, partly due to toxic side effects that eventually became apparent, and partly due to the introduction of insulin in 1922.

Metformin Emerges

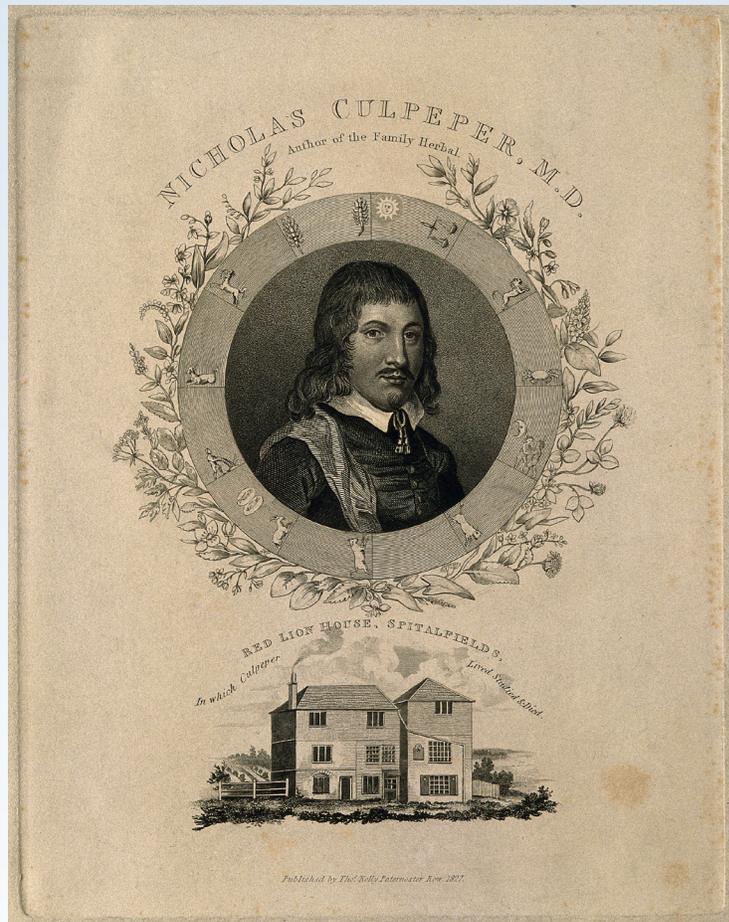
In 1879, Bernhard Rathke fused two guanidine molecules to form biguanide (3). Among the various analogs of biguanide was dimethylbiguanide (metformin), which was first synthesized by Emil Werner and James Bell in 1922 (6).

In 1929, two German research groups reported that metformin lowered blood glucose (3). But they used nondiabetic rabbits and dogs, and high doses of metformin were required to achieve modest glucose-lowering. (Later, diabetic animal models would provide much more compelling evidence.)

The biguanides were less toxic than galegine and Synthalin, and among the various biguanide analogs, metformin was the least toxic (3). But clinicians favored insulin, a more powerful drug.

Metformin by Another Name

During World War II, the Axis powers blockaded regions that produced quinine. The antimalarial drug



Nicholas Culpeper

was essential, especially for Allied soldiers who were fighting in the tropics (3). As an alternative to quinine, British researchers developed proguanil (Paludrine®), a biguanide antimalarial. In 1945, Imperial Chemical Industries, Ltd., in England, began production (4, 5).

Paludrine, which resembles galegine, proved to be quite effective (and is still used). It generated interest among several research groups (4, 5). In 1947, K.K. Chen and Robert Anderson at the Lilly Research Laboratories, while characterizing the toxicity of Paludrine, noted that it also caused a mild decrease in blood glucose in rabbits (7).

Other biguanide analogs were synthesized, attempting to improve on Paludrine's antimalarial efficacy (3). While evaluating those analogs in patients, Eusebio Garcia in the Philippines found that one of them was also effective against influenza (3-5). This compound was named Flumamine, reflecting the serendipitous anti-flu effect.

In his 1950 article in a Philippine medical journal, Garcia, citing guanidine analogs like galegine and Synthalin, speculated that Flumamine's actions were mediated by lowered blood glucose. But he did not measure blood glucose in his patients (4, 5). Flumamine was really just another name for the biguanide that Werner and Bell had synthesized: metformin.

Insulin's the One

After its discovery, insulin became the most common treatment for all patients diagnosed with diabetes mellitus, because of its powerful effect on lowering blood glucose. But physicians were aware that not all diabetic patients were the same.

Since the 19th century, efforts had been made to categorize the disease (8). Some patients, primarily children, rapidly developed elevated blood glucose, were typically lean, and would always die within a few years unless treated. In these patients, insulin was literally a lifesaver.

Other patients developed symptoms as adults and so slowly that, in the early stages, their diabetes was often confused with other ailments. The definitive diagnosis emerged only after those symptoms accumulated. These patients were often overweight, and blood glucose levels often improved with exercise and weight loss (8). To treat severe cases of this "mature-onset" diabetes, insulin was prescribed.

In the mid-1930s, Harold Himsworth was studying carbohydrate metabolism at University College Hospital in London (8). In one insightful study, he gave diabetic patients a glucose drink, along with an injection of insulin. The insulin injection lowered the level of blood glucose in some patients, as expected.

But in other patients, the insulin injection had no effect, and their blood glucose level continued

to rise as the ingested glucose entered their bloodstream over the 90-minute test period (9). In later experiments, Himsworth showed that the peripheral tissues of these patients were insensitive to insulin and failed to utilize glucose normally.

He concluded that "in insulin-sensitive diabetics the disease is due to deficiency of insulin, whilst in insulin-insensitive patients diabetes mellitus results, not from lack of insulin but from lack of an unknown factor which renders the body sensitive to insulin" (9).

In 1979, an international consensus group finally introduced the first universal classification system for diabetes. It reflected Himsworth's observations, defining insulin-dependent diabetes as type 1 and insulin-insensitive diabetes (i.e., patients who still produced insulin) as type 2 (8).

Himsworth's work provided not only a simple test for distinguishing between type 1 and type 2 diabetes, but also the scientific basis for therapeutic management of diabetic patients (8). Unfortunately, despite a better understanding of the two underlying pathologies, clinicians had no drugs that would specifically address insulin insensitivity. Or, perhaps more correctly, they simply overlooked them.

In 1956, tolbutamide, the first of the sulfonylurea drugs, was introduced. The sulfonylureas stimulated release of pancreatic insulin and therefore produced the same effect as injected insulin. These were the first orally active anti-diabetic drugs and could replace insulin injections but did not correct the insulin insensitivity of type 2 diabetic patients. Of course, the

Insulin





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Sir Harold Himsworth

sulfonylureas did not benefit type 1 diabetic patients because they lacked the ability to produce insulin.

The French Connection

Meanwhile, in France, physicians took a different path, thanks largely to Jean Sterne. Sterne trained in medicine in Paris, and during his

internship, he conducted a study of galegine in diabetic patients. But the results were disappointing (3, 5).

During World War II, Sterne served as a battalion medic and was taken prisoner. He escaped to Morocco and later joined the efforts to liberate Toulouse, France (3). After the war, he returned to Morocco as director of medicine at a hospital in Casablanca.

In 1956, Sterne accepted a position at Aron Laboratories, a small pharmaceutical company in Paris (3, 4). He was intrigued by Garcia's short article detailing the effects of Flumamine and embarked on an ambitious program to study various guanidine analogs for anti-diabetic efficacy (3-5).

Assisted by his colleague, pharmacist Denise Duval, Sterne unknowingly repeated studies from the 1920s, noting and confirming the compounds' effects in rabbits, rats, and dogs. Most of the analogs only mildly lowered blood glucose and were fairly toxic (3, 5).

Metformin stood out. Compared to the other analogs, it had better glucose-lowering efficacy and minimal adverse effects both in normal animals and—more significantly—in Sterne's diabetic animal models (3, 5). Based on that data and Garcia's clinical experience with Flumamine (metformin), Sterne conducted the first diabetes clinical trials with metformin at Hôpital Laennec in Paris, where he had clinical privileges. He also persuaded Elie Azerad at Hôpital Beaujon in Paris to join the effort (3). Their patients represented a mix of type 1 and type 2 diabetes, and most were taking insulin.

In patients with type 2 diabetes, metformin replaced the need for insulin in some patients and reduced the required insulin dose in others. The type 1 diabetes patients still required insulin (3). Notably, metformin did

not drive blood glucose to dangerously low levels (as had recently been reported with sulfonylureas), and it had little or no effect on nondiabetic individuals (3, 10). In 1957, Sterne published his results in *Maroc Médical*, a relatively obscure French-language Moroccan journal (3-5).

Sterne suggested the name "Glucophage" (meaning glucose eater), which was adopted by Aron Laboratories as the trade name for metformin (3, 4). He continued his research studies, developed physician education programs, and facilitated Aron's introduction of metformin into clinical practice in Europe (3). Metformin became available in the UK in 1958 and in Canada in 1972.

For type 2 diabetes, metformin had clear advantages over insulin. Patients needed to inject insulin several times each day, timed with meals, whereas the timing of metformin (orally once or twice a day) was not critical. Too much insulin (like too much sulfonylurea) could cause a precipitous drop in blood glucose and coma, whereas metformin would not (4, 5).

Although several prominent diabetes clinics championed metformin, it became the preferred biguanide only in France and Scotland (1, 3). It was not available to patients in the US, where physicians usually treated type 2 diabetes with diet, a sulfonylurea, or the biguanide phenformin which was gaining popularity as the alternative to the sulfonylureas (1, 3, 11).

Phenformin Fiasco

While studying various biguanides, Georges Ungar and colleagues rediscovered and published the glucose-lowering properties of phenformin in 1957 (3). Clinical trials in type 2 diabetes patients confirmed that phenformin had greater glucose-lowering efficacy than metformin, and it was approved by the FDA in 1959 (3). Canadian regulators approved it, along with metformin, in 1972 (4).

From the outset, though, clinicians noted that phenformin could induce fatal lactic acidosis—the buildup of lactic acid from anaerobic metabolism of glucose (1, 4, 10). As the evidence accumulated, the Canadian Diabetic Association reacted quickly and removed phenformin from its treatment recommendations (4).

But FDA regulators were slow to take action. In the US, phenformin prescribing remained strong, due to aggressive marketing by Ciba-Geigy (1, 4). Between 250,000 and 385,000 diabetic patients were taking it (4).



Galega officinalis

Epibiose - own work. Licensed under CC BY-SA 3.0.

By the 1970s, the reports of phenformin-related lactic acidosis and deaths could no longer be ignored (1). An FDA medical officer estimated that in 1973, 4 out of every 1000 phenformin users had died from lactic acidosis, about 4,000 deaths annually. Finally, in 1977, as the death toll mounted and pressure from consumer groups increased, the FDA withdrew its market approval (1, 4).

Metformin's Mechanistic Edge

Meanwhile, European investigators continued to build a case in support of metformin. In 1962, two small-scale clinical trials in the UK confirmed Sterne's observations—the first clinical reports of metformin efficacy to be published in English (4, 5). Those studies were followed by larger trials in 1968 and 1977 at the Royal Infirmary in Edinburgh (1).

The results showed that metformin controlled blood glucose as well as a sulfonylurea. But the patients taking metformin lost weight and rarely experienced hypoglycemia, whereas those taking the sulfonylurea gained weight and were more prone to suffer dangerous hypoglycemia (from the stimulated release of pancreatic insulin) (1, 10-12).

These and other studies revealed that metformin has several actions that seem to work in concert to reverse the abnormalities associated with type 2 diabetes. Metformin slows glucose absorption from the intestines and inhibits glucose production in the liver. It also increases the sensitivity of muscle and other peripheral tissues to insulin (4, 11-14).

Less insulin secretion from the pancreas and better glucose utilization by the body results in lower basal blood glucose, as well as the amount of glucose entering the bloodstream immediately after a meal (4, 12). This may explain metformin's ability to facilitate weight loss in obese type 2 diabetic patients (11, 12).

It is currently unclear whether these effects are due to multiple mechanisms of action or multiple beneficial effects downstream from action at a single target (15-17). For example, a change in the AMP/ATP ratio may be responsible for metformin's suppression of hepatic glucose production and lipid synthesis, increased insulin sensitizing, and decreased plasma insulin. But metformin also increases antioxidant protection, resulting in reductions in both chronic inflammation and oxidative damage (15, 17).

Regardless of its molecular mechanism(s), metformin clearly shifts cellular metabolism in a concerted manner to normalize glucose utilization (16). In short, it reverses the insulin insensitivity that Harold Himsworth first described.

Turning the Corner

The FDA remained cautious of biguanides, including metformin, despite the growing body of clinical evidence. Regulators did not want a repeat of lactic acidosis deaths. But the pharmacokinetics of phenformin and metformin are much different (1, 10, 13).

About 9% of patients of European heritage have a genetic mutation coding for CYP2D6, causing a buildup of unmetabolized phenformin, and that leads to lactic acidosis (1, 3, 12). On the other hand, metformin is excreted unchanged by the kidney. Metformin-related lactic acidosis occurs only in patients who have chronically impaired renal function or acute kidney disease because they cannot excrete the drug (1, 3, 11, 13, 16). When prescribed to patients with normal renal function, the risk of lactic acidosis is 10- to 20-fold less with metformin than with phenformin (4, 10, 11, 18).

In France, Sterne and his colleagues had accumulated considerable experience using metformin safely. Aron Laboratories had been acquired by Lipha

Pharmaceuticals (now Merck KGaA), and in 1986, representatives from Lipha began discussions with the FDA regarding metformin (2, 3). Gerard Daniel, an inspired, meticulous, and pragmatic physician, led Lipha's metformin team. Along with a group of independent scientists, he worked with the FDA to design regulatory-compliant clinical trials (3).

The pivotal Phase 3 trials confirmed and extended the findings of the original Edinburgh studies 20 years earlier (11). Type 2 diabetes patients, who had been poorly controlled with diet or sulfonylurea treatment, achieved improved blood glucose and lipid concentrations after taking metformin alone or in combination with a sulfonylurea (11).

The FDA approved metformin on December 29, 1994, and the design of Lipha's trials provided a template for Phase 3 evaluation of subsequent glucose-lowering agents (3). Bristol-Myers Squibb acquired the US marketing rights and launched an extensive education program as an integral part of its marketing strategy (2). The promotional literature emphasized metformin's benefits over sulfonylureas.

Regarding lactic acidosis, the metformin label contained a warning that metformin should not be given to patients with impaired kidney function (3). Metformin's most frequent—and only troublesome—side effect was gastrointestinal distress (diarrhea, nausea), due to high drug concentrations in the digestive tract. But the discomfort was usually mild and transient (11, 13).

UKPDS Piles On

In 1998, three years after Bristol-Myers Squibb's market launch, American confidence in metformin increased substantially with publication of the United Kingdom Prospective Diabetes Study (UKPDS). This landmark clinical trial had followed overweight type 2 diabetic patients for 10 years. The results confirmed earlier observations that metformin lowers blood glucose without weight gain or the risk of frank hypoglycemia (18). All groups achieved the same level of blood glucose control, but intriguingly, metformin appeared to reduce cardiovascular complications and adverse drug reactions, compared to patients treated with sulfonylureas or insulin (18). Noting metformin's advantages, the authors suggested, "it could be chosen as a first-line pharmacological therapy" (18).

In 2005, the International Diabetes Federation made it official, recommending metformin as the first-line drug for type 2 diabetes. Other clinical organizations

followed, incorporating metformin as the preferred glucose-lowering agent in their guidelines (3). In 2011, WHO included metformin as one of only two oral anti-diabetic drugs (along with the sulfonylurea, gliclazide) in its List of Essential Medicines.

When metformin is insufficient, these organizations recommend combining it with an oral glucose-lowering agent with a different mechanism of action. These fixed-dose combos are based around metformin: the dose of the second agent is tailored to complement the administration schedule of metformin and minimize the risk of hypoglycemia (3).

Metformin is now the most commonly prescribed drug for type 2 diabetes worldwide, either alone or in combination with other glucose-lowering drugs (1, 4, 12, 16). When the Glucophage patent expired in 2000, annual sales had reached \$1.3 billion (4). But wait—there's more.

“Metformin is now the most commonly prescribed drug for type 2 diabetes worldwide”

Preventing Diabetes

In 2008, the UKPDS investigators published results of a follow up study. They had followed their type 2 diabetes patients for 10 additional years (19). In addition to sustained efficacy, as observed in the original study, patients in the metformin group experienced an increased cardiovascular benefit (3).

All groups had maintained similar blood glucose control. But early and long-term treatment with metformin resulted in substantially less risk of heart attacks and death from any cause, compared to treatment with sulfonylureas (19).

The UKPDS studies, following patients for 20 years, showed that starting “intensive glucose control” at the time of the initial diabetes diagnosis was especially beneficial. Based on that finding, clinicians speculated that metformin might actually prevent type 2 diabetes in people who were at risk but had not reached the threshold for a definitive diagnosis. “Prediabetes” is defined as high-normal fasting plasma glucose (100-125 mg/dL), and a high-normal HbA_{1c} (5.7-6.4%) (13, 20).



Galega officinalis

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In 2015, 34% of US adults had prediabetes, as well as nearly half of those over age 65 (20). Most prediabetic individuals already exhibit insulin resistance and are likely to develop type 2 diabetes within 10 years. They may also have acquired some cardiovascular complications associated with the disorder (4).

Elevated blood glucose and HbA_{1c}, although below the cutoff for diabetes, increases microvascular risk (13). Microvascular complications due to diabetes cause damage to the eyes (retinopathy), kidneys (nephropathy), and limb nerves (peripheral neuropathy), leading to blindness, kidney failure, and amputation, respectively (14).

In an American clinical trial, retinopathy was diagnosed in prediabetic patients who did not progress to type 2 diabetes as well as those who did. In a German trial, polyneuropathy was noted in some prediabetic subjects. Elevated blood glucose in prediabetic patients also increases the risk of heart attack, stroke, and cardiovascular-associated death (13).

The ongoing Diabetes Prevention Program (DPP), sponsored by the National Institutes of Health, has found that metformin delays development of type 2 diabetes for at least 10-15 years in subjects at high risk (3, 4, 13, 21).

Both the DPP and the American Diabetes Association emphasize that metformin does not replace lifestyle modifications (i.e., diet and exercise to reduce weight), which remain the cornerstone of care for prediabetic patients and often have a more beneficial effect (12, 13, 21).

When drug therapy is indicated, most guidelines, including those of major expert groups in the US, Europe, and the International Diabetes Federation, favor metformin. In fact, metformin is the only drug recommended for preventing or delaying type 2 diabetes in at-risk individuals because of its effectiveness, good tolerability, and low cost (13).

Improving Fertility?

Polycystic ovary syndrome (PCOS) is a hormonal imbalance (i.e., excess androgen) that results in ovulatory and menstrual irregularity (4, 12). It is the most common endocrine disorder affecting reproductive-age women and is the leading cause of infertility (12). Insulin resistance is characteristic of PCOS and leads to an increased risk of developing type 2 diabetes, cardiovascular complications, and endometrial carcinoma. Between 40-80% of women with PCOS are overweight or obese (4).

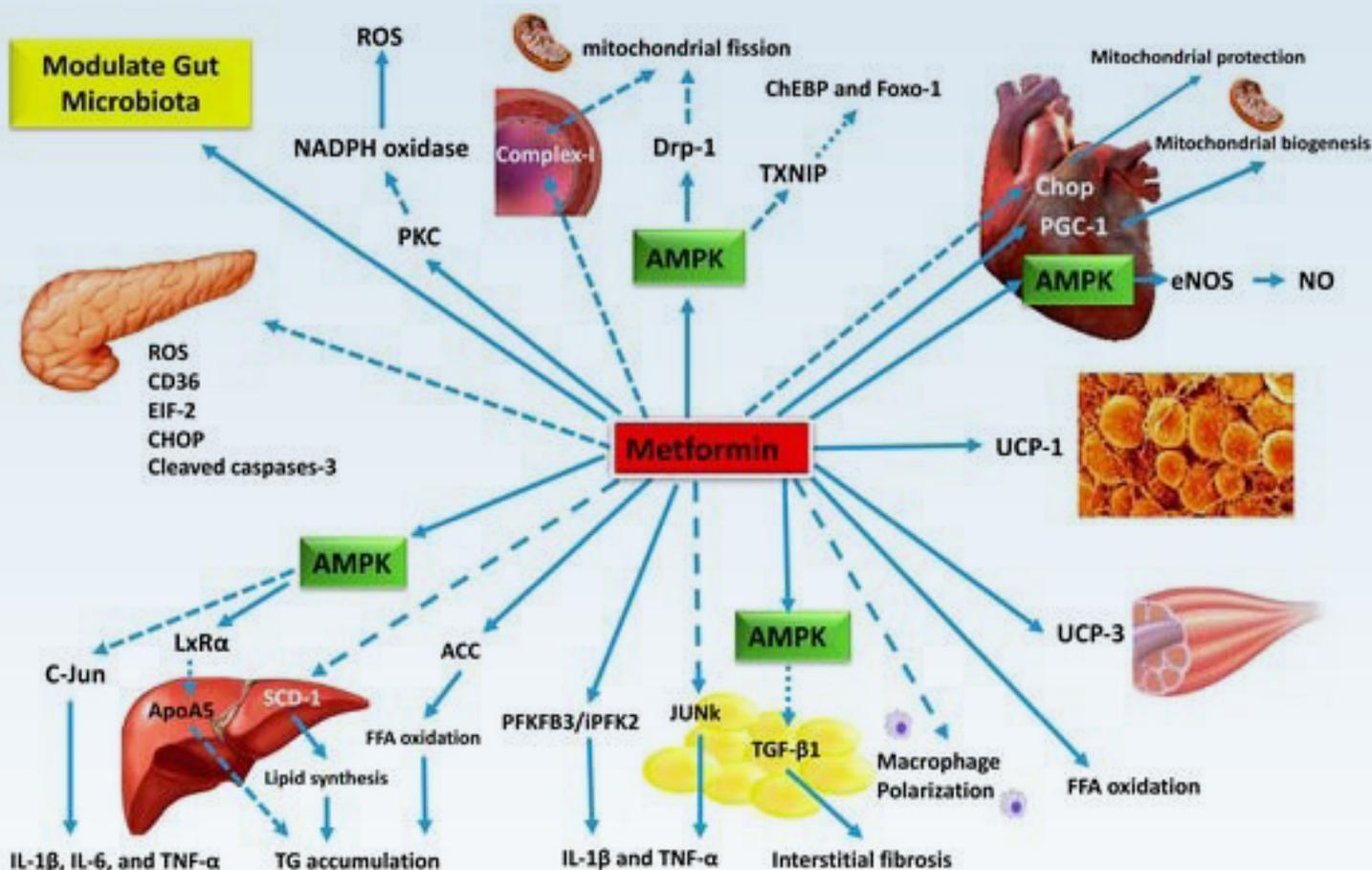
In 1994, clinicians in Venezuela first reported that metformin significantly improved the regularity of the menstrual cycle and reduced circulating androgen levels, as well as insulin. The PCOS women also experienced a marked decrease in insulin resistance and body weight (4).

But although metformin seems to readjust women's hormonal cycles, its efficacy as a fertility agent is unclear.

A Hearty Drug, Too

One of the striking outcomes of the UKPDS trial was the long-term benefit of metformin on reducing cardiovascular risk (19). Coronary artery disease, peripheral arterial disease, and stroke are frequently the cause of death in type 2 diabetes patients (12, 22). Any drug that controls blood glucose will reduce the risk of these cardiovascular complications. But in the course of treating diabetic patients, physicians observed that metformin seemed to have cardiovascular benefits, separate from its control of blood glucose (1, 3, 11, 13, 18).

The pivotal Phase 3 trials conducted by Lipha Pharmaceuticals for US market registration showed that, in addition to reversal of insulin resistance, metformin significantly lowered blood lipids: plasma total cholesterol, low-density lipoprotein (LDL), and triglycerides (11, 12).



The many uses of metformin

Laboratory studies have shown that metformin also has a protective effect on the vasculature by reducing inflammation and oxidative stress (12, 13, 17). These actions, along with better blood glucose management, all work to improve the microcirculation and diminish the likelihood of heart failure, subclinical atherosclerosis, and diabetic cardiomyopathy (4, 12, 13, 15, 18, 19).

These observations led to the idea of repurposing metformin specifically for cardiovascular disease. In a randomized clinical trial of coronary artery disease patients without type 2 diabetes, metformin significantly reduced left ventricular hypertrophy (23). Metformin also reduced the patients' obesity, systolic blood pressure, and oxidative stress, compared to placebo (23).

These findings point to a robust cardioprotective effect of metformin, but specific outcome trials are needed to show a definitive benefit in heart disease. Several such trials are currently ongoing and are scheduled to complete in 2024, including VA IMPACT (NCT02915198) and GLINT (ISRCTN34875079) (13, 15, 23).

A Cancer Sidekick

Diabetic patients have a higher incidence of tumor development than comparable healthy subjects (4, 24). Also, cancer patients with diabetes are less responsive to chemotherapy and exhibit a higher risk of death (24).

In 2005, the first reports appeared indicating that metformin lowers the incidence of cancer in diabetic patients more than other anti-diabetic drugs (4). Several subsequent epidemiologic studies reinforced the notion that metformin reduces the incidence of both cancer and mortality in diabetic patients, compared to those treated with insulin or sulfonylureas (15, 24).

Laboratory studies have revealed that metformin has a direct antitumor effect by suppressing tumor proliferation, inducing programmed cell death, and/or arresting the cell cycle of tumor cells (15, 24). These findings suggested that combining metformin with traditional chemotherapy drugs might enhance the curative effect of, and reduce the adverse reactions associated with, chemotherapy (24).

In a recently published Phase 2 trial, patients with advanced lung adenocarcinoma who were treated with metformin and tyrosine kinase inhibitors had longer progression-free survival and overall survival, compared to those receiving only tyrosine kinase inhibitors (25). More than a dozen clinical trials sponsored by the US National Cancer Institute are currently evaluating the benefit of metformin in prevention and treatment of various solid tumors (breast, prostate, colorectal, cervical, and endometrial) (12, 24,26).

Psyching Out Obesity

Obesity and insulin resistance are recognized side effects of antipsychotic drugs, particularly the atypical antipsychotics (13, 27, 28). Weight gain continues and insulin resistance increases throughout antipsychotic drug treatment (28). In adolescents especially, weight gain is often the reason given for not complying with their prescribed medication (27).

In addition to elevating blood glucose, some antipsychotic drugs also increase blood lipids, leading to an increased risk of mortality (5, 13, 28). Coronary heart disease is the major cause of death in these psychiatric patients, with major contributions from cigarette smoking and diabetes, as well as obesity (28).

Because of its protective action against these adverse metabolic effects, metformin has been explored as a remedy (5). A number of randomized, controlled trials have shown that metformin, co-administered with antipsychotic drugs, improved glucose regulation, reduced insulin resistance, and induced weight loss or limited weight gain (12, 13, 16, 17, 27, 28). Although metformin is not approved for weight loss, a meta-analysis of these trials concluded that there is “sufficient evidence to recommend commencing metformin in patients with antipsychotic-induced weight gain” (28).

Remaining Youthful

Metformin’s cardioprotective and antitumor effects may account for the improved health and delayed mortality seen in diabetes patients. But there is evidence that metformin’s effects on metabolic and cellular processes also hold in check the degenerative diseases associated with aging (15).

Insulin resistance is a common feature of Alzheimer’s disease (12, 29). Also, epidemiology studies show that patients with a history of type 2 diabetes have an increased risk of subsequent Alzheimer’s disease, and

that metformin lowers the rate of dementia more than other diabetes treatments (15, 29).

In a placebo-controlled crossover study, Alzheimer’s patients experienced improved executive functioning while taking metformin but not during the placebo portion of the study. Metformin also tended to improve learning, memory, and attention (29).

In addition to its other mechanisms of action, metformin, like rapamycin, inhibits mTOR (mammalian target of rapamycin), which many researchers think is a key factor in slowing the aging process (15). At least in nematodes and several rodent strains, mTOR inhibitors extend lifespan. They also improved animals’ performance on various tests of motor and cognitive function (15).



Metformin tablets

Several randomized clinical trials and multiple observational studies have provided evidence that metformin-treated patients exhibit fewer age-related diseases—effects that would not be expected from glucose lowering alone (15). In a retrospective meta-analysis, British researchers found that metformin-treated patients with type 2 diabetes had a longer lifespan than patients taking sulfonylurea (30). This was consistent with clinical experience, which has shown that the sulfonylureas have a detrimental effect on cardiovascular function (22). Most surprising, though, was that the diabetic patients taking metformin also lived longer than matched control subjects who were not diabetic and not taking metformin (30).

Likewise, the UKPDS results showed that metformin-treated diabetic patients exhibited a 42% reduction in

“Metformin also tended to improve learning, memory, and attention”

diabetes-related death and a 36% decrease in all-cause mortality (18). This increased lifespan can partly be attributed to metformin-induced glucose control and cardio-protection. But metformin’s multiple effects on cellular metabolism may also contribute to the longer, healthier lives of these patients.

A number of clinical trials (listed in clinicaltrials.gov) are currently assessing the ability of metformin to delay or reduce aging and degenerative disease in non-diabetic and prediabetic adults.

Increasing the Margin of Safety

In recent years, new classes of anti-diabetic drugs have been introduced. These include GLP-1 agonists, DPP-4 inhibitors, and SGLT-2 inhibitors. Like metformin, they facilitate weight loss and are not hypoglycemic. But they are considered second-line drugs and are often added if blood glucose control is not achieved with metformin alone (14, 16).

Unfortunately, each of them has raised safety concerns. SGLT-2 inhibitors can cause ketoacidosis, kidney damage, and—potentially—limb amputation (14, 16). GLP-1 agonists and DPP-4 inhibitors can cause acute pancreatitis (13, 16). As these agents are prescribed more widely, the list of potential side effects continues to grow, and treatment must be monitored, especially in vulnerable patients such as those with concurrent kidney or heart problems (14).

Conversely, the safety profile of metformin continues to improve. Clinicians have minimized metformin’s most frequent side effect, gastrointestinal symptoms (mostly diarrhea) by adopting a “start low, go slow” strategy when initiating treatment (1, 13, 16). In 2000, an extended-release formulation was introduced, which further improved gastrointestinal tolerability (3, 13).

In addition, accumulating evidence from both widespread prescribing and clinical trials indicated that metformin does not increase the risk of lactic acidosis in patients with mild-to-moderate chronic kidney disease (14, 16). In 2014, the FDA—in a rare move—lifted the restriction on metformin for patients with chronic renal disease, except for those with a

glomerular filtration rate less than 30 ml/min (14, 16). Reinforcing this, a study published in 2019 reported that diabetic patients with reduced kidney function had less risk of major cardiovascular events (e.g., heart attacks and strokes) when taking metformin than those taking sulfonylureas (31).

Shortly before he died in 1997, Jean Sterne told an interviewer, “When I look back on my life, I definitely can say that I’ve served a purpose on Earth” (3). Sterne had resurrected metformin (an influenza and malaria drug) from the reject pile to treat type 2 diabetes and provided evidence that it was safer than phenformin.

But he had no way of knowing the benefits metformin would eventually provide to patients with prediabetes, cardiovascular disease, cancer, obesity, PCOS, cognitive deficits, and degenerative diseases—or, for that matter, metformin’s ever-increasing margin of safety. No modern confirmation (yet) on snake bites, worms, and the plague, but who knows?

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Biosketch:



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

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

Dr. Anderson will share the story of FDA: The Crusade for Pure Drugs

**Don't miss the
June 2020 issue.**



Science Policy News

Meet the 2020 Washington Fellows

This year's Fellows class comprises ten graduate students and postdocs from across the country with sterling credentials and a demonstrated interest in how legislation and policy affects the pharmacology profession and the larger biomedical sciences community. This March, Fellows will arrive in Washington, D.C. to participate in a one-day mini-conference organized by ASPET, where they will receive training in advocacy and hear from guest speakers in the policy profession. The next morning, Fellows will travel to Capitol Hill to meet with legislators and staff to discuss the challenges facing the scientific community. Washington Fellows also receive paid registration to ASPET's Annual Meeting at Experimental Biology 2020 in San Diego, CA, where they will have the opportunity to network with ASPET members and with Fellows from previous years.

Sean Collins

University of Cincinnati



A native of Waynesville, OH, Sean received his bachelor's degree in psychology from Wright State University in Dayton, OH. He went on to subsequently earn his PhD from the department of psychology at the University of Illinois at Urbana-Champaign where he developed a

research interest in the exploration of the cellular mechanisms underlying neurological disease. He is currently conducting his postdoctoral work within the Robson laboratory at the University of Cincinnati where he investigates the molecular mechanisms responsible for the generation of neuropsychiatric disorders following traumatic brain injury. Sean believes that the possession of effective advocacy skills is crucial for the next generation of biomedical researchers and that future, sustained federal investments into biomedical research will aid in alleviating the significant health and economic burdens of the American populace. As a Washington Fellow, Sean hopes to gain experience in communicating with state and national lawmakers about the economic and societal value in supporting basic science research.

Bayli Dean

University of Florida



Bayli is a native of Florida and earned her bachelor's degree in biology from the University of Florida. She found a passion for cancer research and advocacy after her mom was diagnosed with metastatic colon cancer. Bayli became involved in research as a sophomore and

is currently pursuing a PhD in biomedical sciences in the Department of Neurosurgery at the University of Florida. Under the mentorship of Dr. Catherine Flores, she is elucidating the role gliomas have on hematopoietic stem and progenitor cells and their progeny. Outside of the lab, she is involved in patient education initiatives such as the creation of informational handouts on oncofertility as well as a guide to pediatric brain tumors. As an ASPET Washington Fellow, Bayli hopes to combine her experience as a caregiver with the knowledge she's gained during her PhD to effectively advocate for solutions to overcome disparities in the cancer patient population.

Angela Dorigatti

University of Texas Health at San Antonio



Angela is an energetic and forward-thinking biomedical scientist originally from Wisconsin. She completed her bachelor's degree in biology at Texas Tech University in sunny Lubbock, Texas, where she volunteered for healthcare-related organizations, participated in academic

research, and was the Vice-President of Tech Young Progressives, a student-led organization aimed at advancing progressive policies.

Angela's strong interest in longevity and aging studies drew her to one of the top biology of aging programs in the nation. At the University of Texas Health at San Antonio, she is pursuing a PhD in biomedical sciences in the biology of aging discipline under the mentorship of Dr. Veronica Galvan at the Barshop Institute for Longevity and Aging Studies. Her award-winning research is focused on cellular senescence and neurodegeneration in Alzheimer's disease (AD) which currently has no cure nor viable treatments to alter the progression of the disease. Her studies have revealed a potential novel mechanism driving neuroinflammation and neuronal dysfunction in AD, linking pathogenic tau to astrocyte senescence and neurodegeneration. This research may lead to potential therapeutic interventions using senolytics (which selectively remove senescent cells) to slow the progression of AD. Under the ASPET Washington Fellows program, Angela hopes to be an effective advocate for healthcare access and scientific research funding.

Lindsey Galbo

Wake Forest School of Medicine



Lindsey is from northwest Pennsylvania and received her bachelor's degree in biology from Allegheny College. Following graduation, Lindsey worked for four years at Charles River Laboratories as a research biologist and later as a project leader in the toxicology department.

She left Charles River to continue her education in a psychological science master's program at Northern Michigan University under the mentorship of Dr. Adam Prus. Here, Lindsey began to develop her deep passion for understanding the behavioral pharmacology of abused drugs. She completed her master's thesis studying the effects of MAO inhibitors on the rewarding properties of nicotine and graduated in May of 2018. In August of 2018 she enrolled at Wake Forest University Graduate School to pursue her PhD in physiology and pharmacology. She is training under the mentorship of Dr. Paul Czoty and is utilizing a nonhuman primate model of alcohol use disorder to investigate alcohol's effects on cognition, and how cognitive-enhancing drugs may be used as potential pharmacotherapies. Since she came to Wake Forest, Lindsey has been appointed as a T32 fellow by the Wake Forest Translational Alcohol Research Center and has founded the Wake Forest School of Medicine chapter of Students for Sensible Drug Policy – an international organization devoted to lobbying against counter-productive drug policies. As an ASPET fellow, Lindsey hopes to learn how to communicate her extensive experience in laboratory animal science, as well as her knowledge of the behavioral pharmacology of abused drugs, in order to advocate for practical drug policy reform.

Shannon Kozlovich

University of California, San Francisco



Shannon developed an interest in the intersection of science and policy as a tobacco research scientist; tobacco research often translates to regulation and public health policy instead of clinical outcomes. She is now a postdoctoral fellow at the University of California San

Francisco in the Center for Tobacco Control Research and Education where she is studying the impact of nicotine on cancer therapeutics and the differences in nicotine pharmacokinetics between JUUL and conventional cigarettes. Shannon was raised to be an activist by a family of activists and she is looking forward to building a career where she can combine her life experiences and scientific training to decrease the

tobacco use rates in the United States. Shannon was born and raised in San Bernardino County California, then went on to raise her own child in Spokane County Washington. She began college for the first time as the single parent of a third grader intent on becoming a nurse. It was during her pre-nursing courses at Spokane Community College where she discovered her fascination with biological chemistry. After receiving her associate's degree she went on to receive her bachelor's degree in chemistry from Whitworth University and her PhD in pharmaceutical sciences from Washington State University, where she served as the student government director of legislative affairs. As an ASPET fellow, Shannon hopes to learn how to develop talking points and written statements to effectively advocate for the importance of the use of scientific evidence in the development of public health policy and product regulation.

Jerry Madukwe

Yale University



Jerry is a biochemistry graduate of Lee University in Cleveland, Tennessee, where he finished with honors. He holds a master's and PhD degree in biochemistry from the University of Rochester, New York. During his graduate studies in biochemistry, examining the mechanism of activation of proteins—implicated in cancer and cardiovascular disease—downstream of G protein-coupled receptors, and characterizing a novel pharmacological compound for ischemic heart disease, he won multiple awards and honors. Also, Dr. Madukwe was selected to participate in the Sao Paulo School of Advanced Science in Cell Biology Workshop at the University of Sao Paulo in Brazil. Currently, he is a postdoctoral associate at the Cancer Biology Institute, Yale University. Dr. Madukwe's postdoctoral work applies advanced biochemical and biophysical approaches to study the interactions of critical receptor tyrosine kinase proteins implicated in the development of cancer and cardiovascular disease, with a view to develop novel pharmacologic therapies to augment current treatment strategies. In addition, Dr. Madukwe has

been involved in science outreach programs in his local community here in the United States and in West Africa, to attract young students to a career in the sciences. As an ASPET Washington Fellow, Dr. Madukwe wants to use his training to advocate for increased diversity in science. He is also interested in advocating for policies that build the science research capacity of underserved communities and promote the application of science for economic development in disadvantaged communities.

Anastasia Robinson

Howard University



Anastasia was born and raised on the twin island Republic of Trinidad and Tobago. She received her bachelor of science degree in biology from Howard University. During her undergraduate tenure, she was introduced briefly to drug discovery and development.

During this time, she also began to ponder on how drugs worked in the body and how they interacted with each other. After doing some research on her own she understood that she was interested in pharmacokinetics and pharmacodynamics in the field of pharmacology. After receiving her degree, Anastasia returned to Trinidad and Tobago where she worked in a public hospital as a laboratory assistant primarily in the microbiology lab. Her aspiration not forgotten, she returned to Howard University where she is currently pursuing a PhD in pharmacology under the mentorship of Dr. Robert Copeland. Her research is focused on the development of a novel treatment of triple negative breast cancer utilizing a 1,4 chloronaphthoquinone analog as well as *Fagara xanthoxyloides* and *Pseudocedrela kotschyj*, crude extracts of plants which are native to West Africa. She hopes to enhance the skills taught to her during this fellowship to become an advocate for increased biomedical funding and to encourage future scientists on the importance of advocating for themselves at the state level.

Aratrika Saha

LSU Health Sciences Center



Born and raised in the city of Kolkata in India, Aratrika graduated in July 2017 from Manipal Institute of Technology, Manipal University, India with her bachelor of technology degree in engineering, majoring in biotechnology. She then moved to New Orleans in August 2017 to pursue a

PhD at the Louisiana State University Health Sciences Center in the department of pharmacology and experimental therapeutics. She is currently in her third year and has been working under the guidance of Dr. Wayne L. Backes. Her research focuses on cytochrome P450s and their interactions. Cytochrome P450s are heme containing enzymes that interact with limited levels of NADPH-cytochrome P450 reductase (POR) to oxidize endogenous and exogenous compounds and convert them into water soluble products. However, they are also capable of forming homomeric and heteromeric complexes that alter the metabolic activity of the P450s involved in these complexes. Aratrika is on the path to identifying the regions of these proteins that are responsible for these complex formations and characterize new complex formations. Additionally, she has been involved with the International Students Association from 2017. She was a founding member and has served as the vice president of the founding committee and then went on to serve as the president in the following year. As an ASPET Washington Fellow, Aratrika hopes to gain a better understanding of the world of policymaking at the state and federal level and to advocate for interdisciplinary and collaborative research between the world of academia and industry.

Christopher Szlenk

Washington State University



Chris was born and raised in Birmingham, Alabama by Polish immigrants. He received his bachelor of science in chemistry from the University of Alabama at Birmingham (UAB). During his time at UAB, Chris became interested in policy from his sociology class. He decided to write a report

on the United States prison system and the unusual number of minorities in jail for non-violent crimes. This opened his eyes to how evidence-based policy could address fixing issues at the federal level. At the same time, he fell in love with organic chemistry and joined a synthesis lab to supplement his fascination with the subject. After he finished his undergraduate degree, he worked for a short time in a skin pathology lab. He quickly realized he needed more mental stimulation and applied to the pharmaceutical sciences PhD program at Washington State University in Spokane. Under the mentorship of Dr. Senthil Natesan, his research is focused on utilizing the membrane in a specific manner to design novel medication. Chris' main project focuses on molecular dynamics simulations of commonly used asthma medication, and also includes designing a biased, allosteric modulator for the mu-opioid receptor to limit side effects. During graduate school, Chris became interested in advocacy, drug policy, and getting involved with the community in Spokane. He joined committees on campus to improve life for students, finished training to become a Dancesafe volunteer, and joined the Health Sciences Student Advocacy Association. As an ASPET fellow, he hopes to learn how to effectively promote evidence-based policy to legislators and expand his understanding of how the entire political process works. Additionally, he wants to begin addressing distrust of science by communicating effectively and listening to what more scientists can do to improve the public's trust.

Melissa Wilkinson

Rutgers Environmental and Occupational Health Sciences Institute



Born and raised in Argyle, New York, Melissa graduated from Nazareth College of Rochester with honors with her bachelor of science degree in biology and toxicology in 2017. While at Nazareth she cultivated her love for science through numerous research opportunities. She

also engaged in her campus community as a varsity swimmer and student senator in the Undergraduate Association. Following her undergraduate education, Melissa moved to New Brunswick, New Jersey, to

pursue her PhD in toxicology at Rutgers University in the joint graduate program in toxicology. Under the mentorship of Dr. Andrew Gow, her research is focused on the use of nitrated fatty acids as an anti-inflammatory agent in acute lung injury and interstitial lung diseases. Melissa continues to stay involved in her campus community through her role as vice president of the Rutgers Association of Toxicology Students and as coordinator of the Toxicology, Health, and Environmental Disease High School Summer Program. As an ASPET Washington Fellow, Melissa hopes to advocate for the importance of STEM education, especially in rural communities like her own, and hopes to utilize her own experiences to demonstrate the importance of funding for biomedical research and education programs.

CSPT 2020 Annual Scientific Meeting

New Horizons in Pharmacology

Ottawa, Ontario

June 10 - 12, 2020

Scientific Sessions

- Systems Pharmacology
- Stress and Disease
- Cancer Pharmacology
- Membrane Proteins and Druggability
- Practical Pharmacology
- Summit on High Cost Drugs in Child Health Care

Featuring

- Welcome Reception
- Canadian Pharmacology Trainee Research Competition
- Presidential Poster Competition
- Annual Award Presentations
- Pharmacology Education Symposium
- Banquet and Social Events

Abstract & Travel Awards Deadline:
March 15, 2020



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Education News

ASPET Mentoring Network Enters its Fifth Year at EB 2020

The *ASPET Mentoring Network: Coaching for Career Development* program was established by the BIG IDEAS initiative in 2015 to promote diversity in the scientific workforce and within ASPET through career coaching. This program follows a coaching model that matches established scientists with cohorts of young scientists to help guide them in their professional development and career advancement. The activities of the program are designed to complement, but not replace, scientific mentors at participants' home institutions. We are pleased to launch the fifth iteration of the *ASPET Mentoring Network* at EB 2020 with in-person programming on Friday, April 3 and Saturday, April 4, followed by virtual interactions throughout the year. Activities at EB 2020 will encourage relationship building across coaching groups, near-peer mentoring between graduate students and postdoctoral scientists, career planning, and networking. The program will lay the groundwork for the rest of the year's activities, with a special emphasis on deconstructing success skills for a variety of career paths.

The program has adapted a coaching model developed by Rick McGee and his colleagues at Northwestern University. Coaches for 2020 include Ashley Guillory (University of Texas Medical Branch), Mike Jarvis (AbbVie), Sandhya Kortagere (Drexel University College of Medicine), and Becky Roof (National Institutes of Health). The program will be facilitated this year by three former coaches and current members of the Mentoring and Career Development Committee: Jan Clark, Susan Ingram, and Dave Jewett. We congratulate the following young scientists who were chosen to participate in the fifth year of the *ASPET Mentoring Network*:



Armina Abbasi, Washington State University
 Faisal Alamri, Texas Tech University Health Sciences Center
 Pravita Balijepalli, Washington State University
 Vrushank Dharmesh Bhatt, Rutgers University
 Indiwari Gopallawa, University of Pennsylvania
 Mahamudul Haque, Washington State University
 Mahmud Hasan, Duquesne University
 Moriah Jacobson, Uniformed Services University
 Rogers Loishooki Laisser, Universidad Autonoma de San Luis Potosi
 Kyle B. LaPenna, Louisiana State University Health Sciences Center
 Yuening Liu, Washington State University
 Maria Lopez Llegus, Medical Science Campus, University of Puerto Rico
 Charlotte Magee, University of Utah
 Jessica Murray, University of North Carolina at Chapel Hill

Jia Nong, University of Pennsylvania
 Saeideh Nozohouri, Texas Tech University Health
 Sciences Center
 Keith Olson, University of Michigan
 Madeline Pantoni, University of California San Diego
 Qianman Peng, Auburn University

Casey Radice, Temple University
 Md Rahatullah Razan, University of the Pacific
 Adaku C. Ume, Wright State University
 Alicja Urbaniak, University of Arkansas for
 Medical Sciences
 Menbere Y. Wendimu, University of Georgia

Updates to the Patient-Oriented Problem-Solving (POPS) Exercises in Pharmacology

Submitted by Mark A. Simmons

The POPS system in pharmacology is a series of interactive exercises consisting of simulations of clinical problems. The exercises have been designed to be used in small group meeting sessions to supplement the teaching of pharmacology to first- or second-year students in the health professions.

New and revised POPS exercises are now available on the ASPET website. The recent addition is *Drug Therapeutics of Elderly Patients* by Laurel Gorman and Mariana Dangiolo of the University of Central Florida College of Medicine. The revised exercise is *Treatment of Essential Hypertension*, which has been updated to reflect the most recent guidelines for the treatment of high blood pressure.

The revised exercises are available on the ASPET website at <http://bit.ly/2Sgl7PU>. Faculty who are ASPET members can download the appropriate files along with an Instructor's Manual which provides guidance in implementing the exercises.

Currently Available POPS Exercises

Title	Authors
<i>Antimicrobial Chemotherapy</i>	Claudine El-Beyrouty, Brian Roslund, and Bhavik Shah
<i>Cancer Chemotherapy</i>	Dennis Peffley
<i>Chemotherapeutic Challenges</i>	Katharina Brandl, Sarah Lerchenfeldt, and Amit K. Tiwari
<i>Complications of Analgesic Therapy</i>	Mark J. Hernandez and Drew Zimmer
<i>Drug Therapeutics of Elderly Patients</i>	A. Laurel Gorman and Mariana B. Dangiolo
<i>Drug Treatment of Heart Failure</i>	Rob Rockhold
<i>Pharmacokinetics Applied to the Treatment of Asthma</i>	David C. McMillan
<i>Therapy of Diabetes Mellitus</i>	Jayne S. Reuben
<i>Treatment of Cardiac Arrhythmias</i>	June Yun
<i>Treatment of Essential Hypertension</i>	Mark A. Simmons
<i>Treatment of Psychosis</i>	Gagani Athauda, Autumn Ning, and Timothy Holley



Journals News

New Manuscript System Now Live



ASPET's wholly owned journals are now accepting new manuscripts through eJournal Press (eJP) at

- dmd.msubmit.net
- jpet.msubmit.net
- molpharm.msubmit.net
- pharmrev.msubmit.net

The new system went live at the end of February. eJP will be familiar to many because it is used by the journals of the Society for Neuroscience, the American Physiological Society, the American Society for Cell Biology, Nature Publishing Group, the American Society for Microbiology, and many others.

The new system offers several advantages that will be immediately evident to users:

- Easier, intuitive navigation
- Autopopulated contact information fields when submitting a manuscript (for those registered with the system)
- Streamlined file uploading (eliminating problems many experienced in the old system)
- A new presubmission process allows authors to upload an abstract and significance statement to ask if a paper is within the journal's scope
- Move among the four ASPET submission and peer review sites without having to log into each one separately
- Rejected manuscripts may be transferred to another ASPET journal

- Online forms using electronic signatures have replaced PDF forms
- Manuscript submission fees are paid by credit card through a secure PayPal site
- Better communication tools for authors, editors, reviewers, and staff that eliminate the need to work outside the system

The PDF reprint order and page charge form previously sent with page proofs has also been replaced. Reprints can be ordered online through our compositor's website (a link is sent with page proofs). Page charges are billed via a personalized link emailed to the corresponding author and can be paid online. We still accept checks and wire transfers for page charges.

Manuscripts that were submitted prior to the launch of eJP will continue through the peer review process, including revisions, in the old system. All new submissions must be made to the eJP sites.

The contact information and expertise terms of everyone who used the system from 2015 through 2019 were exported to the new system. All users are encouraged to check their expertise terms to make sure they are current. Each journal formerly had its own expertise term list. Those have been merged into one list shared by the four journals, so users may find terms that were not available to them in the old system.

ASPET staff are ready to help should you have any questions about the new system. The office is open from 8:00 am through 5:00 pm EST/EDT, Monday through Friday. Send an email to journals@aspet.org or call 301-634-7060.

New Author Guidelines for Data Display and Reporting Data Analysis and Statistical Methods

At the beginning of the year, ASPET implemented new author guidelines for displaying data and reporting data analysis and statistical methods. The guidelines apply to *Drug Metabolism and Disposition*, *The Journal of Pharmacology and Experimental Therapeutics*, and *Molecular Pharmacology*. The Instructions to Authors for these journals have been revised accordingly. The goal of these changes is for authors to provide greater granularity in the description of what has been done and found,

and they continue ASPET's efforts to improve the robustness and transparency of scientific reporting. The changes are summarized and explained in a commentary by Martin Michel, TJ Murphy, Harvey Motulsky published in the three journals. The commentary is freely accessible to all at:

<http://dmd.aspetjournals.org/content/48/1/64>

<http://jpet.aspetjournals.org/content/372/1/136>

<http://molpharm.aspetjournals.org/content/97/1/49>

New *DMD* Editorial Board Members

The Board of Publications Trustees recently approved Dr. Huichang (Nancy) Bi, Dr. José J.G. Marín, and Dr. Brooke Rock to serve on the *Drug Metabolism and Disposition* Editorial Board.

Dr. Bi is professor and associate dean at the School of Pharmaceutical Sciences, Sun Yat-sen University, Guangzhou, China. Her areas of research include metabolism-based regulation of xenobiotics (natural products) and endogenous molecules and their effects on diseases and clinical regimens. She also works on drug-disease interactions mediated by nuclear receptors, metabolizing enzymes, and transporters. She has reviewed for 14 journals and serves on the editorial board of 7 journals.

Dr. Marín is professor and department head of physiology and pharmacology at the University of Salamanca, Spain, positions he has held since 1998. He also holds the position of head of the Laboratory of Experimental Hepatology and Drug Targeting, a multi-site research program that investigates various aspects of liver function and pharmacology. He has



Huichang Bi



José J.G. Marín



Brooke Rock

published over 270 articles in books and journals and brings extensive editorial board experience to *DMD*. Dr. Marín has been an ASPET member since 2003.

Dr. Rock is director in the Department of Pharmacokinetics, Drug Metabolism, and Translational Medicine at Amgen. She manages over 30 scientists in preclinical work for novel therapeutics, including fusion proteins, RNAi, monoclonal antibodies, and bispecific antibodies. Dr. Rock has been an ASPET member since 2005 and served as a co-guest editor for the *DMD* October 2019 special section on pharmacokinetic and drug metabolism properties on novel therapeutics modalities.

Recently Published Special Section on New Opportunities in Targeting Wnt Signaling

Wnt signaling was originally identified as a mediator of carcinogenesis. The *Molecular Pharmacology* February issue includes three review articles that highlight molecular mechanisms of activation, expand roles in cancer to drug resistance, and cover function in cardiomyocyte development. Two of the three are

open access articles; the third is freely accessible to all through April 15.

ASPET members enjoy access to all journal content as a member benefit. Contact info@aspet.org if you need help using your member subscription.

Highlighted Trainee Authors

Congratulations to the latest Highlighted Trainee Authors selected for *Drug Metabolism and Disposition*, *The Journal of Pharmacology and Experimental Therapeutics*, and *Molecular Pharmacology*:

DMD

- Xinwen Wang (University of Michigan, Ann Arbor) – January 2020 issue
- Aaron Bart (University of Michigan, Ann Arbor) – February 2020 issue



Xinwen Wang



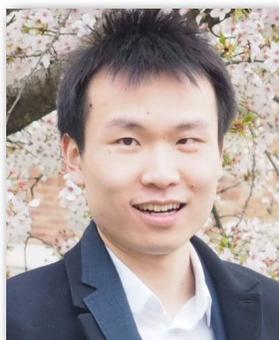
Aaron Bart

JPET

- Rana A. Alaaeddine (American University of Beirut, Lebanon) – December 2019 issue
- Weize Huang (University of Washington) – January 2020 issue
- Chao Zhang (Inner Mongolia Agricultural University, China) – February 2020 issue



Rana A. Alaaeddine



Weize Huang



Chao Zhang

Molecular Pharmacology

- Magdalena Scharf (Philipps-University, Marburg, Germany) – December 2019 issue
- Pawel Kozielowicz (Karolinska Institute, Sweden) – January 2020 issue

A concise description of their areas of research, current projects, the anticipated impact of their work, and what they enjoy when not in the lab is online at <https://bit.ly/2yX1YeH>. We congratulate all of them for being selected.



Magdalena Scharf



Pawel Kozielowicz



Membership News

New Members

REGULAR MEMBERS

- Alexander AgoulNIK, Florida International Univ HWCOM
- Ahmed Alafnan, Univ of Hail, Saudi Arabia
- Samson Amos, Cedarville Univ, OH
- Guohua An, Univ of Iowa
- Sharyn D. Baker, Ohio State Univ
- Sulayman T. Balogun, Univ of Maiduguri, Nigeria
- Debasish Basak, Larkin Univ, FL
- Abhinav Bhushan, Illinois Inst of Technology
- Huichang Bi, Sun Yat-sen Univ, China
- William T. Birdsong, Univ of Michigan
- Ruben Bonilla Guerrero, Admera Health, CA
- Maureen Bunger, NC
- Mathilde J. Busson, Bio-Techne, UK
- Timothy C. Chambers, Univ of Arkansas for Med Sciences
- Qian Chen, Philadelphia Coll of Osteopathic Med, PA
- Jae Won Choi, Yonsei Univ/Wonju Col of Med, AL
- Robert L. Copeland, Jr, Howard Univ, DC
- Yamixa Delgado, San Juan Bautista Sch of Med, PR
- Michael R. Dores, Hofstra Univ, NY
- Mark J. Ferris, Wake Forest Sch of Med, NC
- Houda Filali, Fac of Med & Pharmacy of Casablanca, Morocco
- Debbie P. Fischer, Univ of Manchester, UK
- Victor Garcia, New York Med Coll, NY
- Michael Greff, KGK Science, Canada
- Maged M. Harraz, Johns Hopkins Univ, MD
- Raquibul Hasan, Mercer Univ, GA
- Jennifer Herington, Vanderbilt Univ Med Center, TN
- Florian Holsboer, HMNC Holding GmbH, Germany
- Thomas E. Hughes, Montana Molecular
- Yaritza Inostroza-Nieves, San Juan Bautista Sch of Med, PR
- Daniel G. Isom, Univ of Miami Miller Sch of Med, FL
- Henry James, Arabian Gulf Univ, Bahrain
- Seungwoo Kang, Mayo Clinic Coll of Med, MN
- Thomas Kukar, Emory Univ, GA
- Sutharinee Likitnukul, Mahidol Univ, Thailand
- Shijie Liu, Univ of Arkansas for MedSciences
- Braden Lobingier, Oregon Health Sciences Univ
- Sarah MacInnes, MyoKardia Inc, CA
- Martin J. Mangino, Virginia Commonwealth Univ Sch of Med
- Meredith R. McGuire, Johns Hopkins Univ Sch of Med, MD
- Jeremy C. McIntyre, Univ of Florida
- Conor McMahon, Harvard Medical Sch, MA
- Matthew A. Nystoriak, Univ of Louisville, KY
- Samuel Obeng, Univ of Florida
- Edward Ofori, Chicago State Univ, IL
- Gyu Hwan Park, Kyungpook National Univ, South Korea
- Valentin Pavlov, The Feinstein Insts for Med Res, NY
- Sandeepraj Pusalkar, Takeda Pharmaceuticals Intl Co., MA
- Renee D. Read, Emory Univ Sch of Med, GA
- Carollina Restini, Michigan State Univ
- Andrew Rowland, Flinders Univ of South Australia
- Benjamin D. Sachs, Villanova Univ, PA
- Eduard Sergienko, Sanford Burnham Prebys Med Discovery Inst, CA
- Mehrdad Shamloo, Stanford Univ, CA
- Rob Slack, Galecto Biotech AB, UK
- Rachel Sterne-Marr, Siena College, NY
- Jesus Tejero, Univ of Pittsburgh, PA
- Jetze Tepe, Michigan State Univ
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- David C. Thompson, Univ of Colorado Denver
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In Sympathy

ASPET notes with sympathy the passing of the following members:

Julian L. Ambrus
Edward J. Barbieri
Craig Beeson
Jeffrey L. Blumer
Edward A. Carr, Jr.
Ronald S. Duman
Arnold J. Eisenfeld

Ervin G. Erdos
Robert J. Ertel
Alan P. Poland
Marcus M. Reidenberg
Casey P. Robinson
Ernst E. Seifen
Henry W. Strobel

Have Stole, Will Travel: A Tribute to Henry W. Strobel, Jr.

Submitted by Patrick J. Murphy, Eric T. Williams, and David R. Nelson



We are sad to note the passing of our friend, mentor, teacher, and collaborator Henry Willis Strobel, Jr., who passed peacefully in his sleep on the night of November 22, 2019, at the age of 76 in Houston, Texas. He was born on February 19, 1943, in Charleston,

South Carolina, to parents Henry and Madge Strobel.

Henry earned his Bachelor of Science degree from the College of Charleston in 1964, then went on to earn his Doctor of Philosophy in biochemistry with J. Logan Irvin from the University of North Carolina at Chapel Hill in 1969. In the course of a postdoctoral fellowship with Minor "Jud" Coon at the University of Michigan, Henry began a lifelong interest in the role of cytochromes P450 in metabolism. In 1972, he joined the University of Texas Medical School at Houston as a founding faculty member, was granted full professorship in 1982, then professor emeritus in 2014.

Among his administrative duties were assistant dean for student affairs, associate dean for faculty affairs, and associate dean for alumni affairs.

Henry's research contributions span the period of history including the successful separation of the three components of the P450 system in Coon's lab by Anthony Lu. Henry's research led to the identification of the heat stable factor of this system as phosphatidyl choline. He pursued many aspects of P450 in his later research including the isolation of NADPH-cytochrome P450 reductase from rat liver, colonic metabolism of carcinogens, effects of aging and hormones on metabolism, brain metabolism especially by the CYP4F enzymes, metabolism of drugs in tumors, and numerous efforts in the expression of P450s. He had a great interest in nonhepatic forms of P450 especially those in the gastrointestinal tract and brain. His list of over 150 peer-reviewed publications and 41 book chapters testifies to his broad scientific interests and capabilities.

"I joined Henry's lab as a postdoc in 1985, about the time sequencing of P450s was beginning. I was very interested in the sequences and Henry encouraged that. We had an eight-foot scroll on the wall outside the lab made of graph paper with all the known P450 sequences (about three dozen) written in pencil

and aligned by hand. Every place in the alignment with known topology information was color coded and annotated. Eventually, this resulted in three publications, one on cytochrome P450 evolution and two on the structure of P450s and their orientation in the membrane.” (David R. Nelson)

Henry was honored with many distinguished awards, especially those related to his teaching prowess. The John P. McGovern Outstanding Teacher Award (2002), the TIAA-CREF Distinguished Medical Educator Award (2008), and the University of Texas System Regents’ Outstanding Teaching Award (2012) were among the many accolades he received in the course of his tenure. He mentored 29 PhD students and 21 postdocs.

“Nobody, in the history of our incredible institution, lived the character we all hope to aspire to more than Henry. He was an energetic educator, a steady mentor, a thoughtful leader, a patient listener, a meticulous scientist, and, above all, a remarkable and compassionate friend who taught all those around him how important *relationships* were.” (Matt Hartling, MD; <https://bit.ly/2ux0B5E>)

Many scientists outside of the university system met Henry through his frequent attendance at the Gordon Research Conference on Drug Metabolism. He was chair of the conference in 1998 and continued to attend frequently as his schedule permitted. When the conference decided to have a regular session dedicated to graduate and post-doctoral students, he was a natural discussion leader. As he interviewed, prepared, and instructed the students, one could see all the teaching attributes that he brought to bear to make the students’ presentations a memorable event for each individual. The nervousness involved in a debut presentation was washed away by his calm reassurance, keen interest, and shared skill set. He always introduced these sessions with one of his off-the-wall stories that frequently ended in a forgettable pun. As the groans wore down, audience and

speakers alike were in a more receptive frame of mind for the evening’s presentations.

“Henry always encouraged us to go to the scientific meetings, present our latest findings, and get feedback from experts in the field. At meetings and symposia, he went out of his way to introduce his students to other leading scientists. Under Henry’s guidance, I was able to interact directly and form collaborations with major researchers throughout the world.” (Auinash Kalsotra, PhD)

Another of Henry’s outside interests (passions) was his annual trip to China. For 30 years, he directed an elective course wherein he chaperoned medical students on a tour of Chinese medicine taught and practiced.

While on the faculty in Houston, he was ordained as an Episcopalian priest and served at Palmer Memorial Episcopal Church. He performed marriage ceremonies for many students as well as baptizing many of their children. A common saying of his was “have stole, will travel.”

“Sometime between 1977 and 1980, I was attending a meeting in Houston. Under circumstances I cannot recall, just the two of us wound up having a quiet evening dinner together, and we chatted about science and life. It turned out that we had a lot in common — biochemistry and religion — but I was astonished to find out that he was an academic scientist, and an Episcopalian priest! I told Henry of my plans one day to write a book ‘God as revealed by science and evolution’ (of which, after becoming emeritus professor, I am in the early writing stage). Henry and I were in complete agreement that there is absolutely no contradiction to being both ‘a scientist’ and a ‘firm believer in God.’” (Dan Nebert, MD)

Henry was preceded in death by his parents, daughter Karen Rebecca, and other extended family members. He is survived by his children, Nathaniel Henry Pevey Strobel and Elizabeth Josephine Manigault Fulton; brother, James Madison Strobel; sister, Madgie Ruth Wiggins; and their respective families.

A Special Thanks to Our Member-Get-A-Member Sponsors

We would like to thank all the participants who made the 2019-2020 Member-Get-A-Member program possible. We welcomed 32 new members through the program this past season. The next Member-Get-A-Member program will open Fall 2020, but we encourage you to support ASPET all year long. ASPET is reliant on members to help contribute to the growth and sustainability of ASPET. By telling your friends, colleagues, and students about ASPET, you are not only supporting ASPET to provide more resources and programs for members, but you are also helping us to achieve greater recognition for the field of pharmacology and a louder voice with policy makers.

The next time you attend a meeting or talk to your students or colleagues, be sure to mention ASPET membership and encourage them to join. For more information about the benefits of ASPET please visit: <https://www.aspet.org/aspnet/membership-community/aspnet-member-benefits>.



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Members in the News

Achievements, Awards, Promotions, and Scientific Breakthroughs

James Barrett, PhD & Martin Michel, MD

Drexel Univ College of Medicine, Johannes Gutenberg Univ



James Barrett



Martin Michel

The *Handbook of Experimental Pharmacology* celebrated its 100th anniversary in 2019 with the publication of a "Centennial Volume" entitled "Concepts and Principles in Pharmacology: 100 years of the Handbook of Experimental Pharmacology." The volume, edited by ASPET members James E. Barrett and Martin C. Michel, in collaboration with their colleague Clive Page, president-elect of the British Pharmacological Society and professor at Kings College London, continues the tradition of the founder of the "Handbuch der Experimentellen Pharmakologie," Arthur

Heffter. Over the 100 years since its inception, the *Handbook* has captured the continuing advances and dynamic nature of the discipline of pharmacology, celebrating and disseminating new discoveries in basic understanding of mechanisms of drug action to the delivery of new, safe and effective therapeutics. The *Handbook* is one of the most definitive and influential textbooks in pharmacology, providing critical and comprehensive discussions of the most significant areas of pharmacological research, written by leading international authorities. The Centennial

Volume captures the progress of pharmacology, from its inception in the German pharmacology institutes in the mid-19th century to the current status along with an anticipation of future progress.

Dr. Barrett, past president of ASPET, is professor emeritus and former chair of the department of pharmacology and physiology at Drexel University College of Medicine. He is now professor at the Center for Substance Abuse Research, Lewis Katz School of Medicine at Temple University. He has been a member of ASPET since 1978 and is a member of the **Division for Behavioral Pharmacology**.

Dr. Michel is professor of pharmacology at the Johannes Gutenberg University in Mainz, Germany, and former chair of the department of pharmacology and pharmacotherapy at the University of Amsterdam, Netherlands. He has been a member of ASPET since 1990 and is a member of the **Divisions for Molecular Pharmacology, Cardiovascular Pharmacology, and Translational and Clinical Pharmacology**.

Mohamed Ghonim, PhD

St. Jude Children's Research Hospital



Dr. Mohamed Ghonim is a proud member of ASPET in the Division for Translational and Clinical Pharmacology. He is also currently serving as a member of the Young Scientists Committee. Dr. Ghonim joined Louisiana State University (LSU) Health Sciences Center for research

training and was awarded postdoctoral fellowships from both the American Society of Immunology (AAI) in 2017 and the American Heart Association (AHA)

in 2019. Dr. Ghonim is pleased to announce his new position at St. Jude Children's Research Hospital as a research associate.

Dr. Ghonim has been an ASPET member since 2012 and is a member of the **Divisions for Drug Discovery and Development, Cancer Pharmacology, Cardiovascular Pharmacology, Drug Metabolism and Disposition, Molecular Pharmacology, Pharmacology Education, Toxicology, and Translational and Clinical Pharmacology.**

Jeffrey Herz, PhD

Algomedix, Inc.



Jeffrey Herz, PhD, is the founder and president of Algomedix, a biotech company developing first-in-class non-opioid pain medicines. Dr. Herz was awarded 2 patents (US and Japan) in 2019 that describe novel antagonists of TRPA1, which is expressed on sensory neurons in

the peripheral nervous system. TRPA1 mediates the activation of nociceptive neurons at sites of inflammation and injury, sending pain signals to the brain. The developed compounds block pain signals at their source and produce long lasting analgesic effects in multiple models of chronic pain, including neuropathic pain and osteoarthritis, with no adverse effects. Prior to founding Algomedix, Dr. Herz was the founding scientist and director of discovery research and director of pharmacology at Omeros where he led drug discovery programs that led to 3 late-stage clinical trials and one FDA approved therapeutic. Dr. Herz received his PhD in physiology and anatomy from UC Berkeley. He then completed a NIH post-doctoral fellowship and American Heart Fellowship in the department of pharmacology at the medical school of UC San Diego. He served on the faculty at the University of Texas at Austin before entering the biotechnology industry. He is the inventor of over 150 patents in multiple therapeutic areas.

Dr. Herz has been a member of ASPET since 2003 and is a member of the **Divisions for Drug Discovery and Development, Molecular Pharmacology, Neuropharmacology, and Translational and Clinical Pharmacology.**

Cameron M. Kieffer, PhD

U.S. Department of State's Bureau of International Narcotics and Law Enforcement



Cameron M. Kieffer, PhD joined the 2019-2020 class of executive branch AAAS Science and Technology Policy Fellows in Washington, DC. He will be serving in the U.S. Department of State's Bureau of International Narcotics and Law Enforcement. As a Health

and Science Adviser, he will be applying evidence-based, data-focused approaches to the department's international drug demand reduction programs.

For the past year Cameron has worked at the pharmaceutical company Sanofi as a PhRMA Foundation Regulatory Science and Policy Fellow. In that capacity he evaluated FDA regulations on several topics including phase IV diabetes trial requirements and patient-focused drug development. He received his doctorate in pharmacology from Creighton University in Omaha, Nebraska in 2018 where he was advised by Dr. Peter W. Abel. He is also an alumnus of the ASPET Mentoring Network.

Dr. Kieffer has been a member of ASPET since 2013 and is a member of the **Divisions for Translational and Clinical Pharmacology, Cardiovascular Pharmacology, and Drug Discovery.**

Felix Kim, PhD

Thomas Jefferson University



Dr. Felix J. Kim, associate professor in the department of cancer biology at Thomas Jefferson University and member of the Sidney Kimmel Cancer Center was awarded an R01 from the National Cancer Institute. His grant titled "Multifunctional Regulation of Prostate Cancer

Metabolism by Sigma1 Modulators" will investigate the metabolic pathways and signaling crosstalk engaged in advanced prostate cancer, and evaluate how the

pharmacological modulation of Sigma1 may be used to disrupt cancer metabolism and restrict tumor adaptive mechanisms. Dr. Kim is an active member of ASPET, and the current chair of the Division for Translational and Clinical Pharmacology.

Dr. Kim has been a member of ASPET since 2009 and is a member of the **Divisions for Translational and Clinical Pharmacology, Cancer Pharmacology, Drug Discovery and Development, and Molecular Pharmacology.**

Samba Reddy, PhD

Texas A&M University College of Medicine



Samba Reddy, PhD, RPh, professor at the Texas A&M University College of Medicine, was recognized with the Lifetime Achievement Award at the 13th annual Association of Biotechnology and Pharmacy (ABAP) & International Biotechnology Conference on Dec. 20, 2019, in Vijayawada, India. Dr. Reddy received this honor in recognition of his scientific research and service to the pharmacy profession. His work over the past two decades has laid the groundwork for understanding neurobiology of neurosteroids in brain disorders, especially epilepsy. His research contributed to the development of two medicines for brain disorders (brexanolone and ganaxolone).

He has made a seminal contribution to epilepsy and elucidated the pivotal role of neurosteroids in the brain, leading to the discovery of neurosteroid

replacement therapy for perimenstrual epilepsy and post-partum depression. This therapy consists of administering a synthetic neurosteroid during a period of decreased levels or deficiency state to alleviate seizures or fix a mood disorder, such as catamenial epilepsy, premenstrual syndrome, and post-partum depression. He has discovered the neuro-code as supporting base mechanism for this therapy. This work has had a profound impact in the pharmacy field and has benefitted thousands of patients worldwide.

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

Muhammad Erfan Uddin, MS

The Ohio State University



Muhammad Erfan Uddin, currently a pharmaceuticals PhD student at The Ohio State University, was recently awarded a prestigious American Heart Association (AHA) Predoctoral Fellowship (2020-2021). Mr. Uddin is a member of the Division for Translational and Clinical

Pharmacology, and completed his pharmacy (BS) degree at International Islamic University Chittagong, Bangladesh, and his MS in biological sciences at Youngstown State University. The focus of his pre-doctoral work is elucidating the role of organic cation transporters in the renal elimination of dofetilide, and the underline mechanism of dofetilide-induced proarrhythmia, under the mentorship of Dr. Alex Sparreboom.

Mr. Uddin has been a member of ASPET since 2019 and is a member of the **Divisions for Drug Metabolism and Development, Cardiovascular Pharmacology, Toxicology, and Translational and Clinical Pharmacology.**



Meeting News

National Directors of Graduate Studies in Pharmacology and Physiology (NDOGS) Meeting: June 10-12, 2020



2020 NDOGS MEETING
NATIONAL DIRECTORS OF GRADUATE
STUDIES IN PHARMACOLOGY AND
PHYSIOLOGY MEETING

VANDERBILT UNIVERSITY
NASHVILLE, TN
JUNE 10-12, 2020

The National Directors of Graduate Studies in Pharmacology and Physiology (NDOGS) meeting is the forum for exchanging information among those training graduate students in the disciplines of pharmacology and physiology. As a collaboration between the American Society for Pharmacology and Experimental Therapeutics (ASPET) and the American Physiological Society (APS), the meeting has broad participation among colleagues with a common cause and similar challenges.

NDOGS addresses critical issues related to training pharmacologists and physiologists and has been planned in response to a perceived and real decline in training programs in these disciplines. Since the initial meeting in 2005, the goals have included identifying common problems and opportunities that face PhD training programs in pharmacology and physiology

and how best to provide effective training in these disciplines that are key to translational research. The target audience for this meeting is directors of graduate training programs in pharmacology, physiology, or other related biomedical sciences. This meeting will provide a unique opportunity for these scientists to exchange information and to interact with leaders in industry, government, and academia who help shape these disciplines. A continuing dialogue among directors of training programs and other scientists with an interest in PhD training is identified as a desired major outcome.

The meeting will take place at Vanderbilt University in Nashville, TN, June 10-12, 2020. Please refer to the meeting webpage at <https://bit.ly/2PLq5nl> for information on registration, housing, and travel.

ASPET Participates in the Annual British Pharmacological Society Meeting: Pharmacology 2019

ASPET participated as a guest society at the annual British Pharmacological Society (BPS) meeting, *Pharmacology 2019*, which took place in Edinburgh, Scotland during December 14-17. This was the first annual BPS meeting that took place outside of London in a long time, and Edinburgh provided an attractive venue. Among the over 1,000 attendees, a number of ASPET members and Council members were in attendance as invited speakers, poster presenters, and attendees. To encourage our young scientists to attend this meeting, ASPET provided travel awards through a competitive application process.

The annual prize giving dinner, attended by over 300 guests, was held in the Grand Gallery and Atrium of the Museum of Scotland. An outstanding scientific program included a joint ASPET-BPS symposium sponsored by *Pharmacology Research and Perspectives (PR&P)* and chaired by ASPET member Mike Jarvis (*PR&P* Deputy Editor) and Andy Lawrence (*PR&P* Editor-in-Chief)

The identification and application of genomic information to the prediction, diagnosis, and treatment of specific human diseases has been variously referred to as precision, personalized, stratified, or targeted medicine. The complete sequencing of the human genome at the turn of the century led many biomedical researchers and clinicians to expect that genetic-based diagnosis and appropriately targeted therapies would rapidly become the standard of care for many diseases. Over the last two decades improvements in pharmacogenomic analysis of serious drug reactions and the development of highly effective therapies for some cancers and rare diseases have been realized. However, a broader application of precision medicine approaches has been hindered by issues of pathogenic DNA penetrance and polygenic risk factors associated with many common diseases.

Leading experts in the investigation and application of precision medicine provided the *Pharmacology*

2019 attendees with excellent overviews of the state-of-the-art advances in specific areas of post-genomic disease and interventional research. Dr. Bhagwat Prasad, Washington State University, discussed the application of quantitative proteomics to the scaling (experimental animal to human) of non-cytochrome P450 enzymes and the integration of these data into new models of physiologically-based pharmacokinetics. Additionally, these research efforts have led to the discovery of specific biomarkers of drug metabolizing enzymes and transporters. Professor Sir Munir Pirmohamed, University of Liverpool, discussed the prevalence of genetic and non-genetic factors in adverse drug reactions. While some genetic polymorphisms such as those found in glucose-6-phosphate dehydrogenase are well known, emerging research indicates specific roles for HLA (human leukocyte antigen) associated immune adverse drug reactions. Two examples include HLA-B*57:01 for abacavir hypersensitivity and HLA-B*15:02 for carbamazepine-induced Steven's Johnson Syndrome. Genetic polymorphisms can also determine dose requirements. For example, polymorphisms in VKORC1 and CYP2C9 account for greater than 50% of the individual dose requirements for warfarin. Dr. James Thaventhiran, University of Cambridge, provided an overview of whole genome sequencing approaches to identify multiple pedigrees underlying heterogeneous responses to immune-oncology therapies. A particular interest of Dr Thaventhiran is understanding the mechanisms leading to the development of immune-related adverse events. Professor Steve Cunningham, University of Edinburgh, presented a summary of the scientific development and medical impact for the emerging CFTR-modulator drugs for the treatment of cystic fibrosis (CF). CF is the most common lethal inherited disease in Caucasian populations and is driven by mutations in the CFTR gene. These drugs bind to and modulate the gating properties and/or

correct other functional aspects of the CFTR protein to improve epithelial cell chloride channel function. Emerging real-world evidence and late-stage clinical trial data have demonstrated that these drugs provide significant improvements in lung function for CF patients with gating or misfolded protein mutations.

This symposium was well attended and provided the audience with key insights on the current state of precision medicine as a research approach and as an interventional strategy. The improvements in

care of CF patients provided by the emerging CFTR modulator drugs serves as an illustrative milestone for the potential impact of precision medicine. The presentations in this session also highlighted the current and evolving challenges involved in bringing similar levels of clinical impact to multigenic diseases along with a better understanding of the multifactorial mechanisms that affect pharmacological interventions for these diseases.



ASPET Travel Award Winners (from left to right): ASPET Board of Publications Trustees Chair Emily Scott, Khaled S. Abd-Elrahman, Radhika Joshi, Linh Tram, K. Lockhart Jamieson, and ASPET Past-President Eddie Morgan.



BPS attendee Sinayat Mahzabeen from the University of Cambridge wins the ASPET booth raffle prize.



ASPET leaders and members at the BPS Annual Awards Dinner.



The World Congress of Basic & Clinical Pharmacology is coming to Glasgow, Scotland in 2022



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Division News

2020 Division Elections

The following Divisions held elections for 2020 and received an enthusiastic response from ASPET members:

- Division for Cancer Pharmacology
- Division for Drug Discovery and Development
- Division for Drug Metabolism and Disposition
- Division for Molecular Pharmacology
- Division for Neuropharmacology
- Division for Toxicology
- Division for Translational and Clinical Pharmacology

Please join us in welcoming all newly elected chairs and secretary/treasurers to their respective division's executive committee. The new officers will begin their terms on July 1, 2020.

Division for Cancer Pharmacology

Chair-Elect



Lori Hazlehurst, PhD
Associate Center Director,
West Virginia University
Cancer Institute; Professor
Pharmaceutical Sciences,
West Virginia University

Secretary/Treasurer-Elect



Daniel L. Gustafson, PhD
Professor, Department of
Clinical Sciences, Colorado
State University

Division for Drug Discovery and Development

Chair-Elect



Donald C. Button, PhD
Senior Director, Research,
Adamas Pharmaceuticals

Secretary/Treasurer-Elect



Sujay Kharade, PhD
Research Instructor,
Vanderbilt University
Medical Center

Division for Drug Metabolism and Disposition

Chair-Elect



Xiaobo Zhong, PhD
*Professor, Department of
 Pharmaceutical Sciences,
 School of Pharmacy,
 University of Connecticut*

Secretary/Treasurer-Elect



Kerry Goralski, PhD
*Professor, College of
 Pharmacy, Department
 of Pharmacology, and
 Department of Pediatrics,
 Dalhousie University*

Division for Molecular Pharmacology

Chair-Elect



John R. Hepler, PhD
*Professor, Department
 of Pharmacology and
 Chemical Biology,
 Emory University
 School of Medicine*

Secretary/Treasurer-Elect



Michelle E. Kimple, PhD
*Associate Professor of
 Medicine, Division of
 Endocrinology, Diabetes, and
 Metabolism and Director of
 the Basic Science Selective,
 University of Wisconsin School
 of Medicine and Public Health;
 Research Health Scientist,
 William S. Middleton Memorial
 Veterans Hospital*

Division for Neuropharmacology

Chair-Elect



Carolyn Fairbanks, PhD
*Professor of
 Pharmaceutics,
 Pharmacology, and
 Neuroscience; Associate
 Dean for Research,
 College of Pharmacy,
 University of Minnesota*

Secretary/Treasurer-Elect



Daniel Morgan, PhD
*Assistant Professor
 of Anesthesiology,
 Pharmacology, and
 Neural and Behavioral
 Sciences, Department
 of Anesthesiology and
 Perioperative Medicine,
 Penn State University
 College of Medicine*

Division for Toxicology

Chair-Elect



Brendan Stamper, PhD
Associate Professor,
Pacific University School
of Pharmacy

Secretary/Treasurer-Elect



Cheryl E. Rockwell, PhD
Associate Professor,
Department of Pharmacology
and Toxicology, Michigan
State University

Division for Translational and Clinical Pharmacology

Chair-Elect



Ross Corriden, PhD
Associate Principal
Scientist, Merck

Secretary/Treasurer-Elect



**Brandi M. Wynne,
MS PhD FAHA**
Assistant Professor of
Medicine, Nephrology, and
Hypertension, University of
Utah; Adjunct, Nephrology,
Emory University

Do you know someone who is not yet a member of ASPET?



Help ASPET stay strong by recruiting your fellow colleagues, students, and friends! A growing ASPET means greater recognition for the field of pharmacology, more resources and support for our members, and a louder voice with policy makers.

Tell them to apply online at www.aspet.org

ASPET Division Sponsored Awards



Division for Behavioral Pharmacology

P. B. Dews Lifetime Achievement Award for Research in Behavioral Pharmacology

The ASPET Division for Behavioral Pharmacology sponsors the Dews Award to recognize outstanding lifetime achievements in research, teaching, and professional service in the field of behavioral pharmacology and to honor Dr. Peter Dews for his seminal contributions to the development of behavioral pharmacology as a discipline.



Linda A. Dykstra, PhD
University of North Carolina at Chapel Hill

Dr. Linda A. Dykstra is being recognized for her innovative, outstanding lifetime achievements in behavioral pharmacology research and her strong commitment to the teaching and mentoring of

younger scientists. She was nominated by Dr. Michael Nader from Wake Forest University.

Dr. Dykstra received her PhD in psychology/psychopharmacology from the University of Chicago and did postdoctoral training at the University of

North Carolina (UNC). She has remained at UNC her entire career where she served as dean of the graduate school and is currently the William Rand Kenan Jr. Distinguished Professor Emeritus in the department of psychology and a professor of psychology and pharmacology. Dr. Dykstra's research focused on the behavioral effects of opioid analgesics, using a wide range of animal models including measures of antinociception, drug discrimination, schedule-controlled responding and conditioned place preference.

An ASPET member since 1978, she has served in leadership roles in the Division for Behavioral Pharmacology and the Division for Neuropharmacology.



Division for Behavioral Pharmacology

JH Woods Early Career Award in Behavioral Pharmacology

The ASPET Division for Behavioral Pharmacology established this award in 2019 to recognize outstanding original research by early career investigators in the area of behavioral pharmacology.



Susan K. Wood, PhD
University of South Carolina School of Medicine

Dr. Susan K. Wood is being recognized for her innovative and interdisciplinary research program linking stress-related behavior and neuroinflammation to mood disorders and comorbid

cardiovascular risk. She was nominated by Dr. Rita

Valentino from the National Institute on Drug Abuse.

Dr. Wood is a tenured associate professor of pharmacology, physiology and neuroscience at the University of South Carolina School of Medicine. She completed her PhD in the department of pharmacology at the University of Michigan, under the guidance of Dr. James H. Woods. Her lab's research program uses behavioral models to identify novel neurobiological substrates that underlie individual differences in susceptibility to stress-related disorders in both males and females. Given that stress exposure

has been linked to diverse medical and psychiatric illnesses, her work has direct implications for public health and the development of personalized medicine for stress-related diseases. Additionally, her lab investigates how stress exposure can lead to comorbidity between psychiatric disorders and cardiovascular disease risk, focusing on how stress and therapeutics impact the whole organism. The ultimate goal of Dr. Wood's research is to identify novel

anxiolytic and antidepressant targets specific to stress-related disorders.

An ASPET member since 2005, she has been an active member of the Division for Behavioral Pharmacology most recently serving the division as secretary/treasurer. Additionally, she currently is an associate editor for the *Journal of Pharmacology and Experimental Therapeutics*.



Division for Cardiovascular Pharmacology

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.



Jan Danser, PhD

Erasmus Medical Center

Dr. Jan Danser is being recognized for his seminal discoveries on the roles of prorenin/renin in vascular and cardiac pathophysiology, the targeting of this system by novel therapeutics, and his outstanding mentorship

of young scientists. He was nominated by Dr. Rhian Touyz from the University of Glasgow.

Dr. Danser received his PhD from Erasmus University Rotterdam and is currently a professor of pharmacology at the Erasmus Medical Center. As a

cardiovascular pharmacologist, he has made seminal contributions in the field of the renin-angiotensin system (RAS) and its role in hypertension and heart failure and other cardiovascular diseases. As a trainee of Professor Vanhoutte, Dr. Danser developed an interest in vascular pharmacology and today he is a world-renowned vascular pharmacologist, conducting cutting-edge, clinically relevant research. His research focuses on the local function of the RAS. He has also defined novel mechanisms of regulation of prorenin and its signaling and has identified new functions for prorenin as a regulator of cell metabolism. Many of Dr. Danser's pre-clinical discoveries have impacted clinical research highlighting the translational relevance of his work.



Division for Cardiovascular Pharmacology

Early Career Award

The ASPET Division for Cardiovascular Pharmacology established the Early Career Award in 2020 to recognize and honor individuals working in cardiovascular science.



Sarah Lindsey, PhD
Tulane University

Dr. Sarah Lindsey is being recognized for her fundamental contributions to our understanding of estrogen receptor pharmacology in the cardiovascular system.

Dr. Lindsey received her PhD in pharmacology

from Louisiana State University Health Sciences Center and completed her postdoctoral training at

the Hypertension & Vascular Research Center at Wake Forest School of Medicine. She currently is an associate professor with tenure and holds the Barbara S. Beckman Professorship in the department of pharmacology at Tulane University. She is also a faculty member in the Tulane Brain Institute, the Tulane Hypertension and Renal Center of Excellence, and the Tulane Department of Physiology.

An ASPET member since 2003, she has served ASPET in many roles, most recently on the program committee and as secretary/treasurer for the Division for Cardiovascular Pharmacology.



Division for Drug Discovery and Development

Scientific Achievement Award in Drug Discovery and Development

The ASPET Division for Drug Discovery and Development established this award in 2019 to recognize outstanding investigators that have made significant contributions in drug discovery, translational and/or drug development science.

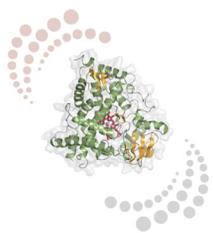


Jonathan Baell, PhD
*Monash Institute of
Pharmaceutical Sciences,
Monash University*

Dr. Jonathan Baell is being recognized for his sustained impact in the field of medicinal chemistry. His seminal work in design of electronic filters to identify “chemically nuisance”

compounds (Pan Assay Interference Compounds or ‘PAINS’) substantially enables the curation of undevelopable NCE’s, benefiting both academic and industrial drug discovery. He was nominated by Dr. Arthur Christopoulos from Monash University.

Dr. Baell received his PhD from the University of Melbourne, Parkville. He currently is a Larkins Fellow, Director of the Australian Translational Medicinal Chemistry Facility, and Research Theme Leader of fragment library design for the ARC Industrial Transformation Training Centre at Monash University. A prestigious NHMRC Principal Research Fellow, his 2010 PAINS publication in the Journal of Medicinal Chemistry has already been cited more than 1600 times. His concept of PAINS has changed the landscape of how drug discovery scientists view and treat assay-active compounds, influencing both ACS publishing policy and Global HTS library design.



Division for Drug Metabolism and Disposition

Bernard B. Brodie Award in Drug Metabolism

The ASPET Division for Drug Metabolism and Disposition established the Brodie Award to honor the fundamental contributions of Bernard B. Brodie to the field. The award recognizes outstanding original research contributions in drug metabolism and disposition, particularly those having a major impact on future research in the field.



Kathleen M. Giacomini, PhD

University of California,
San Francisco

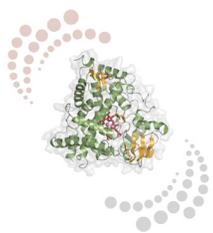
Dr. Kathleen M. Giacomini is being recognized for her seminal contributions to the pharmacogenomics and characterization of drug transporters both in vitro and in vivo, as well as

her collegial interactions through the NIH-funded Pharmacogenomics of Drug Transporters project and the co-founding of the International Transporter Consortium. She was nominated by her former graduate student, Dr. Joanne Wang from the University of Washington.

Dr. Giacomini received her PhD in pharmaceuticals from the State University of New York at Buffalo.

After postdoctoral training at Stanford University, she joined the faculty of pharmacy at UCSF. She is currently professor of bioengineering and therapeutic sciences and co-director of the UCSF-Stanford Center of Excellence in Regulatory Sciences and Innovation. Dr. Giacomini has made outstanding contributions to original research in membrane transporters, pharmacogenomics and regulatory sciences. Her laboratory first cloned and characterized several important human drug transporters and elucidated their roles in renal and hepatic drug disposition. She and her team discovered genetic variants in transporters associated with disposition and response to the anti-diabetic drug, metformin and the anti-gout medication, allopurinol.

Dr. Giacomini has been an ASPET member since 1988 and is an elected member of the National Academy of Medicine.



Division for Drug Metabolism and Disposition

James R. Gillette Awards

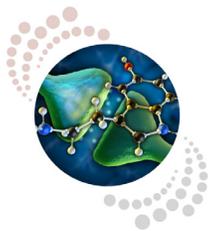
The James R. Gillette Awards are presented each year by the ASPET Division for Drug Metabolism and Disposition for two outstanding papers published in the previous year's *Drug Metabolism and Disposition*.

The award recipient in the Pharmacokinetics/Drug Transporters category for 2019 is **Takeshi Miyake** from the University of Tokyo for the paper titled "[Elucidation of N1-methyladenosine as a Potential Surrogate Biomarker for Drug Interaction Studies Involving Renal Organic Cation Transporters.](#)"

The award recipient in the Drug Metabolism category for 2019 is **Drew R. Neavin** for the paper titled "[Single Nucleotide Polymorphisms at a Distance from Aryl Hydrocarbon Receptor \(AHR\) Binding Sites Influence AHR Ligand-Dependent Gene Expression.](#)" Dr. Neavin was with the Division

of Clinical Pharmacology, Department of Molecular Pharmacology and Experimental Therapeutics, Mayo Clinic, when the paper was written. She is now with the Single Cell and Computational Genomics Lab at the Garvan Institute of Medical Research.

The Gillette awards and short talks based on the papers will be presented at the Division for Drug Metabolism and Disposition Gillette Awards and Junior Investigator Platform Session during the ASPET Annual Meeting at Experimental Biology 2020 on Tuesday, April 7 from 4:50 pm – 6:00 pm in Room 16B of the San Diego Convention Center.



Division for Neuropharmacology

Early Career Award

The ASPET Division for Neuropharmacology sponsors the Early Career Award to honor a young independent investigator working in neuropharmacology.



Erin S. Calipari, PhD

Vanderbilt University

Dr. Erin S. Calipari is being recognized for her innovative and collaborative approaches to research and mentoring that balances use of technology with deep background knowledge to ask and answer questions related to the basic mechanisms of learning, memory, reward processing and motivation, and their dysregulation by disease. She was nominated by Dr. Sara Jones from Wake Forest School of Medicine.

Dr. Calipari earned a PhD in neuroscience from Wake Forest School of Medicine and was a postdoctoral fellow at Icahn School of Medicine at Mount Sinai. She currently is an assistant professor at Vanderbilt University School of Medicine in the department of pharmacology, the department of molecular physiology and biophysics, and the department of psychiatry and behavioral sciences at the medical center. The work in Dr. Calipari's lab is multidisciplinary and uses cutting-edge techniques to outline the neural circuits and molecular mechanisms that underlie both adaptive and maladaptive processes in reward, motivation, and associative learning. She has been an ASPET member since 2012.



Division for Pharmacology Education

Pharmacology Educators Travel Awards

The ASPET Division for Pharmacology Education sponsors travel awards for pharmacology educators. The primary goal of these travel awards is to promote participation in the ASPET Annual Meeting by pharmacology educators and to foster career development in pharmacology education.



Khalil Eldeeb, MD, MSc, PhD

*Campbell University
Jerry M. Wallace School
of Osteopathic Medicine
(CUSOM)*

Dr. Khalil Eldeeb received his medical degree and his MS in pharmacology from Al-Azhar University in Cairo, Egypt.

He earned his PhD in pharmacology at the University of Nottingham, UK. He completed a postdoctoral fellowship at Wake Forest University School of Medicine among the first cohort of the Postdoctoral Research, Instruction, and Mentoring Experience (PRIME) scholarship. He is currently an associate professor of pharmacology at Campbell University Jerry M. Wallace School of Osteopathic Medicine (CUSOM).

Dr. Eldeeb was selected due to his pharmacology educational innovations, his clear dedication to teaching, and promise for pharmacology educational scholarship as evidenced by the quality of his submitted educational abstract.



Stanley V. Smith, PhD

*University of Mississippi
Medical Center*

Dr. Stanley V. Smith earned his PhD in biochemistry from the University of Mississippi Medical Center (UMMC). After several NIH fellowships, he returned to UMMC where he currently is an associate

professor of pharmacology and course director of medical pharmacology, dental pharmacology, and

fundamental pharmacology. He was elected to the Nelson Order of Teaching Excellence and was twice named M-2 All-Star Professor by the Evers Society, a student-based organization that recognizes excellent educators. Dr. Smith is most proud of the Department of the Year Award given to his department for the first time in over a decade by the Evers Society. He would like to dedicate the award to his mentor, the late Dr. Robert B. Koch, professor of biochemistry.

Dr. Smith was selected for the senior educator award due to his lifelong commitment and leadership in pharmacology education as well as his dedication to students. The committee also recognized his years of mentorship to diverse junior colleagues and his contributions to educational scholarship as evidenced by the quality of his submitted educational abstract.

Rupa Lalchandani Tuan, PhD

University of California, San Francisco

Dr. Rupa Lalchandani Tuan received a BS in psychobiology and a minor in education studies from the



University of California, Los Angeles. She earned a PhD in physiology and pharmacology from Georgetown University and then moved to Stanford University as a Neurosciences Institute interdisciplinary postdoctoral scholar. She taught in the undergraduate, graduate, and medical schools

at Georgetown, George Mason University, Notre Dame de Namur University and online through Georgetown's Online Master of Science in Nursing Program. Her current position at the University of California, San Francisco is fully dedicated to teaching and coordinating pharmacology in the Schools of Medicine, Pharmacy, and Dentistry.

Dr. Tuan was selected due to her pharmacology educational innovations, her clear dedication to teaching, and her promise for pharmacology educational scholarship as evidenced by the quality of her submitted educational abstract.



Division for Molecular Pharmacology

Early Career Award

The ASPET Division for Molecular Pharmacology established the Early Career Award in 2020 to recognize scholarly achievements of junior investigators early in their independent careers.



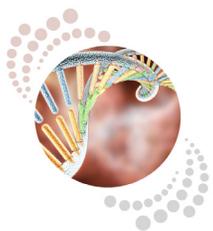
Chia-Hsin (Lori) Chan, PhD *Stony Brook University*

Dr. Chia-Hsin (Lori) Chan is an assistant professor of pharmacological sciences at Stony Brook University. She earned her PhD at National Taiwan University, then undertook postdoctoral studies at the M. D. Anderson Cancer

Center. Her lab is studying how cancer cells evolve to escape the attack of conventional cancer therapies,

and how these drug-resistant cancer cells spread and metastasize to other parts of the human body. She focuses on delineating the roles of cancer-associated ubiquitin ligases in cancer stem cell regulation, metabolic reprogramming, and immune responses. Dr. Chan has made numerous original findings, many of which were published in high-profile journals. Her work has led to a U.S. patent for novel anti-cancer therapeutics.

Dr. Chan was nominated by Dr. Stella Tsirka also from Stony Brook University. She has been an ASPET member since 2014.



Division for Toxicology

Career Award

The ASPET Division for Toxicology annually sponsors the Career Award to recognize outstanding original research contributions to toxicology by an established investigator.



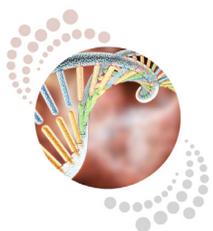
Bryan K. Yamamoto, PhD
Indiana University

Dr. Bryan K. Yamamoto is being recognized for his long-standing contributions to the field of toxicology and his service to ASPET. He was nominated by Dr. Branden Stansley from Vanderbilt University.

Dr. Yamamoto received his PhD in neurobiology from Syracuse University and was a postdoctoral fellow in clinical pharmacology at the University of Colorado Health Sciences Center. He currently is the chair of the department of pharmacology and toxicology and the Robert B. Forney Professor of Toxicology at the Indiana University School of

Medicine. Research in the Yamamoto laboratory has focused on how drugs of abuse affect the neurochemistry of brain. He has studied how amphetamines and their interaction with stress alter brain function and produce damage to regions of the brain that are critically involved in controlling movement and memory processes. More specifically, he is interested in how oxidative, mitochondrial, inflammatory, and excitatory processes converge to damage the dopamine and serotonin systems in the brain and how antagonism of these processes mitigates their neurodegenerative effects. He has been the primary mentor of more than 35 PhD graduate students and postdocs.

He has been an ASPET member since 1998 and serves on the editorial board of *The Journal of Pharmacology and Experimental Therapeutics*.



Division for Toxicology

Early Career Award

The ASPET Division for Toxicology annually sponsors the Early Career Award to recognize excellent original research by early career investigators in the area of toxicology.



Merrie Mosedale, PhD
UNC Eshelman School of Pharmacy

Dr. Merrie Mosedale is being recognized for her excellent achievements in toxicology. She was nominated by Dr. Paul Watkins from the University of North Carolina at Chapel Hill.

Dr. Mosedale received her PhD in biomedical sciences (molecular pharmacology) from the University of California, San Diego and conducted postdoctoral research at the Hammer Institutes for Health Sciences. Since establishing her own research program at the

UNC Eshelman School of Pharmacy, Dr. Mosedale has pioneered the use of the Collaborative Cross mouse genetic reference population to identify risk factors and mechanisms associated with drug-induced liver injury (DILI) in humans. She was also the first to demonstrate that hepatocyte-derived exosome number and content changes in response to idiosyncratic DILI drugs prior to overt necrosis and suggest this contributes to an adaptive immune attack. Her work has led to a greater understanding of the pathogenesis of DILI as well as several nonclinical approaches that may allow for the accurate prediction of idiosyncratic DILI liability for new chemical entities. She has been a member of ASPET since 2008.



Division for Translational and Clinical Pharmacology

Early Career Awards

The ASPET Division for Translational and Clinical Pharmacology sponsors Early Career Awards to recognize excellence in translational and clinical pharmacology research that comes from early career scientists.



Christian A. Fernandez, PhD

*University of Pittsburgh
School of Pharmacy*

Dr. Christian A. Fernandez

is an assistant professor in the department of pharmaceutical sciences and a member of the Center for Pharmacogenetics at the University of Pittsburgh

School of Pharmacy. He received his PhD from the University of Iowa College of Pharmacy, and he completed his postdoctoral fellowship at St. Jude Children's Research Hospital. The research in his laboratory focuses on the pharmacogenomics of adverse drug reactions of agents used in the treatment of leukemia. The overarching goal of his studies is to understand the underlying molecular mechanisms of common drug-mediated toxicities that lead to poor treatment outcome by integrating genome-wide association studies (GWAS) and experimental validations using genetic and pharmacological models. The studies in the Fernandez lab are clinically relevant, highly translational, and aim to improve leukemia survival by mitigating toxicities and ensuring that patients can benefit from the therapeutic effect of modern combination chemotherapy. Dr. Fernandez's award talk is titled *The pharmacogenomics of asparaginase-mediated toxicities in acute lymphoblastic leukemia (ALL) patients*.



Blythe D. Shepard, PhD

Georgetown University

Dr. Blythe D. Shepard

is an assistant professor at Georgetown University. She received a PhD in cellular and microbial biology from The Catholic University of America and did a postdoctoral fellowship at

Johns Hopkins University School of Medicine. Her predoctoral studies in hepatic protein trafficking and her postdoctoral studies in sensory receptor biology and renal physiology have framed the research interests of the Shepard Laboratory. Dr. Shepard's laboratory is focused on the functional roles of G protein-coupled receptors (GPCRs) in both the kidney and liver. She determined that one such receptor, Olfr1393, is expressed in the renal proximal tubule where it contributes to glucose handling in health and disease (type I and type II diabetes). She has also identified a number of understudied sensory receptors including olfactory, taste, and orphan GPCRs in the liver. Efforts are currently underway to determine their ligand profiles and localization. The ultimate goal of Dr. Shepard's laboratory is to uncover novel functions for this highly druggable class of receptors in order to advance our understanding of physiology and facilitate drug discovery. Dr. Shepard's award talk is titled *Orphan sensory receptors are expressed in hepatocytes*.

Other Division News



The Career of Dr. Kenneth Thummel: Unlocking the Genetic and Environmental Factors in Drug Response



Dr. Kenneth Thummel earned his PhD in pharmaceutical science from the University of Washington in 1987, and upon graduation went on to pursue a postdoctoral fellowship in pharmacology at the University of Connecticut Health Sciences Center. In

1989 he was appointed to the faculty at the University of Washington in the department of pharmaceutics, where he served as chair from 2006-2019. Dr. Thummel has enjoyed a long and highly prolific research career in drug metabolism, where he has studied the genetic, hormonal and environmental factors that contribute to inter-individual differences in xenobiotic biotransformation. His body of research has specifically focused on intestinal cytochrome P450 3A-mediated first-pass drug metabolism, as well as gene x diet modifiers of drug response in Alaska Native and American Indian people. His work includes >200 publications and >40,000 citations. Dr. Thummel is a Fellow of the American Association for the Advancement of Science and the American Association of Pharmaceutical Scientists, and the recipient of the Rawls-Palmer Progress in Medicine Award from ASCPT. Dr. Thummel has been very influential in ASPET and has previously served as president of our organization.

With a growing interest and need for personalized medicine, your work has only increased in relevance over the years. Would you mind sharing with our readers what factors originally inspired your research journey?

KT: I started my career with the lofty goal of fully understanding the mechanistic basis of inter-individual differences in intestinal and hepatic first-pass metabolism and drug clearance. In my graduate pharmacokinetics classes, I was struck by observations that patients receiving the same oral drug dose could experience wildly different systemic blood concentrations over time. My initial work focused on external environmental factors, such as concomitantly administered drugs that cause drug-drug interactions, and the internal environment of cell signaling molecules that regulate hepatic and intestinal enzyme expression. With the development of genome analysis tools, it was a natural extension to also study variation in the genes that encode drug metabolizing enzymes. At each stage of my career, my thinking was influenced significantly by a wonderful cadre of collaborators, such as Paul Watkins, Grant Wilkinson, Erin Schuetz, Steve Wrighton and Wylie Burke, who had overlapping research interests and encouraged me to take risks that greatly enhanced what I was able to accomplish. Open-ended conversations about unanswered questions in the field, potential research directions and sharing of discoveries as they emerged is what motivated me most.

Working with people from different cultures, although highly rewarding, must also come with challenges. Which challenges would you consider most significant and what did you do to overcome them? What has been the most rewarding aspect of working with people from different cultures?

KT: It was necessary for me to re-think the entire research process. Building a mutually trusting relationship is an essential first step when working with people from different cultures, such as the indigenous peoples of America. As a scientist, we tend to want to control the content and pace of communication dialogue. I had to put that instinct aside and learn to listen, with patience, to what was being said to me in order to better understand the individual, their cultural history, and what motivated them to want to participate in health research. Developing a trusting partnership also requires full transparency about what will happen at all stages of the research process and providing time for a thorough discussion (and modification if necessary) of research plans and a review of results before they are broadly communicated. Lasting trust comes from a commitment to work with the community beyond the duration of a single study, which only makes sense if your goal is to improve the health of the people participating in your research.

I have thoroughly enjoyed learning something about the rich cultures of indigenous peoples, their traditions and resiliency in the face of a changing world. I can only hope that our research will yield tangible benefits in their lives and those of the next generation.

What advice do you have for young scientists (students or postdoctoral fellows) who are just starting their career?

KT: Find an area of pharmacological discovery that you are passionate about and pursue it, without intimidation or fear of failure. Find collaborators with whom you can share your passion.

You have been highly involved with ASPET/DMDD. What do you feel have been the most rewarding aspects of being involved with the society and what advice do you have for new members?

KT: Pharmacology is a very broad discipline, with many areas of specialization. Being involved in ASPET/DMDD leadership gave me the opportunity to learn more about those sub-disciplines through interactions with a more diverse spectrum of senior and junior society members than I might otherwise have met. I enjoyed this exposure immensely and was proud to represent them to the world. I have also found significant pleasure from seeing the success of young scientists whose careers I have had the opportunity to shape and support, both as a member of the ASPET leadership and as a departmental chair.

As someone who has been in the field a long time, you have witnessed the growth and change that has come along with it. What new frontiers are you most excited about for the coming decade?

KT: The most exciting avenue of new investigation that I see emerging is epigenetics and the process of gene – environment interactions. Its complexity is formidable, but I believe that it will ultimately explain much if not all of the heretofore missing source of variability in drug disposition and response. We are all a product of the genes we inherit and the environment that we live in. Sometimes we can discern the impact of genetic or environmental variation on pharmacological responses in discrete ways, but it seems logical that much of the variation in response that we observe will be the result of complex, multifactorial gene-environment interactions. It may take another generation to sort out, but I am confident that we will get there, enhancing the health impact of precision medicine.



AMSPC News

AMSPC Annual Meeting

Submitted by Kent Vrana

The Association of Medical School Pharmacology Chairs (AMSPC) held its annual meeting in Nassau, Bahamas from January 24-28, 2020. In addition to eight new or first-time attending chairs, the group was joined by representatives from ASPET, FASEB, AAMC, and NIH. The meeting began with the announcement of the Association's newest councilors (each serving two-year terms): Don Bers (University of California, Davis), Joan Heller Brown (University of California, San Diego), and Scott Waldman (Thomas Jefferson University). Dr. Noni Byrnes (the new Director of the NIH Center for Scientific Review) shared the current priorities at CSR. Her far-ranging discussion covered topics such as: 1) plans to simplify review criteria, 2) piloting bias-awareness training, 3) new online chair orientations, 4) active management of undue influence of reviewers, 5) discontinuing continuous submission benefits for ad hoc reviewers, and 6) increasing representation of assistant and associate professors on review panels. Subsequent workshops and discussions addressed "Understanding Unconscious Bias in the Health Professions and How to Mitigate It" (Diana Lautenberger, AMMC), "ASPET Strategic Plan Update"



AMSPC members in Nassau

(Dr. Judy Siuciak), and "Washington Update: 2020 Advocacy and Policy Outlook from FASEB" (Jennifer Zeitzer). Networking sessions included presentations from new chairs and discussions of how pharmacology departments can contribute to the teaching and research environments in their academic health centers. Finally, the chairs celebrated the recent news that two of our members (Dr. Mark Nelson, University of Vermont and Dr. Ted Abel, University of Iowa) have been elected to the National Academies. Complete minutes of the meeting will be available in the coming weeks on the AMSPC website (AMSPC.org).



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Plush 9" donkey in ASPET t-shirt
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T-shirt with ASPET Logo

Gray cotton with logo on front left pocket and across back
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Gray and black upright lunch bag with side mesh pocket
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Explore Pharmacology T-shirt

White cotton with cartoon design
Adult Sizes: S, M, L, XL, XXL
Members: \$15.00 + Shipping



Mug

Gray mug with ASPET logo
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Experiment T-shirt

Navy blue cotton with Experiment. Learn. Fail. Repeat design
Adult Sizes: S, M, L, XL, XXL
*Child sizes available in light blue
Members: \$15.00 + Shipping



Travel Mug with Lid

Tall khaki travel mug with silicone lid
Members: \$12.00 + Shipping



Keep Calm T-shirt

White cotton with Keep Calm and Study Pharmacology design
Adult Sizes: S, M, L, XL, XXL
Members: \$15.00 + Shipping



Journals Mug

White mug with ASPET journal covers
Members: \$10.00 + Shipping



Toddler T-shirt/Onesie

White cotton with Genius design
Toddler Sizes: 2T, 3T, 4T, 5T, 6T
Onesie: NB, 6M, 12M, 18M, 24M
Members: \$10.00 + Shipping



Men's Tie

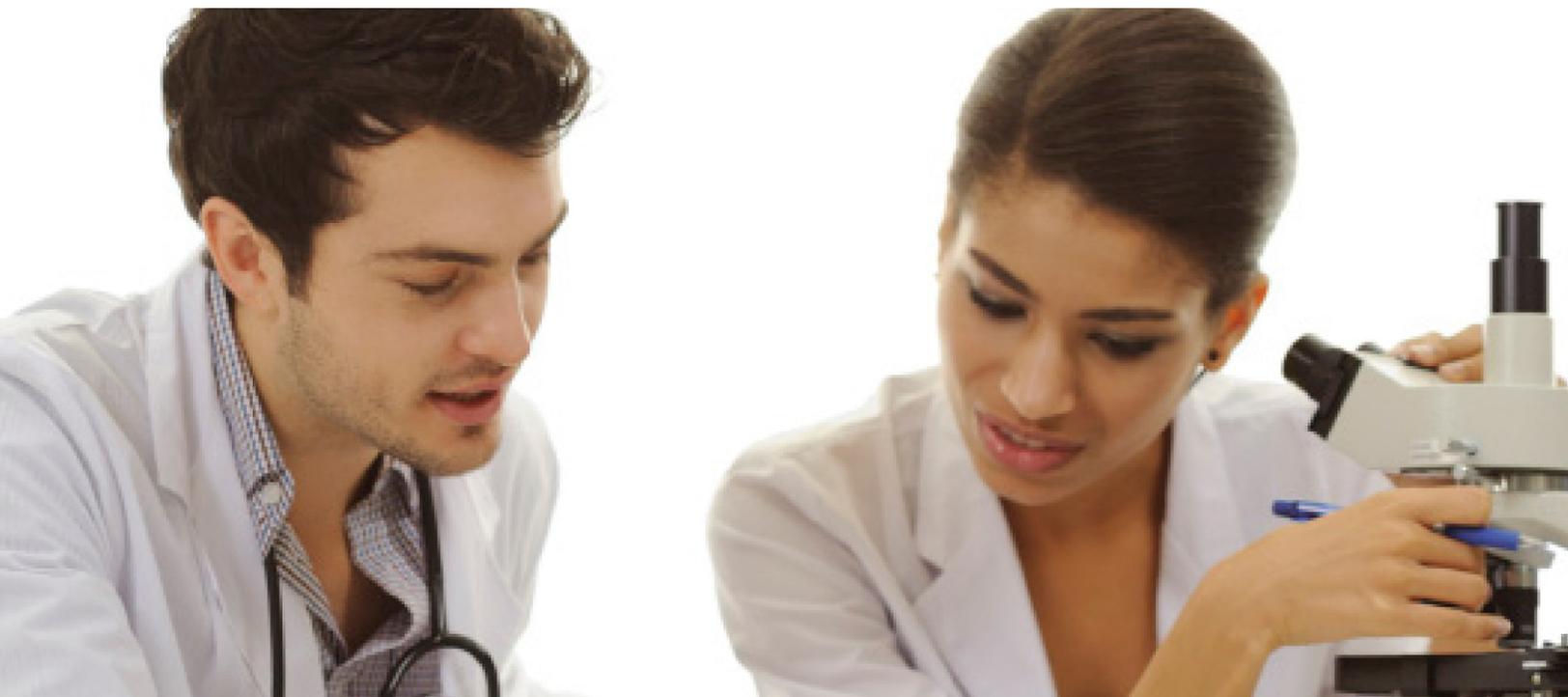
Gray silk tie with ASPET logo
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Women's Scarf

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ASPET is committed to your success:

The ASPET Career Center is the best resource for matching job seekers and employers in pharmacology and related health science fields. Our vast range of resources and tools will help you look for jobs, find great employees, and proactively manage your career goals.



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