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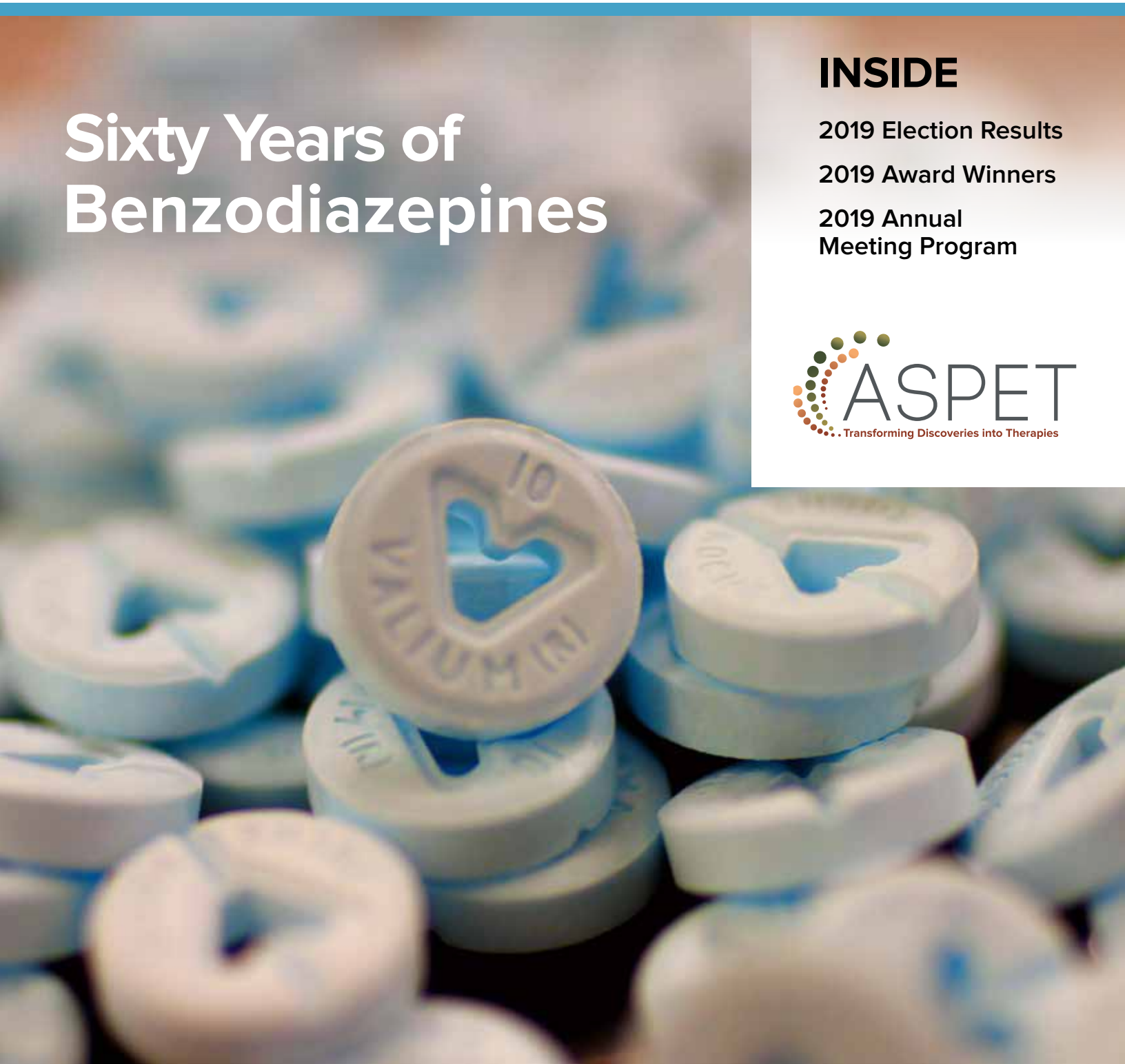

Sixty Years of Benzodiazepines

INSIDE

ASPET
Transforming Discoveries into Therapies

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Message from The President

Dear Members of ASPET,

As we gear up for the ASPET Annual Meeting at Experimental Biology (EB) conference in Orlando, I hope that you are as eager as I am to see the impact of the various innovations being rolled out at this meeting. In particular, we're looking for a markedly improved poster presentation experience for everyone, since there will be no competing programming in this time slot. I urge everyone to use this opportunity to prioritize attendance at the poster presentations, and help make EB the premier venue for our members and trainees to gain exposure for their work and experience in presenting it.

In addition to the outstanding scientific offerings at EB, we welcome our guest societies: the Behavioral Pharmacology Society, the Catecholamine Society, the Chinese Pharmacological Society (CNPHARS) and the Global GI Club to Orlando. Once again, ASPET members will have the opportunity to participate in a day of service, this time with Habitat for Humanity, on the Friday before the meeting. I'd also like to highlight the business meetings of our divisions and strongly encourage all members to put these on your calendars and attend. Your division leaders give great time and effort to ensure that there is exceptional scientific programming, and they need the input of the membership to guide their decisions and give feedback. The divisions are the lifeblood of the Society and need the enthusiasm and commitment of all their members to prosper.

I'm particularly looking forward to the Joint Presidential Symposium series organized by Jeff Sands, the President of the American Physiological Society (APS) and me on the topic of the *Microbiome in Physiology and Pharmacology*. Although neither of us work in this area, Jeff and I both recognize this as a huge emerging area of investigation that will undoubtedly have a great impact on our understanding of human diseases and their treatments. The series will take place from 8:30 – 10:00 am on Sunday, Monday and Tuesday mornings of the meeting, and is supplemented by a Microbiome Workshop on Saturday afternoon. We are indebted to the experts who helped us put this program together and who will co-chair the respective sessions: Drs. Hyunyoung Jeong, Jennifer Pluznick, Laura McCabe, and Julia Cui. This is an exciting step towards more frequent collaborations and interactions of ASPET with our sister societies, and President-Elect Wayne Backes is already working with the APS to organize another Joint Presidential Symposium series at EB 2020. In addition, ASPET is co-sponsoring with the APS the *11th International Conference on Heme Oxygenase & Related Enzymes: From Physiology to Therapeutics* at UCLA in June next year. Also at EB this year, we will host an ASPET-CNPHARS Joint Symposium on *Neuronal Mechanisms and Therapeutic Discoveries to Combat Neurodegenerative Diseases*, chaired by Drs. Yongxiang Zhang and Habibeh Khoshbouei.

Before I leave the subject of the annual meeting, I should say that one of the most revealing aspects of being a Council member and President is seeing the amount of effort it takes for our staff to put on a seamless and enjoyable experience for you, our members. Special thanks go to our Executive Officer Dr. Judy Siuciak and our Meetings Director Melissa Huston, but virtually all of the staff have an important role to play in planning, organizing and running the ASPET meeting at EB. So when you see them in Orlando, and you are enjoying the meeting, please take time to express your appreciation for what they do.

I read with great interest the excellent and insightful op-ed article in PharmTalk by Stephanie Davis, the Chair of our Young Scientists Committee, on the subject of mentoring. As a former long-time graduate program director, I am very familiar with the scenarios described by Stephanie in which students select mentors who, although they may have well-funded and exciting research programs, are incompatible or may have

questionable mentoring skills. The result may be years of frustration experienced by both student and mentor, or even the loss of a student to another lab or graduate program. Fortunately, there are several approaches to mitigate the likelihood of this happening. One solution might be that suggested by Dr. Davis, i.e. the quality of mentoring could be a more important criterion for funding NIH research grants. Another is for graduate program advisors to recognize and stress the value of mentoring skills when the student is selecting a laboratory. Another one is for students and their advisors to recognize that trainees need multiple mentors with different experiences and networks to navigate their training and careers. ASPET has invested greatly in this area, through the ASPET Mentoring Network (see the feature on page 42 in this issue) and the Partnering for Success peer mentoring initiative. We thank Education Director Dr. Catherine Fry, the Mentoring and Career Development Committee, and the Young Scientists Committee for spearheading these important efforts. Finally, training programs should offer (and require) mentor training. At my institution, we founded the Atlanta Society of Mentors 4 years ago, a grassroots organization with the goal of improving the STEM mentoring environment at Emory University and other Atlanta research institutions. For three years we have offered a 6-unit mentoring workshop series, and our experience has been that many faculty, both junior and senior, sign up voluntarily and appreciate the opportunity to improve their skills to build more productive and harmonious relationships with their trainees. It was not as difficult as we perhaps anticipated to get faculty buy-in, and feedback has been uniformly positive. Notably, this success was achieved with faculty facilitators who had no prior expertise in mentor training, and therefore I'd encourage anyone contemplating such an effort at their own institution to grab the bull by the horns and give it a try!

In closing, I'd like to take the opportunity to congratulate the new Council members elected in 2019: President-Elect Charles France, Secretary/Treasurer-Elect Mary-Ann Bjornsti, and Councilor Namandjé Bumpus. Each of them brings a strong commitment and record of service to ASPET, and I'm very much looking forward to working with them. I also want to thank those who were not elected – standing for office is a testament to their commitment to the Society and I'm sure we'll be seeing more of them in the future. Finally, I'd like to congratulate this year's award winners, who comprise one of, if not the, most diverse groups of winners in ASPET's history. The stellar achievements of these scientists reflect the breadth and impact of our discipline, and I will be privileged to be the one presenting their awards at the business meeting. I look forward to seeing you there.

Warm regards,

Eddie Morgan, PhD
ASPET President

2019 Election Results

The 2019 ASPET election closed on February 8, 2019 with a great turnout. Congratulations to newly-elected Council members Dr. Charles P. France, Dr. Mary-Ann Bjornsti, and Dr. Namandjé N. Bumpus, who will begin their terms on July 1, 2019.

President-Elect

Charles P. France, PhD

Professor of Pharmacology and Psychiatry, Robert A. Welch Distinguished Chair in Chemistry, University of Texas Health Science Center

Secretary/Treasurer-Elect

Mary-Ann Bjornsti, PhD

Professor and Chair, Department of Pharmacology and Toxicology, University of Alabama at Birmingham; Associate Director for Translational Research, University of Alabama at Birmingham Comprehensive Cancer Center

Councilor

Namandjé N. Bumpus, PhD

Associate Dean for Basic Research; Associate Professor of Medicine and Pharmacology & Molecular Sciences, Johns Hopkins University School of Medicine

2019 Award Winners

ASPET awards recognize accomplishments in all areas of pharmacology and experimental therapeutics. We are pleased to announce an outstanding group of Scientific Achievement Award winners for 2019.

ASPET will present the awards on Saturday, April 6, 2019 at 4:30 pm at the Business Meeting and Awards Presentation during the ASPET Annual Meeting at Experimental Biology 2019 in Orlando at the Orange County Convention Center in Room W307ABC. 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.

Namandjé N. Bumpus, PhD

Johns Hopkins University School of Medicine

Dr. Namandjé Bumpus is being recognized for her research on the impact of drug metabolites of HIV drugs on their pharmacology and toxicology and on the effect of genetic variation in drug metabolism on anti-HIV drug disposition.

She was nominated by Dr. Paul Hollenberg from the University of Michigan, who stated that "she provides an outstanding role model for other junior investigators, particularly for women and underrepresented minorities. She has demonstrated herself to be a very innovative and creative investigator in pharmacology research and has made numerous unique and extremely valuable contributions to the field."

Dr. Bumpus completed a PhD in pharmacology at the University of Michigan and a postdoctoral fellowship at the Scripps Research Institute in La Jolla, CA. She joined the faculty at Johns Hopkins University School of Medicine in 2010. She is currently associate professor of medicine, clinical pharmacology and associate dean for basic research. Her research focuses on determining the impact of drug metabolites of HIV drugs on their pharmacology/toxicology and on the effect of genetic variation in drug metabolism on anti-HIV drug disposition. Recently, she identified variants of kinases that phosphorylate and thereby activate nucleotide reverse transcriptase inhibitors used to treat and prevent HIV infection. In 2016 she received the Presidential Early Career Award for Scientists and Engineers awarded by President Obama. In 2018 she was invited to give a briefing to the U.S. Congress on how humans process drugs. Dr. Bumpus is chair of the NIH Xenobiotic and Nutrient Disposition and Action study section and an associate editor of *Drug Metabolism and Disposition.* She has been a member of ASPET since 2008.

Dr. Bumpus will deliver the **John J. Abel Award in Pharmacology Lecture** titled *Drug Metabolism, Pharmacogenomics and the Quest to Personalize HIV Treatment and Prevention* on Sunday, April 7, 2019 from 1:00 pm – 1:45 pm in Room W205BC of the Orange County Convention Center.

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.

Alexandra C. Newton, PhD

University of California, San Diego

Dr. Alexandra Newton is being recognized for her research in elucidating the structure and regulation of the protein kinase C (PKC) pathway and for her passion for training and mentoring young investigators.

She was nominated by Dr. Alan Saltiel, also from UCSD, who stated that "she is a paradigm-changing scientist, and a passionate mentor to countless young investigators." Her former trainee, Dr. John Brognard, now at NIH, described Dr. Newton as a “charismatic, optimistic, and motivational lab leader who has an amazingly clear vision for the development of research projects tackling important questions in basic science.” He noted her extreme dedication and commitment to her students even many years after they leave her lab.

Dr. Newton completed her PhD in chemistry at Stanford University and a postdoctoral fellowship in the lab of Dan Koshland at the University of California, Berkeley. She has had a major impact in understanding the structure, function, and regulation of PKC. Her research unveiled the biochemical and cellular mechanisms underlying the activation of protein kinase C by diacylglycerol and Ca^{2+}. She overturned a 30+ year dogma that protein kinase C is an oncogene; her analysis of cancer mutations in protein kinase C revealed an unexpected tumor suppressive function. She showed enhanced activity of protein kinase C in degenerative diseases such as Alzheimer’s. Her paradigm-changing research opened the door to targeting PKC in disease, showing its activity should be restored in cancer and inhibited in degenerative pathologies. In addition to her record of accomplishment as a scientist, Dr. Newton is passionate about mentoring, serving as director of the Molecular Pharmacology training program at UCSD. She has trained over 25 PhD students who have gone on to successful academic and industry careers in pharmacology research.

She was elected as a fellow of the American Association for the Advancement of Science (AAAS) in 2012. She has been a member of ASPET since 1995.

Dr. Newton will present the Axelrod Lecture at the 2020 ASPET Annual Meeting at Experimental Biology in San Diego, April 4-7, 2020.

David Lehr Research Award

The David Lehr Research Award is intended to extend funding for preclinical or clinical research directed toward improving human health. This award is made possible by an endowment to ASPET from Mrs. Lisa Lehr in honor of her husband, the late Dr. David Lehr, former chair of the Department of Pharmacology for New York Medical College.

Kathryn E. Meier, PhD

Washington State University

Dr. Kathryn Meier has been selected to receive research funding to investigate the impact of free fatty acid receptor (FFAR) agonists on the activity of growth factors, with implications for treatment of cancer and inflammatory conditions. The award committee

noted that the lab had recently transitioned to the study of FFARs and the proposed research would build upon previous discoveries within the lab and provide preliminary data for future NIH grant submissions.

Dr. Meier earned a PhD in pharmacology at the University of Wisconsin and had postdoctoral fellowships at the University of California, San Diego (UCSD) and the University of Washington. At UCSD she studied alpha1- and beta2-adrenergic receptors. At the University of Washington, Dr. Meier examined roles of protein kinase C in protein phosphorylation cascades. As a tenured faculty member in pharmacology at the Medical University of South Carolina, she investigated protein phosphorylation and phospholipid metabolism in cancer. Dr. Meier is currently professor and associate dean for faculty and student development in the College of Pharmacy and Pharmaceutical Sciences at Washington State University. Her research group focuses on G protein-coupled receptors as therapeutic targets in cancer.

In her application, she noted that "During my career, I have sought to make a difference in my profession as a molecular pharmacologist in various ways, pursuing a path that has included research, teaching, mentoring, and professional service. The Lehr Award would allow me to continue to participate as a researcher and mentor while seeking NIH funding for our work on the role of FFAR agonists as negative modulators of tumor cell growth."

In 2018, Dr. Meier was elected as a fellow of the American Association for the Advancement of Science (AAAS). She serves as Editor of *Molecular Pharmacology* and has been a member of ASPET since 1994.

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.

Craig M. Crews, PhD

Yale University

Dr. Craig Crews is being recognized for his career-spanning innovations in the area of experimental therapeutics, including research leading to the development of a new proteasome inhibitor for the treatment of multiple myeloma, and the proteolysis-targeting chimeric molecules (PROTACs) drug development technology, based on induced protein degradation. More recently, Dr. Crews has focused on adapting the PROTACs technology to previously undruggable targets.

He was nominated by Dr. John S. Lazo of the University of Virginia, who states: "His laboratory interests are quite broad, spanning from total chemical synthesis and development of novel chemical probes, to the generation of knockout mouse models, and the study of the mechanisms of biological responses to unfolded proteins. Most recently, his work on induced protein degradation is being hailed by many as a new paradigm for drug discovery and development and will almost certainly lead to novel therapeutics."

Dr. Crews graduated from the University of Virginia with a BA in chemistry and received his PhD from Harvard University in biochemistry, where he also did a postdoctoral fellowship. On the faculty at Yale since 1995, his laboratory pioneered the use of small molecules to control intracellular protein levels. He was a co-founder of Proteolix,

Inc. in 2003 and founded Arvinas, Inc. in 2013. Dr. Crews is currently the Lewis Cullman Professor of Molecular, Cellular, and Developmental Biology with joint appointments in chemistry and pharmacology at Yale University and is the director of the Program for Innovative Therapeutics for Connecticut's Health (PITCH), a biotech accelerator. He has been a member of ASPET since 2017.

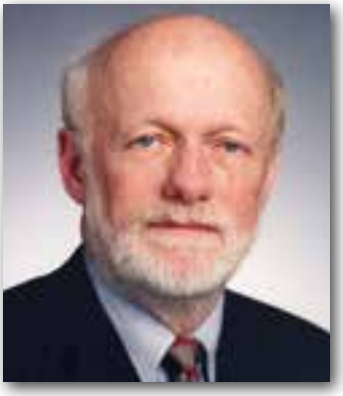
Although he will not be able to join us for the awards presentation due to a schedule conflict, we will celebrate this achievement at the ASPET Business Meeting.

Robert R. Ruffolo Career Achievement Award in Pharmacology

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

Palmer W. Taylor, PhD

University of California, San Diego



Dr. Palmer Taylor is being recognized for his career-spanning research in defining the molecular pharmacology of cholinergic synapses, the structure and function of the nicotinic acetylcholine receptor, and the enzyme acetylcholinesterase.

He was nominated by Dr. William Catterall from the University of Washington who noted that "Palmer is one of the world's leading pharmacologists with respect to his fundamental research discoveries, his academic leadership in pharmacology at UCSD, and his administrative leadership in pharmacology at ASPET and worldwide."

Dr. Taylor received his PhD from the University of Wisconsin. After postdoctoral studies at the NIH and the University of Cambridge, he joined UCSD in 1971 as an assistant professor of medicine, became the founding chair of the Department of Pharmacology in 1987, and was named the founding dean of the Skaggs School of Pharmacy & Pharmaceutical Sciences in 2002. He was elected to the US National Academy of Medicine in 1998 and a fellow of the American Association for the Advancement of Science in 2007. He has been an ASPET member since 1971 and served as president from 1995-1996.

Dr. Taylor is a leader in understanding the molecular pharmacology of cholinergic synapses. Acetylcholinesterase (AChE) terminates neurotransmission by acetylcholine and is the molecular target of several pharmacologic agents, pesticides, and nerve gases. He characterized a peripheral site critical for catalytic and inhibitor selectivity, cloned the gene encoding AChE, showed how alternative splicing of mRNA leads to distinct AChE isoforms with discrete subcellular localizations, and defined a new structural superfamily of hydrolase proteins. His studies contributed greatly to understanding the structure and ligand specificity of proteins related to the cholinesterases in structure, such as neuroligin, and in coordinated synaptic function with nicotinic acetylcholine receptors

Reynold Spector Award in Clinical Pharmacology

The Reynold Spector Award in Clinical Pharmacology was established in 2014 by ASPET in recognition of Dr. Spector's dedication and contributions to clinical pharmacology. The award recognizes excellence in research and/or teaching in clinical pharmacology. This award is made possible by an endowment to ASPET from Dr. Reynold and Mrs. Michiko Spector.

V. Craig Jordan, OBE, PhD, DSc, FMedSci

University of Texas MD Anderson Cancer Center

Dr. V. Craig Jordan is being recognized for his basic, translational, and clinical pharmacology research that resulted in development of the class of drugs known as selective estrogen receptor modulators (SERMs). SERMs revolutionized the field of women's health by providing options for the management of estrogen receptor-positive breast cancers and osteoporosis in postmenopausal women.

He was nominated by Dr. Paula Stern of the Northwestern University Feinberg School of Medicine, who noted that "Dr. Jordan's translational research over the past four decades established the standard of care for the endocrine treatment of breast cancer, chemoprevention of breast cancer, and the first studies of the evolution of drug resistance to long-term anti-estrogen therapy. Tamoxifen was the first SERM, but all SERMs have their origins in scientific discovery in Jordan's laboratory."

Dr. Jordan obtained his BSc, PhD, and DSc in pharmacology and was awarded the first honorary MD from Leeds University, UK. He established "tamoxifen teams" to first study tamoxifen then all SERMS at Leeds and then at Wisconsin as the director of the Breast Cancer Research and Treatment program, at Northwestern University as the director of the Breast Cancer Research program, at the Fox Chase Cancer Center as vice president and research director for Medical Sciences, and at Georgetown University as scientific director. He is currently the Dallas/Ft. Worth Living Legend Chair of Cancer Research and professor of Breast Medical Oncology at MD Anderson Cancer Center. He previously held inaugural named chairs endowed for him. He is a member of the National Academy of Sciences (2009) and the National Academy of Medicine (2017), a fellow of the Academy of Medical Sciences (2009), an honorary fellow of the Royal Society of Medicine (2008), and an inaugural fellow of the British Pharmacological Society (2004). Queen Elizabeth II appointed him OBE for services to international breast cancer research (2003). Dr. Jordan has been a member of ASPET since 1981.

Dr. Jordan will deliver the **Reynold Spector Award in Clinical Pharmacology Lecture** titled *Selective Estrogen Receptor Modulation to Improve Women's Health: Laboratory Concept to Lives Saved* on Monday, April 8, 2019 from 1:00 pm – 1:45 pm in Room W205BC in the Orange County Convention Center.

E. Leong Way Emeritus Travel Award

This award, originally established in 1988, is being relaunched in 2019 to provide financial support to defray the expenses for an ASPET emeritus member to attend the ASPET Annual Meeting at EB. The award honors Edward Leong Way (1916-2017). A former president of ASPET, Dr. Way is remembered for his contributions to drug metabolism research, opioid pharmacology, and a western understanding of Chinese traditional medicine, as well as the numerous scientists he mentored over 75 years of his professional life.

Raymond M. Quock, PhD

Washington State University

Dr. Raymond Quock has been selected in recognition of his career-long and continued involvement in the field of pharmacology, both as a researcher and an educator. The award committee noted that Dr. Quock's interest in the field of pharmacology

began in high school when he was a volunteer in Dr. Way's lab at the University of California, San Francisco (UCSF) and felt it was appropriate that one of Dr. Way's early trainees would be selected as the 2019 recipient of the award.

As Dr. Quock noted in his application "in summer of 1964, Eddie Way gave me, a 16-year old high school student, an opportunity to volunteer in his research laboratory at UCSF. I began by washing glassware and sweeping the floors, then graduated to weighing animals and recording tail-flick reaction times. At the end of the summer, I was surprised by a check and an invitation to return the following summer. I worked in Eddie's lab for seven consecutive summers through the remainder of high school and all of my college years. Eddie introduced me to the world of pharmacology and set me on the road to a fulfilling career in biomedical research and academia. He listed me as a co-author on a *JPET* paper (my first publication) on the effect of 6-hydroxydopamine on morphine tolerance and physical dependence."

Dr. Quock has been a biomedical researcher and academician for over 40 years, rising through the ranks to professor and department chair, recipient of a number of teaching awards, and twice appointed to distinguished professorships at Washington State University. He continues to direct an active research program, focusing on the mechanism of hyperbaric oxygen suppression of chronic pain and opioid dependence. Each fall and spring semester, he teaches a psychology course on drugs and behavior to nearly 200 undergraduate students and an alternating honors course in drug abuse and mental health.

Dr. Quock has been a member of ASPET since 1979 and has previously served on the *JPET* editorial board and on the executive committee of the ASPET Division for Pharmacology Education.

Norman Weiner Award Lecture

This lecture was established in memory of Dr. Norman Weiner, past ASPET president and chair of the Department of Pharmacology at the University of Colorado. It is in honor of his many contributions to both ASPET and to pharmacology research and education.

Mary E. Vore, PhD

University of Kentucky

Dr. Mary Vore completed her PhD in pharmacology at Vanderbilt School of Medicine and a postdoctoral fellowship at Hoffmann-La Roche. She was a graduate faculty member at the University of Kentucky Graduate Center for Toxicology from 1979 until her recent retirement. Along the way she served as vice-chair and acting chair of the Department of Pharmacology, chair of the Department of Toxicology and Cancer Biology, director of the Graduate Center for Toxicology, and associate dean for Faculty Advancement.

She has been a member of ASPET since 1975, served as secretary/treasurer in 2010, and currently serves as chair of the ASPET Board of Publications Trustees.

Dr. Vore will be presented the Norman Weiner award medallion and will deliver the **Norman Weiner Lecture** titled *Cancer Chemotherapy, Oxidative Stress and ATP-Dependent Efflux Transporters* on Tuesday, April 9, 2019 from 1:00 pm – 1:45 pm in Room W205BC of the Orange County Convention Center.

EB ORLANDO

April 6-9
Experimental Biology
2019

Join us at Experimental Biology 2019

Register online at www.aspet.org/eb2019/register

www.experimentalbiology.org

Annual Meeting of:

American Association of Anatomists

aps American Physiological Society

ASBMB American Society for Biochemistry and Molecular Biology

ASIP American Society for Investigative Pathology

ASPET Transforming Discoveries into Therapies
American Society for Pharmacology and Experimental Therapeutics

ASPET Annual Meeting Program

For speakers and full session descriptions, visit www.aspet.org/eb2019-TPharmMar. *Schedule subject to change.*

All ASPET events will be held at the Orange County Convention Center (OCCC) and the adjacent Rosen Centre Hotel. Check the EB 2019 mobile app for the final schedule.

Friday, April 5, 2019

Session/Event	Location	Time
Give a Day of Service to Orlando at EB 2019	Habitat for Humanity	8:00 am - 2:00 pm

Saturday, April 6, 2019

Session/Event	Location at OCCC	Time
An Apel(-in) a Day Keeps Cardiovascular Disorders at Bay? *Chairs: R. Maitra and H. Chun*	Room W206 A	11:00 am - 1:00 pm
Mechanisms of Drug-Induced Liver Injury: From Bedside to Bench and Back *Chairs: X. Ma and N. Kaplowitz*	Room W206 B	11:00 am - 1:00 pm
New Strategies for Augmenting Immune Checkpoint Blockade in Cancer Therapy *Chairs: C. Canman and J. Lazo*	Room W205 A	11:00 am - 1:00 pm
Teaching Institute: Pharmacology Education ADME: Audience, Design, Modality and Experimentation *Chairs: M. Bush and K. Summers*	Room W206 C	11:00 am - 1:00 pm
ASPET-APS Presidential Symposium Workshop: Microbiome Research: What You Need to Know *Chairs: A.D. Patterson and M. Hullar*	Room W311 EF	1:00 pm - 3:00 pm
Graduate Student - Postdoctoral Colloquium: Building Winning Career Connections: The Art of Self-Promotion *Chair: L. Devi*	Room W110	2:00 pm - 4:00 pm
Balancing Content, Critical Thinking, and Creativity in Graduate Education *Chair: M. Nieman*	Room W206 C	2:00 pm - 4:00 pm

Leveraging Novel Insights into Allosteric Modulator Pharmacology for CNS Disorders *Chair: K. Gregory*	Room W205 A	2:00 pm - 4:00 pm
Natural Product-Drug Interactions: Complex Mechanisms and Public Health Impact *Chairs: M. Paine and A. Roe*	Room W206 A	2:00 pm - 4:00 pm
Renal Development and Disease *(EB multi-discipline symposium)*	Room W208 BC	3:00 pm - 4:30 pm
ASPET Business Meeting and Awards Presentation	Room W307 ABC	**4:30 pm - 6:00 pm**
All Society EB Lecture - Tang Prize *Keynote: Brian J. Druker* *Imatinib as a Paradigm of Targeted Cancer Therapies*	Chapin Theater	6:00 pm - 7:00 pm
All Society EB Welcome Reception *Including Scientific Highlights Posters*	Valencia Ballroom	7:00 pm - 8:30 pm

Sunday, April 7, 2019

Session/Event	Location at OCCC	Time
Diversity and Inclusion Breakfast: Becoming a Resilient Scientist - Conversations and Connections That Matter *Chair: J. Clark* *RSVP Required*	Room W206 B	7:30 am - 9:30 am
ACE2/Angiotensin-(1-7)/Mas Receptor Axis: Look How Far We've Come! *Chairs: Y. Jarajapu and R. Valentino*	Room W206 A	8:00 am - 10:00 am
Addressing the Opioid Epidemic Through Science and Policy *Chairs: S. Kaska and C. Paronis*	Room W205 A	8:00 am - 10:00 am
G protein-β -arrestin Interplay: Molecular and Therapeutic Implications *Chairs: D. Tilley and Y. Xiang*	Room W205 BC	8:00 am - 10:00 am
ncRNAs in Drug Metabolism and the Translation of Gene Silencing Technology into Therapeutics *Chairs: B. Ning and J. Lade*	Room W206 C	8:00 am - 10:00 am

= Lectures = Networking

ASPET Welcomes Our Guest Societies!

The following are ASPET guest societies at EB 2019. Members of these organizations can register for EB using the ASPET member discount and can sponsor their own abstracts.

Behavioral Pharmacology Society
Catecholamine Society
Chinese Pharmacological Society (CNPHARS)
Global GI Club

Sunday, April 7, 2019 *continued*

ASPET-APS Presidential Symposium I: Gut Microbiome and Metabolic Disorders *Chairs: E. Morgan and J. Sands*	Room W314	8:30 am - 10:00 am
ASPET Poster Presentations (Boards B1 - B296)	Exhibit Hall	10:00 am - 12:00 pm
ASPET Daily Datablitz *Sponsored by* Pharmacology Research & Perspectives	ASPET Poster Discussion Area, Booth #720	10:30 am - 11:00 am
Networking in the Exhibit Hall *Visit with exhibitors, grab lunch, explore Career Central*	Exhibit Hall	12:00 pm - 1:00 pm
Undergraduate Networking and Career Development Luncheon RSVP Required	Room W206 B	12:15 pm - 2:00 pm
John J. Abel Award in Pharmacology Lecture *Keynote: Namandjé N. Bumpus* *Drug Metabolism, Pharmacogenomics and the Quest to Personalize HIV Treatment and Prevention*	Room W205 BC	1:00 pm - 1:45 pm
Julius Axelrod Award in Pharmacology Lecture *Keynote: Joe A. Beavo* *Cyclic AMP Coordination of Signaling Pathways: What Does Phosphoproteomic Analysis with PDE Inhibitors Suggest?*	Room W205 BC	1:45 pm - 2:30 pm
Axelrod Symposium: Phosphoproteomic Analysis of G Protein-Coupled Pathways *Chairs: J. Beavo and M. von Zastrow*	Room W205 BC	3:00 pm - 5:00 pm
Journals Workshop: An Interactive Guide to Publishing, Reviewing, and Ethics Issues *Chairs: M. Vore and R. Dodenhoff*	Room W206 B	3:00 pm - 5:00 pm

= Lectures = Networking

EB Programming

Unlock the full EB program!

Did you know your registration fee to the ASPET Annual Meeting Includes the full EB program with 5 host societies' annual meetings and 25 guest societies?

This opportunity for transdisciplinary exploration and collaboration in the life sciences community is unmatched. Explore the EB program here: https://bit.ly/2Pxjfnq.

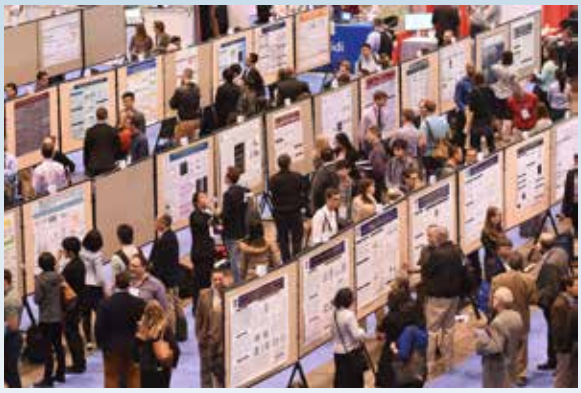
Before heading to Orlando, download the EB 2019 app in the Apple or GooglePlay store. Search for "EB Annual Meetings" The EB 2019 app will keep you organized with up-to-the-minute event information and build your personalized schedule.

Sunday, April 7, 2019 *continued*

ASPET-CNPHARS Joint Symposium: Parkinson's and Alzheimer Diseases: Neuronal Mechanism and Therapeutic Discoveries to Combat Neurodegenerative Diseases *Chairs: Y. Zhang and H. Khoshbouei*	Room W206 A	3:00 pm - 5:00 pm
Companion Animals in the Cancer Therapeutic Development Pipeline *Chair: D. Gustafson*	Room W205 A	3:00 pm - 5:00 pm
Virtual Pharmacology and Experimental Therapeutics: Near or Distant? *Chair: C. A. Hunt*	Room W206 C	3:00 pm - 5:00 pm
David Lehr Research Award Lecture *Keynote: Paul A. Insel* *GPCRs as Novel Therapeutics for Pancreatic Cancer*	Room W205 BC	5:15 pm - 6:00 pm
ASPET Student / Postdoc Poster Competition *Including display tables for university graduate programs*	Valencia Ballroom BC	6:30 pm - 8:30 pm
ASPET Student / Postdoc Mixer	Rosen Centre Hotel, Salon 10	8:30 pm - 11:00 pm

= Lectures = Networking

Over 900 pharmacology posters! Where to start?



Spend a ½ 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.

Look for high-scoring posters designated with a blue ribbon as "Program Committee Picks."

Monday, April 8, 2019

Session/Event	Location at OCCC	Time
Drugging DNA Damage Response and Repair: A Layered Therapeutic Approach for Cancer Treatment *Chair: R. van Waardenburg*	Room W205 A	8:00 am - 10:00 am
Genetic Polymorphisms in Drug Metabolizing Enzymes *Chairs: M. Shah and L.M. Henderson*	Room W206 C	8:00 am - 10:00 am
New Roles and Mechanisms of RGS Proteins in Physiology and Disease *Chairs: K. Martemyanov and R. Fisher*	Room W205 BC	8:00 am - 10:00 am
Targeting Adipose Inflammation in Diabetic Vascular Complications *Chairs: A. El-Yazbi and R. Touyz*	Room W206 A	8:00 am - 10:00 am
ASPET-APS Presidential Symposium II: Gut Microbiota: A Chemical Factory *Chairs: Y. Jeong and J. Pluznick*	Room W314	8:30 am - 10:00 am
ASPET Poster Presentations (Boards B1 - B301)	Exhibit Hall	10:00 am - 12:00 pm
ASPET Daily Datablitz *Sponsored by* Pharmacology Research & Perspectives	ASPET Poster Discussion Area, Booth #720	10:30 am - 11:00 am
Networking in the Exhibit Hall *Visit with exhibitors, grab lunch, explore Career Central*	Exhibit Hall	12:00 pm - 1:00 pm
Translational and Clinical Pharmacology Mentor/Mentee Lunch	Off-site Location RSVP Required	12:30 pm - 1:30 pm
Reynold Spector Award in Clinical Pharmacology Lecture *Keynote: V. Craig Jordan* *Selective Estrogen Receptor Modulation to Improve Women's Health: Laboratory Concept to Lives Saved*	Room W205 BC	1:00 pm - 1:45 pm
Scientific Achievement Award in Drug Discovery and Development Lecture *Keynote: Craig W. Lindsley* *Translational Drug Discovery in an Academic Setting*	Room W205 A	1:00 pm - 1:45 pm
Enteric Drug Metabolism and Drug-Drug Interactions *Chair: A. Li*	Room W206 B	2:00 pm - 3:30 pm
New Opportunities in Targeting WNT Signaling *Chairs: W. M. Blankesteijn and G. Schulte*	Room W205 A	2:00 pm - 3:30 pm
Novel Neuropeptides that Regulate Motivational and Reward-Related Behaviors *Chairs: E. Bobeck and S. Clark*	Room W205 BC	2:00 pm - 3:30 pm
The Need for Scientists in Regulation and Policy: Academia, Government, and Industry *Chairs: B. Gannon and M. Delatte*	Room W206 C	2:00 pm - 3:30 pm
What Does Sex Have to Do With It? Implications for Pharmacotherapy *Chairs: S. Wood and C. Northcott*	Room W206 A	2:00 pm - 3:30 pm

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Monday, April 8, 2019 *continued*

Division for Pharmacology Education: Surviving an Existential Threat - Creating a Niche for Basic Science Educators *Chairs: A. Ram and L. Cohen*	Room W206 C	4:00 pm - 5:30 pm
Drug Metabolism and Disposition Division Awards and Junior Investigator Platform Session *Chairs: X. Ding and A. Yu*	Room W206 A	4:00 pm - 6:00 pm
Division for Molecular Pharmacology Postdoctoral Award Competition *Chairs: Y. Xiang and A. Lyon*	Room W205 A	4:00 pm - 6:00 pm
Division for Neuropharmacology Postdoctoral Scientist Award Finalists *J. Traynor and S. Tsirka*	Room W205 BC	4:00 pm - 6:00 pm
Division for Toxicology: Kidney and Nephrotoxicity *Chairs: B. Cummings and M. Valentovic*	Room W206 B	4:00 pm - 6:00 pm
Annual Division Meeting for: • Division for Pharmacology Education	Room W206 C	5:30 pm - 6:30 pm
Annual Division Meetings for: • Drug Metabolism and Disposition • Molecular Pharmacology • Neuropharmacology • Toxicology	• Room W206 A • Room W205 A • Room W205 BC • Room W206 B	6:00 pm - 6:30 pm
Division Mixers for: • Drug Metabolism and Disposition, Pharmacology Education, and Toxicology • Molecular Pharmacology	Rosen Centre Hotel • Salon 10 • Salon 9	6:30 pm - 8:30 pm

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ASPET Booth #703

Visit the ASPET booth in the Experimental Biology exhibit hall. Items for sale at "Shop ASPET" include t-shirts and plush donkeys. Plus, pick up a FREE ASPET lanyard and your division button.

Tuesday, April 9, 2019

Session/Event		Time
Cardiovascular Signaling via the G Protein-Coupled Estrogen Receptor *Chairs: K. Tran and S. Lindsey*	Room W205 BC	8:00 am - 10:00 am
Functional Output of Sexual Dimorphism of Neuroimmune Cells *Chairs: L. Torres and S. Tsirka*	Room W206 A	8:00 am - 10:00 am
Maximizing the Therapeutic Value of Psychedelics: Recent Preclinical Studies *Chairs: C. Canal and P. Hendricks*	Room W205 A	8:00 am - 10:00 am
Strategies to Assess Drug-Drug Interactions when Developing Fixed Dose Combinations *Chair: Y. Lai*	Room W206 C	8:00 am - 10:00 am
ASPET-APS Presidential Symposium III: Microbiota in Action: The Gut and Beyond *Chairs: L. McCabe and J. Cui*	Room W314	8:30 am - 10:00 am
ASPET Poster Presentations (Boards B1 - B302)	Exhibit Hall	10:00 am - 12:00 pm
ASPET Daily Datablitz *Sponsored by* Pharmacology Research & Perspectives	ASPET Poster Discussion Area, Booth #720	10:30 am - 11:00 am
Networking in the Exhibit Hall *Visit with exhibitors, grab lunch, explore Career Central*	Exhibit Hall	12:00 pm - 1:00 pm
Norman Weiner Lecture *Keynote: Mary Vore* *Cancer Chemotherapy, Oxidative Stress, and ATP-Dependent Efflux Transporters*	Room W205 BC	1:00 pm - 1:45 pm

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Tuesday, April 9, 2019 *continued*

Bridging the Translational Gap in Ischemic Stroke Research *Chair: K. Pennypacker*	Room W206 B	2:00 pm - 3:30 pm
New Paradigms for Targeting Adenosine Receptors: Basic and Translational Applications *Chairs: L. May and R. Corriden*	Room W206 A	2:00 pm - 3:30 pm
Pharmacology of Taste: From Receptors to Behavior *Chair: K. Palmer*	Room W205 BC	2:00 pm - 3:30 pm
Pharmacology Repurposed: Novel Uses for Current Therapies *Chairs: M. Zimmerman and J. Provost*	Room W205 A	2:00 pm - 3:30 pm
Teaching Blitz *Chairs: N. Kwiek and B. Cummings*	Room W206 C	2:00 pm - 3:30 pm
Annual Division Meeting for Translational and Clinical Pharmacology	Room W206 A	4:00 pm - 4:30 pm
Division for Cardiovascular Pharmacology Trainee Showcase featuring the Benedict R. Lucchesi Young Scientist Travel Awardee *Chair: B.O. Ogola*	Room W206 C	4:00 pm - 6:00 pm
Division for Behavioral Pharmacology - Team Science: From Molecules to Test Tubes to Behavior *Chairs: G.T. Collins and J. Cook*	Room W205 BC	4:00 pm - 6:00 pm
Division for Cancer Pharmacology - Young Investigators Symposium *Chairs: J. Yalowich and M. Bjornsti*	Room W206 B	4:00 pm - 6:00 pm
Presentations of Noteworthy 2019 Abstracts from Drug Discovery and Development *Chairs: T. Parry and C. Beeson*	Room W205 A	4:00 pm - 6:00 pm
Division for Translational and Clinical Pharmacology - Young Investigator Awards Platform and Early Career Faculty Showcase *Chairs: M. Holinstat and R. Adili*	Room W206 A	4:30 pm - 6:30 pm

Make sure to attend your

Annual Division Meeting

to learn how you can become more involved!

Tuesday, April 9, 2019 *continued*

Annual Division Meetings for: • Behavioral Pharmacology • Cardiovascular Pharmacology • Cancer Pharmacology • Drug Discovery and Development	• Room W205 BC • Room W206 C • Room W206 B • Room W205 A	6:00 pm - 6:30 pm
Division Mixers for: • Behavioral Pharmacology and Neuropharmacology • Cancer Pharmacology, Drug Discovery and Development, and Translational and Clinical Pharmacology • Cardiovascular Pharmacology	Rosen Centre Hotel • Salon 10 • Salon 9 • Salon 11	6:30 pm - 8:30 pm
DMDD Meet-the-Experts Dinner and Reception for Richard Okita Early Career Award (RSVP required)	Rosen Centre Hotel, Signature 1	6:30 pm - 9:00 pm

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Thank you for being an ASPET member.
Visit the ASPET member lounge.



Visit the ASPET member lounge at the Convention Center where members can grab daily morning coffee, hold one-on-one meetings, network with colleagues, meet ASPET members and leaders, relax, or catch up on work using ASPET Wifi.

Orange County Convention Center, Room #W207A
Hours open:
Saturday, 1 pm – 4 pm | Sunday, 8 am – 6 pm | Monday, 8 am – 6 pm | Tuesday, 8 am – 6 pm

Division-Specific Meetings and Activities

Explore the new division filter to see a full schedule of sessions of interest to your division at EB 2019.
www.aspet.org/eb2019-program-TPharmMar

Date	Time	Session/Event	Location
Tuesday, April 9	12:00 pm - 1:00 pm	BEH Executive Committee Meeting (invitation only)	Rosen Centre Hotel Salon 19
Tuesday, April 9	4:00 pm - 6:00 pm	BEH Division Programming: *Team Science: From Molecules to Test Tubes to Behavior*	OCCC Room W205 BC
Tuesday, April 9	6:00 pm - 6:30 pm	BEH Annual Division Meeting	OCCC Room W205 BC
Tuesday, April 9	6:30 pm - 8:30 pm	Joint Mixer: BEH with Neuropharmacology	Rosen Centre Hotel Salon 10

Date	Time	Session/Event	Location
Tuesday, April 9	12:00 pm - 1:00 pm	DCP Executive Committee Meeting (invitation only)	Rosen Centre Hotel Salon 20
Tuesday, April 9	4:00 pm - 6:00 pm	DCP Young Investigators Symposium	OCCC Room W206 B
Tuesday, April 9	6:00 pm - 6:30 pm	DCP Annual Division Meeting	OCCC Room W206 B
Tuesday, April 9	6:30 pm - 8:30 pm	Joint Mixer: DCP with Drug Discovery and Development and Translational and Clinical Pharmacology	Rosen Centre Hotel Salon 9

Date	Time	Session/Event	Location
Tuesday, April 9	12:00 pm - 1:00 pm	CVP Executive Committee Meeting (invitation only)	Rosen Centre Hotel Salon 21
Tuesday, April 9	4:00 pm - 6:00 pm	CVP Trainee Showcase featuring the Benedict R. Lucchesi Young Scientist Travel Awardee	OCCC Room W206 C
Tuesday, April 9	6:00 pm - 6:30 pm	CVP Annual Division Meeting	OCCC Room W206 C
Tuesday, April 9	6:30 pm - 8:30 pm	CVP Mixer	Rosen Centre Hotel Salon 11

BEH = Behavioral Pharmacology, **CVP** = Cardiovascular Pharmacology, **DCP** = Cancer Pharmacology, **DDD** = Drug Discovery and Development, **DMDD** = Drug Metabolism and Disposition, **MP** = Molecular Pharmacology, **NEU** = Neuropharmacology, **DPE** = Pharmacology Education, **TCP** = Translational and Clinical Pharmacology, **TOX** = Toxicology

Date	Time	Session/Event	Location
Monday, April 8	12:00 pm - 1:00 pm	DDD Executive Committee Meeting (invitation only)	Rosen Centre Hotel Salon 23
Monday, April 8	1:00 pm - 1:45 pm	Scientific Achievement Award Lecture in DDD	OCCC Room W205 A
Tuesday, April 9	4:00 pm - 6:00 pm	Presentations of Noteworthy 2019 Abstracts from Drug Discovery and Development	OCCC Room W205 A
Tuesday, April 9	6:00 pm - 6:30 pm	DDD Annual Division Meeting	OCCC Room W205 A
Tuesday, April 9	6:30 pm - 8:30 pm	Joint Mixer: DDD with Cancer Pharmacology and Translational and Clinical Pharmacology	Rosen Centre Hotel Salon 9

Date	Time	Session/Event	Location
Sunday, April 7	12:00 pm - 1:00 pm	DMDD Executive Committee Meeting (invitation only)	Rosen Centre Hotel Salon 19
Monday, April 8	4:00 pm - 6:00 pm	DMDD Division Awards and Junior Investigator Platform Session	OCCC Room W206 A
Monday, April 8	6:00 pm - 6:30 pm	DMDD Annual Division Meeting	OCCC Room W206 A
Monday, April 8	6:30 pm - 8:30 pm	Joint Mixer: DMDD with Pharmacology Education and Toxicology	Rosen Centre Hotel Salon 10
Tuesday, April 9	6:30 pm - 9:00 pm	DMDD Meet-the-Experts Dinner and Reception for Richard Okita Early Career Award (RSVP required)	Rosen Centre Hotel Signature 1

Date	Time	Session/Event	Location
Monday, April 8	12:00 pm - 1:00 pm	MP Executive Committee Meeting (invitation only)	Rosen Centre Hotel Salon 22
Monday, April 8	4:00 pm - 6:00 pm	MP Postdoctoral Award Competition	OCCC Room W205 A
Monday, April 8	6:00 pm - 6:30 pm	MP Annual Division Meeting	OCCC Room W205 A
Monday, April 8	6:30 pm - 8:30 pm	MP Mixer	Rosen Centre Hotel Salon 9

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Date	Time	Session/Event	Location
Monday, April 8	12:00 pm - 1:00 pm	NEU Executive Committee Meeting (invitation only)	Rosen Centre Hotel Salon 20
Monday, April 8	4:00 pm - 6:00 pm	NEU Postdoctoral Scientist Award Finalists	OCCC Room W205 BC
Monday, April 8	6:00 pm - 6:30 pm	NEU Annual Division Meeting	OCCC Room W205 BC
Tuesday, April 9	6:30 pm - 8:30 pm	Joint Mixer: NEU with Behavioral Pharmacology	Rosen Centre Hotel Salon 10

Date	Time	Session/Event	Location
Monday, April 8	12:00 pm - 1:00 pm	DPE Executive Committee Meeting (invitation only)	Rosen Centre Hotel Salon 19
Monday, April 8	4:00 pm - 5:30 pm	Division Programming: *Surviving an Existential Threat - Creating a Niche for Basic Science Educators*	OCCC Room W206 C
Monday, April 8	5:30 pm - 6:30 pm	DPE Annual Division Meeting	OCCC Room W206 C
Monday, April 8	6:30 pm - 8:30 pm	Joint Mixer: DPE with Drug Metabolism and Disposition and Toxicology	Rosen Centre Hotel Salon 10

Date	Time	Session/Event	Location
Sunday, April 7	12:00 pm - 1:00 pm	TOX Executive Committee Meeting (invitation only)	Rosen Centre Hotel Salon 22
Monday, April 8	4:00 pm - 6:00 pm	Division Programming: Kidney and Nephrotoxicity	OCCC Room W206 B
Monday, April 8	6:00 pm - 6:30 pm	TOX Annual Division Meeting	OCCC Room W206 B
Monday, April 8	6:30 pm - 8:30 pm	Joint Mixer: TOX with Drug Metabolism and Disposition and Pharmacology Education	Rosen Centre Hotel Salon 10

BEH = Behavioral Pharmacology, **CVP** = Cardiovascular Pharmacology, **DCP** = Cancer Pharmacology, **DDD** = Drug Discovery and Development, **DMDD** = Drug Metabolism and Disposition, **MP** = Molecular Pharmacology, **NEU** = Neuropharmacology, **DPE** = Pharmacology Education, **TCP** = Translational and Clinical Pharmacology, **TOX** = Toxicology

Date	Time	Session/Event	Location
Sunday, April 7	12:00 pm - 1:00 pm	TCP Executive Committee Meeting (invitation only)	Rosen Centre Hotel Salon 21
Monday, April 8	12:30 pm - 1:30 pm	Translational and Clinical Pharmacology Mentor/ Mentee Lunch (RSVP required)	See invitation for location
Tuesday, April 9	4:00 pm - 4:30 pm	TCP Annual Division Meeting	OCCC Room W206 A
Tuesday, April 9	4:30 pm - 6:30 pm	TCP Young Investigator Awards Platform and Early Career Faculty Showcase	OCCC Room W206 A
Tuesday, April 9	6:30 pm - 8:30 pm	Joint Mixer: TCP with Cancer Pharmacology and Drug Discovery and Development	Rosen Centre Hotel Salon 9

BEH = Behavioral Pharmacology, **CVP** = Cardiovascular Pharmacology, **DCP** = Cancer Pharmacology, **DDD** = Drug Discovery and Development, **DMDD** = Drug Metabolism and Disposition, **MP** = Molecular Pharmacology, **NEU** = Neuropharmacology, **DPE** = Pharmacology Education, **TCP** = Translational and Clinical Pharmacology, **TOX** = Toxicology

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For more information, visit https://bit.ly/2SmHQfd

ASPET Meetings

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

Thursday, April 4, 2019

		Location
1:00 pm - 4:00 pm	Finance Committee Meeting	Rosen Centre Hotel Salon 20/21
5:00 pm - 10:00 pm	Council Meeting	Rosen Centre Hotel Salon 20/21

Friday, April 5, 2019

8:00 am - 5:00 pm	Council Meeting	Rosen Centre Hotel Salon 17/18
11:00 am - 8:00 pm	Mentoring Network: Coaching for Career Development (mentors)	Rosen Centre Hotel Salon 10
2:00 pm - 8:00 pm	Mentoring Network: Coaching for Career Development (mentees)	Rosen Centre Hotel Salon 10
2:00 pm - 5:00 pm	Council of Division Chairs Meeting	Rosen Centre Hotel Salon 23
6:00 pm - 8:30 pm	Council Dinner	See invitation for location

Saturday, April 6, 2019

8:30 am - 12:00 pm	Mentoring Network: Coaching for Career Development (mentors and mentees)	Rosen Centre Hotel Salon 10
12:00 pm - 1:30 pm	Mentoring Network Lunch	Rosen Centre Hotel Salon 11
1:00 pm - 2:00 pm	Science Policy Committee Meeting	Rosen Centre Hotel Salon 23
8:30 pm - 10:00 pm	President's Reception *(by invitation only)*	See invitation for location

Sunday, April 7, 2019

7:00 am - 8:00 am	Division Communication Officers Meeting	Rosen Centre Hotel Salon 22
7:30 am - 9:30 am	*JPET* Editorial Board Meeting	Rosen Centre Hotel Salon 12
7:30 am - 9:30 am	Diversity and Inclusion Breakfast	OCCC Room W206 B
12:00 pm - 1:00 pm	Executive Committee - Div. for Drug Metabolism and Disposition	Rosen Centre Hotel Salon 19
12:00 pm - 1:00 pm	Executive Committee - Div. for Toxicology	Rosen Centre Hotel Salon 22
12:00 pm - 1:00 pm	Executive Committee - Div. for Translational and Clinical Pharmacology	Rosen Centre Hotel Salon 21
12:15 pm - 2:00 pm	Undergraduate Networking and Career Development Luncheon	OCCC Room W206 B
12:00 pm - 2:00 pm	Board of Publications Trustees Meeting	Rosen Centre Hotel Salon 20
7:30 pm - 10:00 pm	Board of Publications Trustees Joint Editorial Boards Dinner	Rosen Centre Hotel Signature 1

Monday, April 8, 2019

7:00 am - 8:00 am	Nominating Committee Meeting	Rosen Centre Hotel Salon 22
7:00 am - 8:00 am	Young Scientists Committee Meeting	Rosen Centre Hotel Salon 19
7:30 am - 9:30 am	*Molecular Pharmacology* Editorial Board Meeting	Rosen Centre Hotel Salon 12
12:00 pm - 1:00 pm	Executive Committee - Div. for Drug Discovery and Development	Rosen Centre Hotel Salon 23
12:00 pm - 1:00 pm	Executive Committee - Div. for Molecular Pharmacology	Rosen Centre Hotel Salon 22
12:00 pm - 1:00 pm	Executive Committee - Div. for Neuropharmacology	Rosen Centre Hotel Salon 20
12:00 pm - 1:00 pm	Executive Committee - Div. for Pharmacology Education	Rosen Centre Hotel Salon 19
12:00 pm - 2:00 pm	*Pharmacological Reviews* Editorial Board Meeting	Rosen Centre Hotel Salon 21
6:30 pm - 9:00 pm	Past President's Dinner	See invitation for location

Tuesday, April 9, 2019

7:00 am - 8:00 am	Mentoring and Career Development Committee	Rosen Centre Hotel Salon 19
7:30 am - 9:30 am	*Drug Metabolism and Disposition* Editorial Board Meeting	Rosen Centre Hotel Salon 12
12:00 pm - 1:00 pm	Executive Committee - Div. for Cancer Pharmacology	Rosen Centre Hotel Salon 20
12:00 pm - 1:00 pm	Executive Committee - Div. for Cardiovascular Pharmacology	Rosen Centre Hotel Salon 21
12:00 pm - 1:00 pm	Executive Committee - Div. for Behavioral Pharmacology	Rosen Centre Hotel Salon 19
3:00 pm - 5:00 pm	*Pharmacology Research & Perspectives* Management Committee	Rosen Centre Hotel Salon 20

Wednesday, April 10, 2019

8:00 am - 12:00 pm	Program Committee Meeting	Rosen Centre Hotel Salon 9

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Use the hashtags **#ASPET19** and **#ExpBio**

Sixty Years of Benzodiazepines

Reprinted with permission from Tammy Grove, PharmD

Rebecca J. Anderson, PhD

Everybody knows what anxiety is. But crafting a concise clinical definition is difficult because anxiety is an emotion with complex attributes. It results from situations of real or perceived danger, threat, or other unpleasant experience. Increasingly, in our modern society, it may be triggered merely by feelings of insufficiency in coping with the stresses of family, professional life, or society *(1)*. It may be present continuously or intermittently *(2)*. And the symptoms can be expressed predominantly as psychological or physical—or maybe both *(1)*.

Since ancient times, people have attempted to alleviate their anxiety using chemicals. Many found relief with natural products like alcohol, marijuana, and opium *(1)*. In the early 20th century, practitioners realized that an important component of anxiety was a heightened arousal, expressed as nervousness, restlessness, agitation, or tension *(1, 3)*. To reduce the level of arousal and alertness, they prescribed "sedatives," primarily barbiturates. But the risks associated with barbiturates far outweighed their advantages. They impaired intellectual and motor skills, had considerable abuse potential, and overdosing deaths were far too common *(3)*.

The modern era of drug treatment for anxiety began in 1955 with the introduction of meprobamate *(1)*. Frank Berger at Carter Wallace Laboratories was looking for a longer-acting central muscle relaxant *(4)*. But clinicians discovered that Berger's compound, meprobamate, also curbed anxiety—and without undue sedation *(3)*.

By the late 1950s, meprobamate was the most popular psychotropic agent in the U.S. *(1)*. It was widely prescribed by psychiatrists as an outpatient treatment, as well as by general practitioners *(3)*.

Unfortunately, overuse soon made meprobamate's addiction potential apparent. In general practice, clinicians found that meprobamate was not much less sedative or addictive than the barbiturates and almost as dangerous in overdose *(1,3)*.

In parallel with meprobamate, chlorpromazine was approved by the Food and Drug Administration (FDA). Although chlorpromazine was not recognized at that time as a specific treatment for schizophrenia, it clearly had a direct effect on mood disorders. Equally significant, it established that a chemical could provide relief from psychiatric illness—a sharp departure from the prevailing practice of Freudian psychoanalysis among psychiatrists. The term "tranquilizer" was coined for meprobamate and chlorpromazine to describe their vague, psychotropic effects *(1)*.

Meprobamate and chlorpromazine's introduction marked the beginning of psychopharmacology and prompted pharmaceutical companies to search for other drugs to treat psychiatric illnesses *(2)*. At Hoffmann-La Roche, senior managers charged their chemists with finding a "psychosedative" drug that could be patented and would represent a qualitative improvement on the existing tranquilizers *(1, 3)*. Among those Roche chemists was a brash but accomplished senior research chemist named Leo Sternbach.

Leo Sternbach

The Consummate Chemist

Leo Henryk Sternbach was born in what is now Croatia in 1908. His father was Polish and his mother was Hungarian. Because neither spoke the other's language, German was their common language at home *(3)*. As a child, Leo helped in his father's pharmacy shop and learned Hungarian from his mother at home.

Because of post-World War I economic pressure and the shifting of international borders in eastern Europe, Leo's family moved several times. Leo attended German language secondary schools in Austria and Silesia (southern Poland). The family finally settled in Krakow, Poland, and became citizens there. Leo's father opened a pharmacy in the Jewish ghetto. Leo graduated from high school in 1926, while cramming to learn Polish *(3)*.

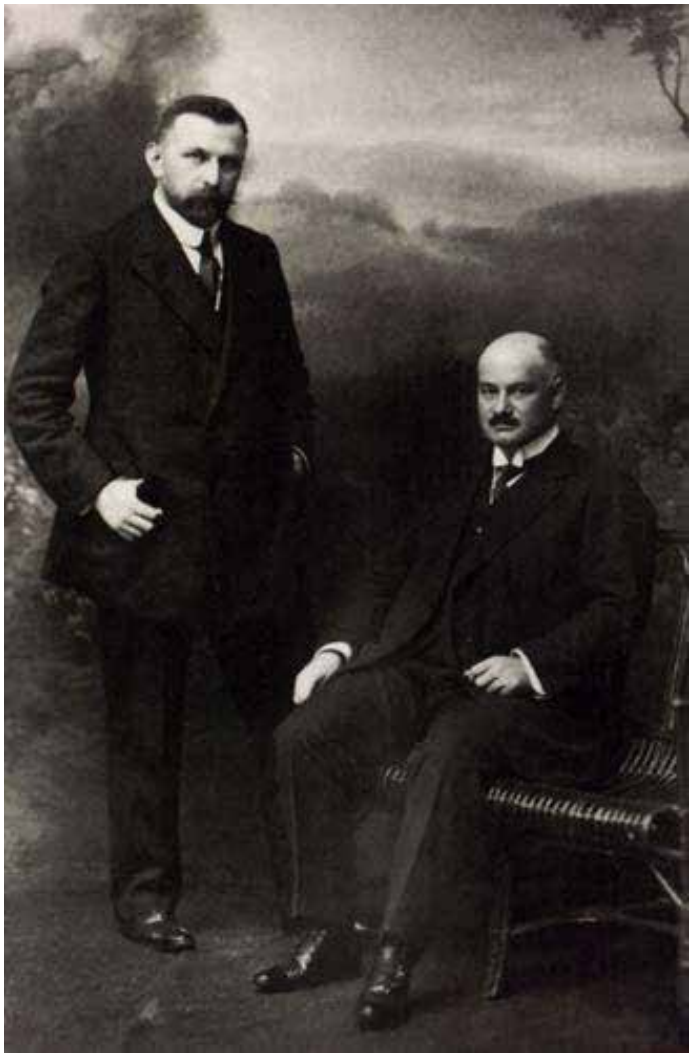
Although not a practicing Jew, Leo faced anti-Semitism throughout his early schooling. Jewish students were effectively barred from studying pharmacy or medicine. But he was accepted in the pharmacy program at the University of Krakow because his father had become an established pharmacist before it was denied to Jews *(3)*. His father hoped that Leo would eventually take over the family business, but Leo's interest lay in chemistry. He saw the study of pharmacy as his path to that goal.

In pharmacy school, Leo acquired extensive knowledge of botany and learned how to make extracts, infusions, and tinctures from leaves, roots, and bark. He received his master's degree in pharmacy in 1929 and his PhD in organic chemistry in 1931. He stayed at the university as a chemistry research assistant and lecturer until 1936, when the university took steps to fill his post with a Polish Christian *(3)*.

Sternbach received a scholarship financed by Feliks Wislicki, a Jewish textile magnate, and moved to Vienna. At the University of Vienna, he briefly worked in colloid, organic, and medicinal chemistry. Then, he landed a position at the Federal Institute of Technology in Zurich, Switzerland. When the Wislicki scholarship expired in March 1939, Sternbach continued employment at the Institute with support from the Rockefeller Foundation *(3)*.

Life became uncertain for the Sternbach family after Germany invaded Poland on September 1, 1939. In Switzerland, Leo was spared the anti-Semitism he had encountered in Austria and Poland. In the prevailing political environment, he could not return to his family in Krakow *(1, 3)*.

Sternbach learned that the Basel-based pharmaceutical company Hoffmann-La Roche was looking for a research chemist. Like other Swiss companies, Roche employed Jews and protected their careers. Sternbach interviewed with the Roche chairman, Emil Christoph Barell, and was offered a position in 1940 *(3)*. His first assignment at Roche was to work on the synthesis of riboflavin (vitamin B_2).



In the public domain.

Emil Barell (left) and Fritz Hoffmann-La Roche (right) in 1898

When Hitler invaded Yugoslavia, Greece, the Soviet Union, and North Africa in 1941, neutral Switzerland found itself in a precarious position, surrounded by Axis powers. In May, Barell made the decision to move the company's headquarters from Basel to Nutley, New Jersey *(3)*.

The Nutley site had been manufacturing Roche products as a subsidiary before the war. In particular, Roche was one of the principal suppliers of vitamins to the US and its allies. Barell set up operations to ensure that for the duration of the war, Roche could ship its products from the US if they could no longer be supplied from Basel.

In addition to the new corporate headquarters, Barell established a research facility in Nutley and relocated many of Roche's best researchers to staff it, including Leo Sternbach. Having mastered German, Hungarian, and Polish, Sternbach now learned a fourth language, American English *(3)*.

Sternbach's first assignment in Nutley was to compare various samples of commercial beta-ionone to establish which was the best starting material for synthesis of vitamin A. His next project was synthesis of water-soluble arsenicals, which were aimed at treating syphilis and could compete with a recently introduced product, Mapharsan. The third project was synthesis of warfarin-like compounds to be used as anticoagulants *(3)*. Sternbach did not consider these projects very challenging, and they were soon discontinued.

A contributing factor was Sternbach's sharp criticism of his superiors, especially those trained as chemists. In his first few months in Nutley, he repeatedly clashed with his bosses and rapidly transferred from one to the next. According to Sternbach, "those who were above me were not my favorites" *(3)*.

Sternbach never doubted his chemical expertise and demanded his bosses' support to work independently. He wanted to follow "the right path," as he saw it, without their interference. Once he made up his mind, he could not be dissuaded. With boundless energy, he overcame all resistance and obstacles, regardless of whether they involved chemistry, personnel, or the company hierarchy *(3)*.

Sternbach was also extremely demanding toward his subordinates and expected their loyal assistance. But for them, he concealed his drive for independence behind warm amiability, and his proud self-confidence behind a charming modesty *(3)*. He was highly respected, and whenever possible, he avoided quarrels. But when angered, he could explode with a string of expletives, often forcefully expressed in Polish. Then, just as quickly, he would cool down and reestablish his basic kindness.

Biotin Breakthrough

Following his uninspiring early assignments, Sternbach's next contribution caught everyone's attention at Roche. In 1940, Vincent du Vigneaud

discovered that biotin (which had first been identified as a yeast growth factor) was also a mammalian vitamin (vitamin B_7). Du Vigneaud had isolated biotin from liver extracts and milk in his laboratory at Cornell University *(5)*. Subsequently, chemists at Merck and Lederle successfully synthesized biotin. But their methods produced extremely low yields, and the vitamin was not commercially viable.

In February 1943, Sternbach started work to synthesize biotin at Roche. His improved method produced a 10-fold greater yield. Roche patented Sternbach's method and began including biotin in its multivitamin preparations. This forced other manufacturers to also include biotin in their multivitamins, and they had to buy biotin from Roche—a real windfall for the company *(3)*.

The success of biotin propelled Sternbach into the select group of Roche's top researchers *(3)*. And biotin was just the first in a string of commercially successful products that Sternbach synthesized: spasmolytics, selective muscarinic receptor blockers, and antihypertensives *(1)*.

Where to Start?

When Roche mandated a research effort to find a new "psychosedative" drug, Sternbach took up the challenge, along with a number of his colleagues. Because Roche wanted a chemically novel drug, the chemists could not simply modify the known active compounds using structure-activity relationships *(1, 3)*. Besides, they knew several competing research groups were already optimizing and patenting active analogs of meprobamate and chlorpromazine *(6)*.

Modifying brain chemistry in a targeted manner was also impossible because, at that time, almost nothing was known about brain processes or biochemistry *(3, 6)*. In fact, despite chlorpromazine's proven efficacy, many psychiatrists still doubted any connection between brain chemistry and psychiatric illness.

Fortunately, behavioral pharmacology worked in the chemists' favor. Animal tests had been developed and proven to be reliable for detecting the pharmacologic actions of sedatives and tranquilizers *(3, 6)*. But the chemists still needed a starting point, and there were only two possible strategies left.

They could pull old compounds off the shelf and screen them in the animals for "psychosedative" activity. Many drug companies in later decades would rely on such "high throughput screening" strategies to identify chemical leads. But for reasons that are unclear, this approach was not considered or followed by the Roche chemists *(1)*.

Modifying brain chemistry in a targeted manner was also impossible because, at that time, almost nothing was known about brain processes or biochemistry.

Alternatively, they could create a priori novel structures unrelated to known drugs. Undoubtedly, the Roche chemists proposed many molecular options. The details of these novel chemical structures are unknown, but we can conclude, based on the lack of patents and publications, that those compounds did not produce desirable pharmacologic results *(1)*. Leo Sternbach was the exception.

The Dye that Didn't Die

In his first 10 years with Roche, Sternbach had acquired considerable medicinal chemistry experience *(1)*. He drew on that practical insight and tackled this new problem in a purely empirical manner *(6)*. In the absence of a logical starting point, Sternbach made choices based on compounds that were relatively unresearched, were easily accessible, and offered the potential for making a variety of analogs *(3, 6)*.

Twenty years earlier, as a postdoctoral assistant at the University of Krakow, Sternbach had researched new azo dyes and dyestuff intermediates *(1, 3, 6)*. His efforts, preparing a group of benzoheptoxodiazines, had involved interesting chemistry, and he produced good yields. But none of the chemicals were useful as dyes *(6)*. Sternbach published his work in a Polish chemical journal and moved to other projects.

Now at Roche, Sternbach remembered those benzoheptoxodiazines, which "looked rather attractive to us and seemed to be well suited for a fairly broad synthetic program" *(6)*. From his earlier work, Sternbach knew these compounds were easy to synthesize, isolate, purify, and crystallize. He did a literature search and found that very little had been published on the chemistry of the compounds, and no studies of their biological properties had been performed *(1, 6)*.

Sternbach made a number of heptoxodiazine analogs. In the course of this work, he realized that the chemical structure of some of the analogs were quinazolines rather than heptoxodiazines *(1, 2, 6)*. Because the quinazoline compounds represented another interesting and novel chemical structure, he proceeded to make a series of about 40 analogs, all of which were easy to synthesize and formed nice crystals *(2)*. "Unfortunately, the pharmacologic properties were rather disappointing" *(6)*.

Sternbach trusted his instincts. And he was not shy about showing that he was more knowledgeable in chemistry than almost anyone else. His sheer joy of chemistry drove him to pursue anything that grabbed him emotionally or fired his intuition. So he soldiered on, with a legendary tenacity.

But by the latter half of 1955, he had lost the confidence of his boss, who felt Sternbach was following a fruitless and dead-end path. He demanded that Sternbach abandon his work on the quinazolines and focus on higher priority projects *(1, 3, 6)*.

Sternbach switched to isolating, purifying, and degrading various antibiotics *(6)*. By April 1957, he was running out of workspace. His lab benches were covered with dishes, flasks, and beakers—all containing various samples and mother liquors. He needed to do some radical spring cleaning and clear out lab space *(3, 6)*.

One Last Chance

During the cleanup operation, Sternbach's coworker, Earl Reeder, discovered a few hundred milligrams of two compounds: a crystalline base and its hydrochloride salt. Sternbach and Reeder had prepared the base in 1955 and the HCl salt in 1956 *(3)*. Because of Sternbach's reassignment, the compounds had been tucked away and never tested *(6)*.

In May 1957, Sternbach submitted the water-soluble salt for pharmacological evaluation under code number Ro 5-0690 *(1, 6)*. He promised the pharmacologists that this would be the last compound from the series he would submit *(1)*. He expected negative results, but it would wrap up their work on the quinazoline series, and at least they hoped to publish their work in a chemical journal *(6)*.

A few days later, Lowell O. Randall, director of Roche's pharmacology department, telephoned Sternbach. Randall had been trained as a biochemist and had almost 20 years of experience as an industrial pharmacologist and toxicologist, first at Burroughs Wellcome and then at Hoffmann-La Roche. His main interest had been in autonomic pharmacology and in analgesic and anti-inflammatory drugs *(1)*.

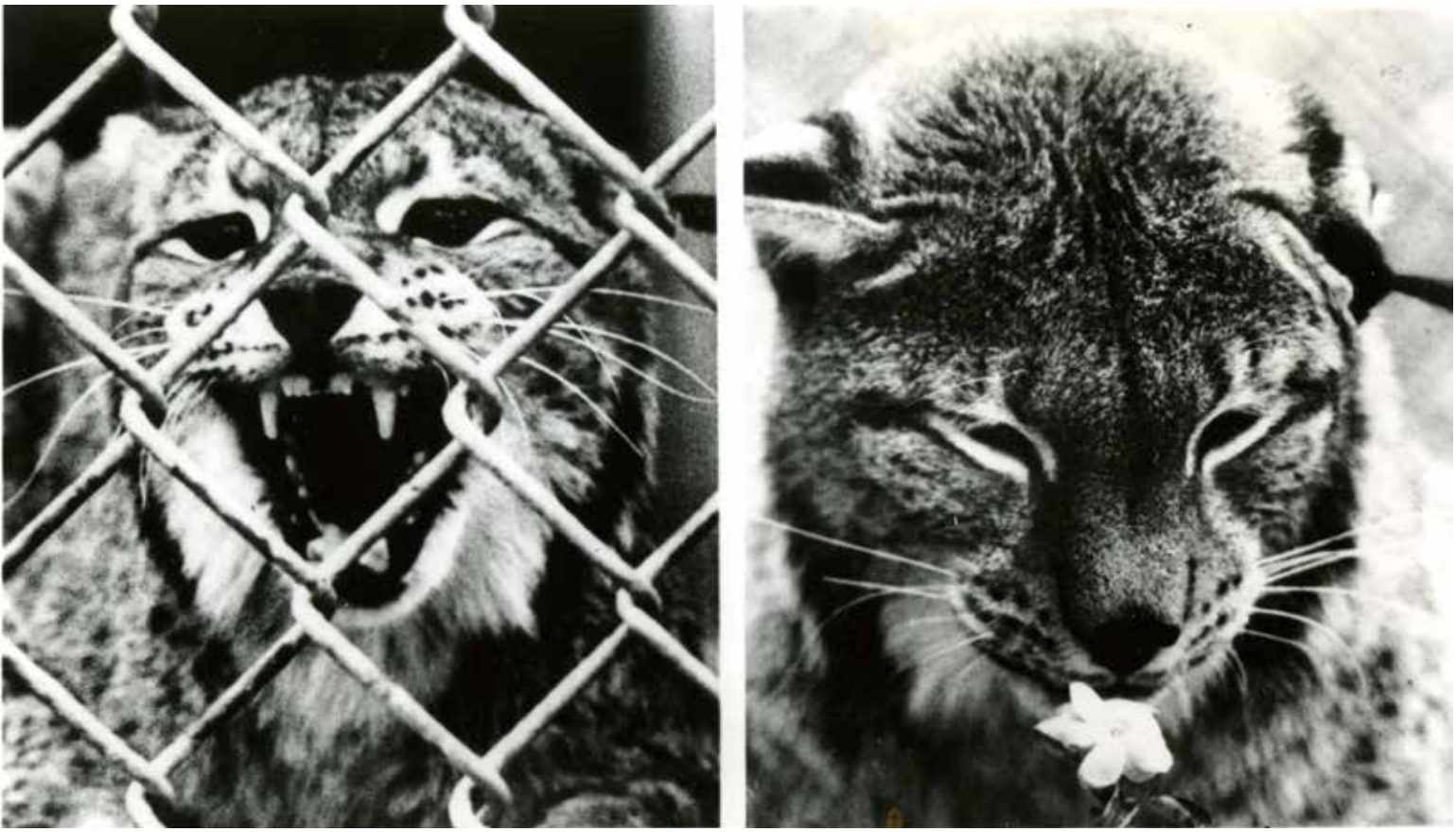
Randall directly supervised Roche's primary screening of compounds for CNS activity *(1)*. And he was enthusiastic about Ro 5-0690. "The compound exhibited unusually interesting qualities" *(6)*. It was a potent muscle relaxant and sedative with no general anesthetic properties, was apparently devoid of autonomic effects, and had very low toxicity *(1)*.

Randall compared Ro 5-0690's activity to the then-most frequently used tranquilizers (meprobamate and chlorpromazine) and a reference anticonvulsant (phenobarbital). Ro 5-0690 was more effective than meprobamate in each of Randall's six preliminary tests. Compared to chlorpromazine, Ro 5-0690 was weaker in the mouse inclined screen and rat foot shock tests, equally effective as a muscle relaxant in the cat, and had a more pronounced anticonvulsant effect *(6, 7)*. The absence of a direct hypnotic effect was another interesting feature and differentiated it from phenobarbital. And unlike chlorpromazine, it had no effect at all on the autonomic nervous system *(6, 7)*.

To Sternbach, "It looked like an ideal compound" *(6)*. He synthesized larger quantities of Ro 5-0690, and Randall put it through a whole gamut of animal tests to define its pharmacological and psychotropic properties *(1)*.

In parallel, Sternbach examined more closely the chemistry of Ro 5-0690. He definitively identified its chemical structure—which proved to be a benzodiazepine rather than a quinazoline—and called it methaminodiazepoxide. Later, the generic name was changed to chlordiazepoxide *(1, 6)*. Sternbach also produced a number of analogs, but none of them proved superior to Ro 5-0690.

Roche filed a patent on the benzodiazepine series in May 1958, and Randall completed the preclinical safety testing of chlordiazepoxide *(1, 6)*. Toward the end of 1959, he presented the pharmacological properties of chlordiazepoxide at a scientific meeting *(1)*. What impressed the pharmacologists more than any other aspect was the drug's "taming" effect. Although no accepted animal models of anxiety existed in the 1950s, Randall reported that chlordiazepoxide suppressed aggressive animal behavior *(1)*. The drug had tamed a colony of vicious



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The picture at left shows a growling caged lynx at the San Diego Zoo. The same lynx nuzzles a wild flower on the right after being given chlordiazepoxide.

cynomolgus monkeys at doses that did not affect their level of alertness or other behavioral responses—an "anxiolytic" type of activity. *(7)*

Those observations were confirmed by veterinarian Werner Heuschele, who was asked to test chlordiazepoxide at the San Diego Zoo *(8)*. Unlike previous tranquilizers, which made the animals groggy, Heuschele found that chlordiazepoxide allowed animals to remain active but made them genuinely gentle and friendly. For example, it transformed a fierce 40-pound lynx into a tranquil tabby, which gamboled lamblike in its cage, allowed its ears to be scratched, and rolled over on its back to have its belly stroked *(8)*. Heuschele had equal success in calming a mean Australian dingo, Tasmanian devil, Sumatran tiger, red kangaroo, and baboon *(8)*.

Sternbach himself took the compound and told the Associated Press: "It had no unpleasant side-effects. It gave you a feeling of well-being" *(1)*. He subsequently tested many of his compounds on himself *(9)*.

The marked anticonvulsant and muscle relaxant activities of chlordiazepoxide were clearly more widely separated from the lethal dose than the safety margins of meprobamate and phenobarbital *(7)*. And Randall found no relevant organ toxicity *(7)*.

Clinical Persistence

Clinical trials began in 1958 under Leonard Hines, Roche's director of biological research *(1, 6)*. The first studies enrolled healthy volunteers and institutionalized elderly patients, who were given rather high doses *(2)*. Chlordiazepoxide produced marked sleepiness, dizziness, ataxia, and slurred speech *(1, 2)*. It looked no different than other sedative drugs, and Roche suspended the clinical trials for several months *(1)*.

Then, Hines convinced Irvin Cohen, a psychiatrist in Galveston, Texas, and two other practitioners to try chlordiazepoxide on some of their outpatients suffering from anxiety and mild depression *(1, 2)*. They administered lower doses and found that

chlordiazepoxide calmed tension, reduced anxiety, and improved sleep with a minimum of side effects *(1)*.

Although the optimal dose was still uncertain, drowsiness and ataxia could be avoided by adjusting the dose. Increased appetite, interest in social activity, and verbal productivity, as well as a feeling of well-being, suggested that the drug had some kind of psychostimulant effect *(1)*.

Interest among clinical investigators became so great that thousands of patients were soon enrolled in the trials and treated with the drug. The clinical trials (and clinical experience in millions of patients over the next 20 years) confirmed the low toxicity and large safety margin of the benzodiazepines *(1, 6)*.

Chlordiazepoxide was approved by the FDA in February 1960—less than two and a half years after Randall's first pharmacological tests. Roche marketed the drug as Librium®—from "equilibrium" *(1, 6, 8)*.

The rapid onset of therapeutic effect in low doses with only minor side effects (perhaps together with the suggestive tradename) impressed both physicians and patients. They enthusiastically embraced Librium as the preferred treatment for anxiety *(1)*.

Diazepam tablets

A Bigger Hit

During the two years that chlordiazepoxide was in clinical trials, very little effort was put into further benzodiazepine research. It was only when Librium approached market introduction that work resumed *(1)*. One drawback of chlordiazepoxide was that the water-soluble salt, which had been developed for the clinic, was extremely bitter. In addition, the compound was unstable in aqueous solution *(1, 6)*. This made it unsuitable for liquid formulations. As a follow up, Sternbach set out to find a tasteless analog that could be used in elixir or syrup formulations for pediatric and geriatric use.

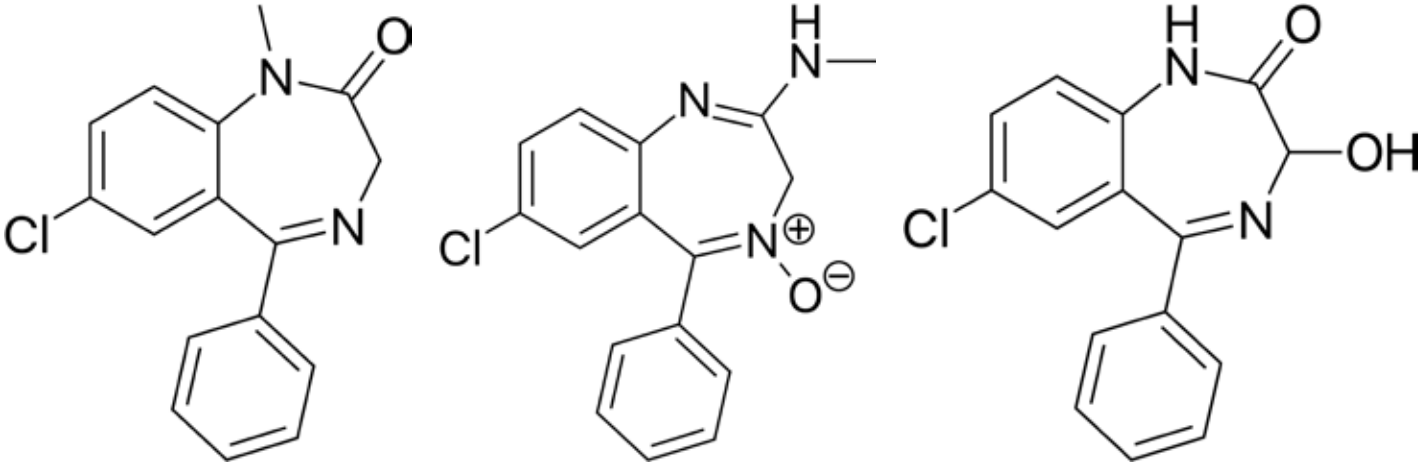
Along with developing more efficient chemical synthesis methods, Sternbach's structure-activity studies helped to elucidate features of the molecule that were essential for pharmacologic activity *(6)*. All of the active benzodiazepine compounds had a similar pharmacologic profile, but one, the 1-methyl derivative, was significantly more potent than chlordiazepoxide.

Hoping that the greater potency would provide advantages in the clinic, Sternbach and Randall intensively studied the compound, which they named diazepam. It had a greater separation between anxiolytic and sedative effects than chlordiazepoxide *(2, 3)*. And the toxicology studies showed that diazepam was extremely safe *(6)*.

Roche first marketed diazepam under the tradename Valium® (from the Latin, valere, meaning "to be strong," and the suffix of Librium) in 1963 *(2)*. Valium largely replaced Librium, and by the end of the 1960s, it was the best-selling psychotropic drug in the western world *(3)*.

As soon as the chlordiazepoxide patent appeared, researchers at other companies began investigating benzodiazepine derivatives, too. Wyeth researchers discovered the biological activity of the analog, oxazepam, which they patented in 1965.

But Sternbach and his team at Roche remained at the forefront of benzodiazepine research. The clinical success of Valium led to Sternbach's promotion to director of medicinal chemistry. He greatly enlarged Roche's chemistry staff, and the Pharmacology Department expanded proportionately *(6)*. Over the next 25 years, they synthesized and pharmacologically evaluated more than 3,000 benzodiazepines, churning out new products like a virtual factory *(1, 3, 6)*.



Structures of diazepam, chlordiazepoxide, and oxazepam

Channeled Chaos

Sternbach's fellow chemists admired his mastery of laboratory skills. He worked with precision and concentration, and his command of crystallization was unequalled *(3)*. To the outsider, his lab bench was chaotic: a jumble of tubes and Erlenmeyer flasks. "Sternbach wrote up his research reports absolutely correctly, although they were thoroughly confusing to everybody else; sometimes he started at the front of the notebook, sometimes at the back" *(3)*.

Sternbach had a knack for surrounding himself with competent people and successfully motivating them. Despite his volatile temperament, he could be a brilliant team worker, fostering collaborations at all levels. He worked closely with Randall's pharmacology team, supported them, and openly communicated with them *(3)*.

Fairness was the rule on Sternbach's team, and to them, he exhibited nothing but enthusiasm, openness, and infinite patience. He also took an interest in their personal problems, even giving them financial support when necessary *(3)*.

Sternbach dealt with problems efficiently, which often meant bypassing official channels. He was obstinate, fired by optimism and self-confidence, and trusted his instincts. But he was also an unwavering realist. When the results differed from his preconceived notions, he relented, saying, "Life is how it is" *(3)*.

A Class Act

Librium and Valium triggered a worldwide industry search for more selective benzodiazepines. Thousands of patents and tens of thousands of research papers were published on benzodiazepine chemistry, pharmacology, and clinical effects *(6)*. By the 1980s, those efforts resulted in more than 30 marketed benzodiazepines *(1)*.

All of them possessed pharmacologic properties that are characteristic of this drug class: muscle relaxant, sedative, antianxiety, anticonvulsant, and hypnotic. But each compound exhibits relatively greater or lesser effects: one may be more hypnotic, another more anxiolytic, and a third more anticonvulsant *(3)*. They also differ in their physicochemical properties, pharmacokinetic behavior, and susceptibility to metabolism.

Probing the Brain

For the first 15 years after the introduction of chlordiazepoxide, clinicians knew little or nothing about how the benzodiazepines worked *(3)*. Research focused on descriptive aspects of the drugs' actions, primarily the anticonvulsant effect *(1)*.

In 1965, diazepam was established as an effective treatment for status epilepticus *(10)*. Status epilepticus is a neurologic emergency characterized by a prolonged, self-sustained, and potentially life-threatening seizure. It is often refractory to treatment. By 1969, diazepam was recommended as (and remains) the drug of choice because it is effective against a variety of seizure types, has a rapid onset of action, and is relatively safe *(10)*.

Studies on the muscle relaxant effect revealed an absence of action on the neuromuscular junction *(1)*. In 1967, the first hint of a neuronal mechanism of action came from a report that diazepam enhanced

Valium advertisement from 1971 targeted at women

In the public domain.

presynaptic inhibition in the cat spinal cord *(11)*. But this report went largely unnoticed because (1) the paper was published in German, (2) presynaptic inhibition was a relatively new phenomenon and not accepted by some neurophysiologists, and (3) the chemical transmitter involved in presynaptic inhibition was not known *(1)*.

Sophisticated electrophysiological and biochemical methods were used in attempts to find the specific neurotransmitter mediating the benzodiazepines' effects on reducing arousal and alertness, preventing the physical responses to stress, and improving sleep. But researchers found negligible effects on the dopamine, norepinephrine, serotonin, and acetylcholine systems *(1)*.

In the early 1970s, it became clear that GABA, a biological compound known for many years and accepted as a transmitter in lower animals, was also a critically important inhibitory neurotransmitter in the mammalian nervous system *(1)*. In some regions of the brain, 20-50% of synapses are mediated by GABA *(3)*.

In an elegant series of experiments using electrophysiologic techniques, Willy Haefely at Roche demonstrated that the GABA synapse was the

primary site of action of the benzodiazepines *(1)*. Using biochemical methods, Erminio Costa independently arrived at the same conclusion. Further studies unequivocally demonstrated that the benzodiazepines amplify GABAergic transmission *(1, 3)*.

The binding sites for benzodiazepines in the brain correlate with the drugs' pharmacological effects in virtually all brain regions. On the other hand, specific binding sites for benzodiazepines outside the brain and spinal cord do not exist, and this accounts for the virtual absence of direct benzodiazepine effects on peripheral tissues *(1)*.

Researchers then began using the benzodiazepines as tools to elucidate the form and function of the GABAergic system, the most important "calming" neurotransmitter in the brain *(3)*.

The benzodiazepines have also helped to establish animal behavioral models for assessing anxiety. It is now generally believed that the anxiolytic effect of drugs in humans correlates with inhibition of behaviors in animals in punishment or conflict tests *(1)*. Many of the discoveries of brain function would not have been possible without the benzodiazepines *(3)*.

Changing Times

Through the 1960s, the benzodiazepines' popularity rapidly increased, and they replaced most other sedatives and anxiolytics *(2)*. Unlike all other psychotropic drugs, the benzodiazepines had a wide therapeutic index. Death from respiratory collapse simply did not occur with the benzodiazepines *(3)*. Overdose would put people to sleep but they would wake up again in a relatively short time and fully recover.

The safety and efficacy led to a public perception that benzodiazepines were a simple answer to overcoming the stress and strain of daily life. In addition to well-defined anxiety disorders, indiscriminate prescription use became common among executives, housewives, and the elderly *(3)*.

The drugs were also used recreationally. In 1966, the Rolling Stones released "Mother's Little Helper," a reference to this widespread prescribing and abuse *(2)*. Contrary to the view of many at the time, the benzodiazepines are not happiness pills. They do not promote happiness; rather, they counteract the perception of stress *(3)*.

By the late 1970s, it was becoming clear that benzodiazepines could cause problems, especially in situations in which they were never meant to be used and in which clinical trials had not confirmed their efficacy *(3)*. The very potent sedative benzodiazepine, Rohypnol, became notorious as the "date-rape drug" *(2)*.

This led, in the early 1980s, to publicity and anecdotal reports of benzodiazepine misuse and abuse, as well as unconfirmed toxicity *(1, 2)*. Medical concern and media pressure spurred politicians and bureaucrats into action. The U.S. Senate held hearings, and federal regulators imposed restrictions. Doctors became more reluctant to prescribe benzodiazepines, even for patients who clearly needed them, and patients were reluctant to take them because of an unfounded fear of addiction *(3)*.

Benzodiazepines can be abused, but mostly by people who have a history of abusing other drugs, particularly opioid- and alcohol-dependent individuals. Long-term use in any patient can also result in tolerance, dependence, and withdrawal symptoms. But interestingly, benzodiazepines are among the few drugs that alleviate the psychological and physical distress in patients withdrawing from narcotics in medical treatment programs *(3)*.

Because of persistent concerns, benzodiazepine prescribing declined significantly in the 1990s, and investigators evaluated alternative classes of drugs to treat anxiety disorders. Unfortunately, none of those alternatives have the speedy onset of action of the benzodiazepines, and a large portion of patients are non-responders *(3)*.

In the last two decades, benzodiazepine use has rebounded *(12, 13)*. From 1996 to 2013, prescriptions for benzodiazepines increased 67% and the total quantity of the drug in filled prescriptions more than tripled *(12)*. Adults aged 50-64 years are now the largest group using prescribed benzodiazepines, and the highest misuse is by young adults aged 18-25 years *(13)*. Benzodiazepine misuse, which now accounts for nearly 20% of overall use, is still strongly associated with those who abuse and are dependent on opiates *(13)*.

The concurrent increase in opioid prescriptions has created dangerous conditions for fatal overdosing. While the sedative effect of the

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Leo Sternbach with molecule of Librium and bottle of Valium

benzodiazepines is limited and not life-threatening, it adds to the sedative effects (particularly respiratory depression) of other drugs. Studies have found that concurrent use of a benzodiazepine with opiates increases the risk of overdose death 4-fold, compared to opioid use alone *(12, 14, 15)*.

In 2016, the benzodiazepine alprazolam (Xanax®) was involved in 6,209 overdose deaths, making it the fifth most deadly overdose drug, behind fentanyl, heroin, cocaine, and methamphetamine *(16)*. Diazepam and clonazepam also made the list, but the benzodiazepine deaths almost always involved concurrent opiate use. Because of this lethal synergy, the Centers for Disease Control and Prevention recommend that "clinicians should avoid prescribing opioid pain medication and benzodiazepines concurrently whenever possible" *(14)*.

Despite real concerns over abuse and misuse, nothing has replaced the benzodiazepines for safe and effective treatment of anxiety and related disorders, when prescribed responsibly. And the World Health Organization continues to include diazepam in its Model List of Essential Medicines *(3)*.

Roche's Wunderkind

In his career, Leo Sternbach was directly responsible for 241 patents. When he retired from Roche in 1973, his discoveries contributed to almost one-fifth of all Roche patents in force at that time *(3)*. He continued to report for work as a Roche consultant almost every day until 2003. And as recently as 1994, the products he patented accounted for 28% of the company's worldwide pharmaceutical sales *(9)*.

Benzodiazepines Discovered by Leo Sternbach

Introduction	Generic Name	Brand Name	Main Indication
1960	Chlordiazepoxide	Librium	Anxiolytic
1963	Diazepam	Valium	Anxiolytic, anticonvulsant
1965	Nitrazepam	Mogadon	hypnotic
1968	Medazepam	Nobrium	Long-acting anxiolytic
1973	Clonazepam	Rivotril, Klonopin	Anticonvulsant, panic disorder
1974	Bromazepam	Lexotan	anxiolytic
1975	Flunitrazepam	Rohypnol	Insomnia, surgical pre-medication
1978	Flurazepam	Dalmadorm, Dalmane	insomnia
1982	Midazolam	Dormicum, Versed	Surgical pre-medication

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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 Viagra: yes to NO.

Don't miss the June 2019 issue.

Science Policy News

Meet the 2019 Washington Fellows

This year's fellows class comprises 10 graduate students from across the country with sterling academic credentials and a demonstrated interest in how legislation and policy affects the pharmacology profession. For the first time in program history, all 10 fellows will arrive in Washington, D.C. on April 30, 2019 to hear from legislative staff and scientists in the policy profession, be trained in advocacy by members of ASPET, and speak with their legislators about how to address the challenges facing the scientific community. Additionally, the Washington Fellows will receive paid registration to the ASPET Annual Meeting at Experimental Biology 2019 in Orlando, FL, where they will have the opportunity to network with each other and with Fellows from previous years.

Jami Conley Calderon

University of Central Florida

Born and raised in Washington, Missouri, Jami graduated with her Bachelor of Science degree in Biochemistry and Microbiology/Cellular/Molecular Biology/Biotechnology from Southeast Missouri State University in 2014. She also served as First-year Student Senator, Secretary, and Chairperson of the Student Issues Committee as part of the Student Government Association throughout her time at Southeast Missouri State University. She is currently pursuing her PhD in biomedical sciences at the University of Central Florida, investigating the role of a dynein mutation in a rare subtype of the peripheral neuropathy known as Charcot-Marie-Tooth disease. As an ASPET Washington Fellow, Jami hopes to meld her passions for science and government by advocating for scientific research, highlighting the importance of science education, and encouraging evidence-based policymaking.

Robert Cassell

Purdue University

Originally hailing from the town of Bournemouth in the United Kingdom, Robert received his Bachelor of Science in chemistry with first class honors from Manchester Metropolitan University in 2014, which included thesis work relating to drugs of abuse. Following a brief stint as a private tutor, Robert moved in 2015 to West Lafayette, Indiana to follow his passion and pursue a PhD in medicinal chemistry and molecular pharmacology from Purdue University with a particular interest in neuropharmacology.

Working in the laboratory of Dr. Richard van Rijn, Robert's research has focused on the discovery and development of drugs targeting the delta opioid receptor with the aim of finding new treatments for treating alcoholism, chronic pain, anxiety and depression. Working in addiction research and with a passion for communication, Robert hopes to use his opportunity as an ASPET Washington Fellow to learn how to effectively advocate for rational, science-based

solutions for the addiction epidemic and provide accurate education and advice to help dispel the large number of harmful misconceptions currently limiting effective approaches.

Joseph Flores-Toro

University of Florida

Joe was born in Philadelphia and raised in York County, Pennsylvania. He received his bachelor's degree in biochemistry and molecular biology from Penn State University. While at Penn State, he cultivated his love of science via participation in academic research and outreach while volunteering in the local community. Following his undergraduate education, he moved to Florida and became a high school science teacher, instructing courses ranging from AP biology to physics. However, the allure of research drew him to graduate school. He is currently pursuing a PhD in biomedical sciences in the Department of Pharmacology and Therapeutics at the University of Florida. Under the mentorship of Dr. Jeff Harrison, his research is focused on developing a new approach for the treatment of glioblastoma by utilizing a novel chemokine receptor inhibitor to unmask efficacy of immunotherapies that have otherwise not worked in glioblastoma. In addition to research, he has remained active in outreach via volunteer work with local school programs, pediatric oncology camps, and the Institute for Learning in Retirement. As an ASPET Washington Fellow, Joe hopes to learn how to leverage his experience as an educator and researcher to effectively advocate for the importance of supporting STEM education and funding biomedical research.

Brittney Garner

University of Arkansas for Medical Sciences

Brittney was born in Louisiana, but grew up in Lake Jackson, Texas. She graduated summa cum laude with Honors from East Texas Baptist University

in 2015 with a Bachelor of Science in biology and chemistry. Subsequently, she was accepted into the PhD program of the Department of Pharmacology and Toxicology at the University of Arkansas for Medical Sciences (UAMS). Currently, Brittney is co-mentored by Drs. Nancy Rusch and Shengyu Mu. Her dissertation project focuses on the contribution of the lymphatic circulation to medication side effects and the development of salt-sensitive hypertension. Brittney is a past scholar of a NIH-funded T32 training program in systems pharmacology and toxicology awarded to UAMS by the National Institute for General Medical Sciences. In addition to completing the coursework required of a PhD student, she has obtained a graduate certificate in regulatory sciences from the College of Public Health at UAMS. As an ASPET Washington Fellow, Brittney hopes to expand her knowledge of regulatory science by gaining a deeper knowledge of how science policy decisions are made at the federal and state levels.

Nicholas Harbin

Emory University

Nicholas grew up in Cullman, Alabama and attained a BS in biochemistry and psychology from Auburn University. During this time, he gained a greater understanding and appreciation for neuroscience and neuropharmacology, with an emphasis in drugs of abuse and neurodegenerative disorders. Currently, Nick is in his second year at Emory University working towards his PhD in molecular and systems pharmacology. Under the guidance of Dr. John Hepler, he is investigating the underlying mechanisms of synaptic plasticity in hippocampal area CA2 and how

a regulator of G protein signaling, RGS14, is able to suppress long term potentiation in CA2 pyramidal neurons. Additionally, Nick is working towards developing a small molecule inhibitor of RGS14 that could potentially improve cognitive function in neurological disorders that result in cognitive decline. As an ASPET Washington Fellow, he wants to learn how to effectively reason with legislators to frame policy around evidence-based thinking, and bridge the disconnect between research and public policy.

Julie Meade

Virginia Commonwealth University

Julie, a PhD candidate in the Department of Pharmacology and Toxicology in the School of Medicine at Virginia Commonwealth University, is ecstatic to have won a Ruth L. Kirschstein National Research Service Award Individual Predoctoral Fellowship to Promote Diversity in Health-Related Research (F31) from the National Cancer Institute (NCI). This award, which commenced on September 24th, 2018, aims to enhance the diversity of the health-related research workforce by supporting the research training of predoctoral students from population groups that have been shown to be underrepresented in the biomedical, behavioral, or clinical research workforce. Ms. Meade completed her undergraduate work at Vassar College in neuroscience and behavior. She is currently working on her PhD in pharmacology and toxicology. Under the tutelage of Dr. M. Imad Damaj and Dr. Dana E. Selley, she is studying molecular and behavioral changes induced by chemotherapy in a mouse model of depression.

Lauren Russell

University of Arkansas for Medical Sciences

Lauren was born and raised in southern Arkansas. She earned her bachelor's degree in biology and environmental chemistry from Southern Arkansas University and is currently pursuing a PhD in pharmacology at the University of Arkansas for

Medical Sciences. While attending her undergraduate institution, Lauren was involved in establishing the Natural Resource Research Center that eventually contracted with local industries to test water samples. This experience gave Lauren her first exposure to science policy, and building on that interest she received a graduate certificate in regulatory science while in graduate school. Currently, her dissertation work concerns behavioral pharmacology and focuses on assessing the potential abuse liability and behavioral and neurotoxicities associated with novel psychoactive substances. Because of her growing interest in regulatory sciences, Lauren is working on a separate project developing and implementing a survey regarding the effectiveness of medical cannabis. One goal of this survey is to identify and collect quantitative data that will benefit policy makers. As an ASPET Washington Fellow, Lauren hopes to learn more about how public policy decisions are made and how scientists can help influence these decisions so she can effectively advocate for the sciences at both the state and federal level throughout her career.

Dianicha Santana

University of Illinois, Chicago

Dianicha was born and raised in Puerto Rico where she earned her BS in biology from the University of Puerto Rico, Humacao Campus. After graduating from college, she completed a post-baccalaureate at the University of Chicago. Dianicha is currently a PhD candidate in the Department of Pharmacology at the University of Illinois at Chicago (UIC) College of Medicine. She previously worked on the characterization of a novel inhibitor of RAS, an elusive target in cancer treatment. Dianicha is currently working in Dr. Yulia Komarova's lab, investigating the role of the recently discovered mechanosensitive

ion channel Piezo1 in regulating adaptive cellular response to mechanical stimuli in the vasculature. In addition to her research, Dianicha is very passionate about advocacy and science outreach. She was a representative for her department at the UIC Graduate Student Council, an organization that allows students to be part of the decision-making of policies at the graduate college. Additionally, she is one of the founders of the Society for Advancement of Chicanos/Hispanics and Native Americans in Science (SACNAS) Graduate Chapter in UIC, an organization that promotes diversity in science. With her background in biomedical science research, she is interested in how science can influence regulatory policies. Through the Washington Fellows program, Dianicha hopes to learn strategies for advocating policy issues such as addressing the increasing public distrust in science. Dianicha's goal is to acquire tools to better identify the causes of this distrust, promote better communication, and start fixing the barrier between scientists and the public.

Angela Van

University of California, San Diego

Raised in Anaheim, California, Angela completed her undergraduate work at the University of California, Berkeley in molecular toxicology and molecular environmental biology. She is currently a fifth-year doctoral student in the Biomedical Sciences Graduate Program at the University of California, San Diego. Under the guidance of her advisor, Dr. Alexandra Newton, Angela is currently investigating the role of protein kinase C (PKC) fusion proteins in cancer. Although PKC has been historically regarded as an oncogene, findings in the Newton laboratory revealed a tumor suppressive role for PKC. Angela's research is focused on biochemically characterizing PKC fusions and determining whether they also support a role for PKC as a tumor suppressor. As a member of the delegation from the Gates Millennium Scholars Program, Angela participated in advocacy efforts with the American Cancer Society Cancer Action Network this past year. Impassioned by this experience, Angela is excited to have the opportunity to learn even more with the ASPET Washington Fellows Program. She believes that it is critical for scientists to communicate effectively with both governing bodies and the greater public, not only as a means for garnering support but also for increasing science literacy. She strives to serve as an advocate for increasing health literacy, especially among disadvantaged populations, promoting policies that encourage preventative strategies and early detection of disease, and most importantly, increasing appropriations for scientific research. Overall, Angela is committed to ensuring that legislators continue to invest in biomedical research for the sake of scientific advancement and for the public good.

Nicholas Warren

Dartmouth College

Nicholas grew up in Vadnais Heights, MN and graduated magna cum laude from the University of Wisconsin-Eau Claire in biochemistry and molecular biology. His undergraduate research in Dr. Sanchita Hati's laboratory focused on computational protein dynamics of amino acyl-tRNA synthetases. In 2012, he was selected as a summer research fellow at the Mayo Clinic to study insulin supplementation on diabetic mice in the laboratory of Dr. Sreekumaran Nair. He joined Dr. Alan Eastman's laboratory at Dartmouth College in 2013 to study the molecular mechanisms of checkpoint kinase 1 inhibition in cancer cells for his dissertation. He has found that a single small molecule inhibitor of checkpoint kinase 1 can elicit distinct molecular mechanisms of cytotoxicity depending on the context of DNA damage. Alongside his PhD studies, Nicholas was a founding member and served for three years as President of Dartmouth's Science, Technology, and Engineering Policy Society. He hopes to promote the use of science to inform policy making and promote funding of critical research to discover new therapies to improve the quality of life for thousands of patients.

Education News

ASPET Mentoring Network Expands in its Fourth Year at EB 2019

The ASPET Mentoring Network: Coaching for Career Development program was established by the BIG IDEAS initiative in 2015 as a means to promote diversity in the scientific workforce 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 the participants' home institutions. We are pleased to launch the expanded fourth iteration of the *ASPET Mentoring Network* at EB 2019 with in-person programming on Friday, April 5 and Saturday, April 6, followed by virtual interactions throughout the year. Activities at EB 2019 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. We are grateful to the Burroughs Wellcome Fund for a grant allowing the expansion of the program to 12 additional participants this year.

The program has adapted a coaching model developed by Rick McGee and his colleagues at Northwestern University. Coaches for 2019 include Pam Hornby (Janssen Pharmaceutical Companies of Johnson & Johnson), Dave Jewett (University of Wisconsin, Eau Claire), Jeff Paul (JPharm Consulting), Patricia Rose (Nova Southeastern University), Michelle Walker (US Food & Drug Administration), and Clinton Webb (Augusta University). McGee and his colleague Veronica Womack will once again be facilitating the training during EB 2019, and we are grateful to them as well as their team at Northwestern for their continued involvement and expertise. Susan Ingram, past-chair of the Mentoring and Career Development Committee, continues to assist in providing oversight for the program and its activities in collaboration with ASPET staff. We congratulate the following young scientists who were chosen to participate in the fourth year of the *ASPET Mentoring Network*:

Postdoctoral Scientists

Ashfaq Ahmad, Virginia Commonwealth Univ.
Mehrdad Alavi, Pacific Univ.
Alicia Avelar, Marshall Univ.
Misuk Bae, Univ. of Illinois at Chicago
Khalid Garman, National Institutes of Health and Georgetown Univ.
Steven Hall, Dalhousie Univ.
Lindsey Kuiper, Wake Forest Baptist Med. Ctr.
Cindy Yanfei Li, Univ. of Washington
Benard Ogola, Tulane Univ.
Souvarish Sarkar, Brigham and Women's Hospital, Harvard Med. Sch.

Graduate Students

Stevie Britch, Washington State Univ.
Kirti Chahal, Univ. of California, San Diego
Magdalena Delgado, Univ. of Arkansas for Med. Sci.
Ankit Gilani, New York Med. Coll.
Reiya Hayden, Univ. of Kentucky
Kimberly Holt, Temple Univ. Sch. of Pharmacy
Alexandros Kokkosis, Stony Brook Univ.
Lakshmi Madhavpeddi, Univ. of Arizona, Coll. of Med., Phoenix
Madelyn Mauterer, Wake Forest Univ. Sch. of Med.
Julie Meade, Virginia Commonwealth Univ.
Shamema Nasrin, Washington State Univ.
Hannah Petrek, Univ. of California, Davis
Priyanka Pinky, Auburn Univ.
Akila Ram, Utah State Univ.
Larry Rodriguez, Univ. of Southern California
Sergio Rodriguez, Univ. of Puerto Rico Med. Sci. Campus
Melissa Ruggiero, Univ. of Kansas Med. Ctr.
Lauren Russell, Univ. of Arkansas for Med. Sci.
Ekundayo Samuel, Univ. of Ibadan
Erica Sequeira, Creighton Univ.
Ali Sifat, Texas Tech Univ. Hlth. Sci. Ctr.
Irina Teslenko, Washington State Univ.
Daniella Thorsdottir, Univ. of Vermont
An-Angela Van, Univ. of California, San Diego
Abdalla Wedn, Alexandria Univ., Egypt
Edric Winford, Univ. of Kentucky

ASPET Mentoring Network participants at EB 2018

AMSPC News

In a new feature for *The Pharmacologist*, we would like to introduce the first in a regular series of submissions from the Association of Medical School Pharmacology Chairs (AMSPC). Our inaugural submission will provide a summary on the annual meeting of pharmacology chairs that was held from January 11-15, 2019 in Kauai, Hawaii. Discussions, as in years past, were far-ranging and focused on initiatives and issues to enhance the discipline of pharmacology, our delivery of the knowledge of drugs and their safe use to health professionals, and advocacy for pharmacology/pharmaceutical science departments and their faculty. A partial list of topics discussed at this year's meeting includes:

The ongoing challenges to conducting drug discovery in an academic environment and considerations for how such efforts can be recognized and valued by promotion and tenure committees. This latter issue (P&T) spilled over to a larger discussion of recognition of the contributions of all individuals involved in greater team science. Readers interested in academic drug discovery efforts are urged to visit the website of the Academic Drug Discovery Consortium (ADDC – http://addconsortium.org).

Considerable time was spent in discussion of how to enhance rigor and reproducibility in science. Clearly, this is an area of increased scrutiny at the NIH (https://grants.nih.gov/policy/reproducibility/index.htm; NOT-OD-18-229). We must impart a recognition of the dangers of implicit bias and preconceived outcomes to our trainees. Moreover, we need to continue to develop and refine best practices for conducting and reporting highly rigorous and reproducible research.

Leadership at ASPET provided an update on strategic planning efforts at the society. More details can be found at https://www.aspet.org/aspet/about-us/2017-strategic-plan, but include: (a) recruiting and training the next generation of pharmacologists; (b) changes to the annual meeting and society journals; and (c) national advocacy efforts.

Chairs (University of Texas Medical Branch and Weill-Cornell Medicine) shared innovative drug discovery graduate school curricula and faculty/researcher support programs.

Best practices were shared on responding to varying institutional policies concerning post-tenure reviews of faculty productivity.

AMSPC meeting attendees enjoy a group hike in Hawaii

Finally, an ongoing theme of meetings for the past several years has emphasized how pharmacology departments can make themselves more relevant in the current medical education environment. Many new medical schools have eschewed the creation of basic science discipline-specific departments. Moreover, many schools with pharmacology departments have reorganized curricula such that they are organized around organ systems (e.g., cardio-respiratory, neural and behavioral sciences) that are supervised by an office of medical education. Conversations throughout the meeting therefore explored how pharmacologists can remain engaged in the education process. For its part, AMSPC will undertake a number of initiatives in the coming year(s). The first is an update to the Pharmacology Knowledge Objectives first created in 1985 (http://amspc.org/resources/). The last revision in the 2012 edition was intended to describe the minimum essential knowledge and competencies in pharmacology that should be taught to, and mastered by, students completing their basic medical education. Efforts during the coming year will update this comprehensive list. Second, a generic-to-brand pocket guide list of the most commonly prescribed drugs will be made available for download from the AMSPC website. Third, a taskforce will undertake creation of a guidance document to prepare medical students for entering the clinical experience (Top-Ten Drug Classes Every Student Should Know).

Readers are urged to reach out to ASPET (membership@aspet.org) or AMSPC (kvrana@psu.edu) with suggestions, requests, or to volunteer to work on any of these initiatives.

Journal News

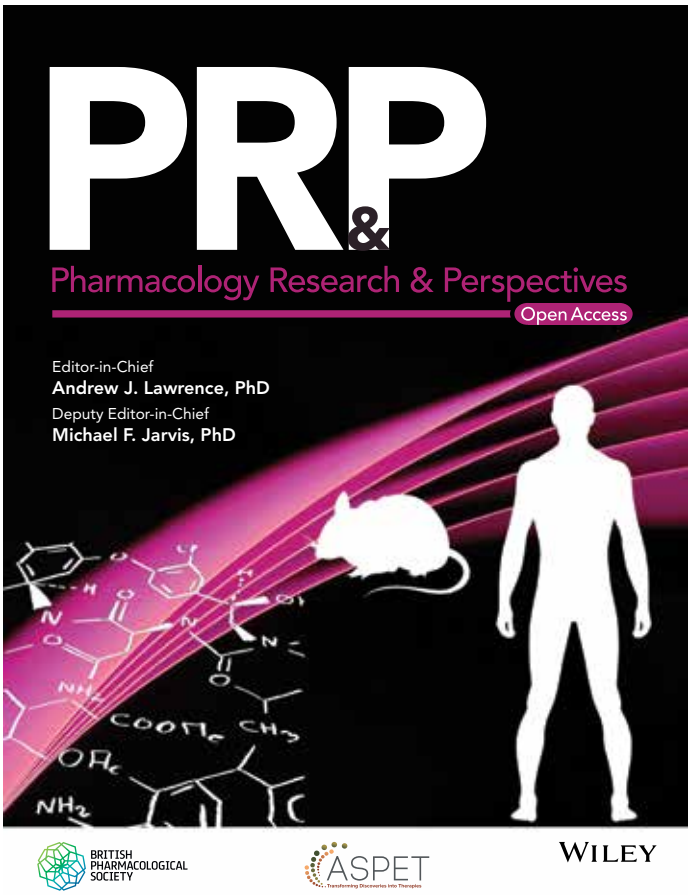
An Update from the Editors of *PR&P*

Pharmacology Research & Perspectives (*PR&P*) is a rapidly growing open access journal that is jointly published by the American Society for Pharmacology and Experimental Therapeutics (ASPET), the British Pharmacological Society (BPS), and Wiley. *PR&P* publishes original research and topical reviews or commentaries covering all aspects of pharmacology research and drug discovery enabling sciences including preclinical research, target validation (or invalidation), translational medicine and clinical development.

PR&P receives cascaded submissions from a diverse set of supporter journals (see the sidebar), and the editorial board strongly encourages direct submission of original research and review papers communicating novel pharmacological hypotheses and insights as well as important replication data that advance or refute key pharmacology dogma. *PR&P* also encourages the direct submission of short communications that report novel pharmacological advances. *PR&P* highly values its diverse readership, authors, and editorial board and is dedicated to providing authors with the opportunity to publish quality research that may otherwise have gone unnoticed by utilizing both Societies' and Wiley's well-developed author and readership networks.

The *PR&P* editorial board is committed to providing authors with timely, relevant and instructive feedback on all submissions. For papers cascaded from supporting journals with prior peer review feedback, editorial decisions will be provided to authors within 7-10 days. For original submissions or cascaded papers requiring peer review, time to first decision is usually within 21 days.

Open science and open access publishing have seen steady growth over the last decade. As an open access journal, papers published in *PR&P* are freely available to read, download, and share globally. In this regard, *PR&P* is fully compliant with



all public and private funding body requirements. *PR&P*'s open access publishing format is based on Article Publication Charge (APC) [https://tinyurl.com/y8xe383t] fees that are competitive compared to other similar open access journals. *PR&P*'s APCs for direct submissions are $2,500/£1,625/€1,900. If you receive a referral from one of ASPET's or the BPS's feeder journals, there is a 20% discount, bringing the cost down to $2,000/£1,300/€1,520. ASPET and BPS members also receive a 10% discount on APCs.

APC fees help fund many important scholarly initiatives and mentoring activities of both Societies including symposia sponsorships and program support

aimed at career development for young scientists. For those with genuine hardship, a limited fee waiver program exists.

Consistent with its mission to advance all aspects of pharmacological science, *PR&P* recently published two joint virtual issues that highlight state-of-the-art pharmacological research in the areas of pain (https://tinyurl.com/y76gupev) and diabetes (https://tinyurl.com/yb7bo5y6). The articles contained in these joint virtual issues offer a diverse array of important scientific insights into cell-surface receptors, biochemical signaling mechanisms, and experimental models that collectively contribute an increased understanding of disease pathology, current treatments, and emerging therapeutic interventions. Other virtual issues (https://tinyurl.com/ybgme55o) have similarly been published with BPS partner journals.

PR&P is committed to supporting scientific development opportunities for Early Career Researchers (ECRs), which include undergraduate, graduate, or post-doctoral scientists. In this regard, *PR&P* is proud to announce its inaugural meeting sponsorship of the ASPET Datablitz presentations by young scientists at the upcoming ASPET Annual Meeting at Experimental Biology 2019 (https://tinyurl.com/yc62cqta) in Orlando. *PR&P* will launch a call for papers for an ECR themed issue ahead of the meeting. For this themed issue, the editors encourage ECR authors to consider submitting original research that confirms or disconfirms pharmacological hypotheses that were used as starting points for their doctoral research plus review manuscripts based on their doctoral thesis introductions. Such data sets are important and could help prevent unnecessary future experiments with the associated waste of time, money, animals, and reagents.

PR&P Supporter Journals

Basic & Clinical Pharmacology & Toxicology
British Journal of Pharmacology (BPS)
British Journal of Clinical Pharmacology (BPS)
Drug Metabolism and Disposition (ASPET)
Journal of Pharmacology
Journal of Pharmacology and Experimental Therapeutics (ASPET)
Molecular Pharmacology (ASPET)
Pharmacoepidemiology & Drug Safety
The Journal of Clinical Pharmacology

Seeking Clarity on Plan S

In the December 2018 issue of *The Pharmacologist*, ASPET President Eddie Morgan and Board of Publications Trustees Chair Mary Vore noted the challenges that Plan S presents to journals and those who publish them, including ASPET. Plan S mandates that the results of research financially supported by participating national funding bodies (16 at last count) must be published in open access journals that meet the principles of Plan S. However, it's estimated that only 15% of science and medical journals in the Directory of Open Access Journals comply with Plan S. The mandate takes effect on January 1, 2020. Most of the funders are based in Europe, but Plan S hopes to enlist more worldwide.

Concerns about Plan S have been published in editorials and letters to the editor in a range of journals. The Plan S implementation guidelines lack clarity. ASPET, with nearly 50 other societies, is a signatory to a feedback document that seeks clarification of the guidelines. For example, the Fast Forward articles in *DMD, JPET,* and *MolPharmacol*, which are made freely accessible at the time a manuscript is accepted for publication and remain free after the formatted version goes online, may (or may not) meet the requirements.

Stay tuned!

New *JPET* Editorial Advisory Board Member

Dr. Mahmood S. Mozaffari has joined the *JPET* Editorial Advisory Board. He is the interim chairperson for the Department of Oral Biology at Augusta University. He is also a professor with Augusta's Department of Oral Biology and Diagnostic Sciences, the Department of Pharmacology and Toxicology, the Department of Restorative Sciences, and the AU School of Graduate Studies.

New Journal Feature Coming

Starting on April 1, ASPET's wholly owned journals will require a significance statement for all new manuscripts that contain an abstract. With a maximum of 120 words, these short descriptions will appear with each article immediately after the abstract and will be used for publicizing articles on social media. Written by the authors, they will be included in the peer review process. The manuscript submission and peer review websites will soon be ready to accept significance statements at the time of submission.

Molecular Pharmacology Highlighted Trainee Authors

We congratulate Carley Heck and Kodye Abbott for being selected as the Highlighted Trainee Authors for the February and March 2019 issues, respectively.

Carley is a pre-doctoral trainee with the Pharmacology and Molecular Sciences Program at Johns Hopkins School of Medicine. Her mentor is Namandjé N. Bumpus. Kodye is a pre-doctoral student with the Biomedical Sciences Program at Auburn University. His mentor is Satyanarayana Pondugula. Read about their areas of research, current projects, and the anticipated impact of their work at https://bit.ly/2GxoCNt.

All trainee authors in *Molecular Pharmacology* are eligible for this honor and may be nominated by the corresponding author of their paper or be self-nominated. Nominations should be submitted immediately after manuscript acceptance.

Membership News

New Members

ASPET welcomes our newest members!

REGULAR MEMBERS

Hatem M. Abuohashish, Dammam Univ, Saudi Arabia
Hiroshi Arakawa, Kanazawa Univ, Japan
Louis R. Barrows, Univ of Utah
Shaibu O. Bello, Usmanu Danfodiyo Univ, Nigeria
Matthew J. Brody, Cincinnati Children's Hosp Med Ctr, OH
Lakshmi S. Chaturvedi, California Northstate Univ
Qi Chen, Univ of Kansas Medical Ctr
Terry S. Elton, Ohio State Univ
Emmanuel U. Etuk, Usmanu Danfodiyo Univ, Nigeria
Usama A. Fahmy, King Abdulaziz Univ, Saudi Arabia
David Fairlie, Univ of Queensland, Australia
Christian A. Fernandez, Univ of Pittsburgh Sch of Pharmacy, PA
Jinping Gan, Bristol-Myers Squibb Co, NJ
Cris Grodzki, Univ of California-Davis
Byunghee H. Han, AT Still Univ of Hlth Sci, MO
Linh Ho, California Northstate Univ College of Pharmacy
Andrey A. Ivanov, Emory Chemical Biology Discovery Ctr, GA
Abishek Iyer, Univ of Queensland, Australia
Pierre-Yves Jean-Charles, Duke Univ, NC
Wannarasmi Ketchart, Chulalongkorn Univ, Thailand
Mariana Lemos Duarte, Icahn Sch of Med at Mt Sinai, NY
Jianxi Liu, Icahn Sch of Med at Mount Sinai, NY
John A. Lynch, St Jude Children's Research Hospital, TN
Shuguang Ma, Genentech Inc., CA
Silvia Moore, Weill Cornell Med, NY
Raj Nagaraja, Agios Pharmaceuticals, Inc, MA
Volker Neugebauer, Texas Tech Univ Hlth Sci Ct
Francisco Neves, Federal Univ of Sao Paulo, Brazil
Ainhoa Nieto Gutierrez, H Lee Moffitt Cancer Ctr, FL
Shaheena Parween, Univ of Bern, Switzerland
Sachin Patel, Vanderbilt Univ, TN
Dinah L. Ramos Ortolaza, Pontifical Catholic Univ of Puerto Rico
Guy Servant, Senomyx Inc., CA
Ryan Sheehy, Kansas City Univ of Med and Biosciences
Ieva Sutkeviciute, Univ of Pittsburgh, PA
Tino Unlap, Univ of Alabama at Birmingham
Kiran R. Vemuri, Northeastern Univ, MA
Hongbin Wang, California Northstate Univ
Carl White, Univ of Nottingham, United Kingdom
Richard J. Wojcikiewicz, SUNY Upstate Med Univ, NY
Mai Zahran, New York City Coll of Tech
Dengwen Zhang, Univ of Hong Kong, China

POSTDOCTORAL MEMBERS

Oghenetega Avwioroko, Redeemer's Univ Coll of Natural Sci, Nigeria
Misuk Bae, Univ of Illinois at Chicago
Ruchika Bajaj, Univ of California San Francisco
Scott D. Barnett, Medical College of Wisconsin
Loren M. Brown, Univ of Michigan
James Chun Yip Y. Chan, Skin Research Institute of Singapore, Singapore
Pierre Couvineau, Institute for Research in Immunology and Cancer, Canada
Claudio de Lucia, Temple Univ, PA
Sergio Dominguez Lopez, Oklahoma Medical Research Foundation
Henry A. Dunn, Scripps Research Institute, FL
Katherine M. Holleran, Wake Forest Univ Sch of Med, NC
Francis W. Hunter, Univ of Auckland, New Zealand
Moriah Jacobson, Uniformed Services Univ, MD
Elaine Jennings, Univ of Texas Hlth San Antonio
Amy Johnson, Vanderbilt Univ, TN
Olga Kashpur, Tufts Medical Ctr, MA
Nayaab S. Khan, RTI, NC

Alix F. Leblanc, Ohio State Univ
Jian-Feng Liu, State Univ of New York at Buffalo
Stephanie Martinez, Washington State Univ, WA
Marcin Maziarz, Boston Univ, MA
Hardik Mody, Univ of Florida College of Pharmacy
Samuel O. Odutola, North Carolina Central Univ
Shreoshi Pal Choudhuri, Univ of Texas Southwestern Medical Ctr
Marsha L. Pierce, Creighton Univ, NE
Muhammad A. Rajput, Multan Medical & Dental College, Pakistan
Sanjay Rathod, Univ of Pittsburgh, PA
Farhana Sakloth, Mount Sinai, NY
Mark Soave, Univ of Nottingham, United Kingdom
Dandan Tian, Washington State Univ
Ruyan Wu, Univ of Buffalo, NY

AFFILIATE MEMBERS

Vincent Alessi, 7 Points Genetics Inc, MI
Karen Nunez, Pacific Shores Medical Group, CA

GRADUATE STUDENTS

Ibrahim Abdelgawad, Univ of Minnesota
Kristen Adams, Wake Forest Univ Graduate Sch, NC
Erum Ahmed, NYITCOM
Allison Anderson, Univ of Minnesota Twin Cities
Jason Anderson, Ohio State Univ
Kaitlyn J. Andreano, Duke Univ, NC
Jessica Armstrong, Mercer Univ Atlanta, GA
Juan A. Azcona, New York Medical College, NY
Nabeela Fatima Baig, St. John's Univ, NY
Yifan Bao, Univ of Connecticut
Paramita Basu, Texas Woman's Univ
Jordan T. Bateman, Univ of Florida
Konuralp Bayrak, Drexel Univ, PA
Michele Benjamin, Florida International Univ
Sarah E. Berman, Cedarville Univ, OH
Josephine Bou Dagher, Univ of Georgia
Sarah Brunty, Marshall Univ, WV
Kathryn A. Carbajal, Univ of Wisconsin
Yiming Chen, Mercer University, GA
Spencer C. Cushen, Univ of North Texas Hlth Sci Ctr
Catherine D'Addario, New York Medical College
Gbenga Daramola, Redeemer's Univ, Nigeria
Ahmed M. Darwesh, Univ of Alberta, Canada
Zachary J. DeBruinec, Van Andel Institute, MI
Magdalena Delgado, Univ of Arkansas for Medical Sci
Alexandra D. Dolezal, Univ of South Dakota
Samantha Edenfield, LA
Chidubem Eneanya, Temple Univ, PA
Paige Estave, Wake Forest Univ Hlth Sci, NC
Xiaoyu Fan, Univ of Arizona
Razaz A. Felemban, Univ of Arizona
Robert Freeborn, Michigan State Univ
Kayla L. Frost, Univ of Arizona
Robert M. Fuchs, Louisiana State Univ Hlth Sci Ctr
Pauravi J. Gandhi, Creighton Univ, NE
Dominique A. Garrison, Ohio State Univ
Ankit M. Gilani, New York Medical College
Hannah Y. Gogulski, Washington State Univ
Pablo Gonzalez Santiago, Univ of Puerto Rico - MSC
Ezekiel Gonzalez-Fernandez Chem, Univ of Mississippi Medical Ctr
Adithya Gopinath, FL
Ludwik Gorczyca, Rutgers Univ, NJ
Zelin Gu, Univ of Louisville, KY
Johnny L. Guevara, CUNY - New York City College of Technology
Vanessa Gutzeit, Weill Cornell Med, NY
Mahamudul Haque, Washington State Univ
Kenneth J. Harris, Meharry Med College, TN
Victor A. Hernandez, Ohio State Univ
Jessica Hersh, Univ of North Texas Hlth Sci Ctr
Michael J. Ippolito, Thomas Jefferson Univ, PA
My Lien T. Jackson, Philadelphia College of Osteopathic Med
Yue Jiarm, St. John's Univ, NY
Dominic Lapadula, PA
Casandra L. Larrivee, Michigan State Univ
Yuan Le, St. John's Univ, NY
Truc Le, California Northstate Univ
Amy C. Leach, Wake Forest Univ Hlth Sci, NC
Tyler Lefevre, Univ of Michigan
Michael Z. Leonard, Tufts Univ, MA
Juanita Limas, Univ of North Carolina, Chapel Hill
Jennie Lipinski, Univ at Buffalo, Jacobs Sch of Med & Biomed Sci, NY
Hao Liu, Guangzhou Medical Univ, China
Wenjie Liu, Zhongshan Hospital, Fudan Univ, China
Oanh Ma, California Northstate Univ
Musarrat Maisha, Tennessee State Univ

Mei Meng, Fudan Univ, China
Siennah R. Miller, Univ of Arizona
Kelle Miyama, Pacific Univ Sch of Pharmacy, OR
Carolina Montanez-Miranda, Emory Univ, GA
Julia Mouch, West Virginia Univ
Mohammed Nasrullah, Auburn Univ, AL
Marco Niello, Medical Univ of Vienna, Austria
Saeideh Nozohouriarm, Texas Tech Univ Hlth Sci Ctr
David Omoniwa, University of Jos, Nigeria
Tesneem Othman, Chicago State Univ, IL
Oluwole S. Owojuyigbe, Federal Polytechnic Ede, Nigeria
Devon R. Pekas, Des Moines Univ, IA
Qianman Peng, Auburn Univ, AL
Priyanka D. Pinky, Auburn Univ, AL
Stephanie Polchtchikov, Univ de Montréal, Canada
Jude k. Prah, Univ of North Texas Hlth Sci Ctr
Rim W. Rafehc, American Univ of Beirut, Lebanon
Sindhu Ramesh, Auburn Univ, AL
Gurpreet Randhawa, Virginia Commonwealth Univ
Azizi Ray, Mercer Univ Atlanta, GA
Maryam Riaz, University of North Texas Hlth Sci Ctr
Aratrika Sahac, Louisiana State Univ Hlth Sci Ctr
Phillip R. Sanchez, Johns Hopkins Univ SOM, MD
Katherine Z. Sanidad, Univ of Massachusetts Amherst
Gabriela Santiago, CUNY Sch of Med, NY
Michael Schaid, Univ of Wisconsin, Madison
Sureka Selvakumaran, Univ of Western Ontario, Canada
Khairunnisa M. Semesta, Duke Univ, NC
Diana E. Sepulveda, Pennsylvania State Univ College of Med
Xueyan Shao, Univ of Connecticut
Sherif Shoieb, Univ of Alberta, Canada
Ali E. Sifat, Texas Tech Univ Hlth Sci Ctr
Kulpreet Singh, Virginia Commonwealth Univ
Sarah E. Sizer, Wake Forest Univ Hlth Sci, NC
Hudson R. Smith, Univ of Texas Hlth Sci Ctr at San Antonio
Badr Sokrat, Univ de Montréal, Canada
Pranav Sopory, All India Institute of Medical Sci, India
Kimberly Mae Soultan, NYIT
Justin C. Strickland, Univ of Kentucky
Sarah M. Sulon, Thomas Jefferson Univ, PA
Christopher Szlenk, Washington State Univ
Tasnim Tabassum, Long Island Univ, NY
Samantha Tang, Ohio State Univ
Rakshit Tanna, Washington State Univ
Swetha Thiyagarajan, North Dakota State Univ
Daniella J. Thorsdottir, Univ of Vermont
Callie L. Troutfetter, Concordia Univ, WI
Heather E. Truearm, Pacific University, OR
Kyle Urquhart, Univ of Arkansas Med Sch
Kelly Ushedo, Redeemer's Univ, Nigeria
Pei Wang, Zhengzhou Univ
Wenhui Wei, Univ of Michigan
Victoria Whitcomb, Des Moines Univ, IA
Edric D. Winford, Univ of Kentucky
Kendall Woodlief, Wake Forest Sch of Med, NC
Xuan Yang, Emory Univ, GA
He Yanjing, Univ of Hong Kong, China
Xiaodong YE, Univ of Hong Kong, China
Yue Zhang, St. John's Univ, NY

UNDERGRADUATE STUDENTS

Alexandra H. Aitchison, Duke Univ, NC
Elan Baskir, Washington Univ in St Louis
Jennifer E. Bissada, Lipscomb Univ, TN
Krisyah T. Clemons, Spelman College, GA
Amanda L. Conti, Duke Univ, NC
Anthony E. English, Ohio State Univ
Molishka A. Flores, Pontifical Catholic Univ of Puerto Rico
Dafni F. Frohman, Tufts Univ, MA
Ryan P. Grabau, Univ of South Florida
Ethan J. Hardin, Univ of Texas at El Paso
Natalie Henderson, Florida State Univ
Evan Kania, Ohio State Univ
Ethan King, Western New England Univ, MA
Varun Kotipalli, Austin College, TX
Maryam Mansoura, Univ of Georgia
James Miller, Wake Forest Sch of Med, NC
Darby Peter, Univ of Wisconsin-Madison
Jonte B. Roberts, Univ of Colorado Denver
Paloma Serna, Univ of Texas at El Paso
Aidan P. Wiley, Wake Forest Univ Hlth Sci

Congratulations

to **Dr. Jianzhong Shen** and **Dr. Phoebe Stewart** on being the winners of the Amex gift cards this year. Thank you for renewing early and participating in our 2019 renew-to-win raffle.

A Tribute to Brian Sorrentino (1958-2018)

Submitted by John D. Schuetz, PhD

Dr. Brian Sorrentino, a physician-scientist, died November 16, 2018 at age 60 years. A childhood cancer survivor who grew up to save children throughout the world, he died of lung cancer, a late effect of the high-dose radiation therapy he received for the treatment of Hodgkin lymphoma. He said he always knew that he wanted to become a physician-scientist, and overcoming a battle with Hodgkin disease at the age of 17 solidified that goal. He was born and raised in upstate New York, attended Union College in Schenectady and graduated from medical school at The State University of New York Upstate Medical Center in Syracuse. After completing an internal medicine internship at the University of North Carolina at Chapel Hill, he fatefully relocated to the NIH where he focused on hematology. In 1992, he reported in *Science* that retroviral transfer of the MDR1 (ABCB1) gene into bone marrow cells conferred in vivo resistance to taxol. For a quarter century, Sorrentino worked at St. Jude, where he served as director of experimental hematology since 2004.

Dr. Sorrentino was a dedicated mentor and friend; I count myself as one of those lucky ones who benefited from his being part of the St. Jude community. His lifelong scientific interest in stem cells led to our over 20-year friendship (in part fueled by our twin loves: science and 20th century blues and rock guitar gods) and enthusiastic collaboration. He mentored me in hematology, his bailiwick, and hematopoietic stem cells. I am forever indebted. Our interests converged on hematopoietic stem cells after he described a phenomenon referred to as the "side-population" of cells. It seemed to be a transporter phenotype, so our labs joined forces to collaborate. In 2001, our team reported in *Nature Medicine* that the expression of a gene called *ABCG2/Bcrp1* (a transporter) allowed scientists to identify not just stem cells from a variety of sources, but also determined that this transporter was a critical protector of stem cells *(PNAS)*. His lab then developed a now widely used antibody that detects conformational changes in ABCG2 as it engages substrates and inhibitors.

One of our favorite quotes, applicable sometimes to science and life, and evidence of his wry humor, came from the song, "Born Under a Bad Sign," popularized by Albert King and then Cream: "if it wasn't for bad luck I wouldn't have no luck at all." For our friend and colleague who died too young, those words seem to ring all too true as we miss our dedicated friend and colleague. He leaves behind his wife Suzanne and children Joseph and Emily.

In Sympathy

ASPET notes with sympathy the passing of the following members.

William Buss
Attallah Kappas
William Novick
Gavril Pasternak
David Reinke
Bernard Salafsky
Arthur Weiss

Members in the News

Achievements, Awards, Promotions, and Scientific Breakthroughs

Claudio Cuello, OC, MD, DSc, FRSC, FMedSci

McGill University

Claudio Cuello, OC, MD, DSc, FRSC, FMedSci was named a Fellow of the Academy of Medical Sciences in London, UK on June 27, 2018 and will continue as the holder of the Charles E. Frosst/Merck Chair in Pharmacology for a fourth 5-year term beginning October 1, 2018.

Dr. Cuello has contributed to his field of research with pioneering publications on dendritic release of neurotransmitters, the localization and role of central and peripheral neuropeptides, trophic factor-induced repair and synaptogenesis, and novel applications of monoclonal antibodies in the neurosciences. During his career, he collaborated very closely with Drs. William F. Ganong, Leslie Iversen, and Cesar Milstein. Currently, he leads a research team working on multidisciplinary aspects (from molecular biology to cognition) of aging, models of Alzheimer's disease neuropathology, inflammation, CNS degeneration/repair, and experimental therapeutics of the AD-like amyloid pathology.

Dr. Cuello has been a member of ASPET since 1988 and is a member of the **Division for Neuropharmacology**.

Juanita Limas

University of North Carolina at Chapel Hill

Juanita Limas, a PhD candidate in the Department of Pharmacology at the University of North Carolina at Chapel Hill, is a recipient of the prestigious Howard Hughes Medical Institute (HHMI) Gilliam Fellowship. Her award, which began in September 2018, is given to predoctoral students who have demonstrated high promise to become leaders in their fields and who desire to become college and university faculty, where they will help shape the next generation of students. The Gilliam program aims to ensure that a diverse and highly trained workforce is prepared to assume leadership roles in science. Further details are available at the 2018 HHMI Gilliam Fellowship Awardees webpage (https://bit.ly/2BtUtey).

Ms. Limas completed her undergraduate work at the University of Iowa in biochemistry and her master's degree at Barry University in Miami, FL. She's currently working on her PhD in pharmacology (cell cycle regulation). Under Dr. Jean Cook, she is studying the mechanisms of oncogene-induced DNA replication stress.

Ms. Limas has been a member of ASPET since 2019 and is a member of the **Divisions for Cancer Pharmacology** and **Molecular Pharmacology**.

Cody J. Wenthur, PharmD, PhD

University of Wisconsin-Madison

Cody J. Wenthur, PharmD, PhD started his appointment as a tenure-track faculty member in the School of Pharmacy at University of Wisconsin-Madison in August 2018. Dr. Wenthur is a PharmD, PhD trained at Purdue University, Vanderbilt University, and The Scripps Research Institute – La Jolla. His laboratory studies neuropharmacology of substance use disorders, currently focusing on the use of immunologic interventions to detect emergent polypharmacologic effects arising from complex chemical mixtures.

Dr. Wenthur has been a member of ASPET since 2013 and is a member of the **Divisions for Behavioral Pharmacology**, **Neuropharmacology**, **Drug Discovery and Development**, and **Translational and Clinical Pharmacology**.

Brenda Gannon, PhD

Steep Hill Arkansas

Brenda Gannon, PhD was promoted to the position of Laboratory Director of Steep Hill Arkansas in Little Rock effective August 1, 2018. Additionally, Dr. Gannon was appointed an adjunct professor at the University of Arkansas for Medical Sciences as of December 1, 2018.

Dr. Gannon has been a member of ASPET since 2012 and is a member of the **Divisions for Behavioral Pharmacology**, **Drug Discovery and Development**, **Neuropharmacology**, **Toxicology**, and T**ranslational and Clinical Pharmacology.**

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

Behavioral Pharmacology:
Alison Wakeford at alison.wakeford@emory.edu

Cancer Pharmacology:
Mark Leggas at mark.leggas@uky.edu
or Megan Zavorka Thomas
at zavorkathomas.1@osu.edu

Cardiovascular Pharmacology:
David B. Averill at daverill@som.geisinger.edu

Drug Discovery and Development:
Craig Beeson at beesonc@musc.edu

Drug Metabolism and Disposition:
Aarti Sawant-Basak at aarti.sawant@pfizer.com

Molecular Pharmacology:
Jason Davis at jedavi0062@icloud.com
or Jennifer Cash at cashjn@umich.edu

Neuropharmacology:
Luisa Torres at lft9@cornell.edu

Pharmacology Education:
Catherine M. Davis at cdavis91@jhmi.edu

Toxicology:
Alison H. Harrill at harrill.alison@gmail.com

Translational & Clinical Pharmacology:
Brandi Wynne at bwynne@emory.edu

Division News

2019 Division Elections

The following Divisions held elections for 2019:

- **Division for Behavioral Pharmacology**
- **Division for Cardiovascular Pharmacology**
- **Division for Drug Metabolism and Disposition**
- **Division for Molecular Pharmacology**
- **Division for Pharmacology Education**
- **Division for Toxicology**

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, 2019.

Division for Behavioral Pharmacology

Chair-Elect

William E. Fantegrossi, PhD
Associate Professor, Department of Pharmacology and Toxicology, University of Arkansas for Medical Sciences College of Medicine

Secretary/Treasurer-Elect

Peter J. Winsauer, PhD
L. Allen Barker Professor of Pharmacology, Louisiana State University Health Sciences Center

Division for Cardiovascular Pharmacology

Chair-Elect

Fadi T. Khasawneh, PhD
Associate Professor and Chair, Department of Pharmaceutical Sciences, School of Pharmacy, The University of Texas, El Paso

Secretary/Treasurer-Elect

Michael Tranter, PhD
Assistant Professor, Department of Internal Medicine, Division of Cardiovascular Health and Disease, University of Cincinnati

Division for Drug Metabolism and Disposition

Chair-Elect

Robert S. Foti, PhD
Principal Scientist, Pharmacokinetics and Drug Metabolism, Amgen Inc.

Secretary/Treasurer-Elect

Aarti Sawant Basak, PhD
Associate Director, Clinical Pharmacology, Early Clinical Development, Pfizer

Division for Molecular Pharmacology

Chair-Elect

J. Silvio Gutkind, PhD
Professor, Department of Pharmacology, Associate Director of Basic Science, University of California, San Diego Moores Cancer Center

Secretary/Treasurer-Elect

Kirill Martemyanov, PhD
Professor and Chair, The Scripps Research Institute

Division for Pharmacology Education

Chair-Elect

Katharina Brandl, RPh, PhD, FAPE
Assistant Professor, Skaggs School of Pharmacy and Pharmaceutical Sciences, University of California, San Diego

Secretary/Treasurer-Elect

Gagani Athauda, MD
Associate Professor, Department of Cellular Biology and Pharmacology, Florida International

Division for Toxicology

Chair-Elect

Qin M. Chen, PhD
Professor of Pharmacology, University of Arizona College of Medicine

Secretary/Treasurer-Elect

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

ASPET Division Sponsored Awards

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.

Jun-Xu Li, PhD
University at Buffalo

Dr. Jun-Xu Li is being recognized for his strong, consistent, innovative approaches to identifying therapeutics to treat pain which are devoid of abuse liability.

He received his PhD from Peking University, China and did his postdoctoral training at the University of Texas Health Science Center at San Antonio. He then joined the Department of Pharmacology and Toxicology at the University at Buffalo and became a tenured associate professor in 2016. Dr. Li's laboratory focuses on understanding the behavioral pharmacology of imidazoline I2 receptor ligands and GABAergic positive allosteric modulators. He also is interested in understanding the role of trace amine associated receptor 1 in drug dependence and addiction. His long-term research goal is to develop novel non-opioid analgesics to treat pain and novel TAAR1-based medications to treat drug addiction. He has been a member of ASPET since 2007.

The award will be presented at the ASPET Division for Behavioral Pharmacology's Annual Division Meeting during the ASPET Annual Meeting at Experimental Biology 2019 in Orlando, FL on Tuesday, April 9, 2019 from 6:00 pm – 6:30 pm in Room W205BC of the Orange County Convention Center.

Division for Cardiovascular Pharmacology

Benedict R. Lucchesi Young Scientist Travel Award in Cardiac Pharmacology

The Benedict R. Lucchesi Young Scientist Travel Award in Cardiac Pharmacology was established by the ASPET Division for Cardiovascular Pharmacology to honor Dr. Lucchesi's lifelong scientific contributions to our better understanding and appreciation of the pharmacological treatment and prevention of cardiovascular disease and for his mentoring of countless prominent cardiovascular pharmacologists in translational approaches.

Aaron J. Trask, PhD, FAHA, FCVS
Research Institute at Nationwide Children's Hospital and the Ohio State University College of Medicine

Dr. Aaron Trask is being recognized for his research on abnormalities in vascular smooth muscle cells from humans with type 2 diabetes, based on his findings of coronary microvascular remodeling in preclinical models of the disease.

In his application, Dr. Trask recalled a surprise opportunity he had to meet Dr. Lucchesi during the ASPET Annual Meeting at EB 2015. During a shared meal, Dr. Lucchesi advised him that "discoveries come to a well-prepared mind." Dr. Trask noted that "I carry those words as a guiding light within me as I progress through my research career in hopes of continuing to make strides in cardiovascular research as he did."

Dr. Trask received his PhD in physiology and pharmacology from Wake Forest University and he completed his postdoctoral training in cardiovascular physiology and pharmacology at Nationwide Children's Hospital. Dr. Trask's research program focuses on the early cardiovascular complications of type 2 diabetes mellitus, hypertension, and metabolic syndrome. Over the last several years, his laboratory has been addressing creative and innovative ideas surrounding coronary microvascular disease (CMD) with the ultimate goal of developing direct diagnostic methods and effectuating novel therapeutic targets of CMD, since it occurs earlier than coronary conduit disease. He has been a member of ASPET since 2009.

The award will be presented and Dr. Trask will give a lecture titled *Receptors, Biomechanics, and Cardiac Function as Modulators of Coronary Remodeling and Flow in Type 2 Diabetes* during the ASPET Annual Meeting at EB 2019 in Orlando, FL on Tuesday, April 9, 2019 from 4:00 pm – 6:00 pm in Room W206C of the Orange County Convention Center.

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.

Dr. Craig Lindsley is being recognized for his highly integrated approach to drug discovery and development that bridges synthetic chemistry, novel approaches to characterization of PK/PD and target validation leading to pre-clinical development of therapeutics for treatments of neurological disorders, cancer and metabolic diseases.

He received his PhD in chemistry from the University of California, Santa Barbara and pursued postdoctoral studies at Harvard University. After a

Craig W. Lindsley, PhD
Vanderbilt University

highly successful period at Merck, Dr. Lindsley moved to his current position at Vanderbilt University, where he holds the William K. Warren, Jr. Chair in Medicine, is Director of Medicinal Chemistry for the Vanderbilt Center for Neuroscience Drug Discovery, and is a University Professor of Pharmacology, Chemistry and Biochemistry. He is a fellow of the American Association for the Advancement of Science (AAAS). Dr. Lindsley has been an ASPET member since 2009.

The award will be presented and Dr. Lindsley will give a lecture titled *Translational Drug Discovery in an Academic Setting* during the ASPET Annual Meeting at EB 2019 in Orlando, FL on Monday, April 8, 2019 from 1:00 pm – 1:45 pm in Room W205A of the Orange County Convention Center.

Division for Drug Metabolism and Disposition

Richard Okita Early Career Award in Drug Metabolism and Disposition

The ASPET Division for Drug Metabolism sponsors the Early Career Award in Drug Metabolism and Disposition, newly named to honor Dr. Richard Okita, in order to recognize excellent original research by early career investigators in the area of drug metabolism and disposition.

Lauren M. Aleksunes, PharmD, PhD
Rutgers University

Dr. Lauren Aleksunes is being recognized for her mechanistic and translational research on transporter biology, including the elucidation of critical roles of transporters in xenobiotic disposition and in the protection of multiple organs against chemical toxicities.

She received her PharmD and PhD degrees from the University of Connecticut and completed a postdoctoral fellowship at the University of Kansas Medical Center. She is currently an associate professor in the School of Pharmacy and the Environmental and Occupational Health Sciences Institute at Rutgers University where her research interests continue in the transport of toxicants in the placenta, kidneys, and brain. She also serves as director of the Rutgers Toxicology Graduate Program. In 2010, Dr. Aleksunes was selected as an Outstanding New Environmental Scientist Awardee from NIH/NIEHS. She has been a member of ASPET since 2010 and currently serves on the Finance Committee.

The award will be presented and Dr. Aleksunes will give a lecture titled T*ransporters as Gatekeepers of Toxicant Exposure* during the ASPET Annual Meeting at EB 2019 in Orlando, FL in the division's platform session on Monday, April 8, 2019 from 4:00 pm – 6:00 pm in Room W206A of the Orange County Convention Center.

Additionally, the division is hosting a special meet-the-experts event and dinner to celebrate the recent naming of the early career award after Dr. Richard Okita on Tuesday, April 9, 2019 from 6:30 pm – 9:00 pm. Advance RSVP required.

Division for Drug Metabolism and Disposition

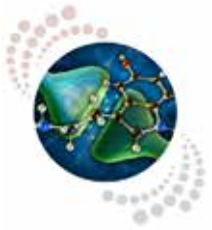
James R. Gillette Awards

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 2018 is **Hong Shen** from Bristol-Myers Squibb for the paper titled "Discovery and Validation of Pyridoxic Acid and Homovanillic Acid as Novel Endogenous Plasma Biomarkers of Organic Anion Transporter (OAT) 1 and OAT3 in Cynomolgus Monkeys."

The award recipient in the Drug Metabolism category for 2018 is **Carsten Ginsel** from the Institute of Pharmaceutical Chemistry, for the paper titled "The Involvement of the Mitochondrial Amidoxime Reducing Component (mARC) in the Reductive Metabolism of Hydroxamic Acids."

The Gillette awards and short talks based on the papers will be presented during the ASPET Annual Meeting at EB 2019 in Orlando, FL in the division's platform session on Monday, April 8, 2019 from 4:00 pm – 6:00 pm in Room W206A of the Orange County 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.

Michelle Mazei-Robison, PhD
Michigan State University

Dr. Michelle Mazei-Robison is being recognized for her excellence in understanding the molecular mechanisms that underlie changes in VTA dopamine neuron signaling, morphology, and activity induced in neuropsychiatric disorders such as addiction and depression.

Dr. Mazei-Robison received her PhD in pharmacology from Vanderbilt University and did postdoctoral training at Vanderbilt, UT Southwestern Medical Center, and Mount Sinai School of Medicine. She is currently an assistant professor in the Department of Physiology and Neuroscience Program at Michigan State University. Her lab studies the molecular mechanisms that underlie changes in ventral tegmental area (VTA) dopamine (DA) neuron signaling, morphology, and activity in neuropsychiatric disorders. She uses an array of cutting-edge techniques such as translating ribosome affinity purification and viral-mediated gene transfer to identify cell type-specific transcriptional and structural changes induced by chronic stress and opiate drugs. The functional consequences of candidate genes are interrogated in a wide array of behavioral assays to evaluate addictive- and depressive-like behaviors. Her lab has identified similar changes induced by both stress and opiates in the VTA, suggesting shared mechanisms for comorbid depression and opiate abuse. Given the current opiate epidemic, her work to define neuroadaptations responsible for altered

opiate reward and intake are particularly exciting and may be critical for improved treatment. She has been a member of ASPET since 2014.

The award will be presented and Dr. Mazei-Robison will give a lecture titled *Novel Molecular Mechanisms Induced in the Ventral Tegmental Area by Drugs of Abuse* during the ASPET Annual Meeting at EB 2019 in Orlando, FL in the division's award platform session on Monday, April 8, 2019 from 4:00 pm – 6:00 pm in Room W205BC of the Orange County Convention Center.

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.

Gagani Athauda, MD
Herbert Wertheim College of Medicine

Dr. Gagani Athauda received her MD in 2002 from Riga Stradiņš University, Latvia. She is currently an associate professor at the Herbert Wertheim College of Medicine, Florida International University where she serves as vice chair of the Department of Cellular Biology and Pharmacology. She is a pharmacology educator for courses in the first three years of medical school and is the course director of the year 1 pharmacology course. She has published her educational research in *Medical Science Educator* and presented her work at meetings both nationally and internationally. She has been a member of ASPET since 2014.

Ashley N. Guillory, PhD
University of Texas Medical Branch at Galveston

Dr. Ashley Guillory received her PhD in pharmacology in 2012 from the University of Houston. She was a postdoctoral fellow at University of Texas Medical Branch at Galveston. Currently, she is an assistant professor as well as the director of admissions in the Department of Physician Assistant Studies at University of Texas Medical Branch at Galveston. She has been a member of ASPET since 2010 and currently serves on the ASPET Mentoring and Career Development Committee and has prior service on the ASPET Young Scientists Committee.

Arun M. Ram, MD
Eastern Virginia Medical School

Dr. Arun Ram received his MD in pharmacology in 2002 from the Madurai Medical College at The Tamil Nadu Dr. M.G.R. Medical University in India. Since then he has held positions in India and Grand Cayman, and is currently an associate professor of clinical pharmacology at the Eastern Virginia Medical School in Norfolk, VA. He is a winner of the Crystal Apple Award for the Best Teacher at the Eastern Virginia Medical School in 2018 and the Golden Apple Award for teaching excellence in 2015 while he was serving at St. Matthews University, School of Medicine in Grand Cayman. He was recently awarded the fellowship of the Academy of Medical Educators in the UK. He has been a member of ASPET since 2014.

The awards will be presented at the ASPET Division for Pharmacology Education's Annual Division Meeting during the ASPET Annual Meeting at Experimental Biology 2019 in Orlando, FL on Monday, April 8, 2019 from 5:30 pm – 6:30 pm in Room W206C of the Orange County Convention Center.

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.

Gary O. Rankin, PhD
Joan C. Edwards School of Medicine, Marshall University

Dr. Gary Rankin is being recognized for his mentoring and leadership in the field of toxicology, especially his exemplary service to ASPET, and to recognize his long history of scholarship in the area of nephrotoxicity.

He received his PhD in medicinal chemistry from the University of Mississippi and had a postdoctoral fellowship at the Medical College of Ohio before joining Marshall University in 1978. He is the current vice dean for basic sciences at the Marshall University School of Medicine and chair of the Department of Biomedical Sciences. Scientifically, he has focused his career on chemical induced nephrotoxicity. His strength is the ability to examine structure-activity relationships and predict cytotoxicity to various organs. He has contributed to examining succinimide structure and susceptibility to nephrotoxicity. He has also examined the role of halogens in the renal damage mediated by aniline, aminophenol and nitrobenzene compounds, which are intermediates in the production of drugs, dyes and pesticides. More recently, Dr. Rankin has focused on the pharmacogenetic changes in drug metabolism that impact opiate overdose. Additionally, he has mentored over 25 undergraduate students, 42 graduate students and 7 postdoctoral fellows and has over 160 research publications in toxicology. He has been a member of ASPET since 1985 and currently serves on the editorial board of *The Journal of Pharmacology and Experimental Therapeutics*.

The award will be presented and Dr. Rankin will give a talk titled *Nephrotoxicity Induced by Dimetachlone, Halogenated Anilines and Their Metabolites* during a symposium on Kidney and Nephrotoxicity at the ASPET Annual Meeting at EB 2019 in Orlando, FL on Monday, April 8, 2019 from 4:00 pm – 6:00 pm in Room W206B of the Orange County Convention Center.

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.

Dr. Cheryl Rockwell is being recognized for her excellent history of funding and publications in high quality journals, as well as her active role in multiple toxicologically-based societies, and her demonstrated success in mentoring the next generation of toxicologists.

Dr. Rockwell received her PhD from Michigan

Cheryl E. Rockwell, PhD
Michigan State University

State University in 2005. As a postdoc, she trained at the University of Missouri Kansas City and the University of Kansas Medical Center. She became an assistant professor at Michigan State University in 2011, where she received tenure in 2017. She has published over 30 peer-reviewed papers as well as a book on immunotoxicology protocols. In 2016, she received an Outstanding New Environmental Scientist award from the NIEHS. She has been a member of ASPET since 2009 and recently served on the editorial board of *Molecular Pharmacology*.

The award will be presented at the ASPET Division for Toxicology's Annual Division Meeting during the ASPET Annual Meeting at Experimental Biology 2019 in Orlando, FL on Monday, April 8, 2019 from 6:00 pm – 6:30 pm in Room W206B of the Orange County Convention Center.

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.

Nariman Balenga, PhD
University of Maryland School of Medicine

Dr. Nariman Balenga received his PhD in molecular medicine (pharmacology) from Medical University of Graz, Austria focusing on pharmacology of GPR55 and its crosstalk with cannabinoid receptors in human neutrophils. During his postdoctoral studies he discovered the aberrant expression of regulators of G protein signaling (RGS) proteins RGS4 and RGS5 in asthmatic airway smooth muscle and parathyroid tumor cells. He developed mouse models of asthma and primary hyperparathyroidism that either are knockout or overexpress these RGS proteins in a tissue-specific manner. He also discovered that a fungal protease allergen resides in muscle bundles of severe asthmatic lungs, degrades the extracellular matrix and exacerbates the airway hyperresponsiveness to GPCR agonists. He showed that GPR64, an orphan adhesion GPCR, is enriched in human parathyroid cells and is overexpressed in parathyroid adenomas of patients with primary hyperparathyroidism. His lab has characterized GPR64 in vitro and has recently generated mouse and zebrafish models to unravel its role in body calcium homeostasis. These translational studies will bolster the understanding of the physiological and pathological roles that GPCRs and their regulators play. He is an assistant professor at the University of Maryland, School of Medicine. He has been a member of ASPET since 2013.

Ross Corriden, PhD
Merck Research Laboratories

Dr. Ross Corriden received his PhD in biomedical sciences from the University of California, San Diego and conducted postdoctoral research

at the Institute of Cell Signalling at the University of Nottingham as well as the Department of Pediatrics at the University of California, San Diego. His academic research focused on neutrophils, the most abundant phagocytic leukocyte of the immune system and the body's first line of defense against invading pathogens. Although neutrophils play a critical role in host defense, aberrant neutrophil activity is a major underlying factor in the pathobiology of numerous inflammatory disorders. By identifying new G protein-coupled receptor mediators of neutrophil behavior, Dr. Corriden's research has identified new potential therapeutic strategies for selectively downregulating specific aspects of neutrophil function that contribute to inflammation while minimizing impact on the innate immune system's ability to combat infections. He has been a member of ASPET since 2010.

Both awardees will give talks on their work during the ASPET Annual Meeting at EB 2019 in Orlando, FL at the Division for Translational and Clinical Pharmacology's platform session and early career faculty showcase on Tuesday, April 9, 2019 from 4:30 pm – 6:30 pm in Room W206A of the Orange County Convention Center.

Member Spotlight: Richard Okita, PhD

Submitted by Michael J. Espiritu and Aarti Sawant-Basak

Richard Okita PhD, is well known for both his work as a professor at Washington State University and as a Program Officer for the National Institutes of Health National Institute of General Medical Sciences (NIGMS) where, until his recent retirement, he was in charge of administering grants in the areas of drug metabolism and transport, drug induced toxicology and drug delivery. Dr. Okita established a track record for going above and beyond his duty as a Program Officer at NIGMS, actively offering detailed guidance to anyone in the field on how to improve their proposals and present their scientific ideas, particularly young investigators. In honor of his many accomplishments and passion for supporting young scientists, he has been named the recipient of the 2019 ASCPT Medal of Merit and the Division of Drug Metabolism and Disposition has named its early career award as the Richard Okita Early Career Award in Drug Metabolism and Disposition. In this interview we had the great pleasure of hearing some of Dr. Okita's scientific and professional acumen.

For our readers, can you summarize your career journey and highlight some of the milestones along the way?

RO: As an undergraduate, I majored in bacteriology at UCLA and graduated in 1971. My PhD was obtained in biochemical pharmacology in 1976 from the University of Southern California under the supervision of Dr. Paul Hochstein. I remember as a grad student in the early 1970s attending my very first scientific meeting which was an ASPET-sponsored conference in San Francisco. I then went to the University of Texas Health Science Center Dallas (Southwestern Medical School) for my postdoctoral training under the mentorship of Dr. Bettie Sue Masters. I was able to obtain a NIH F32 fellowship award to support part of my fellowship period. I then moved to the Medical College of Wisconsin (MCW) in 1982 as an Assistant Professor and was promoted to an Associate Professor at that same institution. I was very fortunate during my time at MCW to obtain 2 NIH R01 awards, one from

NIEHS and one from NICHD, to support my research program. Bettie Sue was the Chair of Biochemistry and when she received her endowed chair at UTHSC San Antonio, I decided to move in 1990 to the College of Pharmacy at Washington State University where I became a Professor of Pharmaceutical Sciences and the Director of their graduate program.

In 1995, when I learned that my competing R01 grant renewal had received an 8th percentile, I told myself that was the last grant application I planned to write, and I would look for something else to do in the future. Just then, due to a change in departmental leadership I was appointed as the acting chair and hired two assistant professors in 1998 and decided to stay until these two new faculty members obtained their first NIH R01 awards, which they did in 2000. From 1988 to 2001, I had served as a regular member on two NIH study sections and on a National Institute of Environmental Health Sciences (NIEHS) review panel for their large grant mechanisms. I really enjoyed reviewing grant applications and serving on review panels. During this time, I became a little familiar with the role of NIH Program Directors and developed a liking for it. In 2001, I applied for a job posted for a NIGMS Health Scientist Administrator (the official title for a NIH Program Director) in my research area and was selected for this position. At the end of August of 2001, I moved from Pullman, WA, (a town of about 24,000 people) across the country to the Washington DC area. My move to the NIH occurred around 9/11 and because of air travel restrictions my very first NIGMS Council meeting was changed from an in-person meeting on the NIH campus to a teleconference. As a Program Director in the NIGMS, I oversaw research grant portfolios in drug metabolism, drug transport, drug delivery, and other topics that were in the area of clinical pharmacology such as bioactive lipid mediators derived from omega-3 and omega-6 polyunsaturated fatty acids.

In addition to research grant awards, I also managed institutional training grants (known as T32 awards) that supported pre-doctoral training in the pharmacological sciences and post-doctoral training in clinical pharmacology. Besides these T32 awards, I managed individual fellowships (F31 and F32) and mentored research trainees at both predoctoral and postdoctoral levels (K08, K23, and K99/R00). In my last two years at NIGMS, I handled institutional training programs that supported undergraduates for careers in biomedical and behavioral sciences. For a brief time period, I also served as a review officer for the NIH Director's New Innovator grant program, which supported Early Stage Investigators.

As a Program Officer, can you please share your insights on the most interesting projects that were funded and investigated during the course of your career?

RO: I don't want to mention specific grantees that I handled so let me just mention topics. Here are a few research areas that I found to be very exciting and very productive in terms of publications and grant awards:

- The role of pharmacogenomics on drug metabolism and drug transport and how variant forms of these proteins affected the pharmacokinetics and pharmacodynamics of drugs.
- Understanding the complexity in P450 reactions, e.g., the role of cytochrome b5 in activating or stimulating a P450 mediated reaction, the regulation of P450 expression, and the structural characteristics of P450 proteins.
- Advancement of research on drug transporters. This was a field that was vastly understudied and there has been tremendous progress made in the last 25 years in characterizing these proteins.
- Identification of lipid derived biomarkers of oxidative damage and the identification of omega-3 derivatives that play a key role in the resolution of inflammation.

Alongside your work in academia and at NIGMS, you have been highly involved with ASPET. What have been the most rewarding aspects of being involved with the society and what advice do you have for our new members?

RO: For my research communities, ASPET and the Drug Metabolism and Disposition Division have been very important in helping investigators disseminate their research results and to support the training of their students and postdocs. The journal *Drug Metabolism and Disposition* is one of the major journals for these research communities. Two other ASPET sponsored journals, *Molecular Pharmacology* and *Journal of Pharmacology and Experimental Therapeutics*, are also very important publications for these researchers.

The ASPET annual meeting is also a very important forum for trainees to learn about current research in their

fields and to meet other researchers who are just starting their research careers or are established investigators whose names they have seen associated with major research programs. ASPET has been excellent at providing travel fellowships to trainees which can be very beneficial for both students and their advisors. ASPET's Division for Pharmacology Education has also played a crucial role in communicating changes in graduate training and education. Joey Barnett from Vanderbilt has played a key role in organizing meetings of pharmacology graduate program directors to discuss critical issues that relate to graduate training. Besides meeting annually at ASPET, he was able to obtain an R13 conference grant that supported graduate program directors from across the country to meet every other year.

One piece of advice that I have given to postdocs and young faculty is to network with others in their immediate research areas and join professional societies such as ASPET and the Division for Drug Metabolism and Disposition. One of the best ways to network is through participation at society meetings by giving oral and poster presentations, attending symposia, asking questions at the oral talks, visiting the posters and talking to the presenters. These oral and poster presentations are very important in the development of students and fellows. These meetings not only allow them to disseminate their own research findings but also to find what others are doing and to meet other scientists. They foster collaborations for research projects and discussion on grant applications.

I also encourage young faculty members to contribute by serving on committees and participating in the planning of future meetings. This allows them to "give back" and support the future of their research community.

What do you consider to be your greatest accomplishment throughout your career?

RO: I haven't really thought about accomplishments as a NIH Program Director, but one part of my job I really enjoyed was advising young investigators about NIH grant programs and the process from application review to how applications are funded. I felt I was performing an important function advising investigators who were trying to understand the NIH grant process. Each NIH institute handles their grant programs differently, e.g., paylines, funding priorities, and funding policies. Since they may differ, if a young faculty member receives advice from a faculty mentor whose grants were funded by one or two institutes, it may not really relate to how another institute operates. It is very important for a faculty member to discuss their project with a Program Director at the different institutes to determine whether their research project would be a good fit. They also need to understand that in almost all cases, unless they are responding to an institute-specific RFA, the review committee is independent from the institute that has been given assignment of their application for possible funding. Most of the study sections that review R01, R21 and R15 applications are operated by the Center for Scientific Review (CSR) and applicants can find information on each study section at CSR's website. If they want further information, they can contact a Scientific Review Officer (SRO) who runs that review committee to ask if the SRO believes their research project would be a good fit for their panel. It is very important that an application is assigned to the right study section which has the proper expertise to review their project.

You have had a long and very successful career that spans both a traditional academic path and nearly 18 years as a program officer for NIGMS. Based on your experience, what advice do you have for young scientists and investigators who are reading this article?

RO: Biomedical research is an exciting and rewarding career; but young investigators are not always prepared to navigate this process at the start of their career as independent faculty. A new assistant professor has looked forward to this phase of their career, but needs to develop a new set of tools to transform an empty room filled with lab benches into a well-run research laboratory. They are on a tight timeline and setting up a lab is a daunting experience. Hiring and training people are critical first steps in running a lab successfully. Then you must begin the process of convincing others that your research ideas are worthy of extramural funding from private or public agencies so you can continue your research program as your startup funds end. Time management and leadership skills become critical in making sure your research staff can meet your research goals to sustain your program. Communicating your ideas is essential and researchers need to do this very well, because you need to get your first NIH grant award and stay funded, so your dream of a research career doesn't end after 5, 6, or 10 years.

Chapter News

Great Lakes Chapter 32nd Annual Meeting, June 21, 2019

The Great Lakes Chapter (GLC) of ASPET will hold its 32nd Annual Scientific Meeting on Friday, June 21, 2019 at Midwestern University in Downers Grove, IL.

The goal of the 2019 meeting is to highlight major advances in our understanding of the microbiome, as well as provide an opportunity for students, postdoctoral fellows, and scientists working in related areas to learn about the field. The annual meeting of GLC-ASPET also provides a forum of learning and exchanging of ideas in all fields of the pharmacological sciences and is a major networking event for biomedical scientists in the area.

The meeting schedule includes:

- **Poster Session** (8:30—10:30 AM)
- **Vendor Exhibit** (8:30 AM—noon)
- **Symposium** I (10:45 AM—noon)
- **Lunch and Learn Career Workshop** (noon—1:30 PM)
- **Symposium II** (1:30—5:00 PM)
- **Poster Awards and Business Meeting** (5:00—5:30 PM)

Our symposium speakers will include:

- **Keynote: Dr. Susan Erdman** (Massachusetts Institute of Technology) *Harnessing our microbiome for healthful longevity*
- **Speakers: Dr. Ali Keshavarzian** (Rush University) **Dr. David Klumpp** (Northwestern University) **Dr. Brad McRae** (AbbVie) **Dr. Nancy Freitag** (University of Illinois—Chicago)
  Dr. John Baker (Medical College of Wisconsin)
- **Young Investigators**

Check the GLC website (www.aspet.org/GLC) for more information about the 32nd annual GLC-ASPET meeting. Abstracts from all fields of pharmacological sciences are due by June 7, 2019.

CSPT 2019 Annual Conference

From Base to Summit: Pharmacology at its Peak

Calgary, Alberta **June 12 - 14, 2019**

Scientific Sessions

- Ontogeny of Drug Metabolism
- Pain and Inflammation
- Ion Channel Pharmacology
- Clinical Toxicology
- Endothelial Pharmacology
- Practical Pharmacology

Features

- Basic and Clinical Tracks
- Pre-conference Workshop
- Open to Non-members
- Student Rates
- Trainee Presentations
- Awards and Bursaries

Deadlines
Abstract submissions: April 3, 2019
Early-bird registration: May 24, 2019

Visit pharmacologycanada.org for updates

CSPT SCPT
Canadian Society of Pharmacology and Therapeutics
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Interest Group News

Natural Products Pharmacology Interest Group

A Natural Products Pharmacology interest group has been formed to serve ASPET members with interests in all aspects of the basic and translational pharmacology of marine, limnological and terrestrial natural products including semi-synthetic products and biologics as derivatives of the natural products. The specific areas will include, but will not be limited to, the discovery and preclinical development based on a defined mechanism of action, novel target or therapeutic indications, toxic manifestations, use as structure-activity templates, preclinical toxicology, clinical development and safety pharmacology, and their biosynthetic and biologic derivatives. The goals of the Natural Products Pharmacology interest group are the following:

- To provide a forum for scientists dedicated to transforming natural product molecules into tools for the betterment of human health.
- To broaden outreach efforts with the goal of increasing membership from both academia and industry and encouraging their participation in ASPET meetings.
- To develop networking strategies for the benefit of junior and senior investigators as well as students working in the field of natural products pharmacology.
- To increase participation of industry-associated members in development of symposia and workshops on natural products pharmacology for Experimental Biology and collaborative interactions that follow.
- To develop programming ideas including workshops addressing current issues and challenges in marine, limnological and terrestrial natural product pharmacology.

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Mitragyna speciosa leaf *(kratom)*

- To establish a working collaboration with the Natural Products Section of IUPHAR (International Union of Clinical and Basic Pharmacology) at https://iuphar.org/sections-subcoms/natural-products/.
- To work towards establishing a new Natural Products Division at ASPET.

If you are an ASPET member with interests that fall within those described above, please consider becoming a member of the Natural Products Pharmacology interest group by either joining our LinkedIn group at https://www.linkedin.com/groups/12163805/ or emailing Dr. Alejandro (Alex) Mayer at amayer@midwestern.edu or Dr. Palmer Taylor at pwtaylor@ucsd.edu.

If you attend the ASPET Annual Meeting at Experimental Biology 2019, April 6-9, in Orlando, we highly recommend that you also take some time to explore the city. Orlando is not only home to the many amusement parks you know and love; there are many other exciting and fun things to do.

VISIT ORLANDO

CHOCOLATE KINGDOM

Chocolate Kingdom, the Factory Adventure Tour, is an interactive journey that uncovers how chocolate transforms from the bean into the creamy, dreamy chocolate bar.

GATORLAND, ALLIGATOR CAPITAL OF THE WORLD™

A great half-day excursion, Gatorland is a 110-acre theme park and wildlife preserve.

KENNEDY SPACE CENTER VISITOR COMPLEX

With the 50th anniversary of Apollo 11's historic mission to the Moon in July as well as the return of human spaceflight on the Space Coast, the Kennedy Space Center Visitor Complex is buzzing with activity this year.

ICON ORLANDO 360™

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ART MUSEUMS

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Einstein T-shirt
Black cotton with Albert Einstein quote
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Members: $15.00 + Shipping

Cooligraphy T-shirt
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Adult Sizes: S, M, L, XL, XXL
Members: $15.00 + Shipping

Explore Pharmacology T-shirt
White cotton with cartoon design
Adult Sizes: S, M, L, XL, XXL
Members: $15.00 + Shipping

Experiment T-shirt
Navy blue cotton with Experiment. Learn. Fail. Repeat design
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*Child sizes availabe in light blue
Members: $15.00 + 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

Toddler T-shirt/Onesie
White cotton with Genius design
Toddler Sizes: 2T, 3T, 4T, 5T, 6T
Onesie: NB, 6M, `12M, 18M, 24M
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Women’s Scarf
Beige silk scarf with ASPET logo
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- Free & confidential résumé posting
- Access to jobs posted on the National Healthcare Career Network (NHCN)
- Career management resources including career tips, coaching, résumé writing, online profile development, and much more

Employers:

- Searchable résumé database
- Hassle-free posting; online account management tools
- Reach ASPET's Twitter followers (almost 2,000), LinkedIn Members (over 2,000), and email subscribers (over 4,000)
- Post to just ASPET or to the entire NHCN network
- Sign up for automatic email notifications of new résumés that match your criteria
- Job activity tracking

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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1801 Rockville Pike, Suite 210, Rockville, MD 20852-1633
Main Office: 301.634.7060
www.aspet.org