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Flint Water—

Lead, by Example

INSIDE

ASPET
Transforming Discoveries into Therapies

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Contents

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Message from The President

Hello ASPET members. The world seems to be arriving at a 'new normal' mutant. Despite the looming spectre of omicron, restaurants are opening up, businesses are functioning, students are mostly attending school in person, and travel is picking up. It seems to be a time for renewal and rejuvenation in the world. Certainly, ASPET is experiencing some renewal and rejuvenation as well.

In mid-October, we had a largely in-person Council meeting. It was wonderful to see Council members face to face, even if the faces were masked. Technology allowed some Council members to attend virtually. ASPET is in the midst of renewal due to the retirement of our hard-working Executive Officer, Dr. Judy Siuciak. Never fear; the Society is in excellent hands. Matt Hilliker, our Chief Financial Officer, and Melissa Huston, our Meetings Director, are formally sharing the interim Executive Officer duties until a new EO is hired. The response to the position advertisement has been overwhelming (over 30 applications were received in the first 2 weeks), and a search committee is reviewing and evaluating the applications.

I want to digress for a minute and praise the ASPET staff. These messages always thank staff for their efforts, but I would like to highlight the staff a bit more. Charles France (Past-president), Mike Jarvis (President-elect), and I visited the ASPET office following the fall Council meeting. We were able to get an up-close look at the staff, and we were impressed, but not surprised, by their experience and dedication and with the innovative ideas they presented.

ASPET is in the midst of re-imagining the annual meeting. You all may be aware that the 2023 meeting is going to be an independent ASPET meeting. Many of you responded to Storycraft Lab, meeting strategy consultants that surveyed our members, to relate your preferences and visions for an ASPET meeting. Council, staff, and especially the Program Committee are paying close attention. We plan to make the 2023 meeting highly innovative and tailored to members' choices. If you have more ideas, they are most welcome. You can contact staff, any member of Council, or your division officers with ideas. The attention put on the 2023 meeting, however, should not detract from the excellent science that will be presented at the upcoming 2022 meeting. I am very excited that the meeting is scheduled to be in person. We need to see our friends and colleagues and share our science in person again. There will be many excellent symposia and presentations, so register for the meeting by February 7, 2022, to get the deepest discounts.

Speaking of renewal, I am reminding you to renew your ASPET membership. Membership is a definite priority for the Society. Membership is often driven by the annual meeting, so we are glad the 2022 meeting will be in person. There are many benefits to ASPET membership, many of which are listed on the ASPET homepage. In addition, there are many programs that serve members and might not be well recognized, such as the Summer Undergraduate Research Fellowships (SURF), the Washington Fellows, which introduces young scientists to scientific public policy, the Focus on Pharmacology webinar series, highlighted trainee authors in ASPET publications, and the many scientific and travel awards. Importantly, ASPET is a home to pharmacologists. The Society promotes the subject of pharmacology, which is often misunderstood by others. In the spirit of renewal, the Society wants to reach out to you and learn what is important to you. No matter where you are in your career, we want to know what you enjoy about ASPET and what more it can do to serve your needs. Pharmacologists are very versatile and work in many settings. To follow through on statements made when I was running for president, we want to be inclusive to all pharmacologists, whether they work in industry, government,

biotech, undergraduate institutions, or consulting firms. I might point out that our Diversity, Equity, and Inclusion (DEI) task force is being very active and is raising the bar at ASPET for DEI involvement.

I urge you to participate in your division's activities. The divisions are designing creative ways of interacting with their members. Ideas you may have for improving the Society or needs you may have within the Society can be easily communicated to your division officers. I urge the divisions to work to increase membership and continue to prioritize active member engagement. The divisions are really the core of ASPET. They also provide an excellent mechanism for young members to advance to leadership positions in the Society.

Finally, I want to give a shout out to the excellent Focus on Pharmacology webinar series. There have been 14 so far in 2021 that have encompassed a number of interesting and useful topics including the COVID vaccine, publishing opportunities for educators, and trainee engagement in the scientific review process. The ASPET Mentoring Network produces webinars on topics of great use to students and early career scientists. A recent Focus on Pharmacology session was a highly interesting joint meeting between ASPET and the Chinese Pharmacological Society on the topic of drug metabolism and transporters. This excellent series is available on our website free to members. Check it out: www.aspet.org/focus

Be assured that ASPET is working for you, but it also helps if you work for ASPET. Sign up for membership, pay your dues, and get involved. ASPET needs your involvement and input. I hope to see all of you in Philadelphia in April 2022. Check out my video on Twitter (https://bit.ly/30pl63U)!

Margaret E. Gnegy, PhD
ASPET President

2021 Year in Review

Membership

3,925 **total members**

in **63** **countries**

439 **new members** in 2021

Career Center

The ASPET Career Center averages **412** **jobs available** on the site daily

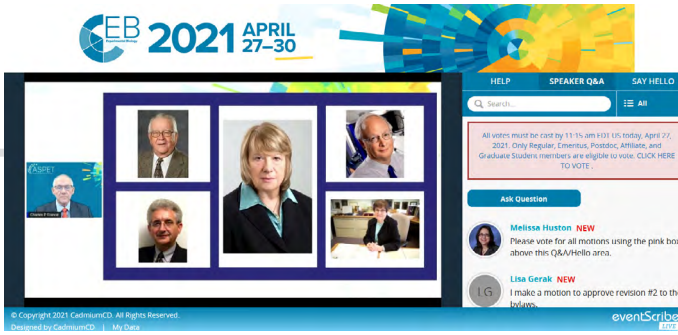
Over **102,200** **page views** in 2021 on the ASPET Career Center

Recognizing Excellence

Recognized **23** distinguished scientists with ASPET scientific achievement awards in 2021

Designated **16** members as ASPET Fellows in the FASPET class of 2021

ASPET Annual Meeting



ASPET held its **1st** virtual annual meeting in 2021 with **1,180** ASPET registrants.

Abstracts

598 abstracts received in pharmacology topics for EB 2021.

We appreciate our volunteers! **133** members volunteered to be abstract reviewers on **11** review teams who submitted **4,292** reviews of EB 2021 pharmacology abstracts.

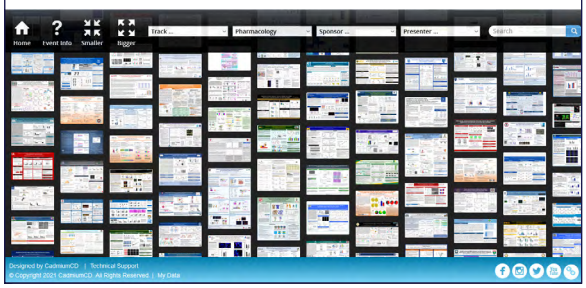
44 abstracts were designated as Program Committee Blue Ribbon Picks based on their top scoring.

179 abstracts selected to compete in the ASPET poster competition.

30 abstracts selected to present in the ASPET Datablitz.

Posters

Over **103** average views per poster in the virtual poster hall.



Sessions

6,452 total views of ASPET's live online sessions

1,459 total views of ASPET's on-demand sessions

ASPETConnect

Since ASPET*Connect*'s launch to the full membership on May 27, 2020, we have had

1,305 **members** actively log in.

We have **10** Division Communities,

31 Committee and Task Force Communities,

1 Focus on Pharmacology Community,

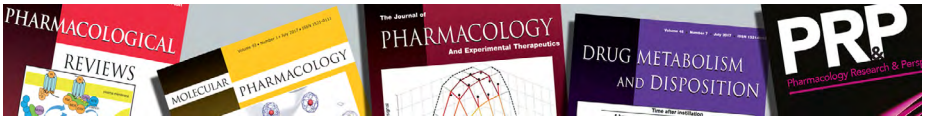
1 NERDS PIT Young Scientists Community.

3,277 **connections** have been made on ASPET*Connect*.

328 **members** have uploaded their profile pictures.

Over **9,460** **content contributions** have been made on the platform.

Publications



67 Highlighted Trainee Award nominations spotlighting emerging scientific talent in the field of pharmacology

106 **Open access articles** were published

Manuscripts submitted from **49** **different countries**

3,555 **manuscript reviews** completed

70 Editor's Choice articles promoted

250 Journal Editorial Board members providing expertise in the peer review process

180 Pre-submission inquiries

The Pharmacologist continues to be an important publication with **15,941** **total hits** from December of last year through October of this year.

FOCUS ON PHARMACOLOGY
ASPET Virtual Series

Webinar Series

ASPET has hosted **14** Focus on Pharmacology virtual sessions with a total of over **1,000** registrants in 2021.

Each virtual session averaged **77** registrants

99% of attendees learned new information at a Focus on Pharmacology virtual session

Session attendees have come from all over the world; the top 5 international countries include:

China
Nigeria
Canada
Saudi Arabia
Jamaica

Satisfaction with webinars in the Focus on Pharmacology series is rated:

4.6 out of 5

Science Policy

18 virtual visits with **House offices**
25 virtual visits with **Senate office**
13 **sign-on letters** endorsed
4 **bills** endorsed
3 **position papers** created

@ Social Media

2,224 **total "likes"** and **2,363** **follows** for ASPET's Facebook page

4,247 ASPET Twitter followers

2,420 ASPET LinkedIn group members

Thank you, ASPET Volunteers!

ASPET's programs, awards, and activities would not be possible without the dedication of our member volunteers. Thank you to all our volunteers this year who have spent countless hours reviewing, planning, attending meetings, and more.

Thank you...

Council Members
Committee Members
Editorial Board Members
Award Reviewers
Abstract Reviewers
Journal Reviewers
Symposia and Session Chairs
Focus on Pharmacology Speakers and Organizers

If you would like to volunteer with ASPET, please contact us at membership@aspet.org.

2021 Contributions

THANK YOU

to Our Supporters

Thank you to all our members for your continued commitment to and support of ASPET. By renewing your membership each year, publishing in our journals, and attending our meetings, you contribute to the growth and success of ASPET and the future of pharmacology.

We especially thank all our individual, institutional, and corporate contributors who have made donations to ASPET above and beyond their membership dues. These donations have helped ASPET support research, publications, science advocacy, and career development for scientists. Contributions from members help increase ASPET's impact in the science community and beyond.

ASPET gratefully acknowledges the following individuals who made contributions from November 2020 through October 2021:

Lauren Aleksunes
Susan Amara
Bradley Andresen
Wayne Backes
Helen Baghdoyan
James Barrett
Namandjé Bumpus
Clinton Canal
Kathryn Cunningham
Gary DeLander
Margarita Dubocovich
Jeffrey Fedan
James Galligan
Susan Gonsalves
Ingeborg Hanbauer
Lori Hazlehurst
Dale Hoyt
Michael Iadarola
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Jorge Iniguez-Lluhi
Paul Insel
Michael Jarvis
Richard Johnston
Emily Jutkiewicz
Jonathan Katz
Thomas Keck
Suzanne Laychock
Qing Ma
Craig Malbon
Martha Martin
Bettie Sue Masters
Bernhard Nausch
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Pancras Wong
Michael Wood
Aiming Yu
Xiaobo Zhong

Thank you to our Meeting Sponsors

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Journal of Biological Chemistry
Multispan, Inc.
Montana Molecular
Pharmacology Research & Perspectives

Consider Donating to ASPET as Part of Your Year-End Giving

If you would like to help support ASPET's mission and strategies for a stronger pharmacology community, please consider donating to ASPET. There are many ways you can give, and all donations are tax deductible.

Contribute to ASPET's 2021 Featured Fund: Young Scientist Travel Fund

As a Society dedicated to attracting and developing the next generation of pharmacologists, ASPET believes young scientists benefit greatly from having the opportunity to travel to the annual meeting. There, students and postdocs have the ability to share their research, get feedback on their work, make connections with senior scientists, build confidence, and develop skills to build their careers. Travel to the ASPET Annual Meeting is a vital component in a young scientist's training, and ASPET provides funds each year to support our young scientists. Your support through the **Young Scientist Travel Fund** will help ASPET continue to provide travel benefits and help sustain the growth of the next generation of members.

Donate to the ASPET Young Scientist Travel Fund at www.aspet.org/donate.

ASPET is committed to providing the best possible Society for our members who conduct research to save lives. The research of our members helps to develop new medicines and therapeutic agents to fight existing and emerging diseases. Your tax-deductible contribution, at any amount, will make a difference! To donate, please visit: www.aspet.org/donate.

Support ASPET by Shopping on AmazonSmile

AmazonSmile is a website operated by Amazon that lets customers enjoy the same wide selection of products, low prices, and convenient shopping features as on Amazon.com. The difference is that when customers shop on AmazonSmile (smile.amazon.com), the AmazonSmile Foundation will donate 0.5% of the price of eligible purchases to the charitable organizations selected by customers.

Choose ASPET as your charitable organization on AmazonSmile while doing your holiday shopping this year! Enter https://amzn.to/3jfibyg into your web browser to start shopping.

Support
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When you shop at **smile.amazon.com**, Amazon donates.
Go to smile.amazon.com
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2022 Elections

The ASPET election for president-elect, secretary/treasurer-elect, and councilor will open on January 5, 2022. Candidate biographies will be available online when the election opens. All regular, postdoctoral, emeritus, affiliate, and graduate student members are eligible to vote. Eligible voting members will receive a notification when the election opens.

The following divisions are also holding elections:

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

Biographical information on division candidates can be found on page 263.

As the ASPET bylaws require, the election will be open for a minimum of thirty (30) days from the day of notification. The election will close on February 9, 2022.

Nominees for President-Elect

Namandjé N. Bumpus, PhD
E.K. Marshall and Thomas H. Maren Professor and Chair, Department of Pharmacology & Molecular Sciences, Johns Hopkins University School of Medicine

Alan V. Smrcka, PhD
Professor of Pharmacology, Benedict Lucchesi Professor of Cardiovascular Pharmacology, University of Michigan

Namandjé N. Bumpus, PhD

Candidate's Statement

I am thankful for the opportunity to be a candidate for ASPET President. ASPET has been my professional home since I was a trainee. During my time in ASPET, I have served on the public affairs committee, awards committee, as an officer in the Division for Drug Metabolism and Disposition, and now as a Councilor. Through these service opportunities, ASPET has nurtured my growth as both a pharmacologist and a member of our pharmacology community. In serving as President, I will work collaboratively to expand the space and the platforms for trainees and early-stage investigators to showcase their work and to grow both professionally and scientifically. To fortify this, it will be important to support our emerging scientists as they progress through the career development continuum by providing increased access to leadership

opportunities as well as robust longitudinal career and professional development programming. As part of this, I will strive to ensure that ASPET feels like home to all of our members, across dimensions of diversity, and that all members see a long-term path for themselves within ASPET. I will listen, I will be open, I will communicate, and I will be transparent as we work together to achieve this.

As a leader, I work from a point of view of service to others. Critical to this has been my ability to think strategically and bring together diverse groups to coalesce around a unified vision. I value collaboration, transparency, and entrepreneurship, and will be a dynamic and energetic president who works in full service of the ASPET mission. I have a deep commitment to excellence, demonstrated creative leadership and management ability, and the energy and vigor to translate ideas into action. My collective professional experience will enable me to make unique and meaningful contributions to ensuring that ASPET achieves the goals outlined in the strategic plan. My background as a leader, with responsibilities in graduate education, pharmacology, and basic and translational science more broadly, position me to be a strong contributor to ASPET's efforts to attract and develop the next generation of pharmacologists. I have a deep interest in and history of actively working in full service of providing emerging and early-stage investigators with support and high-quality educational experiences while aggressively addressing issues related to their success. My time on the public affairs committee of ASPET as well as my personal interactions with legislators on Capitol Hill (including delivering a briefing on pharmacology to the Congressional Biomedical Research Caucus and frequent service as a scientific expert on public panels sponsored by members of Congress), have provided me with valuable perspectives that I will leverage in working to promote pharmacology and ASPET while advocating for critical science policies. In a world with heightened attention on the development of vaccines and therapies, ASPET has an opportunity to ensure that the public, journalists, and others looking for insight into questions related to pharmacology get the highest quality information. Indeed, continued growth for ASPET in the current climate will require strengthening our position and visibility as thought leaders in biomedical science. With an eye toward bridge-building, I will look to strengthen ties with scientific societies with missions similar to our own, ideally through developing collaborative programming that will bring value to our members.

To achieve the goals of reimagining the annual meeting experience, enhancing the ASPET journals, and strengthening ASPET overall, the application of assessment measures will be an important consideration. Through my leadership experience I have established a track-record of employing assessment and accountability measures to help guide and enhance strategic planning goals. Finally, I truly value that ASPET is an environment of shared governance. My experience as a leader and diplomat with strong organizational and consensus-building skills equip me to positively and enthusiastically participate in our shared governance.

Alan V. Smrcka, PhD

Candidate's Statement

My excitement and enthusiasm for the field of pharmacology developed after a dramatic transition from my studies in plant biochemistry during my PhD, where I studied photosynthesis, to my postdoctoral fellowship with Dr. Paul Sternweis in the Department of Pharmacology at UT Southwestern, one of the premier pharmacology departments in the world. At the time, in the early 1990's, the department was chaired by Dr. Alfred Gilman and was a hotbed of GPCR and G protein research. In this environment with cutting edge work being done and fantastic colleagues it was almost impossible not to get excited about pharmacology!

I obtained my first independent position in 1994 in the Department of Pharmacology at the University of Rochester where I encountered another great group of colleagues, but getting started as an assistant professor was tough. One of the critical decisions I made at this time was to become a member of ASPET and to regularly (every year!) attend the ASPET Annual Meeting. This was routinely held as part of a very large Experimental Biology meeting, but the society/division sponsored programming and social events brought people together such that it had much of the taste of a more intimate meeting. At these meetings, I was exposed to exciting new science and developed relationships with scientists that have helped me propel my career and become a successful scientist.

Now that I am an established scientist at the University of Michigan, I am committed to doing the same for other up and coming scientists, with additional goals of exciting young people about pharmacology, and increasing the diversity of our society. I believe that our annual meetings (once in person again) are amongst the most important functions of our society, and I am committed to their success as we transition into a new format independent of Experimental Biology.

I am an active pharmacologist with extensive experience and understanding of the workings and directions of ASPET who is committed to the continued success of the Society. As someone who has worked in the field of pharmacology for 30 years, I have a broad knowledge of the field, and a keen sense of emerging scientific areas where pharmacologists can be leaders. My roles in various leadership positions, at the division and society levels of ASPET and elsewhere, have taught me that leadership is not necessarily about imparting one's own vision, but rather, is about listening to others and bringing ideas together to define a collective vision. I understand the challenges of maintaining a vibrant and forward-looking society that seeks to broaden the extent and diversity of its membership, while at the same time maintaining its appeal to its core constituencies. As ASPET President, I would work with Council to lead the Society to increase the breadth and diversity of its membership, continue to build on and adapt the ASPET strategic plan as new challenges emerge, and work to increase the visibility of ASPET journals. In short, I believe that I have the leadership skills, experience with ASPET, and breadth of scientific background to be a successful and productive ASPET president.

Nominees for Secretary/Treasurer-Elect

Xinxin Ding, PhD
Professor and Head, Department of Pharmacology and Toxicology, University of Arizona College of Pharmacy

Mark J. Hernandez, PhD
Professor of Physiology and Pharmacology, Alabama College of Osteopathic Medicine

Xinxin Ding, PhD

Candidate's Statement

Since becoming an ASPET member in 1997, I have been actively involved in numerous ASPET activities, including services at the division level as a Councilor (2001-2004), Secretary/Treasurer (2005-2006), and Chair (2018-2019), and at the society level as a member of the Nominating Committee (2005-06) and an Editor for the ASPET journal, *Drug Metabolism and Disposition*. Through these activities, I have become deeply impressed by the strong dedication of the ASPET elected officers to the welfare of the society and the success of its members, and by the large impact of ASPET on the discipline of pharmacology. Thus, I feel obligated to contribute my ideas, diligence, and experience to the continued success of ASPET by seeking additional opportunities to serve the society and its membership. I strongly believe that my personal aspirations are aligned with the vision and mission outlined in the ASPET Strategic Plan. I will continue to do my best to advance ASPET's strategic goals. I am confident that my past administrative experience and enthusiasm have prepared me well for the responsibilities of the Secretary/Treasurer position.

Mark J. Hernandez, PhD

Candidate's Statement

As ASPET's Secretary/Treasurer, I will serve to ensure the prudent use of all assets and most importantly to serve its members first. I will work with all members of Council to ensure ASPET continues to advance its mission as described in the 2017 strategic plan where decisions are made in the best interest of the Society. I will help provide guidance and strive to promote camaraderie of all members. I will ensure that ASPET follows its own bylaws reflecting the positive culture in the organization. During the virtual Experimental Biology meeting in 2021, I presented a poster titled "Medical Pharmacology Education at a Crossroads: Looking in a Future Direction." Pharmacology educators have a primordial role in the education of the health sciences professions today. Although we have seen an expansion in the health sciences education professions, pharmacology educators face an existential threat due to the decline in pharmacology trainees. We need to motivate and train new pharmacology scientists and educators. Also, many pharmacologists domestically and abroad seek a professional home and ASPET can be it. Whatever the language or origin of the pharmacologist, ASPET can welcome them and work collaboratively with all its members. To increase membership, I will focus on helping make ASPET more attractive to all educators and students of all levels of training. The annual meeting experience in 2022 presents the unique opportunity following the pandemic to provide a new and more meaningful experience that has professional benefits and opportunities for professional development. Even for those who are unable to attend in person due to financial reasons, ASPET can still provide meaningful limited virtual experiences whenever possible to ensure its growth in the member base. Thank you for your support.

Nominees for Councilor

Catherine M. Davis, PhD
Assistant Professor, Uniformed Services University of the Health Sciences

Nina Isoherranen, PhD
Professor and Chair, Milo Gibaldi Endowed Chair in Pharmaceutics, University of Washington

Catherine M. Davis, PhD

Candidate's Statement

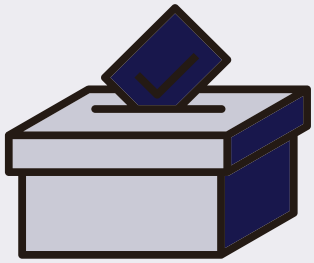
I have been a member of ASPET since 2008 and have been active in different positions since I was a postdoctoral fellow, which has continued as I have transitioned from a trainee to full member. I am interested in the Councilor position because I want to make the society a place where all pharmacologists feel welcome and included and feeling like their voices are heard in their society matters. Since I joined ASPET as a graduate student member, I bring a unique perspective to Council and have experienced a range of services the society offers for these different career levels. This is an important perspective because ASPET needs to offer valuable services that benefit all career levels, so all members gain value from their membership. Further, I want to use this position to reach and recruit junior members to not only join the

society, but also to take active leadership roles within the society. We need new ideas to continue growing our society and evolving to meet the challenges with which we are presented.

Nina Isoherranen, PhD

Candidate's Statement

I am honored to be nominated to serve on ASPET council. I have been a member of ASPET since 2010 and served in multiple roles including Chair and Secretary/Treasurer of the Division for Drug Metabolism and Disposition, member of the Program Committee, member of the Science Policy Committee, and ASPET representative to the FASEB Science Policy Committee. I have also served as an Associate Editor of *Drug Metabolism and Disposition* for the past seven years. Through these activities I have gained experience in three areas that I believe are critical for ASPET in its service to the membership; maintaining strong scientific publications in pharmacology and therapeutics, further developing the annual meeting to have cutting-edge exciting scientific programming, and participating in policy advocacy for legislation that affects pharmacology research. As an academic, I have trained numerous graduate, professional, and undergraduate students and have a commitment to pharmacology education, in particular, as it entails to integration of knowledge and translation of laboratory discoveries to novel therapeutics and better clinical practice. I believe my commitment to education and to increasing awareness of the critical role pharmacology has as a discipline is closely aligned with ASPET's strategic plan. I am interested in serving as ASPET Councilor to support the society leadership, divisions, and membership in executing the six goals of the strategic plan and working towards the society mission "to be the professional home for educators, students, researchers, healthcare practitioners, and other professionals working to advance pharmacology research, exchange knowledge, and increase the impact and influence of this scientific discipline." We are experiencing a time where we will need to capitalize on the developments and feasibility of virtual platforms in designing future scientific meetings, address open access, big data and transparency demands in scientific publishing, and advocate for critical policy issues that have broad impacts on pharmacology research. If elected, I will bring my experience and passion in these areas combined with my knowledge of the changing landscape in academic institutions to serve ASPET and its membership.



The ASPET 2022 election will open on January 5, 2022. All eligible voters will be sent a notification with your login credentials to vote. If you have any questions, please contact membership@aspet.org.

Thank you, Judy!

Congratulations to ASPET Executive Officer, Judith Siuciak, PhD, on her retirement! Judy served as Executive Officer since 2013 and officially retired on September 30, 2021.

Judy brought diverse experience from the academic, industry, and non-profit sectors. She received her PhD in pharmacology from the University of Illinois College of Medicine under the direction of Dr. Claire Advokat and was a postdoctoral fellow at Northwestern University Medical School with Dr. Margarita Dubocovich. She spent almost two decades in the pharmaceutical industry at Regeneron and Pfizer Global Research and Development, ultimately transitioning to the non-profit sector and working at the Foundation for the National Institutes of Health prior to joining ASPET.

During her tenure, Judy oversaw many significant events for the Society including the new ASPET logo and tagline, new ASPET website, ASPET*Connec*t, and a new look for *The Pharmacologist*. She hired ASPET's first staff Education Director to support new Society initiatives and expanded the marketing team to enhance communication with members. She oversaw the design, construction, and relocation of the ASPET staff offices from the FASEB campus, where they had been located for 60 years, to the new location in Rockville, MD, in 2018. Judy was a critical member of the Experimental Biology leadership team and has worked with staff and Council to begin the process of re-envisioning the ASPET Annual Meeting as an independent venture. She also oversaw the formation of many new committees, task forces, and programs, such as the Young Scientists Committee, Partnerships Committee, the ASPET Mentoring Network, and the ASPET Fellows program. Her list of accomplishments is long and impressive, ultimately bringing greater value and increased opportunities for ASPET members.

Judy developed lasting relationships with ASPET's staff, membership, and Council members as well as colleagues from our partner organizations and positioned the organization for continued success even after her departure. We thank her for her exceptional service to the society and congratulate her on her well-deserved retirement.

In retirement, Judy and her husband, who also recently retired, plan to spend time with family and friends, and barring COVID disruptions, have planned several trips over the next year. She is an avid genealogist, and her extensive research into her husband's ancestry documented descent from several Mayflower passengers and resulted in acceptance into the Mayflower Society.

2022 Annual Meeting

April 2-5 | Philadelphia, PA

ASPET 2022 Annual Meeting at Experimental Biology

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

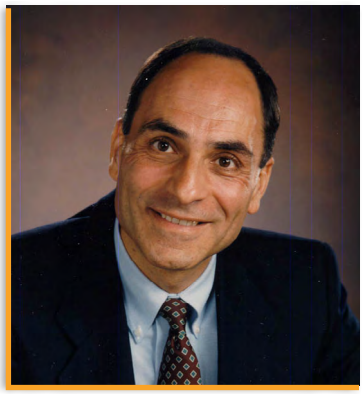
ASPET welcomes all scientists passionate about pharmacology to gather **April 2-5, 2022** in **Philadelphia** as ASPET intersects with other experimental biologists in physiology, biochemistry, molecular biology, pathology, and anatomy at the last Experimental Biology conference (EB).

Be inspired by the latest scientific advances in diverse areas, share your research and get feedback on your work, create connections with your scientific collaborators and discover new ones.

Featured Award Talks

The winner of the 2019 David Lehr Research Award, **Dr. Kathryn E. Meier**, will update us on her investigations that were funded by the award as she shares with us a saga of lipid mediators and their GPCRs.

The winner of the 2021 Axelrod Award, **Dr. Joan Heller Brown** will explore how GPCRs and G-proteins inform our understanding of disease.



The winner of the 2020 Tang Foundation Prize for Biopharmaceutical Science, **Dr. Charles Dinarello** from the University of Colorado, Anschutz Medical Campus will discuss the development of cytokine-targeting biological therapies for treatment of inflammatory diseases.

In early January, we will announce the keynote lectures by the preeminent winners of the John J. Abel Award in Pharmacology, the Goodman and Gilman Award in Receptor Pharmacology and the Otto Krayer Award in Pharmacology.

Preliminary Program

Plan your travel around the ASPET program schedule:

Saturday, April 2, 2022

10:00 am – 10:45 am	Opening award lecture
11:00 am – 12:30 pm	Concurrent symposia
12:30 pm – 1:30 pm	Break for lunch with a colleague
1:30 pm – 3:00 pm	Concurrent symposia
3:15 pm – 4:00 pm	Keynote lecture
4:30 pm – 6:00 pm	ASPET Business Meeting and Awards Presentation
6:00 pm – 7:00 pm	Tang Foundation Prize lecture
7:00 pm – 8:30 pm	EB welcome reception

Sunday, April 3, 2022

8:00 am – 9:30 am	Concurrent symposia
10:00 am – 12:00 pm	Poster presentations including the ASPET Datablitz
12:00 pm – 1:00 pm	Break for lunch with a colleague
1:00 pm – 1:45 pm	Award lecture
2:00 pm – 3:30 pm	Concurrent symposia
4:00 pm – 6:30 pm	ASPET Student-Postdoc Poster Competition
8:30 pm – 11:00 pm	Student-Postdoc mixer

Monday, April 4, 2022

8:00 am – 10:00 am	Division sessions (showcases/awards)
10:00 am – 12:00 pm	Poster presentations including the ASPET Datablitz
12:00 pm – 1:00 pm	Break for lunch with a colleague
1:00 pm – 3:00 pm	Division sessions (showcases/awards)
3:30 pm – 5:00 pm	Concurrent symposia
5:30 pm – 7:00 pm	Division mixers

Tuesday, April 5, 2022

8:00 am – 9:30 am	Concurrent symposia
10:00 am – 12:00 pm	Poster presentations including the ASPET Datablitz
12:00 pm – 1:00 pm	Break for lunch with a colleague
1:00 pm – 1:45 pm	Award lecture
2:00 pm – 3:30 pm	Concurrent symposia
3:30 pm – 4:30 pm	Poster Awards and closing networking event

ASPET Symposia

Program information as of November 2021

Saturday, April 2

Julius Axelrod Award Symposium and Lecture: GPCRs and G-Protein Signaling: Insights into Disease

11:00 am - 12:30 pm

The 2021 Axelrod Awardee, **Joan Heller Brown**, has organized a fast-paced symposium that will include her award lecture. It is now appreciated that G-protein coupled receptors and G-protein signaling pathways regulate chronic responses mediated through changes in gene transcription. Dr. Heller Brown will discuss studies that began with G-protein regulation of astrocyte growth and of cardiomyocyte hypertrophy, and lead to discovery of pathways critical for glioblastoma tumorgenesis and development of heart failure. Immediately following we'll hear from **Stefan Offermanns** exploring novel GPCRs regulating metabolic disease, **Gerald Dorn** discussing G-proteins in mitochondrial dynamics and heart disease, and wrap up with a talk from **Bryan Roth** about GPCRs in psychiatric disorders.

Targeting Autophagy in Cancer

11:00 am - 12:30 pm

Chairs: **Rushika Perera, Christina Towers and Andrew Thorburn**

Speakers: **Eileen White, Rushika Perera, Ravi Amaravadi, and Christina Towers**

This session will discuss recent advances in targeting autophagy as a treatment for cancer. Four leading investigators will discuss recent advances in the field that explain how autophagy modulation in cancer can affect anti-tumor immunity, how lysosomes regulate cancer behavior, the development of new autophagy inhibitors that target the lysosome in novel ways, and how cancer cell resistance to autophagy inhibitors can arise and may be circumvented.

Induction of Early Onset Cardiovascular Disease by Methamphetamine

11:00 am - 12:30 pm

Chairs: **Kevin Murnane and Md. Shenuarin Bhuiyan**

Speakers: **Md. Shenuarin Bhuiyan, Ralph Shohet, and Paari Dominic**

Amphetamine-type stimulants are the most widely used class of illicit drugs in the world after cannabinoids, and there is a growing epidemic in illicit methamphetamine use. Methamphetamine can have adverse and potentially fatal effects on arteries and blood vessels, including elevated blood pressure, acute vasospasm, and atherosclerotic cardiovascular disease, and methamphetamine induces structural and electrical remodeling of cardiac tissue. This symposium will present human and animal studies regarding the impact of methamphetamine on the cardiovascular system, and discuss the findings that individuals exposed to methamphetamine present with early onset cardiovascular disease.

Automating the Patient-Oriented Problem-Solving Sessions in Pharmacology

11:00 am - 12:30 pm

Chairs: **Catherine Fry and Mark Simmons**

Speakers: **Mark Simmons, David McMillan, Jayne Reuben, Rob Rockhold, and Jeff Graham**

The new Automated Patient-Oriented Problem-Solving System in Pharmacology provides an online platform for problem-solving exercises, active learning, and interprofessional education in pharmacology. With the Automated POPS, students can meet remotely or in person. Breakout groups can run simultaneously or asynchronously. The system records extensive student performance metrics and provides instantaneous feedback. Attendees should bring a laptop or tablet to use to do a run-through of an Automated POPS exercise.

Student-Postdoc Colloquium

1:30 pm - 3:00 pm

Organized by the Mentoring and Career Development Committee

Each year this popular colloquium focuses on career development topics of special interest to young scientists. Visit the online program at **www.aspet.org/eb2022/program** for more details.

Immunotherapies for Substance Use Disorders: State-of-the-Art Approaches

1:30 pm - 3:00 pm

Chairs: **Marco Pravetoni and Sandra Comer**

Speakers: **Andrew Norman, Keith Ward, and Marco Pravetoni**

Deaths attributed to synthetic opioids, such as fentanyl, and stimulants, such as cocaine and methamphetamine, have increased tremendously in the past year. Although several effective medications are available for treating opioid use disorder, relapse rates are high and medications for treating opioid overdose, such as naloxone, may be less effective against synthetic opioids compared to heroin. No medications have been approved in the U.S. for treating stimulant use disorders. Monoclonal antibodies and vaccines represent an alternative approach to treating overdose and substance use disorders. This symposium will provide an update on immunotherapies that are currently in clinical testing.

Novel Microphysiological and Microtissue Systems to Advance Transporter Research

1:30 pm - 3:00 pm

Chair: **Lauren Aleksunes**

Speakers: **Catherine Yeung, Seyoum Ayehunie, and Pouria Fattahi**

Recent advances in the development of novel testing systems that recapitulate the human microenvironment and microanatomy have advanced drug and chemical screening. Using microphysiological systems, investigators are able to consider the influence of fluid flow, cell-cell communication, extracellular matrix, and 3-dimensional organization in organs-on-a-chip and tissue-engineered organ constructs and microtissues. Advancement of this technology includes the robust characterization of transporter expression and function, often in concert with evaluation of drug metabolizing enzymes and regulatory factors. This session will highlight examples of microfluidic systems and novel tissue cultures that recapitulate human transporter function across a number of organ systems. Speakers will review the potential application of these model systems for drug development and toxicity screening.

Pharmacology Perspectives on Attaining Diversity, Equity and Inclusion in Clinical Trials

1:30 pm - 3:00 pm

Chairs: **Pamela Hornby and Deborah Luessen**

Speakers: **Staci Hargraves, Sapna McManus, and Richardae Araojo**

This symposium aims to increase awareness of the ongoing and pervasive issues surrounding inequality in clinical trial development and provide insights on how these factors impact the validity and use of clinical trial results that currently perpetuate health disparities. This symposium will highlight the pharmacological insights and novel strategies to diversify scientific approaches involved in pharmacotherapeutic clinical trial design, execution and outcome analysis to overcome barriers for patients from underrepresented populations. The symposium will provide unique perspectives from leaders in the field of pharmacology representing a broad range of disciplines (industry, academia, government). The speakers have been selected based on their alignment with pharmacological scientific approaches and will present on topics of interest to a broad group of preclinical and clinical pharmacologists.

Sunday, April 3

Opioid Dependence and Non-Canonical Targets for Medication Development

8:00 am - 9:30 am

Chairs: **Jill Turner and Rita Valentino**
Speakers: **Lilian Goncalves Custodio, Fair Vassoler, and Georgia Hodes**

Opioid use disorder (OUD) is a leading cause of morbidity and mortality in the United States. Yet very few therapeutic options are available to individuals suffering from opioid use disorder, indicating novel drug development for OUD is critically needed. This panel, chaired by Dr. Jill Turner, the 2021 Division for Neuropharmacology Early Career Awardee, will discuss new and exciting directions in medication development for this debilitating disorder, centered on modulating neuroinflammatory responses to opioid exposure and withdrawal.

Targeting Gq Signaling in Disease

8:00 am - 9:30 am

Chair: **Jeffrey Benovic**
Speakers: **Evi Kostenis, Kendall Blumer, and Philip Wedegaertner**

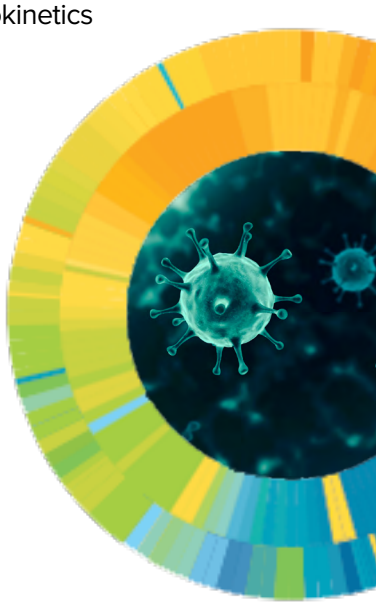
The heterotrimeric Gq protein family plays an important role in regulating signaling through a number of effectors. Gq signaling has been implicated in a number of diseases including asthma and uveal melanoma. Several inhibitors have been identified that can effectively and specifically inhibit Gq including constitutively active Gq mutants found in some cancers. The goal of this symposium is to provide: 1) insight into the development of Gq inhibitors that might be used to treat various diseases; 2) insight into the use of Gq inhibitors to treat disease; and 3) mechanistic insight into Gq inhibitor function.

COVID-19 Vaccines and the Virus: Impact on Drug Metabolism and Pharmacokinetics

8:00 am - 9:30 am

Chairs: **Maria Croyle and Kerry Goralski**
Speakers: **William Honer, William Zamboni, and Maria Croyle**

Acute infection and inflammation transiently suppress hepatic drug metabolism. This session will discuss clinical cases supporting altered pharmacokinetics of small molecules and biologics following SARS-CoV-2 infection or immunization and examine the mechanisms of interactions between the innate immune response and small molecule and biologic metabolism following SARS-CoV-2 infection or immunization. Understanding the impact of emerging infections and vaccine technologies on drug metabolism will help mitigate drug toxicity and improve drug and vaccine safety and effectiveness.



Diversity and Inclusion Session

8:00 am - 9:30 am

This popular breakfast session is organized by the ASPET Mentoring and Career Development Committee. Visit the online program at **www.aspet.org/eb2022/program** for more details.

COVID-19: Long Haul Symptoms, Testing and Impact of Environmental Exposures

2:00 pm - 3:30 pm

Chair: **Cheryl Rockwell**
Speakers: **Angela Slitt and Ilona Jaspers**

The emergence of the SARS-CoV-2 virus in 2019 precipitated a cataclysmic global pandemic. This symposium will focus on various timely issues related to this epidemic. The first presentation will focus on long haul symptoms of Covid-19 infection. The second speaker will present on the transition of her laboratory from basic research to development of a novel Covid-19 diagnostic test. The third presentation will discuss the potential effects of vaping on the immune response to respiratory viruses. Taken together, this program will cover a range of issues related to Covid-19, ranging from long haul Covid and testing to environmental exposure and susceptibility.

Taking Care of Business: Funding Drug Discovery through the SBIR/STTR Programs

2:00 pm - 3:30 pm

Chair: **Stephanie Davis**

Speakers: **Katie Bratlie, Stephanie Davis, Mary-Ann Bjornsti, John Lazo, and Harshini Neelakantan**

The Small Business Innovation Research (SBIR) and Small Business Tech Transfer (STTR) programs are congressionally-mandated programs that allow federal agencies to fund promising technologies that fulfill their missions. SBIR/STTR grants through the NIH and NSF are a valuable resource to academic pharmacologists and early-stage entrepreneurs looking to bring their new therapeutics to the market. This panel will feature NIH and NSF program staff, SBIR/STTR awardees, and reviewers who have served on SBIR/STTR study sections and provide information for pharmacologists who are interested in pursuing these opportunities.

Behavioral Paradigms to Model Substance Use Disorders in Animals

2:00 pm - 3:30 pm

Chairs: **Holly Moore and Michelle Doyle**

Speakers: **Susan Ferguson, Edward Townsend, and Marco Venniro**

Although standard intravenous drug self-administration procedures remain the gold-standard for assessing the abuse potential of psychoactive drugs, substance use disorders (SUDs) are complex, multifaceted, and not fully recapitulated by any single animal model. Recently, novel behavioral paradigms have been developed to model specific aspects of SUD to better understand the neurobiology of individual vulnerabilities to develop SUD-related behaviors, and to evaluate candidate medications for treating SUDs. After a brief introduction on the use of animal models of SUDs, three speakers will discuss their research evaluating SUD-related phenotypes in rats, the use of drug-food choice procedures, and a social-operant choice assay.

Envisioning the Scope of Pharmacology Education for the Next Decade

2:00 pm - 3:30 pm

Chairs: **Kelly Quesnelle and Joe Blumer**

Speakers: **Michael Lee, Brooks McPhail, and John Szarek**

Pharmacology educators are looking for guidance on incorporating the most essential drugs while fostering deeper understanding in their learners and avoiding cognitive overload. This session will address the challenges of balancing these demands. Participants will be assigned to a working group using either a) hypertension or b) diabetes as a model disease state and they will be asked to refine an expansive drug list, learning objectives, and effective teaching pedagogies for the disease state. Large group discussion will follow about this process and whether ASPET should engage in this work more frequently. Participants will leave with their team-curated lists.

New Closing Event to Celebrate Achievements of our Young Scientists

Don't leave early! **Be sure to arrange your travel so you can attend ASPET's Closing Networking Event that will include announcement of all of our 2022 Student-Postdoc Poster Competition winners. The event starts immediately after the conclusion of our last scientific sessions of the day at 3:30 pm on Tuesday, April 5.**

Monday, April 4

Division-focused sessions

Join your division for a session focused on the top science in your specialty or be inspired by the latest research in a related specialty.

Division for Drug Metabolism and Disposition

Bernard B. Brodie Award, Gillette Awards, and Junior Investigator Platform Session
8:00 am - 10:00 am
Chairs: **Xiaobo Zhong and Joanne Wang**
This session will feature a lecture by the 2022 winner of the Bernard B. Brodie Award as well as talks from the authors of the two best papers of 2021 from the journal of *Drug Metabolism and Disposition* who received the James R. Gillette Awards in pharmacokinetics (transporters) and drug metabolizing enzymes. The session will also include abstract-based oral presentations from graduate students and postdoctoral fellows.

Division for Molecular Pharmacology

Early Career Award Lectures and Postdoc Competition
8:00 am - 10:00 am
Chairs: **Michelle Kimple and John Hepler**
This award competition features oral presentations from postdoctoral trainees selected from the submitted abstracts as well as a lectures from the winners of the ASPET Division for Molecular Pharmacology Early Career Award.

Division for Neuropharmacology

Early Career Award Lectures and Postdoctoral Fellow Showcase
8:00 am - 10:00 am
Chairs: **Carolyn Fairbanks and Daniel Morgan**
This session will feature oral presentations from postdoc finalists selected from the submitted abstracts as well as talks by the winners of the Division for Neuropharmacology Early Career Award.

Division for Pharmacology Education

Are You Measuring What You Think You Are? Writing Board-Style Multiple Choice Questions
8:00 am - 10:00 am
Chairs: **Rupa Tuan and Rob Augustyniak**
Speakers: **Adrienne Ables, Rupa Tuan, Rob Augustyniak, and Miguel Paniagua**
Health science educators are often tasked with creating relevant exam items without training in question-writing, resulting in questions that are too easy or too difficult with overall low discrimination ability. Due to the COVID-19 pandemic, question banks have been depleted or compromised as a result of wide-spread remote virtual testing. This interactive, skills-building workshop will provide educators with the opportunity to learn the basic steps of writing board-style examination questions and actively work together to improve their own questions using constructive peer feedback. This will help faculty towards developing versatility in item-writing skills based on curricular needs and exam stakes.

Division for Toxicology

Precision Medicine and Toxicology: Data Science for Environmental Contaminants and Drug Safety Prediction
8:00 am - 10:00 am
Chairs: **Qin Chen and Brendan Stamper**
Speakers: **Sudin Bhattacharya, Gary Miller, Qin Chen, and awardees to be announced in January**
This session describes the current state-of-the-art of selected areas of toxicology-related basic, epidemiologic, and clinical research being presented at ASPET 2022 and award lectures from Early and Established Career Awardees. The session is directed toward new investigators and trainees (e.g., undergraduate students, graduate students, and postdoctoral fellows) in the toxicology field.

Division for Behavioral Pharmacology

Postdoctoral Showcase and P.B. Dews Award Lecture
1:00 pm - 3:00 pm
Chairs: Emily Jutkiewicz and Brenda Gannon

The first half of this session will showcase the work of finalists for the Behavioral Pharmacology Postdoctoral Award. Finalists will be selected based on submitted abstracts, with a panel of judges selecting a single Behavioral Pharmacology Postdoctoral Awardee. Additionally, during this session, the winner of the 2020 P. B. Dews Award for Research in Behavioral Pharmacology, **Dr. Linda A. Dykstra** from the University of North Carolina at Chapel Hill will deliver the P.B. Dews Award Lecture.

Division for Cancer Pharmacology

Young Investigators Symposium and Susan B. Horwitz Award Lecture in Cancer Pharmacology
1:00 pm - 3:00 pm
Chairs: Lori Hazlehurst and Daniel Gustafson

This session will highlight oral presentations by young scientists doing research in cancer pharmacology who were selected from the submitted abstracts. Additionally, the session will feature the inaugural lecture by the winner of the 2022 Susan B. Horwitz Award in Cancer Pharmacology.

Division for Cardiovascular Pharmacology

Trainee Showcase and the Paul M. Vanhoutte Distinguished Lectureship in Vascular Pharmacology
1:00 pm - 3:00 pm
Chairs: Kishore Chittimalli, Owais Bhat, and Bradley McConnell

This session will feature the Trainee Showcase oral presentations by young scientists. The session will also include award presentations from both the 2022 Early Career awardee and the 2022 Mid-Career Awardee. The 2020 awardee of the Paul M. Vanhoutte Distinguished Lectureship, **Dr. Jan Danser** from Erasmus Medical Center, will deliver the keynote address.

Division for Drug Discovery and Development

Scientific Achievement Award Lecture and Notable Abstracts Platform Presentations
1:00 pm - 3:00 pm
Chairs: Donald Button and Alicja Urbaniak

This session features notable students and postdoctoral fellows who submitted abstracts for EB 2022. The talks range from basic drug discovery to drug development. It will also include a keynote address from the 2022 Scientific Achievement in Drug Discovery and Development awardee.

Division for Translational and Clinical Pharmacology

Young Investigator Awards Platform and Early Career Faculty Showcase
1:00 pm - 3:00 pm
Chairs: Ross Corriden and Brandi Wynne

This session will feature oral presentations from young scientists selected from the submitted abstracts as well as talks by the winners of the Division for Translational and Clinical Pharmacology Early Career Awards.

The Division Town Hall meetings will again take place online. Last year's move of the division business meetings to a virtual format provided members with an opportunity to meet a larger variety of members than they normally would at an in-person annual meeting.

These Town Halls celebrate division award winners, introduce you to division leadership, and provide an overview of division activities including how you can get involved. They all also prioritize time for small group networking to get to know other members.

Town Halls will take place from February 22 to March 7. Registration is free and open to all ASPET members and guests.

ASPET Presidential Symposium: The Intersectionality of Health Disparities: Pharmacology, Prescribing Bias and Social Determinants of Health

3:30 pm - 5:00 pm

ASPET president, **Dr. Peggy Gnegy** and session co-chair **Dr. Jayne Reuben** have organized a symposium that will address the complex intersection of mechanisms, practices, and beliefs that impact clinical outcomes and research approaches in the development of pharmacological treatment for diverse populations. **L'Aurelle Johnson** from the University of Minnesota will approach DEI using the fundamental concept of signal transduction. **Nora Volkow** from NIDA will highlight how NIH researchers are using scientific advances to develop new treatments as well as prevention and treatment interventions in healthcare and justice settings that aim for equity in access to the support needed for recovery. **Asa Radix** from the Callen-Lorde Community Health Center will describe best practices for clinical management of trans and gender diverse adults as well as summarize research related to applicability of sex-based algorithms for transgender people.

$GABA_A$ Receptor Subtypes as Targets for Fast-Acting Antidepressants

3:30 pm - 5:00 pm

Chair: **Uwe Rudolph**

Speakers: **Jamie Maguire, Etienne Sibille, and Scott Thompson**

This session will explore the role of inhibitory neurotransmission and specifically of molecularly defined $GABA_A$ receptor subtypes in the response to chronic stress, which has been implicated in the development of depression. Speakers will present basic science and translational aspects linking different $GABA_A$ receptor subtypes to depressive-like behaviors. A combination of pharmacological, biochemical, molecular modeling, medicinal chemistry, electrophysiological and behavioral approaches has been applied to elucidate the mechanisms behind the surprising observation that both positive and negative allosteric modulation of a5-containing $GABA_A$ receptors exhibit fast antidepressant actions and the suitability of this receptor subtype as a drug target for a novel class of antidepressants will be discussed.

Journals Workshop: An Interactive Guide to Publishing, Reviewing, and Ethics Issues

3:30 pm - 5:00 pm

Chairs: **Emily Scott and Maria Pasho**

Speakers: **Xinxin Ding, Lyn Daws, and Beverley Greenwood-Van Meerveld**

Sponsored by the ASPET Publications Committee, this interactive workshop will feature the editors of ASPET's journals. The discussion will take the mystery out of manuscript reviewing and publication decision-making. You'll learn more about what editors look for in journal submissions and discuss how open access and Creative Commons factor into the sharing of research.

Importance of Prodrug-activating Enzymes in Drug Development and Precision Pharmacotherapy

3:30 pm - 5:00 pm

Chair: **Hao-Jie Zhu**

Speakers: **Namandjé Bumpus, Longqin Hu, Hao-Jie Zhu, and Joy Feng**

This session will discuss how genetic variants and tissue-specific expression of drug-metabolizing enzymes could affect the activation, pharmacokinetics, and therapeutic efficacy of various prodrugs with a focus on antiviral and anticancer medications. The session will stimulate the discussion regarding how to use genetic variants and tissue-specific proteomics information of drug-metabolizing enzymes to improve the design and delivery of prodrugs and enhance the efficacy and safety of prodrug pharmacotherapy.

Tuesday, April 5

Developmental Neurotoxicity of Cannabinoids

8:00 am - 9:30 am
Chairs: **Qingcheng Mao and Qing Ma**
Speakers: **Ken Mackie, Ryan Bogdan, and Jennifer Iudicello**

Recent studies have revealed that cannabis is the second most used drug after alcohol in the US. Evidence shows that cannabis use in adolescents and young adults is associated with adverse neurocognitive reactions. Studies also show that cannabis use by pregnant women has been consistently increasing over time. Cannabis use among these special populations is expected to further increase with recent trends toward legalization of recreational consumption, representing a potential but great public health concern. This symposium is therefore timely with respect to understanding neurotoxicity of cannabinoids in infants and adolescents.

Evolution of Drug Resistance

8:00 am - 9:30 am
Chair: **James DeGregori**
Speakers: **Robert Gatenby, Ariosto Silva, and Rena Emond**

This session will explore how cancers evolve resistance to therapies. It will explore the importance of tumor heterogeneity, both genetic and epigenetic, and the microenvironment in the evolution of drug resistance. Attendees will also learn about the tradeoffs associated with drug resistance, and how these costs can be exploited for the design of more effective and less toxic therapeutic regimen. The application of evolutionary approaches to understand and to treat cancers will be demonstrated for multiple malignancies, including breast and prostate cancers and multiple myeloma.

Ectopically Expressed Olfactory Receptors: Promises and Challenges of the Understudied GPCR Family

8:00 am - 9:30 am
Chairs: **Vladlen Slepak and Jennifer Pluznick**
Speakers: **Blythe Shepard, Jennifer Pluznick, and Alexey Pronin**

G protein-coupled receptors (GPCRs) are the arguably the most important drug target. About 50% of the ~800 GPCRs belong to the families of olfactory and taste receptors. While they were originally cloned from sensory organs, in the past decade expression of these genes was discovered in many other tissues. Technical difficulties with functional expression of these receptors in vitro and unavailability of tools for their analysis impeded progress in this field for many years. This session will highlight recent advances facilitating investigations of these understudied GPCRs and insights into their physiological functions, pharmacology and potential role in human disease.

The Importance of Pharmacology to Regenerative Medicine Innovation

8:00 am - 9:30 am
Chairs: **Traci Czyzyk and Jeffrey Paul**
Speakers: **George Christ, Don Ingber, Barbara Boyan, and Kaitlyn Sadtler**

Regenerative medicine, broadly defined, encompasses therapeutic interventions that replace, engineer or regenerate cells, tissues or organs to restore or establish normal physiology. Regenerative pharmacology is specifically focused on the biochemical stimulation of the body's own repair mechanisms to functionally heal previously irreparable tissues or organs. Integration of pharmacological approaches with the development of biomanufacturing, tissue/cell maturation and evaluation of tissue engineered constructs/products represent major opportunities for further expanding active areas of investigation. This symposium will explore the breadth of ways in which pharmacology is woven into the very fabric of regenerative medicine.

ASPET "Guppy Tank" Translational Science Pitch Showcase

2:00 pm - 3:30 pm

Members of the ASPET Young Scientists Committee, **Yadira Perez Paramo** and **Khalid Garman** have organized the 2nd ASPET Guppy Tank. This competition will showcase translational science pitches from four ASPET trainees who will be coached by mentors with established experience in the biotech, pharma, and entrepreneurship realms. In addition, the Guppy Tank event will feature a keynote discussion by **Nancy Stagliano**, a seasoned scientific entrepreneur who will highlight the importance of a translational vision to scientific innovations and effective strategies for a successful science pitch. This session will be an exciting and essential educational opportunity for ASPET trainees to hone their translational scientific communication skills while getting publicly recognized for their talents.

G Protein Signaling in CNS Disorders

2:00 pm - 3:30 pm

Chairs: **Qin Wang and Venetia Zachariou**
Speakers: **Heidi Hamm, Brian Muntean, Qin Wang, and Venetia Zachariou**

This session will focus on recently identified roles of G protein signaling components in brain disorders, pointing to novel therapeutic pathways. Translational studies highlight the essential role of regulator of G protein signaling 4 in the maintenance of chronic pain states, the importance of spinophilin/coffilin interaction in post-traumatic stress disorders, the impact of striatal cAMP signaling components on movement disorders and the impact of Gβγ–SNARE interaction on restoration of the release of hormones and neurotransmitters.

Teaching Blitz

2:00 pm - 3:30 pm

Chair: **Selvanayagam (Niru) Nirthanan**
Speakers: **Nicholas Conway, Islam Mohamed, Patrick Murphy, and Yasmin Elsobky**

Active learning approaches where students "learn by doing and thinking about what they are doing" have been established as being more effective than transmissionist approaches that rely on "teaching by telling." This symposium will showcase three exemplars of innovative and contemporary active learning strategies which enhance learner engagement and experience as well as learning outcomes, including gamification and augmented reality in pharmacology education. The audience will experience these learning and teaching methods through brief interactive demonstrations.

Program Committee Platform Session

The ASPET Program Committee will select hot topics from the submitted abstracts across all areas of pharmacology and experimental therapeutics to be highlighted at this closing platform session.

Explore the full ASPET program at www.aspet.org/eb2022/program

Explore the full EB program at www.experimentalbiology.org

Explore the ASPET program by specialty area at: www.aspet.org/eb2022/divisions

Career Resources

While in Philadelphia, take advantage of these opportunities offered by all the EB societies in EB Career Central to develop your career in science:

- Interactive Workshops and Symposia – Career building topics led by expert speakers
- Roundtables – Small group career-development discussions with facilitators
- Short Talks – Power-packed tips for those with limited time between sessions
- Mentor Matching Programs – Navigate EB with someone who can also offer career advice
- Job Boards – Job openings across all areas of science

Featured ASPET Career Development Sessions:

- Student–Postdoctoral Colloquium
- Journals Workshop: An Interactive Guide to Publishing, Reviewing, and Ethics Issues
- Undergraduate Networking and Career Development Luncheon
- Diversity and Inclusion Breakfast Session
- Taking Care of Business: Funding Drug Discovery through the SBIR/STTR Programs
- "Guppy Tank" Translational Science Pitch Showcase

EB HEALTH AND SAFETY INFORMATION

As scientific societies working in the life sciences, the EB host societies support vaccines and vaccine research as essential tools in the fight against disease, including the current pandemic. **For the health and safety of our members and community, EB 2022 is requiring COVID-19 vaccines for anyone attending the event.** More information can be found at https://www.experimentalbiology.org/healthandsafety.

STATEMENT FROM THE PENNSYLVANIA CONVENTION CENTER (PCC)

The PCC remains committed to the safety and well-being of all our guests, and throughout the course of the pandemic we have invested heavily in ensuring that our guests can return to the facility with confidence. Despite our commitment, we recognize that the risk of exposure to communicable disease exists in any public place where people are present. As such, you must follow all PCC policies, including safety policies and posted instructions while in the PCC. To reduce the risk you assume by entering this public space and to ensure your safety and the safety of others, please remember to wash your hands, wear your mask, and keep your physical distance from other guests.

ASPET congratulates the Pennsylvania Convention Center for achieving the Global Biorisk Advisory Council (GBAC) STAR accreditation on outbreak prevention, response and recovery. Recognized as the gold standard of safe venues, the PCC is one of the largest venues in the northeast to receive the GBAC STAR™ accreditation.

At the time of this printing, the Pennsylvania Convention Center has a policy that requires masks be worn inside the facility. In addition, the PCC requires its entire workforce to be fully vaccinated against the COVID-19 virus with limited exceptions as may be required by law.

Flint Water – Lead, by Example

Rebecca J. Anderson, PhD

LeeAnne Walters had never attended a city council meeting before, but by January 2015 she and many other residents of Flint, Michigan were just plain angry. They were tired of the smelly, murky drinking water, and they wanted something done. Unfortunately, the city council had almost no power to fix the problem. But as it turned out, those residents did.

The Switch

A once-thriving auto manufacturing center, Flint was hit hard by the 2008-2009 recession. Manufacturing had dwindled to one General Motors plant, which assembled engines. The city's population dropped from 200,000 to 95,000, many of whom lived below the federal poverty line *(1-5)*. Navy SEALs trained there, because parts of Flint could simulate remote, war-torn battlegrounds *(3)*.

In 2011, newly elected Governor Rick Snyder appointed emergency managers to oversee Michigan's financially strapped cities, including Flint. By 2013, those unelected managers governed half of Michigan's Black population, but only 2% of white residents *(3)*.

The emergency managers were told to balance city budgets by any means and answered only to the governor's office. In Flint, social services and the city pension program were slashed. The police force was reduced from 265 to 98 sworn officers *(2, 3)*.

Flint's water service was also targeted. Since 1967, Flint had purchased its drinking water from the Detroit Water and Sewerage Department, which drew water from Lake Huron, a relatively clean source *(2-4)*. But because of Detroit's charges and dwindling revenue from local taxes, the impoverished residents

of Flint were paying the highest water rates in the nation *(3, 4, 6)*.

In April 2013, Flint's emergency manager and the governor's office decided to switch to the new Karegnondi Water Authority, which they said would save Flint $5 million *(4, 7)*. Some questioned the switch because there was nothing wrong with Detroit's water. A *Detroit Free Press* investigation later found conflicting studies regarding Karegnondi's merits. Politics seemed to drive the project's financing, permits, and contractors *(4)*.

Construction of the Karegnondi pipeline to Lake Huron would take at least 2 years *(4, 8)*. To bridge the gap in service (after the Detroit contract ended in April 2014), the emergency manager and Public Works officials decided to reactivate the Flint Treatment Plant. It had been idle for decades, and city engineers rushed to retrofit it *(2-4, 8)*.

The interim water source, the Flint River, had been an industrial dumping site and contained high concentrations of heavy metals, chlorides, sulfates, and sewage *(2, 3)*. It had caught fire twice *(3)*.

The Flint Treatment Plant's water quality supervisor strongly urged the city to delay the April 2014 switch date. They were not ready to assume responsibility for full-time operation, and the installed technologies were not adequate to produce safe drinking water *(4, 9)*.

But the emergency manager forged ahead, and on April 25, 2014, with public fanfare, Flint switched to Flint River water *(1-3, 10)*.

Problems, Problems

Within months, residents complained about foul-tasting, reddish water that smelled like rotten eggs. City officials said they were "winterizing" the water system *(1, 2, 8)*. But in August and September 2014, the Flint Treatment Plant recorded high levels of *E. coli* bacteria, which violated U.S. Environmental Protection Agency (EPA) regulations *(11)*. Officials instructed residents to boil the water but said it was safe *(1, 2, 8, 10)*.

The Flint Treatment Plant added chlorine disinfectant to the Flint River water, which already contained high levels of chlorine *(1, 2, 8)*. Residents' tap water now smelled like bleach, irritated people's skin and eyes, and created another problem *(1, 3)*.

Chlorine reacts with organic matter in the water to create toxic byproducts, the trihalomethanes *(1, 8)*. Trihalomethanes can cause adverse health effects, and some are carcinogenic if inhaled *(3)*. The high level of trihalomethanes also violated the EPA's drinking water standards *(4, 11)*.

For the next few months, the Flint Treatment Plant shuttled between EPA citations for unacceptable *E. coli* levels (due to too little chlorine disinfectant) and unacceptable trihalomethane levels (due to too much chlorine) *(11)*.

E. coli and trihalomethane limits are specified under the EPA's Safe Drinking Water Act. But the agency delegates primary responsibility for enforcing these water regulations to the states. In Michigan, responsibility fell to the Michigan Department of Environmental Quality (MDEQ). Early on, MDEQ anticipated that using Flint River water would be problematic, but it allowed the switch to proceed *(4)*.

On October 13, 2014, Flint's General Motors plant switched back to Detroit water, because the chlorinated Flint River water was corroding its steel engine parts *(4, 8, 10)*. While officials were telling Flint residents that the water was safe, the State Office Building in Flint quietly installed water coolers for state employees use *(1-4)*.

LeeAnne's Persistence

In December 2014, LeeAnne's family stopped drinking their tap water *(11)*. She collected a series of water samples in a rainbow of industrial colors: from light yellow to nasty, dark-looking cooking grease *(7, 9)*.

One of LeeAnne's 3-year-old twin boys, Gavin, broke out in red bumps after bathing in the smelly water. A clump of hair fell out in her teenage daughter's hand while she was taking a shower. All of the Walters family experienced rashes and abdominal pain *(3)*.

At the city council meeting on January 15, 2015, LeeAnne and many others brought bottles of brown water, clumps of hair, and photos of skin rashes

Courtesy of Virginia Tech

LeeAnne Walters' tap water, collected January 2015

(2, 3, 10). The sympathetic councilmen could only pass resolutions. The emergency manager made the decisions, and he didn't budge.

LeeAnne, a medical assistant, requested technical documents from the city and browsed online sources to learn about drinking water, treatment plants, and lead exposure *(1-3, 7)*. On February 18, 2015, at LeeAnne's insistence, a city technician collected a tap water sample, which registered a lead level of 104 parts per billion (ppb) *(9, 11)*.

Lead displaces calcium in soft tissues and bone and causes lethargy, muscle paralysis, loss of appetite, abdominal pain, hypertension, anemia, vision and hearing losses, and, in extreme cases, kidney failure, coma, and death *(3, 12)*. Lead is also associated with increased fetal deaths and reduced birth weights *(13, 14)*.

The Centers for Disease Control and Prevention (CDC) has stated that there is no safe blood level of lead and recommends that all sources of lead exposure should be controlled or eliminated *(15, 16)*. But as a practical matter, "Lead concentrations in drinking water should be below the U.S, EPA's action level of 15 ppb" *(15)*. Anything above 40 ppb is considered an imminent and substantial danger to pregnant women and young children *(2)*.

EPA's Lead and Copper Rule requires public water utilities to sample residential water under "worst case" conditions. Typically, 100 homes are sampled, at least half of which must have lead service lines. If more than 10% of the samples register lead above the "actionable level" of 15 ppb, the public utility must "optimize" water treatment, inform residents that their tap water is unsafe to drink, and replace all of the lead service pipelines *(17-19)*.

To avoid this very costly undertaking, utilities sometimes take advantage of loopholes that will minimize their lead readings. For example, the technician who sampled LeeAnne's water pre-flushed the tap before collecting the sample and used a very low flow rate. He said he was following MDEQ guidelines, but those procedures (which were not specifically prohibited by EPA) underestimated the true lead concentration *(3, 9)*. Even so, LeeAnne's water had a dangerously high lead level.

LeeAnne "got a frantic phone call from the water department telling me not to drink it, not to let the kids drink it, not to mix my kids' juice with it" *(7)*.

Michigan is in EPA's Region 5, and fortunately, when she called their Chicago office on February 25, 2015, Miguel Del Toral answered *(4, 11)*. Del Toral was the Regulations Manager of EPA's Ground Water and Drinking Water Branch. He had earned the respect of his colleagues for his high standards, exceptional vigilance, and resistance to bureaucratic pressure. Some viewed him as the foremost expert in the country on the Lead and Copper Rule *(2, 3)*.

Del Toral was already aware of Flint's problems with *E. coli* and trihalomethane byproducts. "It was obvious to me that something was really wrong there" *(1)*. LeeAnne described her family's experiences and the recent lead measurements in her tap water.

She read him the list of chemicals from the Treatment Plant's Monthly Operation Report *(1)*. Everything seemed reasonable, except one chemical was missing. He asked her to read the list again. The missing chemical, for corrosion control, was another violation of EPA regulations *(1)*.

Controlling Corrosion

For thousands of years, water pipelines were constructed from lead, because it is inexpensive and more flexible and durable than iron *(1, 20)*. In fact, the word "plumbing" and the chemical symbol for lead (Pb) come from the Latin, *plumbum (21, 22)*.

For cities with a population over 50,000, the EPA requires water utilities to control corrosion of lead plumbing, and orthophosphate is typically the corrosion inhibitor *(1, 8)*. Orthophosphate reacts with lead, iron, and copper to form an insoluble mineral that coats the inside of the pipes. This crusty mineral layer then forms a protective barrier, trapping and preventing the pipe's metal from leaching into the water *(1, 8, 17)*.

A theory has persisted that lead poisoning from Rome's extensive plumbing system caused the fall of the Roman Empire. But mineral deposits inside the pipes and the rapid flow of pure mountain spring water likely kept lead leaching under control *(23)*. Most historians now agree that the reasons for Rome's downfall, whatever they may be, were unlikely due to lead poisoning *(23, 24)*.

> ***"All of the problems associated with the Flint water crisis can be traced to this single point of failure."***

Likewise, the drinking water supplied by Detroit contained sufficient orthophosphate to ensure reasonable corrosion control *(9)*. Adding orthophosphate to the Flint River water would have cost less than $100 a day, and no one has ever explained why the Flint Plant did not include orthophosphate in its treatment procedures *(2, 3, 8)*. All of the problems associated with the Flint water crisis can be traced to this single point of failure.

Without a corrosion inhibitor, the relatively acidic Flint River water began to crumble and dissolve the mineral barrier, which had built up for decades in Flint's water mains and service lines *(1, 2, 8, 9)*. The bare surface of iron pipes then began leaching iron into the water, turning it a rusty reddish-brown. Lead is colorless and tasteless, but particles of the lead-laden crust floated freely and dissolved into the water. Lead also leached from the bare lead pipes *(1, 2, 8)*.

Concerned about the lead in her water, LeeAnne was able to get Gavin tested. He had a blood lead level of 3 µg/dl *(11)*. A nurse at the Michigan Department of Health and Human Services (DHHS) seemed unconcerned about those results and Gavin's sluggish growth *(7)*.

The next week a city employee again sampled LeeAnne's water, which registered 397 ppb, despite the pre-flushing procedure *(9, 11)*. Suspicious of a possible conflict of interest at the local health department, LeeAnne convinced the family's dermatologist on March 27, 2015, to retest her children's blood. Gavin was anemic and had a blood lead level of 6.5 µg/dl, which is considered lead poisoning *(2, 11)*.

On April 2, 2015, the city again tested LeeAnne's water, which now had 707 ppb of lead *(9, 11)*. The next day, the city shut off water at the Walters home, due to the toxic lead levels. They ran a garden hose from a neighbor's house to provide the Walters family with cleaner water for bathing, washing dishes, and washing clothes *(3, 11)*.

MDEQ assured Del Toral in an email that the city used corrosion control and said the lead likely came from sources in the Walters' home *(3, 11)*. However, when the Walters family moved into their home in 2011, they installed new plastic plumbing throughout. Del Toral visited the home on April 27, 2015, and confirmed that all of the house's pipes, fittings, and valves were made of polyvinyl chloride that was certified for drinking water use *(3, 11)*.

That same day, MDEQ finally confirmed to Del Toral that the Flint Treatment Plant was, in fact, not using corrosion control. Internally, MDEQ officials complained about Del Toral's persistent questioning *(4)*.

Del Toral temporarily turned LeeAnne's water back on to collect samples for an independent analysis. They followed a strict protocol designed by Marc Edwards, who directed them, step-by-step, over the phone from his office in Blacksburg, Virginia *(1)*.

Seen This Before

Marc Edwards, a civil and environmental engineering professor at Virginia Tech University, was an acknowledged drinking water expert, thanks to his work in Washington, DC a decade earlier. In 2003, he had been hired as a consultant to investigate an unprecedented number of small leaks in DC's copper water pipes. Under a subcontract with the EPA, he found 1,250 ppb of lead in DC's water—and those were diluted samples *(25)*.

When Edwards reported the lead results to DC officials, his funding was canceled, his subcontract with the EPA was terminated, and he was denied further access to DC utilities data *(3, 25)*. Edwards stubbornly continued anyway, taking a second mortgage on his home to pay for his research *(1, 7, 25)*. As the lead evidence accumulated, city and federal officials attempted to discredit his work *(3)*.

But the science was irrefutable. Tens of thousands of DC homes had elevated lead levels in their water *(25)*. When Edwards was finally able to obtain blood lead data in 2009, his analysis showed a fourfold increase in the number of DC infants with elevated blood lead levels during the peak period of the lead-in-water crisis *(26)*.

Courtesy of Virginia Tech

Bottle for collecting Flint water samples

For his efforts, Edwards was hailed as a hero by consumer advocates, was vilified by public works officials, and earned a truckload of professional accolades, including a MacArthur Foundation "genius" grant *(3, 27)*.

It's the Worst

Under Edwards' direction, Del Toral and LeeAnne collected 32 sequential water samples from her kitchen tap and express mailed them to Virginia Tech for analysis *(9, 11)*. The samples ranged from a minimum lead content of 217 ppb to a high of 13,200 ppb. Anything over 5,000 ppb is considered hazardous waste *(11)*. Edwards said, "It was the worst contamination I'd seen in 25 years" *(1)*.

On May 6, 2015, contractors replaced the old, corroded lead and galvanized iron pipes on the Walters property. The new copper service line ran from their house to the water main in the street *(9, 11)*.

Although hundreds of Flint residents were complaining about the nasty water and health issues, Flint officials claimed it was an isolated problem. One official intimated that LeeAnne and her neighbors were spiking their own water to draw attention *(7)*.

The Flint Treatment Plant was required to conduct two six-month assessments for lead and copper *(11)*. The first assessment (July-December 2014) sampled 100 homes, and the second assessment (January-June 2015) sampled 71 homes. Only nine and seven of the sampled homes, respectively, had lead service lines, many fewer than the 50% that the EPA requires. Both assessments reported lead levels below the 15 ppb action level, and "conveniently" excluded the Walters' samples from the reports *(4, 9, 17)*.

Criminal Neglect

On June 24, 2015, Del Toral summarized his findings in an interim memo to his boss at EPA Region 5, with copies to other EPA employees, MDEQ officials, and Edwards *(11)*. The absence of corrosion control in Flint's water supply, he said, was "a major concern from a public health standpoint…To me that borders on criminal neglect" *(11)*.

He had contacted EPA's Cincinnati office, where corrosion control experts were standing by to assist MDEQ and Flint *(11)*. But instead of investigating Flint's Treatment Plant, EPA's management reprimanded Del Toral and referred him to the agency's ethics office. He was no longer allowed to talk to anyone in Flint or to anyone about Flint *(2, 3)*. Internal MDEQ emails characterized Del Toral as a rogue EPA employee and said he had "acted outside of his authority" *(4)*.

During a meeting with government officials in Lansing on August 4, 2015, MDEQ's top drinking water regulator told LeeAnne, "Mr. Del Toral has been handled" *(4)*. However, LeeAnne trusted Del Toral. She shared his memo with an investigative reporter, who posted it publicly *(1, 3)*.

Citizen Scientists

Defining the scope of the lead problem and convincing local officials required more data. With a $50,000 National Science Foundation grant, Edwards embarked on a systematic study of Flint's drinking water *(1, 28)*.

He sent an email to the Virginia Tech student body, asking for volunteers. Dozens of students (enticed with free pizza) assembled 300 test kits, packed them into vans, and drove 550 miles from Blacksburg to Flint *(1)*.

In mid-August 2015, the Virginia Tech team and a cadre of motivated Flint "citizen scientists," including LeeAnne, distributed the kits, ensuring that they covered every Flint zip code equally *(1)*. Despite the rigorous sampling protocol, an impressive 277 kits (92%) were returned within 3 weeks *(9, 17)*.

Edwards's lab group dropped their other projects to analyze the water samples *(10)*. One-third of the homes had lead levels above 15 ppb *(4)*. Some were six times higher than the EPA allowed *(1)*.

The Virginia Tech students called Flint households where the lead levels were highest and advised them not to use their tap water without a lead-clearing filter *(1, 10)*. An effective filter costs about $25 and can remove 99% of lead and other metals. Some residents

Courtesy of Virginia Tech

Students preparing water collection kits at Virginia Tech

Courtesy of Virginia Tech

Virginia Tech students calling to inform Flint residents of the water sample results

replied, "I live on social welfare. There's no way I can afford that in at least the next two months" *(10)*. So, a graduate student set up an online fundraiser, and within two weeks, they had raised thousands of dollars for Flint residents *(10, 29)*.

On September 15, 2015, Edwards's Virginia Tech team, supported by LeeAnne and the Flint "citizen scientists," held a press conference in front of City Hall *(17, 27, 28)*. Based on his data, Edwards estimated that over 40% of Flint homes had elevated levels of lead in their water, and as many as 8,000 children under 6 years old were exposed *(1)*. The Flint residents demanded switching back to Detroit water *(28)*.

But an MDEQ spokesperson again insisted that Flint River water was within allowable regulatory limits. He also criticized Virginia Tech. "This group specializes in looking for high-lead problems" *(7)*.

The Barbeque

On August 26, 2015, while students were analyzing the water samples at Virginia Tech, Mona Hanna-Attisha hosted a backyard barbeque for a couple of old friends. They had stayed in touch after high school, but they had not seen each other for about 10 years *(3)*.

Elin Betanzo had become an environmental engineer, working at the EPA Office of Ground Water and Drinking Water in Washington, DC. Then, she moved back to Detroit to work as a water engineering consultant *(33)*.

Mona Hanna-Attisha also championed environmental issues, but her career took a different path. She earned a Master of Public Health degree at the University of Michigan and her medical degree at Michigan State. Now a pediatrician, she was also Director of the Pediatric Public Health Initiative at Hurley Children's Hospital, a public teaching hospital in Flint affiliated with Michigan State University. Because her name was a mouthful for her little patients, everyone called her Dr. Mona.

At the barbeque, Elin asked, "What are you hearing about the Flint water?" *(3)*. Dr. Mona was aware of the complaints, but she accepted the city's assurances. Elin sent her the now-public Del Toral memo and related documents.

The data shocked Dr. Mona. Like all pediatricians, she knew lead was a powerful neurotoxin in children, thanks to the pioneering work of Herbert Needleman *(3)*.

The Tooth Fairy

Lead-induced brain damage was well known, but in the 1950s, clinicians presumed children could recover from acute poisoning without lasting harm *(30)*. As chief resident at Children's Hospital in Philadelphia, Herbert Needleman thought the brain damage was more serious. But how could he prove it?

Lead quickly disappears from the blood after acute exposure *(3, 30)*. It accumulates in fingernails and hair but cannot be measured accurately. Biopsies for lead in bone were more accurate, but the process was laborious, costly, and unethical in children *(3, 30)*.

Needleman realized that children possessed another source. Measurements of lead deposited in baby teeth were easy and reliable. So, Needleman became a scientific tooth fairy, handing out gifts to children for their baby teeth *(30)*.

Courtesy of Virginia Tech

LeeAnn Walters with her husband and sons, listening to a presentation by Virginia Tech researchers

Needleman and his dental research partner, Irving Shapiro, analyzed thousands of baby teeth. They found that children in impoverished urban areas accumulated more than five times as much lead as affluent suburban children *(31)*.

Needleman and other researchers then found that high lead levels in children correlated with slower motor development, lower IQs, serious difficulties in school, and behavioral issues *(32)*. Needleman also found lead exposure increased the likelihood of criminal behavior in young men *(3, 30)*.

Needleman endured harsh pushback from manufacturers, but his findings led to the 1978 U.S. ban on lead-based paint *(3, 30)*. In 1986, tetraethyl lead was eliminated from gasoline, and lead was restricted in plumbing, including lead solder *(19, 20)*. Consequently, blood lead levels in the U.S. have steadily declined, sparing thousands of American children from a lifetime of disability *(3, 30)*.

However, homes in poor neighborhoods still contained old lead paint and paint dust, and curious toddlers ate the sweet-tasting lead paint chips. For that reason, all children insured by Medicaid must be screened for blood lead levels at 1 and 2 years of age *(3, 13)*.

Proving Lead Exposure

After the barbeque, Dr. Mona began her own investigation. When the blood lead data she requested from the county was not forthcoming, she called Karen Lishinski at Michigan's DHHS *(3)*. Lishinski mentioned, in passing, that their epidemiologist had seen a spike in blood lead levels after the water switch in 2014, but Dr. Mona received no data. Internal memos later revealed that DHHS dismissed the results and concluded there was no problem in Flint *(4)*.

Dr. Mona reviewed the lab results from her own patients and the medical records at Hurley Children's Clinic, a total of 1,746 Flint children *(13, 33)*. Although any lead exposure is considered harmful, the CDC recommends intervention to eliminate the sources of exposure when a child's blood lead level reaches 5 µg/dl *(13, 16)*. Her initial analysis suggested that more children had blood lead above this level after the Flint water switch than before *(3)*.

She contacted Marc Edwards, who made several key suggestions for refining her analysis. Most importantly, he emphasized focusing on children under 15 months of age. Unlike 1- and 2-year-olds, who explore and eat paint chips, the hazard from ingesting lead-laden water predominantly affects infants *(26)*.

Water (from reconstituted powdered formula) is a major component of infant diets, so infants would show higher blood lead levels than toddlers *(13, 26)*. Edwards also suggested controlling for seasonal variation and organizing her data by zip code *(3)*.

With these refinements, Dr. Mona's results (before vs. after the water switch) showed that the number of children with elevated blood lead levels more than doubled in the zip code locations where Edwards had found the highest water lead levels *(13)*.

On September 21, 2015, Dr. Mona and her colleagues shared the data with city officials, urging them to issue a health advisory. Instead, they cited MDEQ's official statement and said the city's water was safe *(3)*.

On Thursday, September 24, 2015, Dr. Mona presented her data at a press conference in the Hurley conference room, backed up by public health and medical representatives and the United Way. Attending, either in person or via a live-streamed video, were Edwards, Del Toral, her friend Elin, LeeAnne, Flint Public Works officials, EPA representatives, elected officials, and the media *(3)*.

Citing her results, Dr. Mona and her colleagues recommended several immediate steps. Infants

Courtesy of Mona Hanna-Attisha; Photo credit: Doug Pike

Dr. Mona Hanna-Attisha at the press conference on September 24, 2015

on formula, pregnant women, and other high-risk individuals should not use tap water. Lead-clearing water filters should be distributed. Flint should switch to Detroit water as soon as possible *(3)*.

The blowback was swift and harsh. Local and state officials repeated their standard message that Flint water was in compliance. They said Dr. Mona's data had been "spliced and diced" *(3)*.

Nick Lyon, Director of Michigan's DHHS, instructed his department to "make a strong statement," including the possibility that the results were simply due to seasonal variation *(4)*. His office issued a one-page table of blood lead data for Flint children under age 16. Without providing any analysis, they said it proved there was no lead problem *(3, 4)*.

Legionnaires' Disease

The publicity surrounding Dr. Mona's announcement overshadowed an equally serious and more immediate health threat from Flint's contaminated water: Legionnaires' disease.

Low levels of *Legionella* bacteria are commonly found in drinking water distribution systems *(34, 35)*. But disinfectant treatment typically inhibits the growth of waterborne microbes, including *Legionella*, as well as *E. coli (34)*.

In Flint, leached metal in the water combined with the chlorine, decreasing its disinfectant activity *(8, 18, 35)*. In LeeAnne's tap water, for example, the Virginia Tech researchers found no detectable chlorine *(8, 35)*.

Of particular concern was iron in the water, because iron is an essential nutrient for *Legionella*. The rough surface of the corroded pipes permitted the bacteria to attach, and iron helped it to multiply and thrive *(8, 34, 35)*. Legionnaires' disease (caused by *Legionella*) is a severe form of pneumonia and is often fatal, especially in people with weakened immune systems *(1, 3, 36)*.

The county health department spotted a sudden increase in Legionnaires' disease cases in the summer of 2014 *(4, 8, 37)*. They suspected those cases might be related to the water switch *(4)*.

An epidemiologist at Michigan's DHHS also expressed concerns, but in March 2015, MDEQ concluded (without providing data) that the outbreak was unrelated to the water source *(4)*. Then, in May 2015, a second Legionnaires' outbreak began *(8, 37)*. Again, the county health and Michigan DHHS officials failed to take action *(4)*.

The two outbreaks totaled 88 Legionnaires' cases, including 12 deaths, along with an uptick in pneumonia mortality *(3, 4, 35)*. A later investigation found that 77% of the Legionnaires' patients in Flint had noticed water quality changes (discoloration, taste, odor, etc.) in the 2-week period prior to diagnosis, the typical incubation period for Legionnaires' disease *(4, 35)*.

At a press conference on January 11, 2016, state and county health officials finally admitted that the Legionnaires' outbreaks "might" be linked to the water switch *(3, 4, 35)*. Prior to this briefing, Eden Wells, Michigan's chief medical executive, showed Dr. Mona a graph of the huge spike in Legionnaires' cases following the water switch. Wells' DHHS boss, Nick Lyon, joined their conversation and said, "Can't we just say this is due to seasonality, too?" *(3)*. But the data were compelling.

The Tipping Point

Despite the harsh backlash, Dr. Mona's revelations marked the turning point in the Flint water crisis. The morning after her press conference, the mayor's office and the county health department issued a "lead advisory," and the new superintendent of schools unilaterally ordered children to stop drinking water at school *(3, 4)*.

A statistician at the *Detroit Free Press* conducted an independent analysis of Dr. Mona's data and the state's scanty one-page tabulation. The *Press* published her conclusions: the state's data actually confirmed Dr. Mona's analysis *(3, 4)*.

In a phone call, Eden Wells admitted to Dr. Mona that after re-analyzing the DHHS data, "the state's

Sign posted in the home of a Flint resident

blood lead numbers are consistent with yours" *(3)*. Wells also told her that DHHS was, finally, sending her the blood lead data she had requested.

After officials warned residents not to drink the water, the local United Way coordinated community volunteers (the food bank, Red Cross, and church groups) to distribute donated bottled water, filters, and premixed formula *(3, 4, 10, 37)*. Priority was given to formula-fed babies, pregnant women, and residents with zip codes where Edwards' data identified the most toxic water *(3, 4, 13)*.

On October 16, 2015, government officials yielded to public pressure, and Flint switched back to Detroit water *(1, 17)*. A month later, Flint signed a 30-year water contract with Detroit *(2)*.

Also on October 16, 2015, the EPA commissioned the Flint Safe Drinking Water Task Force (later, the Flint Drinking Water Technical Support Team), including Miguel Del Toral as a member *(38)*. The Task Force provided technical advice to MDEQ and the city. They also issued a directive, preventing state water agencies from using fraudulent test methods and intentionally minimizing lead content *(38)*.

On October 21, 2015, Gov. Rick Snyder commissioned the five-member Flint Water Advisory Task Force, also called the Five Guys, to conduct an after-action review *(4)*. Their 112-page report was unsparing in its criticism: "The Flint water crisis is a story of government failure, intransigence, unpreparedness, delay, inaction, and environmental injustice" *(4)*.

They said MDEQ was primarily at fault because the agency failed to enforce drinking water regulations and stubbornly worked to discredit those who attempted to spotlight the unsafe water, lead contamination, and *Legionella* cases. Also blamed was Michigan's DHHS, which delayed analysis of its own child blood lead data, was reluctant to share that data, and failed to promptly act to protect public health *(4)*.

Finally, there were missteps by the governor, state-appointed emergency managers, the Genesee County Health Department, the Flint Treatment Plant, and the EPA's management *(4)*. One Virginia Tech researcher said, "The only job these people have is to protect the public, and they ended up doing everything but that" *(10)*.

What did work, the Five Guys said, was the active involvement of Flint residents, government epidemiologists, academic researchers, and the free press. They drew attention to government mismanagement. "Without their courage and persistence, this crisis likely never would have been brought to light and mitigation efforts never begun" *(4)*.

The Road to Recovery

It would take many months to restore the mineral layers on Flint's water pipes after 18 months of corrosion from Flint River water *(1, 3, 8)*. On December 9, 2015, the Flint Treatment Plant began supplementing Detroit's water treatment, tripling the orthophosphate level *(4, 10, 39)*.

Courtesy of Virginia Tech; Photo credit: Logan Wallace

From left to right: LeeAnne Walters, Miguel Del Toral, Mona Hanna-Attisha, and Marc Edwards

But the water was still unsafe to drink. Truckloads of bottled water were donated by FEMA, Girl Scouts in Ohio, Chicago UAW locals, and an Ann Arbor ballroom dance club *(3, 4)*. County sheriff deputies and the Michigan National Guard distributed the water. Union plumbers volunteered countless hours to install lead-clearing filters *(3, 10)*.

Because the corrosive water had further damaged Flint's already aging infrastructure, workers began replacing the lead and galvanized iron water pipes on March 4, 2016 *(1, 2, 10, 17)*. Finding them was difficult because Flint's Public Works stored its service line records on index cards. University of Michigan-Flint researchers identified lead pipes at 4,376 locations, but there were no records for more than 10,000 other properties *(4)*. Despite these challenges, the pipes were essentially all replaced by September 2021 *(40)*.

Lifetime Commitment

Dr. Mona's biggest worry was the lasting effect on Flint's 25,000 children *(5)*. Chelators can remove lead from the blood, but in the rapidly developing brains

of children, lead-induced damage is permanent *(1, 3)*. Flint's children would need lifelong services to mitigate their developmental delays and cognitive deficits.

Dr. Mona and community leaders set up the Flint Kids Fund *(3)*. This 20-year project provides education programs, behavioral interventions, parenting support, home visits, coaching, and tutoring to foster the children's resilience *(4-6, 10, 33)*. In addition, the Hurley Clinic distributes $15 nutrition vouchers, which can be cashed at the farmer's market, located on the ground floor of the Hurley building *(6)*.

To pay for the public health services and infrastructure upgrades, the state budgeted $240 million, including $55 million to replace the lead service lines *(4, 7, 10)*. Emergency declarations by Flint's mayor on December 14, 2015, Gov. Snyder on January 5, 2016, and President Barack Obama on January 16, 2016, authorized $80 million in federal funds to assist Flint *(3, 4, 10)*.

The Virginia Tech team continued to monitor lead levels in the water supply, in collaboration with Flint's "citizen scientists" *(18)*. The lead levels progressively declined, and by August 2017, Flint's water was below EPA's action level *(17, 18, 27)*. Edwards, the EPA, and state authorities agreed that Flint's tap water was now safe to drink, with a filter *(1, 7, 38)*. Unfiltered water was safe to bathe in *(27)*.

But regaining the public's trust has been challenging. Many residents still use bottled water *(7, 5, 33, 40)*. One of them told a reporter, "I don't even give [the water] to my dog…I don't care how many filters they give us" *(18)*. Hundreds of Flint residents still come every week to local churches, where cases of donated water are distributed *(5, 33, 40)*.

Courtesy of Virginia Tech

Virginia Tech students testing water samples in the home of a Flint resident

Repercussions

Flint's water crisis triggered a number of actions and reforms. Implicated federal, state, and local government officials were either fired or resigned *(4, 10)*.

EPA's Inspector General investigated Region 5 management's lack of oversight *(4, 10)*. On June 10, 2021, the EPA made the first major revision in the Lead and Copper Rule since 1991 *(41)*. Utilities must now notify citizens within 24 hours after receiving water lead results that exceed the actionable level, and the requirements for corrosion control have been tightened *(41)*.

The EPA, FBI, U.S. Attorney's office, and U.S. Postal Inspection Service coordinated criminal investigations *(4)*. In 2017, 13 officials were indicted *(7, 42)*. Seven of them pleaded no contest to misdemeanor charges and cooperated with investigators *(36)*.

In January 2021, renewed felony and misdemeanor indictments were issued to nine government officials, including Gov. Snyder. Eden Wells and Nick Lyon were charged with nine counts of involuntary manslaughter, stemming from the Legionnaires' disease outbreaks *(36, 43)*. They all pleaded not guilty *(43)*. As of press time, the defendants were awaiting trial.

More than 50 lawsuits were filed, and on August 20, 2020, Michigan announced a $641 million class-action settlement *(5, 44)*. Most of the money was earmarked for children who were younger than 7 at the time of the water crisis.

Penny Wise, Pound Foolish

Rather than saving $5 million in water fees and $100 a day in orthophosphate treatment, Flint is spending nearly $1 billion in state and federal funds to restore its water infrastructure *(1, 2)*. Only three other cities have replaced all of their lead service lines since 2001: Madison, WI, Lansing, MI, and Newark, NJ *(17, 41)*.

Faced with a lead crisis similar to Flint's, Newark officials took quick action and replaced all of the city's 18,720 lead service lines in about two years—a job that was initially estimated to take 10 years *(41)*.

Most of the remaining six million lead service lines in the U.S. were installed nearly a century ago and are approaching the limit of their usable age *(1, 8, 10, 19, 20)*. Edwards says many of them threaten serious lead exposure *(45)*. "The miracle of Flint was, they got caught" *(7)*.

References

1. Smith L (May 31, 2017) *NOVA: Poisoned Water*, DVD, directed by Llewellyn Smith. WGBH Educational Foundation, Boston.
2. Science Channel (November 18, 2020) Deadly Engineering – Exxon Valdez Declassified.
3. Hanna-Attisha M (2018) *What the eyes don't see*. One World, New York.
4. Davis MM, Kolb C, Reynolds L, Rothstein E, and Sikkema K (March 2016) Final report: Flint Water Advisory Task Force; available from: https://www.michigan.gov/documents/snyder/FWATF_FINAL_REPORT_21March2016_517805_7.pdf.
5. Gray K (August 20, 2020) Most of $600 million settlement in Flint water crisis will go to children. New York Times; available from: https://www.nytimes.com/2020/08/20/us/flint-water-crisis-settlement-children.html.
6. Burke KL (2019) First person: Mona Hanna-Attisha. *American Scientist* **107(5)**: 264-265.
7. McQuaid J (December 2016) Whistleblowers: Marc Edwards + LeeAnne Walters. *Smithsonian Magazine* pp 48-50.
8. Torrice M (2016) How lead ended up in Flint's tap water. *Chem Eng News* **94(7)**: 26-29.
9. Pieper KJ, Tang M, and Edwards MA (2017) Flint water crisis caused by interrupted corrosion control: Investigating "ground zero" home. *Environ Sci Technol* **51**: 2007-2014.
10. Burke KL (2016) Moving forward after Flint. *American Scientist* **104(3)**: 137-139.
11. Del Toral MA (June 24, 2015) High lead levels in Flint Michigan – Interim Report. WG-15J. U.S. EPA Region 5; available from: http://flintwaterstudy.org/wp-content/uploads/2015/11/Miguels-Memo.pdf.
12. Levin J (October 18, 2002) Plumbing the depths: The EPA finds too much lead in DC tap water. Washington City Paper; available from: https://washingtoncitypaper.com/article/257006/plumbing-the-depths/.
13. Hanna-Attisha M, LaChance J, Sadler RC, and Schnepp AC (2016) Elevated blood lead levels in children associated with the Flint drinking water crisis: A spatial analysis of risk and public health response. *Am J Public Health* **106(2)**: 283-290.
14. Edwards M (2014) Fetal death and reduced birth rates associated with exposure to lead-contaminated drinking water. *Environ Sci Technol* **48**: 739-746.
15. Notice to readers (May 21, 2010) Examining the effect of previously missing blood lead surveillance data on results reported in MMWR. *MMWR* **59(19)**: 592.
16. Centers for Disease Control and Prevention (August 5, 2021) Childhood lead poisoning prevention: Recommended actions based on blood lead level; available from: https://www.cdc.gov/nceh/lead/advisory/acclpp/actions-blls.htm.
17. Pieper KJ, Martin R, Tang M, Walters L, Parks J, Roy S, Devine C, and Edwards MA (2018) Evaluating water lead levels during the Flint water crisis. *Environ Sci Technol* **52**: 8124-8132.
18. Roy S (2017) The hand-in-hand spread of mistrust and misinformation in Flint. *American Scientist* **105(1)**: 22-26.
19. Felton R, Gill L, and Kendall L (2021) How safe is our drinking water? *Consumer Reports* **86(5)**: 34-43.
20. Khazan O (September 11, 2019) The trouble with America's water: lead-tainted drinking water is not only a problem in Flint and Newark. *The Atlantic*; available from: https://www.theatlantic.com/health/archive/2019/09/millions-american-homes-have-lead-water/597826/.
21. Lewis J (May 1985) Lead Poisoning: a historical perspective. *EPA Journal*; available from: https://archive.epa.gov/epa/aboutepa/lead-poisoning-historical-perspective.html.
22. Petroski H (2019) A taxed infrastructure. *American Scientist* **107**: 278-281.
23. Mclaughlin W (November 22, 2017) The reasons why Rome fell—Lead poisoning is often dismissed as a major cause for the decline of Rome, but the theory does have some merit. *War History Online*; available from: https://www.warhistoryonline.com/ancient-history/the-reasons-why-rome-fell-lead-poisoning-is-often-dismissed-as-a-major-cause-for-the-decline-of-rome-but-the-theory-does-have-some-merit.html.
24. Delile H, Blichert-Toft J, Goiran J-P, Keay S, and Albarède F (2014) Lead in ancient Rome's city waters. *PNAS* **111(18)**: 6594-6599.
25. Burke KL (2016) Flint water crisis yields hard lessons in science and ethics. *American Scientist* **104(3)**: 134-136.
26. Edwards M, Triantafyllidou S, and Best D (2009) Elevated blood lead in young children due to lead-contaminated drinking water: Washington, DC, 2001-2004. *Environ Sci Technol* **43(5)**: 1618-1623.
27. Stein P (January 16, 2019) Aqua Man. *The Washington Post Magazine*; available from: https://www.washingtonpost.com/news/magazine/wp/2019/01/16/feature/they-helped-expose-unsafe-lead-levels-in-flints-and-in-d-c-s-water-then-they-turned-on-each-other/.
28. Fonger R (September 15, 2015) Virginia Tech professor says Flint's tests for lead in water can't be trusted. *The Flint Journal Mlive.com*; available from: https://www.mlive.com/news/flint/2015/09/virginia_tech_researcher_says.html.
29. Siddhartha Roy, personal communication, September 20, 2021.
30. Marsa L (2019) Heavy metal. *Discover Magazine* **40(9)**: 68-71.
31. Needleman HL, Tuncay OC, and Shapiro IM (1972) Lead levels in deciduous teeth of urban and suburban American children. *Nature* **235**: 111-112.
32. Needleman HL, Gunnoe C, Leviton A, Reed R, Peresie H, Maher C, and Barrett P (1979) Deficits in psychologic and classroom performance of children with elevated dentine lead levels. *New Engl J Med* **300**: 689-695.
33. Mona Hanna-Attisha, personal communication, September 21, 2021.

34. Wang H, Masters S, Hong Y, Stallings J, Falkinham JO, Edwards MA, and Pruden A (2012) Effect of disinfectant, water age and pipe material on occurrence and persistence of *Legionella*, *mycobacteria*, *Pseudomonas aeruginosa*, and two amoebas. *Environ Sci Technol* **46**: 11566-11574.
35. Rhoads WJ, Garner E, Ji P, Zhu N, Parks J, Schwake DO, Pruden A, and Edwards MA (2017) Distribution system operational deficiencies coincide with reported Legionnaires' Disease clusters in Flint, Michigan. *Environ Sch Technol* **51**: 11986-11995.
36. White E, Eggert D, and Webber T (January 12, 2021) Michigan plans to charge ex-Gov. Snyder in Flint water probe. *Associated Press*; available from: https://apnews.com/article/Flint-lead-water-crisis-gov-rick-snyder-801ba227340f0ac2e10e37a06a82f08d.
37. Zahran S, McElmurry SP, Kilgore PE, Mushinski D, Press J, Love NG, Sadler RC, and Swanson MS (February 20, 2018) Assessment of the Legionnaires' disease outbreak in Flint, Michigan. *PNAS* **115(8)**: E1730-E1739.
38. EPA Flint Drinking Water Technical Support Team (March 10, 2017) Status of System Recovery; available from: https://www.epa.gov/sites/default/files/2017-03/documents/20170310-flint-technical-assessment-summary.pdf.
39. Roy S and Edwards MA (2020) Efficacy of corrosion control and pipe replacement in reducing citywide lead exposure during the Flint, MI, water system recovery. *Environ Sci Water Res Tech* **6**:3024-3031.
40. Dennis B and Greeson B (September 17, 2021) Flint has replaced over 10,000 lead pipes. Earning back trust is proving harder. The Washington Post; available from: https://www.washingtonpost.com/climate-environment/interactive/2021/flint-clean-water-crisis-photos/.
41. Baraka RJ (January 8, 2021) Newark actions to eradicate lead from drinking water go beyond newest EPA guidelines: available from: https://www.newarknj.gov/news/newark-actions-to-eradicate-lead-from-drinking-water-go-beyond-newest-epa-guidelines.
42. Fonger R (February 16, 2017) CDC finds first genetic link between Legionnaires' outbreak, Flint water. *The Flint Journal Mlive.com*; available from: https://www.mlive.com/news/flint/2017/02/cdc_finds_first_genetic_link_b.html.
43. LeBlanc B (January 14, 2021) Here are nine officials charged in Flint water crisis. The Detroit News; available from: https://www.detroitnews.com/story/news/michigan/flint-water-crisis/2021/01/14/nine-michigan-officials-charged-flint-water-crisis/4161106001/.
44. Egan P (August 20, 2020) Michigan to pay $600M in Flint water crisis settlement; victim compensation fund created. Detroit Free Press; available from: https://www.freep.com/story/news/local/michigan/flint-water-crisis/2020/08/20/flint-water-crisis-lawsuit-settlement/5614724002/.
45. Marc Edwards, personal communication, September 24, 2021.

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 smallpox history and vaccines.

Don't miss the March 2022 issue.

Meeting News

Focus on Pharmacology Virtual Series

ASPET's Focus on Pharmacology Virtual Series was launched in July 2020 as a venue for communicating innovative science in pharmacology and experimental therapeutics. The webinars are broadcast live, and many have interactive components before, during, and after each session. The Focus on Pharmacology Virtual Series is free for ASPET members. Recordings of all the sessions are available on the ASPET*Connect* Focus on Pharmacology community.

4th Joint CNPHARS-ASPET Symposium on Pharmacology

Submitted by Edward T. Morgan, PhD

On Monday, October 25th from 8:00 – 10:00 pm EST (8:00 – 10:00am on Tuesday, October 26th in China), ASPET and the Chinese Pharmacological Society held the 4th joint CNPHARS-ASPET Symposium on Pharmacology (first virtual joint symposium in this series), moderated by Dr. Eddie Morgan, former ASPET President and Chair of the ASPET Partnerships Committee. More than 300 CNPHARS and ASPET members registered for the symposium, which was presented as part of the Focus on Pharmacology webinar series. Approximately 227 registrants viewed the symposium in real time and the recording was made available on ASPET*Connect* for ASPET members to view.

In his opening address, CNPHARS President, Dr. Yonxiang Zhang, extended a warm welcome to all the participants from the USA and China. He reviewed the history of the series, which began at EB 2014 in San Diego, CA with a program focused on drug discovery in the United States and China. Subsequent joint CHPHARS-ASPET symposia have highlighted advances in molecular pharmacology, traditional medicines, and drug discovery for neurodegenerative diseases. Dr. Zhang described how the pandemic had disrupted the sequence and timing of this joint series, leading to a decision between the two societies to conduct this meeting virtually. Both societies agreed on a topic of drug metabolism and disposition, an area of great strength and interest for the membership of both societies, and resolved to invite a prominent early career scientist from each society as speakers.

ASPET President, Dr. Margaret Gnegy, offered a special welcome to our Chinese colleagues, pointing out that although it was disappointing not to meet in person, the virtual meeting format perhaps offers an opportunity to reach a broader world-wide audience.

Dr. Guanhua Du, Past-President of CNPHARS, introduced the first speaker, Dr. Xin Wang, from East China Normal University, who presented his cutting-edge research using CRISPR-Cas9 technology to generate rat models of cytochrome P450 and drug transporter deficiency in order to understand their roles in drug disposition, drug interactions, toxicity and disease.

Dr. Gnegy then introduced the ASPET speaker, Dr. Bhagwat Prasad, from Washington State University. Dr. Prasad described a different and complementary approach using quantitative proteomics of drug metabolizing enzymes coupled with physiologically-based pharmacokinetic modeling to study the roles of drug metabolizing enzymes and transporters. His presentation focused on recent findings with UDP glucuronosyltransferase family 2 member B17 (UGT2B17), a key enzyme responsible for glucuronidation of androgens which he found to be highly variable in geographically diverse human populations. The juxtaposition of these two presentations nicely highlighted how genetic and proteomic studies can complement each other in elucidating enzyme and transporter pharmacology. The symposium concluded with remarks from Drs. Du and Gnegy, reflecting on the quality of the presentations and the importance of this symposium for the respective societies.

View Past Focus on Pharmacology Sessions

Visit ASPET*Connect*'s Focus on Pharmacology community at https://bit.ly/FOPrecordings to view past recordings of our virtual sessions. This is free for all ASPET members.

Education News

Individual Summer Undergraduate Research Fellowship (SURF) Program

Applications Due Tuesday, February 1, 2022 for Summer 2022 Fellowships

ASPET's individual SURF program introduces undergraduate students to pharmacology research through a 10-week laboratory research experience. The goal of the program is to use authentic, mentored research experiences in pharmacology to heighten student interest in careers in research and related health care disciplines. The SURF individual awards are intended to support students whose institutions do not have a currently funded institutional SURF program. Research may be conducted at the student's home institution or another institution, as appropriate to the research project.

Who Should Apply

Undergraduate students conducting pharmacology-related research including, but not limited to, students representing departments of pharmacology, toxicology, pharmaceutical sciences, and/or biological chemistry are invited to apply to the program. Applications from women and underrepresented minorities are particularly encouraged.

Program Details

- Students must apply with a mentor who is a regular or affiliate member of ASPET in good standing or an emeritus member who is still active in research.
- Students and mentors must have already identified, and briefly describe, a summer research project that the student proposes to undertake.
- If awarded, ASPET will provide a student stipend of $2800 for a minimum of ten weeks' participation.
- The student must apply for membership in ASPET no later than the beginning of their summer research experience.

For more information and to apply, please visit www.aspet.org/awards/SURF. For questions, please contact Catherine L. Fry, PhD at cfry@aspet.org.

Well-Being Initiative for Women Faculty of Color to Promote Professional Advancement in Pharmacy and Pharmaceutical Sciences Research

Submitted by Klarissa D. Jackson, PhD

This year, the University of North Carolina (UNC) Eshelman School of Pharmacy launched the "*Well-Being Initiative for Women Faculty of Color to Promote Professional Advancement in Pharmacy and Pharmaceutical Sciences Research"*. The Program is designed to support the well-being and professional advancement of BIPOC (Black, Indigenous, and People of Color) women faculty at the assistant and associate professor level at research-intensive, predominately white U.S. schools of pharmacy and departments of pharmacology nationwide. This research study is funded by Genentech, a member of the Roche Group. The Program launched in spring 2021 and will continue through December 2022.

Motivation for Developing the Program

The UNC Eshelman School of Pharmacy, in partnership with Houston Wellness Workshops for Women (H3W), developed this Program to support the retention, advancement and sustained professional success of BIPOC women faculty in pharmacy and pharmaceutical sciences through wellness and well-being. We believe that well-being is a critical prerequisite to achieve faculty retention, self-advocacy, leadership development, and professional advancement. Programs that specifically address well-being among BIPOC women faculty in biomedical research at predominantly white institutions (PWIs) are lacking and widely nonexistent. An intentional focus on well-being and resilience has been identified by key stakeholders in the pharmacy profession as a critical strategy to sustain the pharmacy and biomedical research workforce.

Program Design

The *Well-Being Initiative* is a two-year longitudinal program that uses a three-fold approach: 1) **Connection** through virtual and in-person conferences; 2) **Coaching** through ongoing wellness coaching; and 3) **Community** through facilitating communication, professional networking, relationships, and exchange of information through online platforms.

The Program includes quarterly conferences, which have been conducted virtually in 2021 (year 1). Three virtual conferences and one in-person conference are anticipated for 2022 (year 2). The conferences focus on developing consistent self-care practices for holistic well-being (mind, body, spirit), incorporating well-being in the workplace, building self-advocacy skills, and leadership development with recognition of the intersectionality of identity as a BIPOC woman in academia. Conferences feature guest speakers, small group discussions, and self-reflective and relaxation activities. The curriculum is divided into four core units that are explored with cohort members during quarterly conferences over the course of the two years. The topics are: 1) Unit 1 – Renew: Selfcare and Leadership; 2) Unit 2 – Restore: Authenticity and Self-Advocacy; 3) Unit 3 – Reset: Resilience and Negotiating Skills; 4) Unit 4 – Refocus: Goal Setting and Negotiating Advanced Roles. The curriculum is designed to provide the BIPOC faculty participants with a practical tool kit for professional advancement, including developing and implementing a Personal Well-Being & Self-Care Plan, a Successful Self-Promotion Strategy, and a Personal and Professional Strategic Plan based on 5-year, 1-year, quarterly, and monthly time horizons.

In addition, each cohort member has the opportunity to receive 1-on-1 wellness coaching sessions with a wellness coach every three months. Participation is completely voluntary. The cohort community is also supported by an online platform with ongoing administrative support to facilitate communication and community building.

Assessments

Members of the cohort are invited to participate in this research study to evaluate the impact of the Program on the participants' overall well-being, career advancement, and sustained professional success. Participation is completely voluntary. Members of the cohort who agree to participate in this research take confidential pre- and post-well-being assessments evaluating the impact of the program on three factors: well-being, burnout, and their self-perceptions of self-efficacy in their professional academic roles. IRB-approved surveys have been developed using the following validated instruments: *Well-being*: The Well-Being Index (WBI) measures personal well-being and multiple dimensions of distress. The Maslach Areas of Worklife Survey (AWS) measures professional well-being through employees' perceptions of work-setting qualities. *Burnout*: An abbreviated Maslach Burnout Index (MBI) measures burnout using items with evidence of highest factor loading specifically in domains of: (1) emotional exhaustion, and (2) depersonalization. *Self-efficacy*: The assessment of self-efficacy has been adapted from the General Self-Efficacy Survey (GSES) based on the socio-cognitive theory of perceived self-efficacy according to Bandura. Self-efficacy is defined as one's "beliefs in their personal ability to manage life demands." Cohort members also have the opportunity to self-report on a voluntary basis indicators of career advancement (e.g., faculty reappointment, promotion and/or tenure, appointments to leadership positions, awards, grants, etc.), as well as retention within their academic institution, or movement to a new institution. Data will be presented in aggregate to protect the identity of cohort members. This research is approved by the University of North Carolina at Chapel Hill Institutional Review Board (IRB #: 20-3724).

Program Evaluation and Knowledge Dissemination

During the first year of the Program, we are gathering feedback data from study participants to assess their level of satisfaction with the program, its alignment with the program objectives and their personal goals, and to identify areas of improvement. The feedback and level of engagement by cohort members and has been very positive and informative. We look forward to refining our program in year 2 for long-term success and impact. The findings of our 2-year program evaluation and outcomes will be submitted for publication in a professional pharmacy journal. Using the program evaluation data, key outcomes, and individual and programmatic success metrics, we intend to share *Best Practices in Supporting BIPOC Faculty at Research-Intensive Academic Institutions* to disseminate our findings.

Project Team

The project team at the UNC Eshelman School of Pharmacy includes **Carla White**, principal investigator and Associate Dean for Organizational Diversity and

Carla White

Suzanne Harris

Klarissa Jackson

Karla Aghedo

Inclusion, **Suzanne Harris**, co-investigator, Director of Well-being and Resilience, and Assistant Professor of Practice Advancement and Clinical Education, and **Klarissa Jackson**, co-investigator and Assistant Professor of Pharmacotherapy and Experimental Therapeutics. **Karla Aghedo**, Founder and CEO, H3W (Houston Wellness Workshops for Women) is the vendor for the program who oversees the overall development, planning, organization, implementation, and evaluation of the virtual and in-person conference experiences.

Dislcosure

Klarissa Jackson, co-investigator on this study, is a faculty member with UNC Eshelman School of Pharmacy. She is working on the research with a family member as external vendor. Jackson received a speaker honorarium from Genentech to present research that is not part of this study.

For more information about the *Well-Being Initiative for Women Faculty of Color*, please visit https://pharmacy.unc.edu/about/our-diversity/well-being/.

Science Policy News

Recapping the Year in ASPET Advocacy

Many of the same challenges in advocacy that began last year with the onset of the COVID-19 pandemic persisted into 2021. The Capitol Hill complex remained closed to visitors, meetings with congressional staff and stakeholders continued to be conducted virtually, and our members continued to feel disruptions to their research that Congress is still working to address. Nevertheless, ASPET's advocacy work continued, and we made significant progress on many key issues. The Winter issue of *The Pharmacologist* gives us an opportunity to look back at the year in advocacy and assess our advocacy results and anticipate what's in store for 2022.

FY 22 Appropriations

Much like previous years, Congress was unable to finalize an appropriations package before the end of the fiscal year on September 30, 2021, and the government is currently operating under a continuing resolution (CR) that funds the government at FY 21 levels. The CR expires on February 18. Below is a look at the amounts ASPET requested for agencies that fund scientific research. These numbers were developed with our umbrella organization, the Federation of American Societies for Experimental Biology (FASEB).

- National Institutes of Health (NIH)
  - » $46.11 billion requested
- National Science Foundation (NSF)
  - » $10 billion requested
- Veterans Affairs (VA) Medical and Prosthetic Research Program
  - » $902 million requested

ASPET and its partners advocated for these funding levels at virtual hill days, in testimony, and in targeted messaging to congressional leadership. ASPET also made FY 22 appropriations a centerpiece of its Washington Fellows program, and fellows met virtually with congressional staff to encourage robust, sustained, and predictable funding for biomedical research. Though Congress is still negotiating the final FY 22 package, the House and Senate have both proposed funding levels for the federal science agencies. At present, those numbers are:

- National Institutes of Health (NIH)
  - » $45.5 billion (Senate) vs. $46.4 billion (House)
- National Science Foundation (NSF)
  - » $9.5 billion vs. $9.6 billion
- Veterans Affairs (VA) Medical and Prosthetic Research
  - » $882 million vs. $904 million

Before voting on a final package, the two chambers will have to reconcile differences between their appropriations numbers. ASPET and its partners will continue to advocate for increased funding for biomedical research until the process is completed.

In anticipation of the FY 23 appropriations process, ASPET has developed several position papers that provide explanations of why ASPET supports funding for the NIH, NSF, and the VA's Medical and Prosthetic Research Program. The papers provide background on the agencies, highlight areas of biomedical research that these agencies support, and reinforce ASPET's commitment to advocating for congressional support for these agencies. The position papers will form the basis for ASPET's advocacy on appropriations funding moving forward and help standardize ASPET's messaging on this issue. You can view the newly created position papers on the ASPET website.

Animal Research

Much like last year, ASPET is working with a coalition of scientific societies and institutions to prevent language harmful to animal research from being included in the final report that accompanies the FY 22 appropriations bill. Some examples of the language included in the House bill are directives to agencies to develop non-animal alternatives to animal research without consulting the research community and collecting and publicly reporting data on the number of animals used in federally funded research. To educate congressional staff on why this language should not be included, ASPET provided researchers for FASEB organized outreach to congressional staff and has conducted its own outreach. At present, this issue is still unresolved due to the continuing resolution under which the federal government is operating.

In addition to our appropriations work on animal research, ASPET also endorsed a letter to the Department of Transportation seeking resolution to a complaint regarding the refusal of certain airlines to transport animals for research purposes. In 2018, ASPET submitted a comment to the department in support of the complaint. Since that time, the issue has not been addressed. ASPET is hopeful that the agency's decision to appoint a Chief Science Officer this year will be a catalyst for the resolution of the issue.

Drug Policy

ASPET continued its work on the classwide scheduling initiated by the Temporary Emergency Scheduling Order (TESO) of fentanyl-related substances in 2017. This year, the Biden administration convened an interagency working group of representatives from criminal justice and scientific agencies that developed a legislative framework for addressing the issue. Many of the recommendations of ASPET and its partners were included in the framework, such as streamlining the registration process for obtaining a Schedule I license and changing the requirements for researchers conducting research at multiple sites on the same campus. Many of these recommendations were also included in the Streamlining Research with Controlled Substances Act, introduced in the House in April. The TESO for fentanyl-related substances was recently extended until January 28, 2022. The administration and Congress hope to have an agreement to resolve this issue before the expiration of the current order. ASPET will continue to work with Congress to make sure the perspective of researchers is included in the final bill.

Other Policy Issues

Elsewhere, ASPET has remained active on many issues that impact its members including the proposed creation of an Advanced Research Projects Agency for Health (ARPA-H). ARPA-H would be a high-risk, high-reward agency tasked with driving biomedical breakthroughs, and it would be modeled on the Defense Advanced Research Projects Agency (DARPA) at the Department of Defense. ASPET participated in four listening sessions hosted by NIH and the White House Office of Science and Technology Policy (OSTP) to share input on the formation of the agency, its structure, its leadership, and how it should operate. Additionally, ASPET provided input to Congress on ARPA-H in a letter to the authors of the 21st Century Cures Act. In anticipation of further discussion on

this issue, ASPET is working with FASEB to prepare a federation-wide response to ARPA-H.

ASPET also continued its advocacy on the Research Investment to Spark the Economy (RISE) Act, a bill that would provide relief to NSF-funded researchers who had their work disrupted by lab closures related to the COVID pandemic. ASPET joined letters from Research!America, the American Association for the Advancement of Science, and the Coalition for NSF Funding requesting that the Biden administration and Congress address the issue. ASPET is hopeful that relief funding will be included in either the final FY 22 appropriations package or a larger bill that addresses structural changes to be made at NSF.

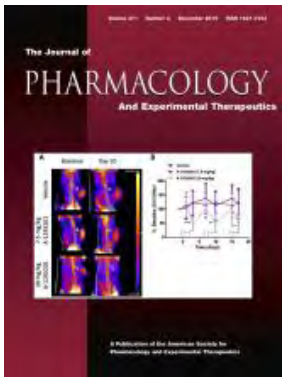
Elsewhere on science workforce issues, ASPET endorsed two pieces of legislation promoted by the majority of the House Science, Space, and Technology Committee: the STEM Opportunities Act and the Combatting Sexual Harassment in Science Act. The former bill directs OSTP to develop evidence-based practices to promote the progress of underrepresented groups in STEM studies and research careers, and the latter bill provides resources for research into the causes and impact of sexual harassment and directs agencies to review and update policies to prevent sexual harassment.

Last, ASPET submitted a response to NIH's Request for Information (RFI) on the topics of diversity, equity, and inclusion (DEI) in the biomedical research workforce. The RFI is part of NIH's UNITE Initiative to identify and address structural racism within the NIH-supported and the greater scientific community. ASPET's response included suggestions on how NIH can partner with scientific societies to address DEI issues, addressed the role of diverse mentorship, and identified existing barriers to recruitment and retention of scientists with a diverse background. ASPET will continue to monitor this issue both through its Science Policy Committee and its newly formed DEI task force.

Journals News

New Editors and Publications Committee Members

JPET and *PharmRev*



ASPET's Publications Committee is pleased to announce that Dr. Beverley Greenwood-Van Meerveld and Dr. Lyn Daws have been selected to succeed Dr. Kenneth Tew as editor of the *Journal of Pharmacology and Experimental Therapeutics* and Dr. Eric Barker as editor of *Pharmacological Reviews*, respectively. The transition to the new editors is effective January 1, 2022.

Beverley Greenwood-Van Meerveld

Dr. Greenwood-Van Meerveld, professor emeritus, has served as George Lynn Cross Research Professor and President's Associates Presidential Professor at University of Oklahoma Health Sciences Center. She was also Senior VA Research Career Scientist at Oklahoma City VA Medical Center.

Having recently been selected as an ASPET Fellow in 2021, Dr. Greenwood-Van Meerveld has been very active with the Society. She was a member of the ASPET Board of Publications Trustees from 2018-2020 and served as a JPET Associate Editor from 2012-2018. She has also served on several other editorial boards in various roles, including ad hoc journal reviewer since 1986.

As of this writing, she has published 163 research articles, 26 reviews, and 20 editorials, book chapters, and letters. She also holds 9 U.S. patents.

Dr. Daws is a Frost Bank Distinguished Professor in Biomedical Research and Director of the Physiology and Pharmacology Discipline of the Integrated Biomedical Sciences Graduate Program at the University of Texas Health Science Center at San Antonio.

Lyn Daws

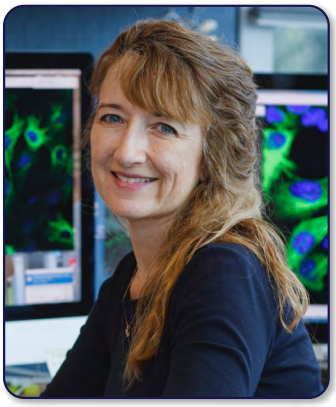
Dr. Daws has served as Associate Editor for *Pharmacological Reviews* since 2010. She has also served as guest editor for four other journals and edited a volume of the *Handbook of Experimental Pharmacology*. Over the years she has served as an ad hoc reviewer for almost 40 journals.

As of this writing, she has published 73 research articles and has also written 29 editorials, reviews, and book chapters.

We extend our thanks and say farewell to outgoing editors Dr. Kenneth Tew and Dr. Eric Barker as they hand over the reins to Dr. Greenwood-Van Meerveld and Dr. Daws.

New Publications Committee Members

Dr. Jack Bergman and Dr. Lyn Daws, members of the Publications Committee, will end their six-year terms at the end of 2021. The new at-large members and their terms are Dr. Laura Bohn (2022-2027) and Dr. Susan Wood (2022-2027).



Laura Bohn

Dr. Bohn is Chair and Professor, Dembling Endowment Fund for Drug Discovery and Human Health Research, in the Department of Molecular Medicine, Department of Neuroscience, at The Scripps Research Institute in Jupiter, Florida. She is Professor in the Skaggs Graduate School in Chemical and Biological Sciences and an Affiliate Member in The Brain Institute, Florida Atlantic University.

Dr. Bohn was a Mini-reviews editor from 2010-2013 on *Molecular Pharmacology*, where she currently serves as an editorial board member. She is also active on several other editorial boards and committees. She has received numerous honors and awards, including the 2011 John J. Abel Award from ASPET, sponsored by Pfizer. Dr. Bohn chaired ASPET's Neuropharmacology Division Executive Committee from 2013-2015 and served on the Program Committee from 2015-2017. She has been an ASPET member since 2004.

Susan Wood

Dr. Wood is an Associate Professor in the Department of Pharmacology, Physiology & Neuroscience at the University of South Carolina School of Medicine.

She has been the recipient of numerous honors and awards, including the Distinguished Undergraduate Research Mentor Award, University of South Carolina, in 2020, and the J.H. Woods Early Career Award in Behavioral Pharmacology from ASPET in 2020. Dr. Wood has been an Associate Editor on the *Journal of Pharmacology and Experimental Therapeutics* since 2018 and has served on many other boards and committees. She has been an ASPET member since 2005.

The Society is indebted to our retiring editors and Publications Committee members for their dedicated service. Their steadfast leadership and commitment to ASPET's publications program leave the journals in excellent condition for their successors.

Call for Papers on Non-Coding RNAs – *The Journal of Pharmacology and Experimental Therapeutics* Special Section

A special section on Non-Coding RNAs is being planned for publication in the August 2022 issue of *Journal of Pharmacology and Experimental Therapeutics*. The submission deadline is **January 5, 2022**.

Original research pertaining to innovative systems based on non-coding RNAs and their emerging clinical applications will be considered for this special section. Manuscripts describing efforts in demonstrating the role of non-coding RNAs as a biomarker of disease as well as their emerging functional role as targets to treat human disease are especially welcome. Research papers describing innovative in vitro/ex vivo/ in vivo, bioanalytical, -omics, modeling, and/or clinical research approaches to advance the understanding of the biological properties of non-coding RNAs are highly encouraged. Reports on animal models

addressing any of these topics will be considered if a clear translation to humans is shown.

Review articles addressing any aspects of the aforementioned topics will be considered as well; proposals for such articles should be sent to the guest editors, **Dr. Roberto Levi** (rlevi@med.cornell.edu) and/or **Dr. Gaetano Santulli** (gaetano.santulli@einsteinmed.org), for approval prior to submission.

Pharmacology Research & Perspectives Introduces: Pharmacology Education and Innovation Series

PR&P has recently launched a new series with the title "Pharmacology Education and Innovation."

Articles published so far as part of this series can be found here: https://bpspubs.onlinelibrary.wiley.com/doi/toc/10.1002/(ISSN)2052-1707.pharm-ed

Pharmacology education is an essential element of biomedical science and practice. Knowledge of drug action on biological systems, patient outcomes, and how the body responds to pharmacological interventions are key curricular competencies in schools of medicine, nursing, pharmacy, dentistry, physiotherapy, and veterinary medicine, particularly in the context of disease and variable physiological and clinical parameters.

In addition, emerging biomedical scientific developments require the continual evolution of pharmacology educational methodology and practices. Assessing the downstream utility and practice of such training in the research and clinical settings, by way of clinical efficacy, toxicity, and adverse prescribing behaviors provides valuable opportunities to evaluate the quality of educational outcomes in pharmacology.

Call for Papers – Now Open

Educational research-related papers have been a key component of the content published in *PR&P* in recent years. To build on this important feature of the journal and to further the advancement of pharmacology education, PR&P has opened a call for papers on all aspects of current and future pharmacology education including:

- Curriculum development
- Learning strategies
- New pedagogical models
- Approaches to the delivery of pharmacology content

More information about this call for papers can be found on the call for papers page (found at https://bpspubs.onlinelibrary.wiley.com/hub/journal/20521707/cfp_pharmacology_education) and in the Editorial (found at https://bpspubs.onlinelibrary.wiley.com/doi/full/10.1002/prp2.772) by the Editor-in-Chief, Dr. Mike Jarvis, and Deputy Editor, Dr. Jennifer Martin.

Submission Requirements

As part of this series, we encourage submissions of all article types (e.g., Original Articles, Reviews, Commentaries). The *PR&P* Author Guidelines provide further information about submission requirements for manuscripts submitted as part of the series, and can be reviewed here: https://bpspubs.onlinelibrary.wiley.com/hub/journal/20521707/author-guidelines.html

APC Discount

Articles accepted as part of the Pharmacology Education and Innovation Series are also eligible for a **20% discount** on the Article Publication Charge, the details of which can be reviewed at: https://bpspubs.onlinelibrary.wiley.com/hub/journal/20521707/article-publication-charges.html.

Highlighted Trainee Authors

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

Drug Metabolism and Disposition

- Lloyd Wei Tat Tang (National Univ. of Singapore) – September
- Jessica Beers (Univ. of North Carolina at Chapel Hill) – October
- Zivile Useckaite (Flinders Univ.) – November

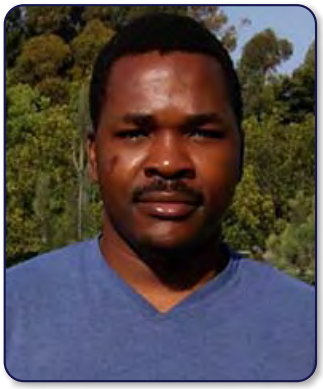
Lloyd Wei Tat Tang

Jessica Beers

Zivile Useckaite

JPET

- Alex Mabou (Univ. of California, Irvine) – September
- Lucy Martinez-Guerrero (Univ. of Arizona) – October
- Jessica Gambardella (Albert Einstein College of Medicine) – November



Alex Mabou

Lucy Martinez-Guerrero

Jessica Gambardella

Molecular Pharmacology

- Courtney Bouchet (Oregon Health & Science Univ.) – September
- Christopher Szlenk (Washington Univ.) – October
- Vivek Venu (Univ. of Calgary) – November

Courtney Bouchet

Christopher Szlenk

Vivek Venu

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

Membership News

The Value of ASPET Membership

ASPET works to fulfill the Society's mission of promoting pharmacology and to provide our members with the necessary tools to enhance their careers, expand their networks, and share their important research to transform discoveries into therapies. We asked ASPET member, Alicja Urbaniak what ASPET membership has meant for her.

Alicja J. Urbaniak, PhD is an ASPET postdoc member at University of Arkansas for Medical Sciences of the Health Sciences. She joined ASPET in 2016.

Why did you join ASPET?

I joined ASPET before my first EB meeting while I was a final year graduate student. I thought it would be a great resource for mentoring and supporting my future career.

How has membership in ASPET benefited your career?

ASPET offers a variety of mentoring programs which are especially important at the early stage of a career. Through ASPET's workshops, I learned a variety of important career skills including, but not limited to, preparing scientific posters and presentations, and what to expect on a job interview. I also got a lot of support with CV writing.

What do you enjoy most about the ASPET Annual Meeting?

ASPET meetings are great opportunities for networking within the scientific field. The scientists I've met at the meetings have continued to be a resource for references and collaboration later in my career.

What advice would you give to students and postdocs who want to get more involved in ASPET?

Connecting with your primary division's executive committee would be a great place to start. That's the best way to get more involved in the division's activities.

What advice would you give to students who are interested in pursuing pharmacology?

It's important to take advantage of every career opportunity you're presented with. I was trained in organic chemistry but got a chance to move into biochemistry to expand the applicability of my work. This transition had a huge positive impact on my future career since it broadened my skillset.

Renew Your ASPET Membership for 2022

Thank you for choosing to be a member of ASPET! We hope you are enjoying and utilizing all the benefits of membership. Renew your membership early so that you don't miss out on any exciting opportunities to grow your connections and advance your career.

How to Renew

You should have received your 2022 dues renewal notice earlier this Fall. You may complete your renewal online by visiting www.aspet.org/renew or by contacting Member Services at 301-634-7060. Thank you for your valued support of ASPET. We look forward to another amazing year!

New Members

Regular Members

Mohammad Abdollahi, Tehran Univ Med Sci, Iran
Khaled Abduljalil, Certara UK, United Kingdom
Robert D. Arnold, Auburn Univ, AL
Maria P. Avila Garcia, Sanofi / FUCS, Colombia
Wilmin Bartolini, Ikena Oncology, MA
Morris J. Birnbaum, Pfizer, MA
Lawrence H. Boise, Emory Univ, GA
Gemma Casadesus Smith, Univ of Florida
Angel E. Cespedes Rubio, Univ del Tolima, Colombia
Ian Copple, Univ of Liverpool, United Kingdom
Verginia C. Cuzon Carlson, Oregon Hlth Sci Univ
David A. Galvis Pareja, Univ CES, Colombia
Giovanny Garavito Cardenas, Univ Nacional, Colombia
Alasdair J. Gibb, Univ College London, United Kingdom
Mario F. Guerrero Pabon, Univ Nacional de Colombia, Sede Bogota
Timothy Haystead, Duke Univ, NC
Hsin-Ting Huang, Arcus Biosci, CA
Carlos A. Jimenez Castro, Lab Alcon de Colombia S.A.
Maksim Khotimchenko, Verisim Life Inc, CA
Joseph P. Lyssikatos, Enliven Therapeutics, CO
Jorge E. Machado Alba, Univ Tecnológica de Pereira, Colombia
Donald Manning, Travecta Therapeutics, NJ
Jennifer Martin, Univ of Newcastle, Australia
Ikuo Masuho, Sanford Res, SD
Michael J. Muirhead, Unity Health System, Searcy, AR
Maria M. Murillo Munoz, Fundacion Univ Autonoma de las Americas / Inst Colombiano de Invest en Farmacol
Jeanne M. Nerbonne, Washington Univ School of Med, MO
Belkis De La C. Palacio Villalba, Clinica Iberoamerica, Colombia
Misha Perouansky, Univ of Wisconsin-Madison SMPH
Jeremy W. Prokop, Michigan State Univ
Thomas P. Sakmar, Rockefeller Univ, NY
Marilena Tauro, H Lee Moffitt Cancer Center, FL
Xinwen Wang, Northeast Ohio Med Univ, OH
Yibing Wang, BeiGene, IL
Philip Wedegaertner, Thomas Jefferson Univ, PA
John T. Williams, Oregon Health Sciences Univ
Luke A. Wittenburg, Univ of California, Davis
Libin Xu, Univ of Washington, WA

Postdoctoral Members

Lawrence Carey, Univ of Texas Health Science Center, San Antonio
Isabella Cavalieri, Chapman Univ, CA
Yining Jin, Michigan State Univ
Eleanor Johnson, Univ of Kentucky
Kirill S. Korshunov, Northwestern Univ, IL
Harmony I. Risca, Univ of Texas HSC
Cora Smiley, Univ of South Carolina Sch of Med

Affiliate Members

Martin L. Alvis Serrano, Univ del Atlantico / Empresas Soc del Estado Manati, Colombia
Isaac Arbelaez Quintero, Tecnoquímicas S.A. y Univ Javeriana, Colombia
Claudia V. Arce Solarte, Univ Libre seccional Cali, Colombia
Nage Aun Quicena, Univ Del Magdalena / Univ Cooperativa de Colombia
Marlene M. Duran Lengua, Univ de Cartagena, Colombia
Jose H. Karan Rozo, U los hemisferios, Farma de Colombia
Graciela A. Leon Alfonso, Univ de los Llanos, Colombia
Natalie Nguyen, Mirati Therapeutics Inc, CA
Aparna Nigam, Univ of Pittsburgh, PA
Octavio Pineros, Fac de Salud, Univ del Valle, Colombia
Magda V. Solano Roa, Fundacion Univ Cafam, Colombia
Alvaro G. Vallejos Narvaez, Megalabs Colombia / Fund Univ de Ciencias de la Salud,
Mauricio Vargas Malagon, Univ de la Sabana, Colombia

Graduate Student Members

Ojomo Abiola, Univ of Lagos, Nigeria
Saamera Awali, Michigan State Univ
Carolina Caban Rivera, Temple Univ HSC, PA
Joseph M. Crecelius, Med Coll of Wisconsin
Jake Doiron, Louisiana State Univ
Shanukie R. Embuldeniya, Dalhousie Univ, Canada
Kimberly M. Ferreroc, Lewis Katz Sch of Med, Temple Univ, PA
Zakiyah Henry, Rutgers Univ, New Brunswick, NJ
Erin K. Hughes, Wake Forest Univ, NC
Melody C. Iacino, Wake Forest Univ, NC
Kristopher A. Knight, Emory Univ, GA
Goutham Kodakandla, Rowan Univ, PA

Nina D. Kosciuszek, New York Inst of Tech Coll of Osteopathic Med, CT
Saloni Malla, Univ of Toledo, OH
Brendan T. McKeownc, Dalhousie Univ, Canada
Vrutti Mehta, Long Island Univ Library, NY
Jacinta Nalweyisoc, UCSI Univ, Malaysia
Christian Priday, Midwestern Univ, AZ
Mario Riera Romo, Univ of Toronto, Canada
Caitlin J. Risener, Emory Univ, GA
Lloyd Wei Tat Tang, National Univ of Singapore
Rulaiha E. Taylor, Rutgers Univ, NJ
Yik Pui Tsang, Univ of Washington, WA
Richa Tyagi, Mercer Univ, GA
Jingyuan Wang, Univ of Pittsburgh, PA
Xiaoxiao Yu, St. John's Univ, NY

Post-baccalaureate Members

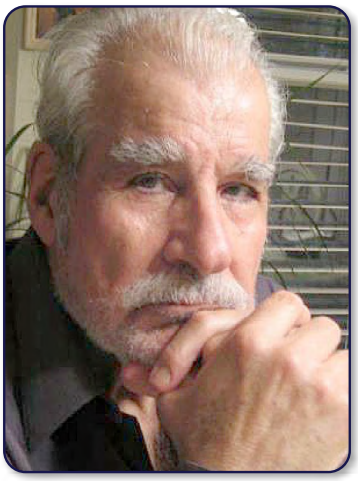
Yhon C. Angel Hernandez, Instituto Nacional de Medicina Legal y Ciencias Forenses, Colombia
Ligia A. Bello Benavides, Aruna Asesores, Colombia
Andres D. Escobar Roa, GSK, Colombia
Camilo J. Estrada Villarraga, Clinica Sahio, Colombia
Anthony Ferranti, Vanderbilt Univ, TN
Isabel Gallinger, Vanderbilt Univ, TN
Sandra L. Laverde Cubillos, Audifarma SA, Colombia
Jorge J. Parra Camacho, COLMEDICA, Colombia
Roland M. Rodriguez, Vanderbilt Univ, TN

Undergraduate Student Members

Bowei Deng, Emory Univ, GA
Isaac E. Kaba, Univ of Toledo Coll of Pharmacy & Pharmaceut Sci, OH
Sarah Kassis, Kent State Univ, OH
Karolina Kopyonkina, Univ of Kentucky
Taraneh Mousavi, Tehran Univ of Med Sci, Iran
Sophia A. Pellechia, Villanova Univ, PA
Omaris Velez Acevedoc, Univ of Puerto Rico

Kadhim Nouri Salman, PhD (1929 – 2021)

Submitted by Ayser Salman, Zaid Salman, and Lameace Salman



We are saddened to announce the passing of Dr. Kadhim Nouri Salman on October 3, 2021. He was 92.

Kadhim's journey with pharmacy and pharmacology started in the mid 1950's when he left his home country of Iraq to study in the United States. He received his master's degree in pharmacology from the University of Michigan (where his son would later go to school to get his bachelor's degree), and he followed with his PhD in pharmacology from the University of Maryland. He was the first Iraqi to get a PhD in pharmacology. After he received his doctorate in the mid 1960's, he turned down a position with NASA in favor of returning to Iraq to educate pharmacy students at the University of Baghdad.

In the early 1970's, he returned to the United States with his wife and young children to work in academic research, first at Ohio State University and then at the University of Kentucky. Following that, in 1979, he went to Saudi Arabia to establish a graduate program for the pharmacy school at the King Saud University in Riyadh. After 6 years there, he returned to the University of Kentucky to continue academic research.

During his career as a college professor, Kadhim personally mentored and educated several hundred students. Many of his students went on to get their own doctorate degrees in pharmacology, working both in academics and in industry, and they cited him as the direct influence for them pursuing that path. Some of his students who went on to teach even modeled their own teaching methods after him and his style.

In the late 1990's, he obtained his pharmacy license in Nevada and then Texas, and then in early 2000 he settled down in Austin and spent the next 18 years dedicating his time serving the veterans at the Veteran's Administration hospital and clinic until he retired at age 89.

Kadhim continued to work his job despite having a chronic heart condition and later a bout with cancer at age 82. Before the start of his cancer treatment, his oncological team warned him that the chemotherapy might be worse for him than the actual cancer, but he wouldn't listen. He went through chemotherapy like it was a walk in the park and spent the next ten years living life as if cancer had never touched him.

He was an unshakable optimist. Nothing ever got to him, he took nothing personally, and his default presumption was that everything would be okay. He often quoted from the 1998 song "Don't Worry, Be Happy" by Bobby McFerrin whenever he was faced with a challenge or difficult situation. In his personal life, he was an avid student of world politics. In the days before YouTube and Facebook, he would spend hours listening to global news broadcasts on his shortwave radio. He knew the intricate goings-on of practically every nation in the world. He was also a skilled calligrapher, creating flowing scripts with Arabic lettering.

His family, friends, and peers remember him with pride, gratitude, and honor. He is survived by his wife, Jenan Al-Yazdi Salman, and his three children, Ayser, Zaid, and Lameace.

A Tribute to Dr. Edward Domino

Submitted by Margaret E. Gnegy, PhD

On November 3, 2021, Edward Felix Domino, MD, a giant in the field of clinical neuropsychopharmacology, died at the age of 96. At the time of his death, Ed was an active professor emeritus in the Department of Pharmacology at the University of Michigan. I stress active, because until he could no longer hold a pen or conduct a sustained conversation, Ed was focused on neuropsychopharmacology research. He was one of the most remarkable and dedicated scientists I have ever known. Ed was a Regular member of ASPET from 1953-1988 and then was an Emeritus member until his death.

Ed was born in Chicago in 1924. During World War II, he served as an Electronic Technician's Mate First Class on the USS Pittsburgh and fought in the Pacific theater. He was justifiably proud of being awarded two battle stars and two ribbons for raids and campaigns in the Pacific. No doubt his knowledge of the military contributed to his service as Consultant to Commander, U.S. Army Medical Research and Development Command in Fort Detrick, MD, from 1979-1982. He had security clearances from the U.S. Army, Navy and Air Force. Shortly after I began my tenure at the University of Michigan, he explained to me that he was performing classified research on soman and sarin.

After the war, he earned BS degrees (1948, 1949, pre-medicine), an MS (pharmacology, 1951) and an MD (1951) from the University of Illinois. In 1953, he began a long and productive career as a scientist and educator at the University of Michigan, Ann Arbor, which extended well past his transition to active emeritus status in 1999. In addition to being a Professor at the University of Michigan, Ed also began to work at a hospital for the mentally ill, the Lafayette Clinic, in Detroit in 1957. He served as Director of the Laboratory of Pharmacology and of the Michigan Neuropsychopharmacology Research Program from 1967-81 and Director of Clinical Psychopharmacology from 1981-83. From 1984-86, he was a clinical professor in the Department of Psychiatry at Wayne State University School of Medicine.

Ed's neuropharmacological research was applicable to the fields of anesthesiology, gerontology, neurology, psychiatry, and toxicology. In 1965, Ed published a landmark study: the first investigation of the pharmacodynamic effects of ketamine (CI-581) in humans[1]. He found that ketamine induced a powerful analgesia and short-term anesthesia. He suggested the drug be called a "dissociative anesthetic", but credits his wife, Antoinette (Toni), with conferring the term[2]. By the 1970s he had worked out a mass

spectrometry assay to measure ketamine. For a recent teaching video clip of Ed discussing the discovery of ketamine as a faster-acting antidepressant alternative and the need to "tame the ketamine tiger" see: https://www.med.umich.edu/mva/library.html. Perusal of Ed's long curriculum vitae reveals that there is not a psychoactive drug left unexplored. His basic and clinical research probed most psychoactive drugs (opioids, tobacco, anesthetics, hallucinogens, marijuana, and alcohol) and neurophysiological and disease states (anesthesia, analgesia, sleep, smoking, Parkinson's disease, epilepsy, and schizophrenia). Ed did not worry about getting all of his papers in *Cell, Science,* or *Nature*. As a professor in the truest sense of the word, he was more interested in disseminating information and contributing to science.

Ed professed as an author in his numerous publications and as an educator and mentor of students and faculty. His curriculum vitae lists over 900 publications when one counts peer-reviewed articles (~379), book editorships (~20), book reviews, chapters, letters to journals and newspapers (~195), and abstracts (~400). Quite a few of his papers were published in the *Journal of Pharmacology and Experimental Therapeutics*. Ed was as prolific and dedicated to teaching as he was to writing. Throughout his whole career he was devoted to the teaching of pharmacology to medical, pharmacy, dental, and graduate students. A classic example of Ed's highly interesting human teaching demonstrations is shown in this video, "Pharmacology of Tobacco Smoking" on YouTube.

In the 1950s, he began training pharmacology students from Japan and continued his collaboration with Japanese scientists until his death. As recently as two years ago, he was running research courses for medical students and mentoring a Master's student in the Department of Pharmacology. He also helped educate many young faculty, including me, in the knowledge and joys of neuropharmacology. Ed will be remembered by generations of students and faculty for his unbounded and infectious enthusiasm for pharmacology and research in general.

Here is a story that sums up the quintessential Ed Domino as told by a former UM pharmacology student, Dr. Timothy Geary. "One [story] that deeply affected me was told by Dr. Domino in neuropharmacology seminar in 1976. He got a bit off topic, not an unusual event, and related a story from his days as a medical intern/resident/researcher at Illinois. A woman who had inadvertently been given an enormous overdose of morphine for post-partum pain was doomed, but Dr. Domino had been working on an investigational new drug, naloxone. He told us he raced to get, came back, and administered it to the woman, who promptly revived, saved from death. He told us that was the moment he realized he needed to devote himself to pharmacology. He had tears in his eyes as he recounted the story. 45 years later, I remember being inspired. I had made the right choice and had enrolled in the right department. His passion showed me that what we do, as demanding as it sometimes may be, is a vocation and not a job."

Ed was honored at the University of Michigan with the naming of the Edward F. Domino Lecture in Consciousness Science in 2016, the Edward F. Domino Research Professorship in 2017, and the Edward F. Domino Research Center in 2018. Ed was preceded in death by his wife Toni in 2002. They were blessed with 5 children, 10 grandchildren and 4 great-grandchildren.

1 Domino EF, Chodoff P, Corssen G., Pharmacologic effects of Cl-581, a new Dissociative anesthetic, in man. Clin Pharmacol Ther. 1965 May-Jun;6:279-91

2 Domino EF. Taming the ketamine tiger. 1965. Anesthesiology. 2010 Sep;113(3):678-84

In Sympathy

ASPET notes with sympathy the passing of the following members:

Edward F. Domino, MD

Kadhim N. Salman, PhD

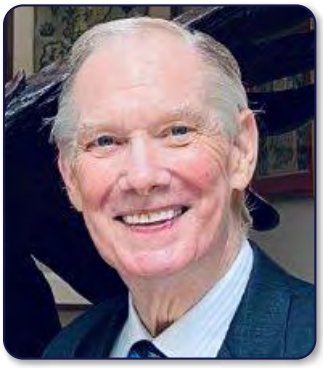
Mitsuhiro Yoshioka, MD, PhD

Members in the News

Achievements, Awards, Promotions, and Scientific Breakthroughs

V. Craig Jordan, PhD

University of Texas MD Anderson Cancer Center



V. Craig Jordan, PhD, recently received the 2021 Golden Goose Award. The American Association for the Advancement of Science (AAAS) established "The Golden Goose Award" (i.e., Lays the golden eggs!) to recognize the work of those funded by federal grants that advanced society by economic growth and, in Dr. Jordan's case, improved women's health and saved millions of women's lives. The Golden Goose ceremony occurred September 22, 2021[1].

Dr. Jordan's original laboratory translational research resulted in clinical trials that established tamoxifen becoming the first long-term targeted therapy (to the breast tumor estrogen receptor) for all stages of breast cancer and the first FDA approved chemo-preventive therapy for any cancer[2].

Dr. Jordan's laboratory discovery of selective estrogen receptor modulators (SERMs) with two SERMs, tamoxifen and the failed breast cancer medicine keoxifene (to eventually be renamed raloxifene), resulted in his publication of a "road map" for the pharmaceutical industry to follow[3]. He documented that the SERMs switch on or switch off estrogen target issues around the female body: the ideal SERM would build bone, reduce cholesterol and heart attacks, prevent breast cancer, and reduce the risk of endometrial cancer. There are now five FDA approved SERMs, each with discovery links to Dr. Jordan's laboratory[4].

Dr. Jordan's work was supported by $30 million worth of federally funded grants and critical support by philanthropy from the Susan G. Komen Foundation, The Lynn Sage Foundation (Chicago), and The Avon Foundation ($35 million).

In addition to the Golden Goose Award, in celebration of the 50th anniversary of the passing of the National Cancer Act, Dr. Jordan was recognized by the National Cancer Institute as an individual whose research contributions propelled progress in preventing cancer and saving lives.

Dr. Jordan has been a member of ASPET since 1981 and is a member of the **Divisions for Molecular Pharmacology**, **Drug Discovery and Development**, **Drug Metabolism and Disposition**, **Pharmacology Education**, **Toxicology**, and **Translational and Clinical Pharmacology**.

1 Jordan VC (2021) Turning scientific serendipity into discoveries in breast cancer research and treatment: a tale of PhD students and a 50-year roaming tamoxifen team. *Breast Cancer Research and Treatment* doi: https://doi.org/10.1007/s10549-021-06356-8.

2 Jordan VC (2021) 50th anniversary of the first clinical trial with ICI 46,474 (tamoxifen): then what happened? *Endocr Relat Cancer* 28(1):R11-R30.

3 Lerner LJ and Jordan VC (1990) Development of antiestrogens and their use in breast cancer. *Cancer Res* 50:4177-4189.

4 Maximov PY, Lee TM, Jordan VC (2013) The discovery and development of selective estrogen receptor modulators (SERMs) for clinical practice. *Curr Clin Pharmacol* 8:135-155.

S. Niru Nirthanan, MBBS, PhD, FRCPE

Griffith University

S. Niru Nirthanan, MBBS PhD FRCPE, is the Deputy Head for Education in the School of Pharmacy and Medical Sciences, and Discipline Lead for Pharmacology in the School of Medicine and Dentistry in the Griffith Health Group at Griffith University, Queensland, Australia. After graduating MBBS, he completed his PhD in pharmacology and biochemistry at the National University of Singapore (2002) and postdoctoral fellowship as the Alice and Joseph Brooks Fellow in Neurobiology at Harvard Medical School, Boston (2002-2006). He was elected Fellow of the Royal College of Physicians of Edinburgh in 2020.

Prof. Nirthanan has been awarded the 2021 Rang Prize for Clinical Pharmacology by the British Pharmacological Society. This prestigious international award, named in honor of Prof. Humphrey Rang, eminent pharmacologist and author of the widely used textbook *Rang & Dale's Pharmacology*, recognizes sustained excellence in the teaching of the discipline of pharmacology. His award was presented at the BPS Pharmacology 2021 Conference held in September 2021.

His interests in teaching scholarship have focused on future-ready program design, technology-enabled education, capstone experiences, student transitions to medical school, students-as-partners in curriculum design, and service-learning and humanities in health professions education.

Prof. Nirthanan has been a member of ASPET and the **Division for Pharmacology Education** since 2005. He was elected Fellow of the ASPET Academy of Pharmacology Educators in 2021 and also serves in the division's executive committee. He is also a member of the **Divisions for Drug Discovery and Development**, **Molecular Pharmacology**, and **Neuropharmacology**.

Shankar Munusamy, PhD

Drake University College of Pharmacy and Health Sciences

Shankar Munusamy, PhD, is the 2020-2021 recipient of the Hartig Distinguished Professor Award. The Hartig Distinguished Professor Award is awarded annually by the Dean of the Drake University College of Pharmacy and Health Sciences to recognize a faculty member who has distinguished him/herself in teaching, scholarship, service, or practice. This monetary award is designed to recognize uniqueness, innovation, and creativity.

Dr. Munusamy is an associate professor at the Drake University College of Pharmacy and Health Sciences. He received his PhD in pharmacology from the University of Arkansas for Medical Sciences and holds a bachelor's degree in pharmacy and a master's degree in pharmacology from India. He utilizes innovative and evidence-based teaching methods and teaching technologies in his pharmacology courses. He is also recipient of the Teacher of the Year Award (2019-2020) from the Drake University College of Pharmacy and Health Sciences. His educational research focuses on 1) assessing the effectiveness of mnemonics (memory aids) in promoting knowledge retention and applying pharmacological concepts into clinical scenarios, and 2) the impact of mindfulness sessions and weekly wellness messages on reducing perceived stress and improving resilience among pharmacy students.

Dr. Munusamy has been a member of ASPET since 2013 and is a member of the **Divisions for Translational and Clinical Pharmacology**, **Cancer Pharmacology**, **Drug Discovery and Development**, **Molecular Pharmacology**, **Pharmacology Education**, and **Toxicology**.

Najam Sharif, PhD, DSc

Santen Inc, USA

Najam Sharif, PhD, DSC, was elected to the Scientific Advisory Board of The Glaucoma Foundation in May 2021 and is the recipient of the Ernst H. Barany Prize from the International Society for Eye Research (ISER) for "outstanding contributions to ocular pharmacology" in June 2021.

Dr. Sharif has over 34 years of pharmaceutical research and development experience in neuroscience and ophthalmology. Dr. Sharif is a Gold Fellow of AOPT, ARVO, and British Pharmacological Society, and has received the Dr. Roger Vogel Award and the Sir James Black Award for contributions to research and drug discovery. Dr. Sharif has published over 215 papers and has had 24 patents issued.

Dr. Sharif has been an ASPET member since 2010 and is a member of the **Divisions for Drug Discovery and Development**, **Molecular Pharmacology**, **Neuropharmacology**, and **Translational and Clinical Pharmacology**.

Paul V. Kaplita, PhD

Massachusetts College of Pharmacy and Health Sciences

Paul V. Kaplita, PhD, was promoted to Professor of Pharmaceutical Sciences at the Massachusetts College of Pharmacy and Health Sciences, Worcester/Manchester on July 1, 2021. He was also appointed Assistant Dean of Graduate Studies on November 1, 2021.

As a postdoc, Dr. Kaplita performed toxicology studies on sodium azide and organonitriles. His tenure in pharmaceutical industry research and development included HTS assays, pharmacological characterization of natural products, and ADME-PK profiles of hit-to-lead compounds. As Professor of Pharmaceutical Sciences at MCPHS, Dr. Kaplita teaches pharmacology, pathophysiology, and translational medicine, and offers opportunities for research.

Dr. Kaplita has been an ASPET member since 1991 and is a member of the **Divisions for Drug Discovery and Development**, **Pharmacology Education**, and **Toxicology**.

Saganuwan Alhaji Saganuwan, PhD

Federal University of Agriculture Makurdi, Nigeria

Saganuwan Alhaji Saganuwan, PhD, was promoted to the rank of Professor of Pharmacology and Toxicology at the Federal University of Agriculture Makurdi, Nigeria.

Dr. Alhaji Saganuwan obtained his DVM, MSc (Pharmacology), PhD (Pharmacology), PGD (Science Education), and PGD (Statistics) in 1998, 2004, 2012, 2015, and 2011, respectively. He started his lecturing career in 2005, rose through ranks, and was promoted to Professor of Pharmacology and Toxicology in 2019. He has supervised over ten master and doctoral theses in the fields of pharmacology and physiology, with over 100 published articles in journals of high repute 721 article citations, and has an h index of 14. His areas of research interest are pharmacokinetics, oncology, medicinal chemistry, toxicology, clinical pharmacology, and mathematical pathology. He was head of department for 2 1/2 years and was the college registration officer for 6 years. He has presented conference papers in the U.K., United States, Australia, Japan, China, India, and Cyprus, among others.

Dr. Alhaji Saganuwan has been a member of ASPET since 2015 and is a member of the **Divisions for Translational and Clinical Pharmacology**, **Behavioral Pharmacology**, **Cancer Pharmacology**, **Drug Discovery and Development**, **Drug Metabolism and Disposition**, **Neuropharmacology**, and **Toxicology**.

Division News

2022 Division Elections

The 2022 election includes nominees for ASPET Council (president-elect, secretary/treasurer-elect, and councilor), as well as officers from the Division for Cancer Pharmacology (DCP), Division for Drug Discovery and Development (DDD), Division for Drug Metabolism and Disposition (DMDD), Division for Molecular Pharmacology (MP), Division for Neuropharmacology (NEU), Division for Translational and Clinical Pharmacology (TCP), and Division for Toxicology (TOX). The election will open on January 5, 2022 and eligible voting members will receive an email with instructions.

Division for Cancer Pharmacology

Nominee for Chair-Elect

William J. Placzek, PhD
Associate Professor, Department of Biochemistry and Molecular Genetics, University of Alabama at Birmingham

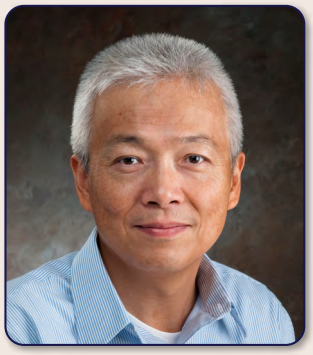
Nominees for Secretary/Treasurer-Elect

Lawrence Boise, PhD
R. Randall Rollins Chair in Oncology and Professor, Department of Hematology and Medical Oncology, Emory University School of Medicine and Associate Director of Education and Training, Winship Cancer Institute of Emory University

Sanjay K. Srivastava, PhD
Distinguished Professor and Chair, Department of Immunotherapeutics and Biotechnology, Texas Tech University Health Sciences Center

Division for Drug Discovery and Development

Nominee for Chair-Elect



Xiaodong Cheng, PhD
Walter and Mary Mischer Distinguished Professor in Molecular Medicine, Department of Integrative Biology and Pharmacology, The University of Texas Health Science Center, Houston

Nominee for Secretary/Treasurer-Elect

Francis S Willard, PhD
Research Advisor and Group Leader, Eli Lilly and Company

Division for Drug Metabolism and Disposition

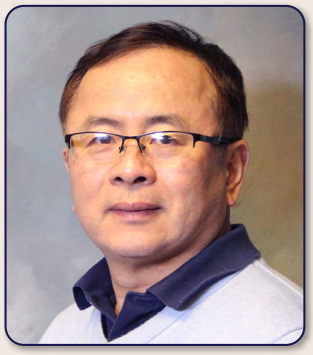
Nominees for Chair-Elect

Hyunyoung (Young) Jeong, PhD, PharmD
Professor, Departments of Industrial and Physical Pharmacy (IPPH) and Pharmacy Practice (PHPR), College of Pharmacy, Purdue University

Bhagwat Prasad, Ph.D.
Associate Professor, Department of Pharmaceutical Sciences, Washington State University

Nominees for Secretary/Treasurer-Elect

Julie M. Lade, PhD
Principal Scientist, Pharmacokinetics & Drug Metabolism, Amgen Inc.



Baitang Ning, MD, PhD
Senior Scientist, US Food and Drug Administration

Division for Molecular Pharmacology

Nominees for Chair-Elect

Maurine E. Linder, PhD
Professor and Chair, Department of Molecular Medicine, Cornell University

Rennolds Ostrom, PhD
Professor, Chapman University School of Pharmacy

Nominees for Secretary/Treasurer-Elect

Roshanak Irannejad PhD
Assistant Professor, Department of Biochemistry and Biophysics, Cardiovascular Research Institute, University of California, San Francisco

Matthew Torres, PhD
Associate Professor, Georgia Institute of Technology

Division for Translational and Clinical Pharmacology

Nominee for Chair-Elect

D. Adam Lauver, PhD
Assistant Professor, Department of Pharmacology and Toxicology, Michigan State University

Nominee for Secretary/Treasurer-Elect

Traci Czyzyk, PhD, MBA
Principal Scientist, Merck Research Laboratories

Division for Neuropharmacology

Nominees for Chair-Elect

Shaifali Bhalla, PhD
Associate Professor of Pharmaceutical Sciences, College of Pharmacy Midwestern University

Venetia Zachariou, PhD
Professor, Nash Family Department of Neurosciences, Department of Pharmacological Sciences, Friedman Brain Institute, Icahn school of Medicine, Mount Sinai

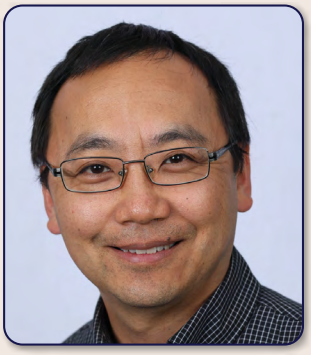
Nominee for Secretary/Treasurer-Elect

Erin Bobeck, PhD
Assistant Professor, Utah State University

Christopher Olsen, PhD
Associate Professor, Medical College of Wisconsin

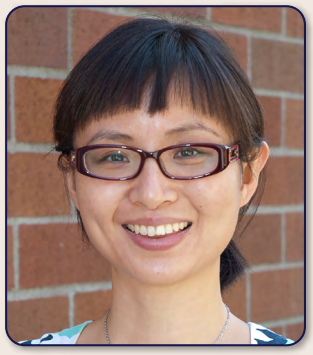
Division for Toxicology

Nominee for Chair-Elect

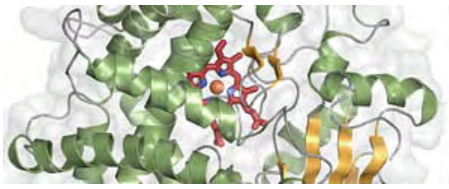


Qing Ma, PharmD, PhD
Associate Professor, Director of Translational Neuropharmacology Group, Department of Pharmacy Practice, University at Buffalo

Nominee for Secretary/Treasurer-Elect



Julia Cui, PhD, DABT
Associate Professor, University of Washington



Drug Metabolism & Disposition
a division of ASPET

Reflecting on Past and Present Innovations in the Study of Drug Metabolism and Transport: An Interview with Dr. David Rodrigues, PhD

Submitted by Lindsay Czuba and Andrew Rowland

David has been in the pharmaceutical industry for 31 years and currently holds the title of Senior Scientific Director as head of the Transporter Sciences Group at Pfizer (Groton, CT, USA). Before joining Pfizer in 2014, he spent productive periods at other US-based pharmaceutical companies (Searle, Abbott Labs, Merck, and Bristol-Myers Squibb). During that time, he served on both scientific and managerial ladders. He has authored 175 peer-reviewed manuscripts, presented >80 seminars, and served on the editorial boards of various DMPK-related journals. In addition, he has edited/co-edited four DMPK-related textbooks. Presently, he serves as adjunct professor at the College of Pharmacy, University of Rhode Island. In 2009, David was inducted as Fellow of The American Association of Pharmaceutical Scientists (AAPS). He is the recipient of the 2021 Distinguished Accomplishments in Drug Discovery & Development Award bestowed by the International Society for the Study of Xenobiotics (ISSX).

Over the past few decades in vitro tools to investigate drug metabolism and drug transport have expanded. What do you feel has been the most significant innovation and what do you think needs to be improved upon?

DR: Significant advances have been driven by multiple innovations integrated over time. For example, the drug metabolism in vitro tool kit only really took off in the 1990s with the advent of microtiter plate technology, automation, and the increased availability of tandem LC/MS-based detection methods. The widespread availability of human tissue-derived cryopreserved cells and subcellular fractions also helped considerably. Presently, numerous labs are developing microphysiological (chip-based) systems supporting the study of human tissue function in vitro under more dynamic (flow) conditions. However, beyond cryopreserved human primary hepatocytes, the availability of fully validated human primary enterocytes and renal proximal tubule epithelial cells is limited. Only with the greater availability of different primary cell types will the vision of "multi-organ on a chip" be realized. Perhaps stem-cell approaches, once matured further, can be leveraged to circumvent the need for donor tissue.

What are the biggest challenges when it comes to assessing phenotype and DDI risk for transporters? How can the use of endogenous biomarkers for transporters complement current methods?

DR: Transporter in vitro-to-in vivo extrapolations are challenging because of the complex nature of the DDI/phenotyping and many uncertainties regarding the projection of human PK prior to first-in-human dosing. Consequently, agencies are very conservative and have proposed low thresholds for DDI risk. Therefore, most pharmaceutical companies are managing portfolio compounds that present a DDI risk but know that many will register as false positives clinically. Embedding plasma- and urine-based transporter biomarkers in Phase I studies supports the quick de-risking of DDI liabilities. Examples

include plasma coproporphyrin I (liver OATP1B1/3), plasma isobutyl-L-carnitine (liver OCT1), plasma/urine N^1-methylnicotinamide (renal OCT2/MATEs) and pyridoxic acid (renal OAT1/3). If a compound modulates one or more of these biomarkers in a Phase I study, then targeted DDI studies with probe drugs can be prioritized [Clin Pharmacol Ther. (2018) 103:434]. If biomarkers are not impacted, then there is no need for clinical follow up.

What advice would you give graduate students and postdocs interested in an industry career in DMPK?

DR: This is a difficult question that I get asked a lot. It is challenging since each individual person that I engage with needs to be respected because of their unique circumstances, experiences, aspirations, and career path. In general terms, I have experienced that a career in the pharmaceutical industry is very rewarding. One gets to discover and develop important medicines while doing great state-of-the art DMPK science. But not every pharmaceutical company is the same. I have experienced many different organizational constructs, cultures, visions, charters, etc. Therefore, when young DMPK scientists consider their options, they must do their homework. Even if you are not ready to job hunt, network (conferences, meetings, LinkedIn, etc.) and find out about the culture of different companies and ask many questions. Who are the key players in each company? Do they publish? Are they visible? When you get a job interview, always remember that the interviews are two-way events. Candidates also "interview" the company too. Be passionate about the science you are doing, project it, but always make it relevant. You are more than a list of techniques and projects on your resume. You are whole person with a brand. Ask yourself these questions: What is my brand? What kind of person am I? How do I solve problems? How effective am I in a matrix environment and can I positively influence others without authority? Am I open to feedback and mentoring? How effectively do I communicate ideas, concepts, hypotheses to others?

Are there any new scientific advancements or trends that you are excited about and find promising?

DR: Without a doubt the advent of extracellular vesicle (EV)-based liquid biopsy is at the top of my list right now. The fact that EV are shed by different organs into the blood and can be isolated is very exciting. Pfizer is working with Flinders University (Dr. Andrew Rowland) to develop EV-based approaches, as "liquid biopsy", to support subject phenotyping and DDI assessment. For example, it is possible to profile enzymes such as CYP3A4 in plasma-derived liver EV before and after dosing with an inducer [Clin Pharmacol Ther. (2021) 110:248]. It is also possible to relate EV enzyme expression and activity to a subject's P450 genotype (e.g., CYP2D6 and CYP3A5). Ultimately, the marriage of EV-based and small molecule ADME biomarkers (as described above for transporters) will revolutionize the execution of Phase I studies. Especially if the methods are multiplexed, automated, and miniaturized! Secondly, the study of remote sensing (inter-organ communication or "crosstalk") via the circulatory EV will emerge. There is already evidence that donor cells shed EV and transfer their cargo to recipient cells. Imagine such a scenario across multi-organ axes! I am predicting that the science of remote sensing will go mainstream within the PK-ADME community [Drug Metab Dispos. (2021) doi: 10.1124/dmd.121.000411; Clin Pharmacol Ther. (2019) 105:1407; Int J Mol Sci. (2019) 20:6178].

Chapter News

Canadian Society of Pharmacology and Therapeutics (CSPT)

From the New CSPT President: Leading Leaders Towards a Common Goal

Submitted by Bruce Carleton, FCP, FISPE

Maybe you are wondering, "who is the president and what is he planning for CPST?" I think it's more important to ask, "who are the Leaders within CSPT and what are they planning?" Jeswald Salacuse wrote a terrific book (*Leading Leaders*) that I think is particularly pertinent for my first column as president for CSPT's newsletter. The objective of Salacuse's book was to note that great leaders do less leading and more co-leading than less-than-great leaders. "Whether your leadership is innate or thrust upon you, you're in for a whole new set of challenges when managing other leaders. Think of the qualities that have brought you to a leadership role: your vision, confidence, and charisma, or perhaps your experience, unique skills, expertise, or network of powerful allies. Now remind yourself that other leaders share some or all of these qualities with you. The potential contributions of these elites to any organization are vital, but the likelihood of friction is also high if you don't manage relationships carefully. In any case, they are people with significant resources – and strong opinions."

I suppose one way to "manage" these strong opinions is to control them. To ask for help if and when I want an opinion. But this isn't keeping with the mandate of either CSPT or of science. Here I am speaking of the importance of ***collaboration.*** Instead, we will all be working together - that includes YOU, our members at large, CSPT's Board of Directors and its Executive Committee – to advance our organization to be even more successful in the future.

My goal in leading CSPT these next two years is to share the leadership of the organization with others. We will focus our attention on seven things:

1. **Direction.** We will negotiate a common vision for CSPT.
2. **Integration.** We will make all the stars of CSPT into a team focused on our common vision.
3. **Mediation.** We will resolve conflicts over turf and power that may arise.
4. **Education.** We will educate each other, even though we are highly-educated people.
5. **Motivation.** We will move our leaders to do the right thing for CSPT.
6. **Representation.** We will lead our members while co-leading each other.
7. **Create Trust.** We will gain and keep each others' trust, the vital capacity our Society depends on.

So who are the Leaders of CSPT? They are the workhorses of the organization and run the Committees.

CSPT Leadership

Education – Fabiana Crowley
fabiana.crowley@schulich.uwo.ca
Publications – Dylan Burger
dburger@uottawa.ca
Awards – Abby Collier
abby.collier@ubc.ca
Scientific Program – Thomas Velenosi
thomas.velenosi@ubc.ca
Outreach – Bruce Carleton
bcarleton@popi.ubc.ca
ASPET Liaison – Kerry Goralski
kerry.goralski@dal.ca
History – Michael Rieder
mrieder@uwo.ca
Finance – Don Miller
donald.miller@umanitoba.ca
COVID19 – Antonios Diab
antonios.diab@dal.ca
Nominations – Kerry Goralski
kerry.goralski@dal.ca

Want to get involved with CSPT? Not sure where to land? Unclear what a committee does? Contact the leaders and ask your questions or express your interest in joining us. Not sure if you have time? Interview them and find out what they are doing and where their committee is going. Ask about committee meeting frequency and what committee members are expected to do.

This is OUR organization - meaning that YOU have an important role in where we are going. Get involved. Help us lead.

Mid-Atlantic Pharmacology Society (MAPS)

MAPS 2021 Annual Meeting in Review

The Mid-Atlantic Pharmacology Society (MAPS) held its 2021 annual meeting on October 29 in a virtual format. The meeting's theme was ion channel pharmacology and started with a keynote lecture from **Dr. Lori Isom**, University of Michigan. Dr. Isom's talk focused on voltage-gated sodium channel mutations associated with Dravet syndrome and the development of novel pharmacotherapies for this disorder. Featured invited talks from **Dr. Tibor Rohacs**, Rutgers New Jersey Medical School, and **Dr. Vera Moiseenkova-Bell**, University of Pennsylvania, explored different aspects of TRP channel structures and functions, highlighting field advances that can improve therapeutic development for disorders such as chronic pain and epilepsy.

MAPS is committed to supporting trainees and was pleased to invite three graduate students, **Daniel Farkas** (Temple University), **Taylor McCorkle** (Drexel University), and **Jason Wickman** (Drexel University), to give short research presentations.

Each was invited to speak based on the quality of their submitted abstracts. Twenty other abstracts were submitted by research trainees and each produced a short video poster presentation that meeting attendees (and poster judges) could view online from October 26 through 29. A selection of publicly available videos is currently viewable at the MAPS YouTube channel (https://bit.ly/3F1kbpn). Six trainees were honored for the quality of their presentations: **Richa Pande** (Drexel University), **Saba Ghodrati** (University of Texas at San Antonio), **Sarah Uribe** (Rowan University), and **Nicole Hinds** (Rowan University) all tied for third place, **Christina Besada**

(Drexel University) earned second place, and **Shreya Kelshikar** (Rowan University) earned first place.

During the meeting, **Dr. Bradford Fischer** was recognized for his leadership as President of MAPS from 2019-2020. **Dr. Michael White** of Drexel University was honored with the George B. Koelle Award, an annual distinction given to a regional scientist who demonstrates profound commitment to teaching, fondness for encouraging students, excellence in research, and strong devotion to the science of pharmacology. Dr. White regaled meeting attendees with anecdotes about Dr. Koelle, his devotion to pharmacology, and his talent for trivia.

Overall, 46 presenters and attendees experienced a diverse array of exciting research. MAPS leadership and members are looking forward to an in-person meeting next year! Stay tuned for details on a spring Biotech Roundtable hosted by MAPS and ASPET. Thank you to all our attendees and presenters, and to ASPET for financial and technical support! This meeting was planned and executed with the collective efforts of MAPS officers and councilors (President Thomas Keck; Vice-President Kyle Palmer; Past-President Bradford Fischer; Treasurer Linda Console-Bram; Secretary Catherine Moore; and Councilors Seena Ajit, Carol Beck, Julie Blendy, Amada Fakira, Marlene Jacobson, and Ellen Unterwald). Please join us on social media at @MAPS_ASPET on Twitter and on LinkedIn!

See you next year!

Great Lakes Chapter (GLC)

GLC 2021 Annual Meeting in Review

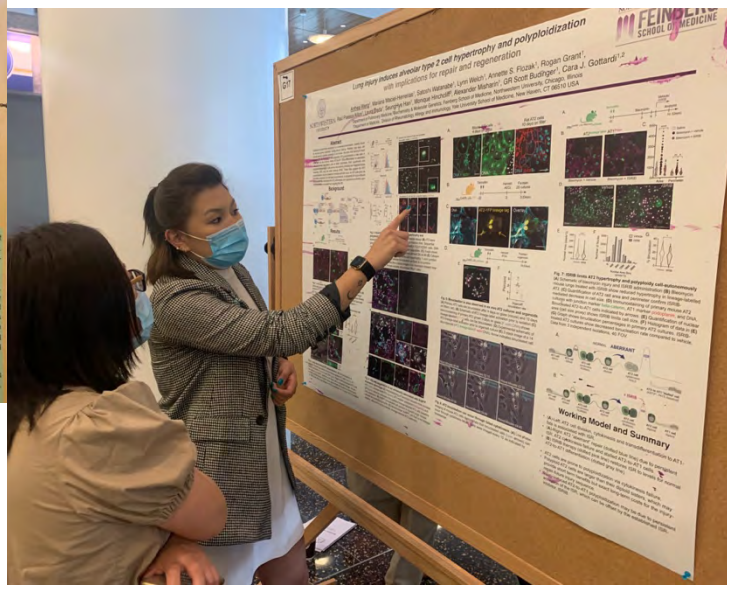
COVID-19: Therapeutics, Diagnostics, and Surveillance

The Great Lakes ASPET chapter (GLC-ASPET) hosted its 34th annual symposium on August 27, 2021 with the theme: COVID-19: Therapeutics, Diagnostics, and Surveillance. The goal of the 2021 meeting was to highlight recent advances in our understanding of the prevalence, prevention, and treatment of COVID-19 and discuss technological advances related to diagnosis and testing. Our intent was to provide a forum for students, postdoctoral fellows, and scientists working in this and related areas to participate and engage in fruitful discussions with colleagues in the field. The annual meeting of the GLC of ASPET has historically provided an excellent 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 Great Lakes region of the Midwest.

The symposium was held as an in-person conference at the Simpson Querrey Auditorium and the adjacent atrium at Northwestern University Feinberg School of Medicine. The in-person meeting took considerable organization, preparation, and care to accommodate social distancing, testing, and vaccination recommendations, and it was gratifying that the meeting was completed without any significant logistical and health issues. Fittingly, the focus of this year's meeting was on COVID-19 and covered a series of topics on many aspects of the devastating pandemic.

The meeting began with a poster session by trainees (postdocs, graduate students, and undergraduate students). The session attracted 35 posters covering a range of pharmacological topics from airway diseases to drug development. This was followed by a "Young Investigator" symposium featuring 15-minute talks from four outstanding young investigators. **Nir Drayman, PhD** (University of Chicago) began with an intriguing talk on a drug repurposing approach that led to the identification of a novel drug (masitinib) which blocked replication of SARS-CoV-2 in vivo. **Lamiaa El-Shennawy, PhD** (Northwestern University) followed with a fascinating presentation of a novel pathway involving exosome vesicles containing the ACE2 receptor and their therapeutic utility in blocking SARS-CoV-2 infection by serving as a decoy for the virus. The third talk by **Lisa Volpati** (University of Chicago) discussed antigen formulation in COVID-19 vaccines, and the influence of surface display on the efficacy

GLC Poster Session



of the vaccines. Specifically, the use of nanoparticle polymer vesicles markedly enhanced neutralizing antibody production suggesting a new therapeutic approach to enhance vaccine efficacy. The final talk by **Lucy Zhang** (University of Illinois, Chicago) discussed the engineering of a high affinity ASCE peptide whose introduction in vivo therapeutically mitigated lung vascular injury and mortality. Together, these talks offered a number of intriguing avenues for therapeutics against COVID-19 that could also be broadly applicable to other airway diseases and beyond.

The young investigator symposium was followed by a special symposium seminar presented by **Shihai Huang, PhD**, Senior Director at Abbott Labs, who spoke about the challenges and trends in the development of technologies for COVID-19 diagnostics. Multiple testing approaches have been brought to the market in the last year for detecting SARS-CoV-2 nucleic acid and proteins and Dr. Huang addressed the use of various modalities involving targeted biomarker, test performance, and procedures that are needed to address the diverse diagnostic needs for detecting SARS-CoV-2. He emphasized that in the era now where society has to live with SARS-CoV-2 for an extended length of time along with other seasonal respiratory viruses, a multiplex molecular testing regimen will be critical for the foreseeable future to ensure proper patient management.

The keynote symposium was given by **GR Scott Budinger, MD**, chair of the division of Pulmonary and Critical Care Medicine, Northwestern University. Dr. Budinger spoke on pathobiology and treatment of SARS-CoV-2 pneumonia and discussed his team's findings from a recent study where they directly sampled lungs from 88 patients with COVID-19 and who were on ventilators and compared results to lungs from 211 patients with peneumonia arising from other pathogens. This analysis revealed that the pathobiology of SARS-CoV-2 pneumonia substantively differed from patients with pneumonia from other pathogens. Specifically, alveolar macrophages harboring the SARS-CoV-2 virus expressed molecules associated with the recruitment and activation of T cells in the alveolar space, which led to further activation of the SARS-CoV-2 containing macrophages. His results suggested a self-sustaining, slowly propagating inflammatory circuit between alveolar macrophages and T cells that explains the slow and sometimes severe time course of COVD-19 and suggested important opportunities for therapy.

The next talk of the symposium by **Dr. Tony Haight, PhD**, AbbVie Inc, addressed the lessons learned from prevailing efforts to develop therapeutics against COVID-19. Hie highlighted some of the prevailing approaches on development of antiviral drugs targeting viral replication and the future directions that industry is pursuing.

Karen Teri, DVM, PhD, clinical professor and chief of the Zoological Pathology program at the University of Illinois, Chicago gave a fascinating presentation on the monitoring of emerging zoonoses and their current efforts focused on Cook County, IL but also spanning global surveillance in Africa. The majority of infectious diseases of concern for human health have wildlife reservoirs. She discussed the importance and necessity of surveillance for emerging zoonotic pathogens to help understand not only the role of migratory species in spreading infections, but also to understand individual species and ecosystems. The presentation highlighted ongoing efforts at disease monitoring in wildlife from around the globe to Illinois.

The next talk by **Alexis Demonbruen, PhD**, Northwestern University, discussed her group's findings using serological testing for antibodies and the information it has provided on the prevalence of COVID-19 in the Chicago area and the effects of vaccines. They recruited > 8000 participants to their study and measured IgG levels against the receptor binding protein of SARS-CoV-2. They found the prevalence of SARS-CoV-2 antibodies was about 7-fold higher than measured by viral testing, consistent with a number of worldwide studies indicating that the prevalence of COVID-19 is likely much higher than officially reported numbers. Following the first dose of the vaccine, there was a modest increase in the anti-RBD IgG in those without a prior COVID-19 diagnosis. However, a second dose provided a robust IgG response which was about 10-fold higher than IgG levels obtained from non-hospitalized, natural SARS-CoV-2 infection. Additionally, women had significantly higher anti-RBD IgG responses to vaccination than men.

The last talk of the meeting featured **Egon Ozer, MD/PhD**, Northwestern University, who discussed his group's findings on monitoring of novel variants by genomic sequencing. Through whole-genome sequencing of SARS-CoV-2, his group is monitoring how viral variants have emerged in the Chicago area and throughout the last 18 months. Pairing the viral genome data with patient clinical data and laboratory studies allowed the group to determine how past and emerging variants differed in the severity of the diseases and their ability to evade the immune defenses of affected individuals.

The symposium was followed by poster prizes for the best posters selected by a panel of judges. The winners were: postdoc category: 1st place, **Dr. Mariana M Herrerias** (Northwestern University); 2nd place, **Dr. Emilce Artur de la Villarmois** (UIC); 3rd place, **Dr. Ines Pulido** (UIC). Graduate student category: 1st place, **Monica Yanni** (Rosalind Franklin University); 2nd place, **Rogan A. Grant** (Northwestern University); 3rd place, **Kenneth Horner** (Rosalind Franklin University). Undergraduate category: 1st place, **Alexis Cooper** (Saint Xavier University); 2nd place, **S. Dube**, (UIC); 3rd place, **Ian Q. Weigle** (University of Chicago).

All together, these symposium talks provided the audience with an amazing opportunity to hear from leading investigators using cutting-edge approaches to monitor, diagnose, treat, and develop novel therapeutics for SARS-CoV-2 infection. It was gratifying to see the talent and extraordinary efforts going into the management and treatment of this devastating pandemic, and offered great hope that the disease will soon be brought under control.

The GLC-ASPET Executive Committee gratefully acknowledges financial and in-kind support for the meeting from: ASPET; Department of Pharmacology, Feinberg School of Medicine, Northwestern University; AbbVie Inc., and the Department of Pharmacology, Midwestern University.

Election Results

GLC ASPET Councilors, 2021-2024

- William Conrad, PhD, Lake Forest College
- Hemraj Dodiya, PhD, University of Chicago
- Marsha Pierce, PhD, Midwestern University
- Rachel Miller, PhD, Rush University

GLC ASPET Treasurer, 2022-2024

- Adriana Caballero, PhD, University of Illinois

GLC ASPET Vice President, 2021-2023

- James O'Donnell, PhD, Rosalind Franklin University of Medicine and Science

GLC ASPET President, 2021-2023

- Takeshi Shimamura, PhD, University of Illinois

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Wishing you a warm holiday season and a happy new year!
- from the ASPET staff