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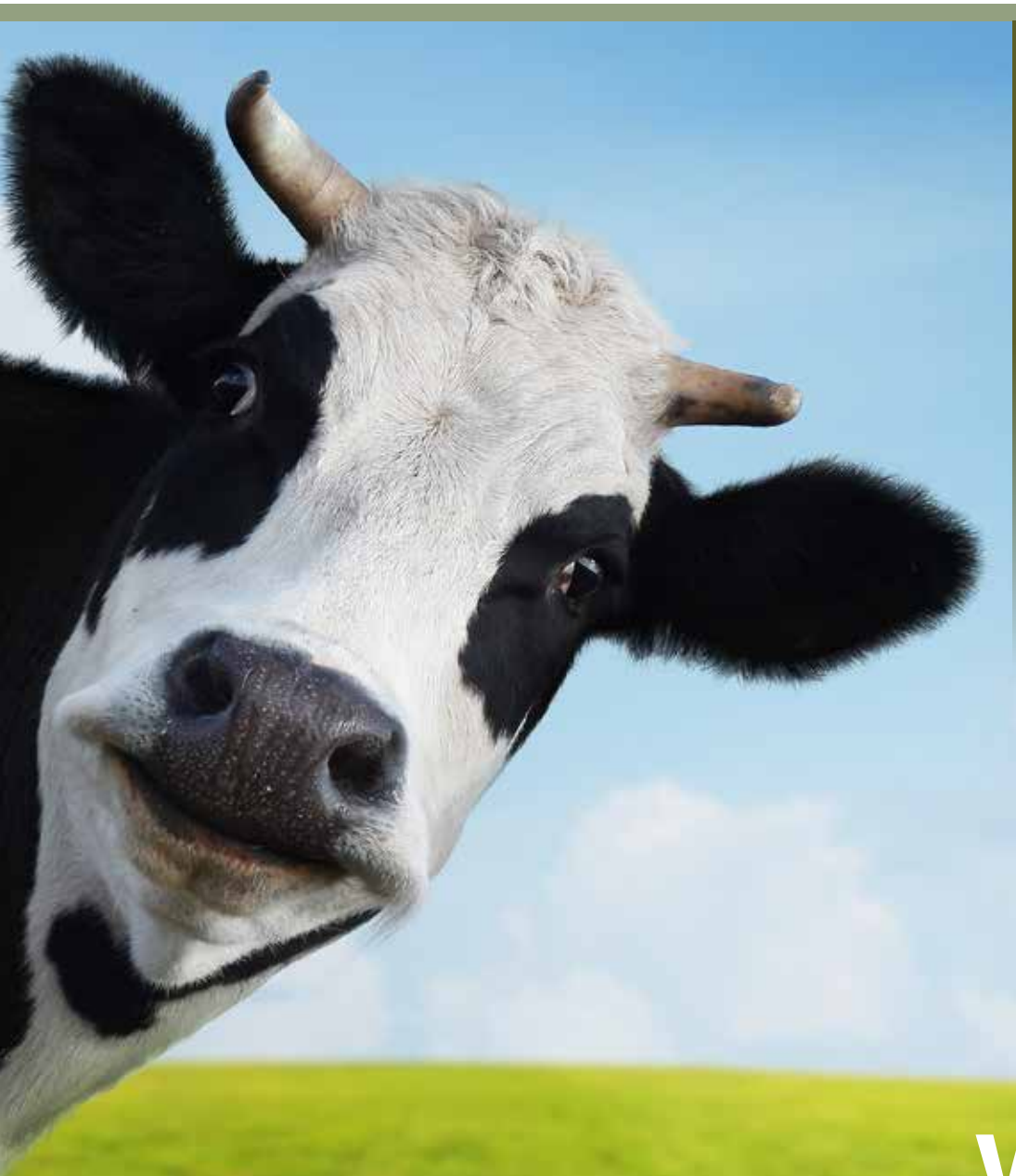

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ASPET
Transforming Discoveries into Therapies

Warfarin:

An Auspicious Student Project

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

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Message from The President

Dear Members of ASPET,

Several programs have continued to develop since our message from last September; however, before providing those updates, I would like to thank Dr. Mary Vore for her service as chair of the Board of Publications Trustees. Mary has been chair since 2014, a time where the journals have increased the stature and visibility of ASPET, and have provided a solid financial foundation for the Society. During her tenure, an open access option was added to the journals, plagiarism detection and image forensics were implemented, the BPT supported the NIH Principles and Guidelines for Reporting Preclinical Research, and ASPET's journals were made freely accessible in developing countries. These are only some of the positive changes she oversaw. I would like to thank Mary for her continued dedication to this important aspect of our Society. As mentioned in the previous issue, Dr. Emily Scott will become the new chair in January, continuing to provide her experience to the BPT.

ASPET Connect – We are excited about the upcoming release of ASPET Connect. ASPET Connect is a private online community that will allow ASPET members to communicate with each other. It is currently undergoing beta testing by several ASPET committees and Council. We anticipate release to the full ASPET membership in April at EB 2020.

EB 2020 – We are excited about EB 2020, which will be in San Diego. There were several additions and modifications to the 2019 meeting that have been viewed enthusiastically by a post-meeting member survey. These include offering symposia of 90 minutes and 2 hours, unopposed poster sessions, the Datablitz sessions, and poster bingo. These will be continued for EB 2020.

Under the guidance of the Program Committee, chaired by Michael Wood, symposia have been selected that are of interest across divisions. ASPET and APS will continue the joint presidential symposium series that was initiated last year. The theme of the 2020 series is "inflammation and oxidative stress." The series will consist of three symposia and a workshop. ASPET and the Japanese Pharmacological Society have participated in an ongoing lecturer exchange program since 2016. The invited JPS speaker for EB 2020 will be Dr. Yoshikatsu Kanai who will be discussing nutrient transporters in molecular target drug discovery. More details can be found at www.aspet.org/dec-tpharm-eb2020.

I would like to give a special thanks to all our individual and corporate contributors (see page 206). It is through their generosity that we are able to provide quality programs and services to our members. I would also like to thank the members of the ASPET Council, who not only give their time and effort to the Society, but all donated to ASPET during 2019. As we approach the end of year, I would ask that you keep ASPET in mind as a home for your charitable donations. **Tax-deductible donations** to ASPET support research, publications, travel awards, science advocacy, and career development for scientists. Making a donation is a great way to demonstrate your commitment and support to the future of ASPET and pharmacology! Thank you for your support!

Global Partnerships Taskforce – To fulfill ASPET's mission, there is a need to identify and establish global partnerships that are for the benefit of Society members. Dr. Eddie Morgan chaired this task force to examine our current global partnerships, assess our current regional and international chapters, and identify and prioritize our global outreach opportunities. ASPET Council has approved and provided funding for the formation of a

Partnerships Committee that will help direct and foster the growth of our new and ongoing global partners.

Science Policy Issues – ASPET co-signed a letter opposing the inclusion of language in the House Appropriations Military Construction-Veterans Affairs subcommittee bill that would ban Category D and E research on canines. ASPET also joined a letter opposing the inclusion of language in the House Appropriations Labor-HHS subcommittee's report accompanying its funding bill restricting the use of nonhuman primates for research purposes. Most recently, ASPET issued a statement opposing the EPA's directive to reduce and eventually eliminate the use of animals for toxicity testing by 2035.

The Science Policy Committee has also been active with issues related to the opioid crisis and the effects of additional scheduling that will restrict access to controlled substances for biomedical research. You can keep up-to-date on ASPET's science policy issues by signing up for *Prescribed Policy*, a monthly newsletter that recaps ASPET's work on important congressional and regulatory issues.

Washington Fellows Program – The Washington Fellows Program enables developing and early career scientists interested in science policy to learn about and become more engaged in public policy issues. The program was modified this year so that all of the fellows could arrive in D.C. on the same day and receive additional training on ASPET's policy issues from guest speakers and staff. This year, fellows heard from the chief of staff to Rep. William Timmons (SC-4), Moutray McLaren, on how to conduct a successful hill meeting; from FASEB Associate Director for Legislative Affairs Ben Krinsky on the ins-and-outs of the appropriations process; and from BGR Group Vice President Remy Brim on careers in science policy. The next morning, guides selected from previous Washington Fellows classes escorted fellows to their hill meetings with lawmakers and staff where they advocated for increasing funding for biomedical research. Applications have been submitted for the 2020 class of fellows, and we look forward to another successful hill day.

Thank you for your continued support of ASPET, and I look forward to seeing you in San Diego.

Warm regards,

Wayne L. Backes, Ph.D.
ASPET President

2019 Year in Review

Membership

4,254
total members
in
78
countries

392
new members
in 2019

Awards

Young scientists received
58 **poster awards**
and
119 **travel awards** at
the ASPET Annual Meeting at
EB 2019

$162,750
of support for
ASPET scientific achievement
award winners

Publications

142 **Open access articles** were published, including **71** **in *PR&P***

Manuscripts submitted from **48** **different countries**

2,552 **manuscript reviews** completed

Data supplements accessed an average of **17,500** **times per month**

Figures downloaded to PowerPoint an average of **6,214** **times per month**

Articles accessed through RSS feeds an average of **55,146** **times per month**

The Pharmacologist continues to be an important publication with **23,420** **total hits** from December of last year through October of this year – a significant increase from previous years.

Career Center

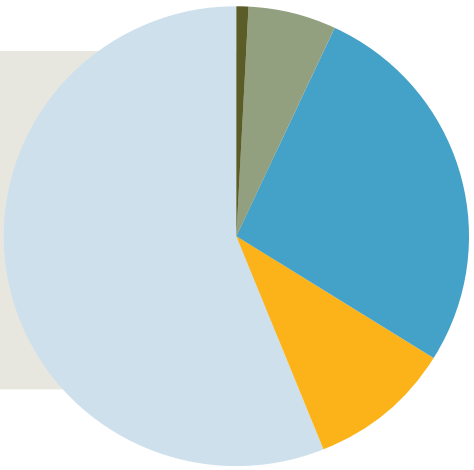
The ASPET Career Center averages **304** **jobs available** on the site daily, an almost **300%** increase from last year. **18,894** **page views** on the ASPET Career Center

Annual Meeting at EB 2019

EB 2019 was well attended by nearly **10,000** **multidisciplinary scientists**, including **1,483** **pharmacologists.**

The mixture of younger and established scientists at the ASPET Annual Meeting allowed for great networking:

- 1% high school students
- 6% undergraduates
- 27% graduate students
- 10% postdocs
- 56% established scientists



The **countries with the highest representation** of scientists at the ASPET Annual Meeting were:

1. United States
2. China
3. Canada
4. Brazil
5. South Korea

ASPET abstract submissions show continued growth!

We received

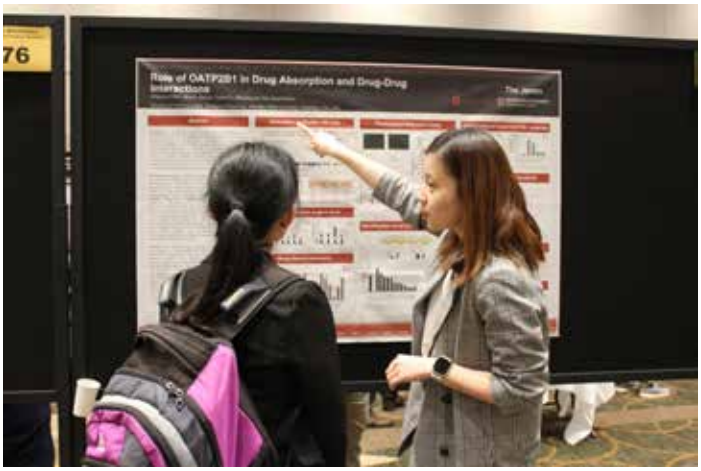
921

abstracts in pharmacology topics for EB 2019

an increase from the

894

abstract submissions for EB 2018



30
top scoring abstracts from young scientists featured in the ASPET Daily Datablitz sessions

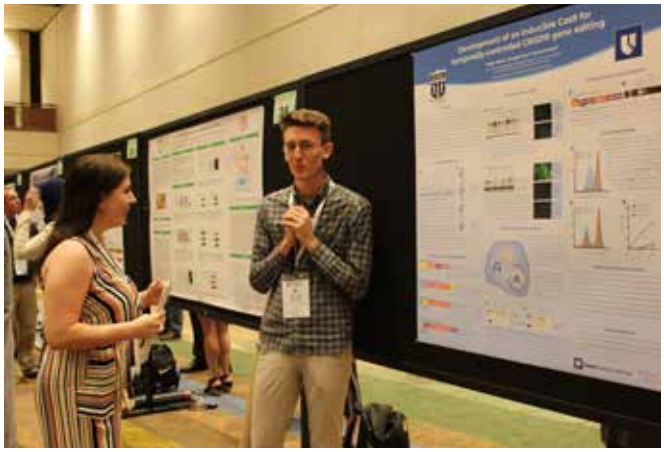
58
abstract submitters were selected to present talks at ASPET symposia

70 **abstract reviewers** on **11** **review teams** submitted **4,582** **reviews**

41
abstracts were designated as Program Committee Blue Ribbon Picks

11 **ASPET abstracts** selected for the EB-wide Scientific Highlights poster session

134 **young scientists** were selected to compete in the ASPET student/postdoc poster competition



87% of ASPET members surveyed were satisfied with our new unopposed poster presentation hours

★★★★½

ASPET sessions were rated **4.65** stars out of **5 on the mobile app, and average attendance at sessions increased by more than 10% over last year**

Pharmacology research presented at the ASPET Annual Meeting attracted coverage in major news outlets including:

- Atlanta Journal-Constitution
- CNN
- USA Today
- UPI
- Scientific American
- The Guardian (U.S. Edition)

Science Policy

ASPET was consulted by congressional committees **5** times

45 **House office visits**

28 **Senate office visits**

17 **letters sent** to legislators and administration officials

10 **members** in the 2019 Washington Fellows

7 **action alerts** sent to membership

2 **position papers** produced

@ Social Media

2,158
total "likes"

2,259
follows for ASPET's **Facebook** page

2,749
ASPET **Twitter** followers

2,319
ASPET **LinkedIn** group members

2019 Contributions

Thank You to Our Supporters!

Thank you to all our members for your continued support of ASPET. By renewing your membership each year, publishing in our journals, and attending our annual meeting, 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, travel awards, 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 2018 through October 2019:

Susan Amara
Bradley Andresen
Aisar Atrakchi
Wayne Backes
Mary-Ann Bjornsti
Judith Bond
Sterling Bradley
David Brown
Namandjé Bumpus
Maria Almira Correia
Kathryn Cunningham
Catherine Davis
Gary DeLander
Xinxin Ding
Robin Dodson
Margarita Dubocovich
Doug Eikenburg
Jeffrey Fedan
Charles France

James Fujimoto
Ronald Gaddis
Brenda Gannon
Margaret Gnegy
Morton Goldberg
Susan Gonsalves
Joseph Hanig
Paul Hollenberg
Dale Hoyt
Michael Iadarola
Paul Insel
Nina Isoherranen
Margaret James
Hyunyoung Jeong
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Bertram Katzung
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Craig Malbon
John Markowitz
Bettie Sue Masters
Donald Mattison
John McCullough
Donald McMillan
Kathryn Meier
Andrew Milewski
Keith Miller
Edward Morgan
Senthil Natesan
Richard Okita
Mark Osinski
Mary Owen
Mary Paine
Achilles Pappano
James Patrick

Bhagwat Prasad
Walter Prozialeck
Gary Rankin
Emily Scott
Judith Siuciak
Alan Smrcka
Palmer Taylor
Rita Valentino
Mary Vore
Hongbing Wang
Joanne Wang
Pancras Wong
Michael Wood
Aiming Yu
Jin Zhang
Qing-Yu Zhang

THANK YOU

to our Annual Meeting Sponsors:

Amgen

Association for Medical School Pharmacology Chairs

Emory University

Pharmacology Research & Perspectives

University of Florida

University of Michigan

University of Minnesota

University of Wisconsin

UT Health San Antonio

Wake Forest University

Washington State University

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 2019 Featured Fund: Summer Undergraduate Research Fellowship Fund

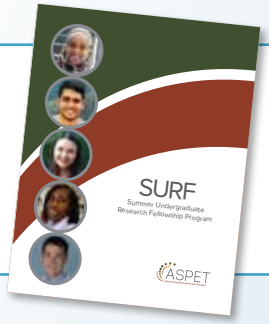
The ASPET Summer Undergraduate Research Fellowship (SURF) program is designed to introduce pharmacology research to undergraduates through a 10-week summer laboratory experience. The SURF program has been funded for many years by the initial donations from the Anthony and Theresa Zannoni Scholarship Fund, the Gerald J. Dalton/Vincent G. Zannoni Fund, and the Glenn E. Ullyot Fund. To ensure the future of the program, we rely on support from our members. Funds are used solely for student support in the form of stipends and housing during the summer research period.

Panshak Dakup, 2014 SURF participant

"My mentor for the summer provided a flexible learning environment that afforded me the opportunity to take initiative, and I began to comprehend what working with a passion meant. It was fun and exciting. The SURF program made a huge impression on me and consequently, I returned to the home of my SURF experience to pursue my PhD. It was an easy decision."

Donate to the ASPET SURF Fund at www.aspet.org/donate.

Learn more about the history of the ASPET SURF program and read compelling stories from past participants. Check it out at https://bit.ly/2PqwKDM



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: https://www.aspet.org/aspet/utility-nav/donate/donate-to-aspet.

ASPET
Commemorative Travel Awards

Support Young Scientists



An ASPET commemorative travel award is a great way to honor a family member, friend, colleague, or yourself. Create a lasting legacy with ASPET while supporting the future of young scientists.

ASPET is committed to supporting the future of pharmacology by encouraging the career development of young scientists through their participation in the ASPET Annual Meeting at Experimental Biology. We believe that attendance at the annual meeting provides the opportunity for young scientists to learn about recent advances in pharmacology, network with peers and international experts in the field, and to contribute their own work to the scientific dialogue. ASPET commemorative travel awards are given to the top scoring travel award recipients each year.

Establish a Commemorative Travel Award Fund:

If you are interested in initiating a new ASPET commemorative travel award please contact ASPET's Executive Officer, Dr. Judy Siuciak at jsiuciak@aspet.org.

Donate to a Commemorative Travel Award Fund:

Travel awards are made possible through the generosity of our members and are always open for donations. ASPET currently has five commemorative travel awards. The Karl H. Beyer, Jr. Travel Award (established in 1997), the Steven E. Mayer Travel Award (established in 2010), the Akira E. Takemori Travel Award (established in 1998), the Atul & Jayashree Laddu Travel Award (established in 2016), and the Nancy Rutledge Zahniser Travel Award (established in 2017) celebrate the contributions of these members to the field of pharmacology and ASPET. Read more about each of these members online at www.aspet.org/donate/travel-award-funds.

If you would like to donate to any of the commemorative award funds, please visit us online at www.aspet.org/donate/travel-award-funds.

2020 Election

The ASPET election for president-elect, secretary/treasurer-elect, and councilor will open on January 6, 2020. Eligible voting members will receive notification when the election opens.

All regular, postdoctoral, emeritus, affiliate, and graduate student members are eligible to vote. In addition, the following divisions are 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

Full candidate biographies will be available online when the election opens. Division candidate information is on page 257.

As the 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 7, 2020.

Nominees for President-Elect

Margaret E. Gnegy, PhD
Professor of Pharmacology, University of Michigan Medical School

Michael F. Jarvis, PhD
ACOS Senior Research Fellow, Senior Scientific Director, Global Medical Affairs, AbbVie, Inc.

Margaret E. Gnegy, PhD

Candidate's Statement

It has been my pleasure to serve on ASPET Council for the past six years as councilor and as treasurer. I would consider it an honor to continue serving as president of the Society. I have been a member of ASPET for almost my whole career and consider the Society and its annual meeting an important source of up-to-the-minute pharmacology knowledge, for pharmacology dissemination, and for meeting/networking with colleagues. Therefore, it is my priority to push boundaries to keep ASPET significant and beneficial for pharmacologists.

A roadmap to meet my goals is laid out in the ASPET strategic plan, which I was fortunate to help formulate. There are several issues contained within the plan that are especially important to me. Prime among these is increasing diversity, equity, and inclusion within the Society. I was stunned to learn recently that only 29% of the members of our Society are women! My goal is to increase that number, both by reaching out to young investigators and trainees, but also by engaging established pharmacologists who may not be members. The Society needs to be a place where all pharmacologists feel included, independent of sex, gender, color, or workplace. I will work to ensure ASPET has relevance for all pharmacologists, not just academics and members of the pharmaceutical industry. The advantage of our discipline is that pharmacologists can easily work in a variety of environments. Many who embraced ASPET and the annual meeting during their student years filter into other work environments, such as government work, advocacy, or scientific writing, and then leave ASPET. I propose to tap into these environments and envision ways that the Society can serve this constituency, and vice versa.

An exciting opportunity is presented through the first two goals in the strategic plan, which involve promoting pharmacology and attracting the next generation of pharmacologists. I served as a member of the Global Partnership Task Force which assessed existing and potential global partnerships. ASPET already has an international presence, but I see additional opportunities to strengthen and extend partnerships. I want to reach across borders so the Society can enhance collaborative ventures, help underserved students, promote pharmacology, and increase its membership.

Certainly there are other challenges facing the Society. We are highly dependent upon the Society journals for our yearly budget. A full implementation of Plan S, an initiative that would make journal articles freely accessible in a relatively short time, will cause difficulties for subscriptions. It is essential that we work together to develop other funding strategies to cushion our dependence upon the journals for our budget. We must also continue to produce an excellent yearly meeting. Many aspects of the meeting have changed over the past few years as ASPET keeps progressing to respond to its membership and strive toward the best science. The annual meeting is the most visible face of ASPET and, as such, we must endeavor to produce the best possible experience for our members. Challenges exist there, too, because of the changing face of EB as some member societies depart.

I don't have immediate answers to all the challenges facing ASPET, but one thing I am sure of is that ASPET has many extremely dedicated members and a very dedicated staff. In my service on Council and on several committees, I have witnessed the deep commitment that ASPET's members and staff have to pharmacology as a discipline and to the Society in particular. Should I be elected president, I promise to keep that commitment, follow through on my promises, and serve our Society to the best of my abilities.

Michael F. Jarvis, PhD

Candidate's Statement

During the closing days of 1908, John Abel and colleagues founded ASPET to "further the growth of pharmacology and experimental therapeutics in this country and to facilitate personal intercourse among investigators in these branches of science." Since then ASPET has consistently fostered the advancement of pharmacological science and the professional development of its members. Today ASPET continues its foundational role in leading pharmacological science and thereby facilitating the discovery of new medicines. The Society has accomplished these important endeavors through the exemplary leadership of its membership and the Society's excellent staff. ASPET is financially strong, its journals continue to serve as the "gold-standards" of cutting-edge pharmacological research and insight, and the ASPET annual meeting has ever increasing vitality.

For nearly three decades, my membership in ASPET has provided me with valuable mentorship and inspiration as well as personal and professional collegiality across a diverse array of academic and industrial pharmacologists. I have had the good fortune to serve on numerous ASPET committees including the Board of Publication Trustees as editor of *JPET* and deputy editor of *PR&P*, Science Policy, Program, and Mentoring and Career Development, and to see firsthand the dedication and

professionalism of its membership. My experience as a pharmacology researcher working on both basic research and clinical programs, as well as with diverse medical affairs teams across a global organization, gives me a unique perspective on the great importance of ASPET's mission to advance pharmacology science and to facilitate the generation of new and impactful therapies. It is truly an honor to be nominated to run for the position of president of the Society.

ASPET's recently implemented strategic plan has provided a great roadmap for the continued growth of the Society. Importantly, the strategic plan is based on its vision of pharmacology as "the essential integrative discipline" in creating and translating new pharmacologic knowledge into novel therapies. The strategic plan fosters the development of early career pharmacologists by leveraging its engagement with students, educators, and research pharmacologists from academia, government, and industry. ASPET's scientific and policy community outreach efforts have expanded to form productive international collaborations with pharmacology societies from Japan, China, and most recently Canada. These efforts coupled with ASPET's established SURF, Washington Fellows, and travel award programs provide members with an enhanced level of scientific and professional engagement that continue to serve the Society and its members well.

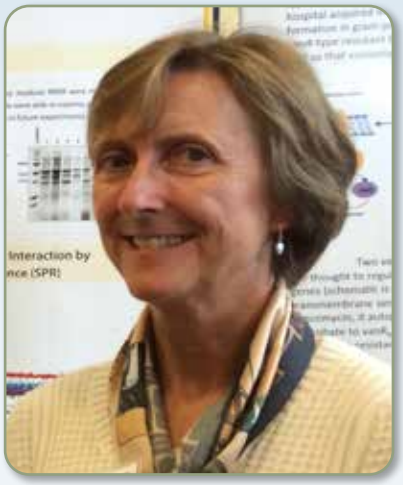
To further build on this great progress, I see two elements of the strategic plan, *Attracting and Developing the Next Generation of Pharmacologists* and *Reimagining the Annual Meeting Experience,* as essential drivers for the sustainable vitality of the Society. These goals also serve as foundational elements that enable the Society to achieve its other key strategic goals. I believe that our journals and the recent changes to the ASPET Annual Meeting at Experimental Biology are essential tools to enable scientific collaboration and foster the development of all of our members. We've already seen that dedicating specific times for poster presentations, the new ASPET Daily Datablitz oral presentation sessions, and the implementation of Career Central have contributed to the high positive ratings (4.6/5 stars) for the 2019 annual meeting. We have a wonderful legacy and foundation to build upon.

Additionally, the recent changes to the ASPET bylaws that enable greater participation by student and affiliate members in the Society provide important support for the sustained growth, diversification, and professional development of our members. Through my experiences with the Mentoring Network, Mentoring and Career Development Committee, and Big Ideas initiatives, I have benefited immensely from the curiosity and enthusiasm shown by pharmacology students and early career scientists, and witnessed the positive impact of these important ASPET initiatives on the next generation of pharmacologists as they navigate their early career milestones.

If elected, I will work with the Society's leadership and staff to continue the great progress ASPET has made and to identify and implement additional initiatives that further enhance ASPET's interactions with its members and the biomedical research community. These efforts include examining new ways to further support pharmacology education and advance pharmacology research excellence through ASPET's journals. Another important aspect will be exploring new ways for increased interactions between ASPET and its international and regional chapters in terms of expanding scientific collaboration and enhancing the regional and national membership and meeting experiences. I also see ASPET's efforts to further engage with FASEB and other scientific societies that help shape key scientific, governmental, and global policy issues relevant to pharmacologists as a critical strategy for strengthening ASPET.

Nominees for Secretary/Treasurer-Elect

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



Pamela J. Hornby, PhD
Senior Principle & Fellow, CV & Metabolic (CVM), Janssen R&D, LLC.; Adjunct Professor, Department of Physiology and Pharmacology, College of Medicine, Drexel University

Carol L. Beck, PharmD, PhD

Candidate's Statement

I was honored to serve as an ASPET councilor from 2016-2019. This experience broadened my understanding of our chosen field of pharmacology. Being a part of the year-long development of our strategic plan also gave me new insights. I was excited to see that our newly articulated mission is for ASPET to be the professional home for anyone working to advance the field of pharmacology. There are many opportunities for us to engage those involved in pharmacology well beyond medical and pharmacy schools. What's the best way to accomplish this? The number and range of projects proposed for the Big Ideas initiatives in 2014 and 2016 clearly demonstrated that ASPET members have abundant creativity; let's utilize this resource to benefit pharmacology. Big Ideas competitions spark creativity and engage members in working towards common goals, while also providing leadership development. Unfortunately, implementing ideas takes money, staff time, and volunteers. The secretary/treasurer, the Finance Committee, and the Investment Subcommittee are responsible for the fiscal health of ASPET; we can't spend money that isn't there… or for projects that do not align with our mission.

If elected secretary/treasurer, I would work with the Finance Committee, the Investment Subcommittee, ASPET leadership, and staff to explore funding mechanisms for additional rounds of Big Ideas competitions and to establish an infrastructure to allow Big Idea competitions to be scheduled on at least a biennial basis.

I would welcome the opportunity to serve ASPET as secretary/treasurer and to look for ways to fund and engage the talents of our members in working towards our shared mission.

Pamela J. Hornby, PhD

Candidate's Statement

I would like to serve as secretary/treasurer because I think I can help execute ASPET's strategic plan, especially in the following areas: developing the next generation of pharmacologists; promoting ASPET; and reimagining the annual meeting experience.

There is a growing gap of trainees needed to meet the increasing demands of drug discovery, from government (NCATS) to academic centers, biotechnology to contract research organizations. Scientists skilled in applying and interpreting pharmacology at the bench, at the program level, and for appropriate documentation, are increasingly hard to find. One reason for this gap is that the exposure of trainees to many non-academic roles has not kept pace with their career accessibility. As the Division for

Translational and Clinical Pharmacology chair, and as a member of the Mentoring and Career Development Committee, I have promoted pharmacology as a set of skills applicable to many different careers. I would like to further spread this knowledge across my peers, early career scientists, and trainees through greater involvement in ASPET.

To promote pharmacology to other scientists and the general public, we must be able to communicate our ideas to them. My experience with bridge to employment high school students and their parents has demonstrated how big this shortfall of communication is. It has taught me how hard it is to simply state why the community should care about what we do, and how things would be if we didn't do this. However, communication can be improved by knowledge, training, and practice. *The Pharmacologist* is a tremendous resource and has made good progress in this, but I would like to work with members to explore more communication avenues.

I am starting to reimagine the meeting experience by working with the Young Scientists Committee and members of other divisions. My outreach with the New Orleans Bioinnovation Community has demonstrated the value of pitch competitions in scientific entrepreneurship. I am delighted that new ideas for symposia are being considered. Our traditional successful discipline-based symposia are unique for trainees, and there is risk in using one of those slots to attempt a novel forum. However, success will not only engage attendees, it will also expand our membership.

Being elected secretary/treasurer would advance my own goals, which are to gain insight into fiscal oversight and contribute to strengthening ASPET. This would provide experience for me to consider potential career opportunities in not-for-profit organizations.

Nominees for Councilor

Lakshmi A. Devi, PhD
Professor of Pharmacological Sciences, Dean for Academic Development and Enrichment, Icahn School of Medicine at Mount Sinai

Randy A. Hall, PhD
Professor, Department of Pharmacology & Chemical Biology, Emory University School of Medicine

Lakshmi A. Devi, PhD

Candidate's Statement

I am honored by the nomination to serve as ASPET councilor because the ambitious strategic plan to attract and develop the next generation of pharmacologists is strongly aligned with my own passion for mentoring and career development of trainees and faculty at all levels. I've taken active roles to nurture and promote rising pharmacologists by organizing career development sessions at national and international conferences, participating in the annual ASPET award application reviews, and establishing the ASPET Neuropharmacology Division's Young Investigator Award. During my time as chair of the Mentoring and Career Development Committee, I also organized the ASPET-wide Graduate Student-Postdoctoral Colloquia to enhance diversity and inclusion and promote career advancement. Within the Icahn School of Medicine at Mount Sinai, I have led the academic enrichment programs to promote career advancement for all faculty over the past

10 years. As the dean for the Office of Academic Development and Enrichment, I ensure that faculty of all disciplines have access to the guidance and resources needed to achieve fulfilling careers through enhanced mentoring, collaboration, and leadership opportunities. In this role I learned that the most beneficial and impactful programs partner with stakeholders of varying interests, such as the Office for Gender Equity, Diversity in Basic Research Committee, Center for Multicultural Affairs, and Institute for Translational Science. These experiences show that I have a passion and skill for uniting researchers and stakeholders who might not share a mutual academic focus, but certainly agree that enriching the fabric of the research community will lead to incredible discoveries for health and science. Through my experiences organizing and supervising these conferences and programs, I've come to realize the vital role societies such as ASPET play in developing and nurturing future leaders. As councilor, I will help promote the pharmacology discipline by working with divisions and subgroups to help novice researchers and emerging leaders achieve their potential and advance their careers into an exceptionally bright future.

Randy A. Hall, PhD

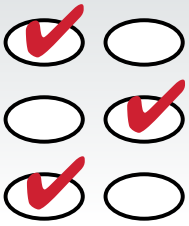
Candidate's Statement

I have been an enthusiastic member of ASPET for more than two decades and served the society in a variety of different leadership roles. This experience has positioned me well to serve as an effective member of the ASPET Council. For example, one of the core goals of the most recent ASPET strategic plan is "enhancing the ASPET journals." I served for six years on the Board of Publications Trustees, which oversees the ASPET journals, so I possess a wealth of knowledge about how our journals work as well as many ideas for helping to promote and enhance our journals.

Another core goal of the ASPET strategic plan is "reimagining the annual meeting experience." I served for several years on the ASPET Program Committee and have many ideas about ways in which the annual meeting can be enhanced. Thus, as a member of Council, I would be able to interface easily with the current Program Committee as well as other members of ASPET leadership to help accomplish this goal.

"Attracting and developing the next generation" is another core goal of the ASPET strategic plan. For the past decade, I have directed the pharmacology graduate program at Emory. I have also won awards for my teaching. Thus, I feel that I have my finger on the pulse of what students find interesting and engaging. As a member of Council, I would bring this knowledge to bear on the crucially important efforts by ASPET to attract and develop the next generation of pharmacology researchers.

I believe that ASPET and other scientific societies play essential roles in the scientific enterprise. ASPET brings people together–I am aware of numerous scientific collaborations that began as conversations at ASPET meetings. I also know many students who found their first positions after graduation because of contacts made at ASPET meetings. My hope as a member of Council will be to enhance the many ways in which ASPET brings people together to promote the advancement of pharmacology research, education, and public outreach.



The ASPET 2020 election will open on January 6, 2020. All eligible voters will be sent notification with your login credentials to vote. If you have any questions, please contact membership@aspet.org.

ASPET Annual Meeting Program

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

For speakers and full session descriptions, visit www.aspet.org/eb2020 -TPharmDec.

Schedule subject to change.

Friday, April 3, 2020

Session/Event	Time
Give a Day of Service to San Diego at EB 2020 *Contact Dr. Charles France to volunteer (france@uthscsa.edu or 210-567-6969)*	8:00 am - 3:00 pm
Colloquium on G Protein Coupled Receptors: Evolving Insights from Pharmacology to Physiology (separate fee - day 1 of 2) *Chairs: T. Handel, P. Insel, and J. Pluznick*	2:00 pm - 7:00 pm

Saturday, April 4, 2020

Session/Event	Time
Colloquium on G Protein Coupled Receptors: Evolving Insights from Pharmacology to Physiology (separate fee - day 2 of 2) *Chairs: T. Handel, P. Insel, and J. Pluznick*	8:00 am - 12:30 pm
Challenges of Academic Drug Discovery in Cancer *Chairs: M. Leggas and M. Arkin*	11:00 am - 1:00 pm
Teaching Institute: Preparing the Next Generation of Scientists to be Best Practice Educators *Chair: N. Kwiek*	11:00 am - 1:00 pm
The NLRP3 Inflammasome as a Pharmacological Target in Cardiovascular Disease *Chairs: J. H. Brown and S. Miyamoto*	11:00 am - 1:00 pm
Yin-Yang of the Prostaglandin-E2 Receptors: Novel Therapeutic Approaches *Chair: T. Ganesh*	11:00 am - 1:00 pm
ASPET – APS Joint Presidential Symposium Series on Inflammation and Oxidative Stress: Workshop on CRISPR-Cas and miRNAs in the Study of Drug Metabolism, Cancer, and Other Diseases *Chairs: A. Moutal and W. Xie*	1:00 pm - 3:00 pm

Saturday, April 4, 2020 *continued*

Brain Microglia and Astrocytes in Health and Disease *Chair: A. Bhattacharya*	2:00 pm - 4:00 pm
G Protein Signaling in Regulation of Metabolism and Diabetes *Chairs: A. Marchese and V. Slepak*	2:00 pm - 4:00 pm
Student/Postdoctoral Colloquium: Strategies for Dealing with Conflict and Difficult Conversations *Chair: M. I. Davila-Garcia*	2:00 pm - 4:00 pm
ASPET Business Meeting and Awards Presentation	4:30 pm - 6:00 pm
Tang Prize Lecture *Keynote: Tony Hunter*	6:00 pm - 7:00 pm
All Society EB Welcome Reception *Including Scientific Highlights Posters*	7:00 pm - 8:30 pm

Sunday, April 5, 2020

Session/Event	Time
Diversity and Inclusion Breakfast: Being Heard and Telling Your Story To Claim Your Place – Strategies for Success (RSVP Required) *Chair: L. Devi*	7:30 am - 9:30 am
NIH Funding and Other Translational Research Opportunities *Chairs: R. Roof and S. Koduri*	8:00 am - 10:00 am
Novel and Integrated Intestine-liver Crosstalk on Hepatic Xenobiotic Metabolism *Chairs: G. Guo and H. Wang*	8:00 am - 10:00 am
Updating the Opioid Crisis: Novel Approaches to Reducing Opioid Abuse and Overdose *Chairs: G. Collins and S. Withey*	8:00 am - 10:00 am
Utilizing Educational Tools to Enhance Student Learning in the Health Sciences *Chairs: K. Brandl and G. Athauda*	8:00 am - 10:00 am
ASPET - APS Joint Presidential Symposium: Inflammation and Oxidative Stress: CV and Renal Inflammation in Health and Disease *Chairs: C. Banek and J. Imig*	8:30 am - 10:00 am
ASPET Poster Presentations *Discover the latest with more than 250 pharmacology poster presentations*	10:00 am - 12:00 pm
ASPET Daily Datablitz *Fast-paced overview of the most exciting poster science of the day*	10:30 am - 11:00 am
Young Scientists Town Hall	12:00 pm
Networking in the Exhibit Hall *Visit with exhibitors, grab lunch, explore Career Central*	12:00 pm - 1:00 pm

Lectures Networking Opportunity

Sunday, April 5, 2020 *continued*

Undergraduate Networking and Career Development Luncheon (RSVP Required)	12:15 pm - 2:00 pm
Goodman and Gilman Award in Receptor Pharmacology Lecture *Keynote to be announced in January*	1:00 pm - 1:45 pm
Axelrod Award in Pharmacology Lecture: Protein Kinase C Out of Tune *Keynote: Alexandra Newton*	2:00 pm - 2:45 pm
Axelrod Symposium: Protein Kinases in Tune *Chair: Alexandra Newton*	3:00 pm - 5:00 pm
Behavioral Pharmacology of Biased Agonists *Chair: W. Fantegrossi*	3:00 pm - 5:00 pm
Cardiometabolic Diseases: At the Crossroads of Adipose Tissue and Cardiac Health *Chairs: M. Tranter and A. Mughal*	3:00 pm - 5:00 pm
Cross Talk in Metabolism of Xenobiotics and Endogenous Substrates *Chairs: A. Pandey and X. Ding*	3:00 pm - 5:00 pm
Journals Workshop: An Interactive Guide to Publishing, Reviewing, and Ethics Issues *Chairs: E. Scott and R. Dodenhoff*	3:00 pm - 5:00 pm
Award Lecture *Keynote to be announced in January*	5:15 pm - 6:00 pm
ASPET Student/Postdoc Poster Competition *Including display tables for university graduate programs*	6:00 pm - 8:30 pm
ASPET Student/Postdoc Mixer	8:30 pm - 11:00 pm

Lectures Networking Opportunity

EB Career Central

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

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

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

Monday, April 6, 2020

Session/Event	Time
46 Years of GPCR Pharmacology and Mentoring in the Field of Pain Research; A Tribute to G. W. Pasternak *Chairs: J. Clark and K. Standifer*	8:00 am - 10:00 am
Experimental Approaches for the Treatment of Infectious Disease *Chairs: R. Corriden and E. Anderson*	8:00 am - 10:00 am
Immune Mechanisms in Pathogenic Responses to Particles, Nanomaterials, and Nanomedicines *Chairs: Q. Ma and K. Pollard*	8:00 am - 10:00 am
The Use of Chemogenetic Tools to Analyze Behavior in Non-human Primates *Chairs: K. Grant and V. Cuzon Carlson*	8:00 am - 10:00 am
ASPET - APS Joint Presidential Symposium on Inflammation and Oxidative Stress: Inflammation and Drug Disposition *Chairs: R. Ghose and M. Piquette-Miller*	8:30 am - 10:00 am
ASPET Poster Presentations *Discover the latest with more than 250 pharmacology poster presentations*	10:00 am - 12:00 pm
ASPET Daily Datablitz *Fast-paced overview of the most exciting poster science of the day*	10:30 am - 11:00 am
Networking in the Exhibit Hall *Visit with exhibitors, grab lunch, explore Career Central*	12:00 pm - 1:00 pm
John J. Abel Award in Pharmacology Lecture *Keynote to be announced in January*	1:00 pm - 1:45 pm
“Guppy Tank” Translational Science Pitch Showcase *Chairs: R. Staudt and H. Neelakantan*	2:00 pm - 3:30 pm
Drug Discovery from Bench to Artificial Intelligence: Treating the Rare and Ignored *Chairs: K. Garman and K. Pennypacker*	2:00 pm - 3:30 pm
New Tools in ADME Prediction: Quantitative Omics, Liquid Biopsies, and Modeling *Chairs: B. Prasad and A. Rowland*	2:00 pm - 3:30 pm
Teaching Blitz *Chair: M. Hernandez*	2:00 pm - 3:30 pm
Networking Break *Visit exhibitors, explore Career Central, or relax in the ASPET Member Lounge*	3:30 pm – 4:00 pm

Lectures Networking Opportunity

Call for Proposals for EB 2021

Got an idea for a great symposium? It’s members like you who create the high quality, innovative sessions that are the hallmark of the ASPET annual meeting. Symposium proposals will be accepted from January 13 to March 2.

Monday, April 6, 2020 *continued*

Scientific Achievement Award in Drug Discovery and Development Lecture *Keynote to be announced in January*	4:00 pm - 4:45 pm
P.B. Dews Lifetime Achievement Award for Research in Behavioral Pharmacology Lecture *Keynote to be announced in January*	4:00 pm - 5:00 pm
Division for Cardiovascular Pharmacology Trainee Showcase *Chair: B. McConnell*	4:00 pm - 5:15 pm*
Division for Cancer Pharmacology – Young Investigators Symposium *Chairs: A. Thorburn and C. Canman*	4:00 pm - 6:00 pm
Division for Translational and Clinical Pharmacology – Young Investigator Awards Platform and Early Career Faculty Showcase *Chair: F. Kim*	4:00 pm - 6:00 pm
Notable Platform Presentations in Drug Discovery and Development *Chair: T. Parry*	4:45 pm - 6:00 pm
Behavioral Pharmacology Postdoctoral Award Competition *Chairs: J. Li and S. Wood*	5:00 pm - 6:00 pm
Paul M. Vanhoutte Distinguished Lectureship in Vascular Pharmacology *Keynote to be announced in January*	5:15 pm - 6:00 pm*
Annual Division Meetings for: Behavioral Pharmacology Cancer Pharmacology Cardiovascular Pharmacology Drug Discovery and Development Translational and Clinical Pharmacology	6:00 pm - 6:30 pm
Division Mixers for: Behavioral Pharmacology and Neuropharmacology Cancer Pharmacology, Drug Discovery and Development, and Translational and Clinical Pharmacology Cardiovascular Pharmacology	6:30 pm - 8:30 pm

Lectures Networking Opportunity

*Tentative Times

ASPET Welcomes Our Guest Societies!

Members of these ASPET guest societies at EB 2020 can register for EB using the ASPET member discount and can self-sponsor abstracts.

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

Tuesday, April 7, 2020

Session/Event	Time
Development of Cannabinoids for Clinical Use - CNS Hazards and Therapeutic Effects *Chairs: M. Delatte and Z. Cooper*	8:00 am - 10:00 am
Heavy Traffic: Targeting Diseases through Chemokine Receptor Antagonism *Chairs: S. Davis and S. Rajagopal*	8:00 am - 10:00 am
Precision Medicine Strategies for Treating Cardiovascular Disease *Chairs: E. Gross and H. Patel*	8:00 am - 10:00 am
Targeting Autophagy in Cancer *Chairs: A. Thorburn and R. Perera*	8:00 am - 10:00 am
ASPET - APS Joint Presidential Symposium on Inflammation and Oxidative Stress: Central Nervous System Inflammation: Pain and Cognition *Chairs: T. Vanderah and A. Kavelaars*	8:30 am - 10:00 am
ASPET Poster Presentations *Discover the latest with more than 250 pharmacology poster presentations*	10:00 am - 12:00 pm
ASPET Daily Datablitz *Fast-paced overview of the most exciting poster science of the day*	10:30 am - 11:00 am
Networking in the Exhibit Hall *Visit with exhibitors, grab lunch, explore Career Central*	12:00 pm - 1:00 pm
ASPET - JPS Lecture: Nutrient Transporters in Molecular Target Drug Discovery *Keynote: Yoshikatsu Kanai*	1:00 pm - 1:45 pm
#DiversiSci *Chairs: J. Reuben and L. Johnson*	2:00 pm - 3:30 pm
ADME in Neonates and Infants: Therapeutics, Toxicity, and Development of New Drugs *Chairs: X. Zhong and P. Annaert*	2:00 pm - 3:30 pm
Emerging Approaches to Drug Metabolism *Chairs: K. He and M. Cerny*	2:00 pm - 3:30 pm
G Protein Signaling in Neuropsychiatric Disorders *Chairs: V. Zachariou and Q. Wang*	2:00 pm - 3:30 pm
Recent Progress in Drugging the "Undruggable" RAS Oncogene *Chairs: C. Canman and J. Sebolt-Leopold*	2:00 pm - 3:30 pm
Networking Break *Visit exhibitors, explore Career Central, or relax in the ASPET Member Lounge*	3:30 pm – 4:00 pm
Bernard B. Brodie Award in Drug Metabolism Lecture *Keynote to be announced in January*	4:00 pm - 4:45 pm
Methodologies for Integrating Basic and Clinical Sciences in Pharmacology Education *Chair: D. Peffley*	4:00 pm - 5:30 pm

Lectures Networking Opportunity

Tuesday, April 7, 2020 *continued*

Division for Molecular Pharmacology Postdoctoral Award Competition *Chairs: A. Lyon and K. Martemyanov*	4:00 pm - 6:00 pm
Division for Neuropharmacology Early Career Award Lecture and Postdoctoral Fellow Showcase *Chairs: K. Standifer and S. Bhalla*	4:00 pm - 6:00 pm
Highlights and Advances in Toxicology	4:00 pm - 6:00 pm
Division for Drug Metabolism and Disposition Gillette Awards and Junior Investigator Platform Session *Chairs: A. Yu and R. Foti*	4:45 pm - 6:00 pm
Annual Division Meeting for: Pharmacology Education	5:30 pm - 6:30 pm
Annual Division Meetings for: Drug Metabolism and Disposition Molecular Pharmacology Neuropharmacology Toxicology	6:00 pm - 6:30 pm
Division Mixers for: Molecular Pharmacology Drug Metabolism and Disposition, Pharmacology Education, and Toxicology	6:30 pm - 8:30 pm

Lectures Networking Opportunity

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

https://experimentalbiology.org/2020/About/Policies.aspx#FAQLink262

Register Now for EB

For one registration fee, you have access to five society annual meetings in one location.

Check "Pharmacology" and "ASPET" when you register for EB to receive all relevant info for pharmacology programming.

Renew your membership to receive the deepest discounts! Renew today and encourage your colleagues to join ASPET at https://bit.ly/2xVQNOs

The early registration deadline is **Wednesday, February 5, 2020**. To register, please visit: http://bit.ly/32fRv8h

Division Specific Meetings and Activities

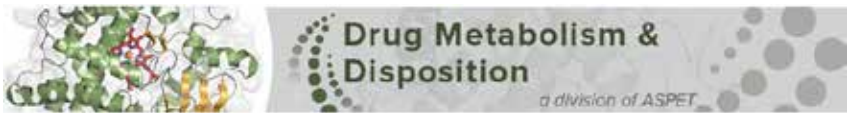
Explore the online division filter to see a full schedule of sessions of interest to your division at EB 2020.
www.aspet.org/eb2020 -program-TpharmDec

Monday, April 6	4:00 pm - 5:00 pm	P.B. Dews Lifetime Achievement Award for Research in Behavioral Pharmacology Lecture
Monday, April 6	5:00 pm - 6:00 pm	Behavioral Pharmacology Postdoctoral Award Competition
Monday, April 6	6:00 pm - 6:30 pm	Annual Division Meeting - Division for Behavioral Pharmacology
Monday, April 6	6:30 pm - 8:30 pm	Joint Mixer: Divisions for Behavioral Pharmacology and Neuropharmacology

Monday, April 6	4:00 pm - 6:00 pm	Division for Cancer Pharmacology – Young Investigators Symposium
Monday, April 6	6:00 pm - 6:30 pm	Annual Division Meeting - Division for Cancer Pharmacology
Monday, April 6	6:30 pm - 8:30 pm	Joint Mixer: Divisions for Cancer Pharmacology, Drug Discovery and Development, and Translational and Clinical Pharmacology

Monday, April 6	4:00 pm - 5:15 pm*	Division for Cardiovascular Pharmacology Trainee Showcase
Monday, April 6	5:15 pm - 6:00 pm*	Paul M. Vanhoutte Distinguished Lectureship in Vascular Pharmacology
Monday, April 6	6:00 pm - 6:30 pm*	Annual Division Meeting - Division for Cardiovascular Pharmacology
Monday, April 6	6:30 pm - 8:30 pm	Mixer: Division for Cardiovascular Pharmacology

Monday, April 6	4:00 pm - 4:45 pm	Scientific Achievement Award in Drug Discovery and Development Lecture
Monday, April 6	4:45 pm - 6:00 pm	Notable Platform Presentations in Drug Discovery and Development
Monday, April 6	6:00 pm - 6:30 pm	Annual Division Meeting - Division for Drug Discovery and Development
Monday, April 6	6:30 pm - 8:30 pm	Joint Mixer: Divisions for Drug Discovery and Development, Cancer Pharmacology, and Translational and Clinical Pharmacology



Tuesday, April 7	4:00 pm - 4:45 pm	Bernard B. Brodie Award in Drug Metabolism Lecture
Tuesday, April 7	4:45 pm - 6:00 pm	Division for Drug Metabolism and Disposition Gillette Awards and Junior Investigator Platform Session
Tuesday, April 7	6:00 pm - 6:30 pm	Annual Division Meeting - Division for Drug Metabolism and Disposition
Tuesday, April 7	6:30 pm - 8:30 pm	Joint Mixer: Divisions for Drug Metabolism and Disposition, Pharmacology Education, and Toxicology

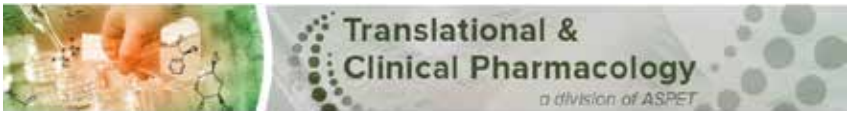
*Tentative Times

Friday, April 3 – Saturday, April 4	See schedule	Colloquium on G Protein-Coupled Receptors: Evolving Insights from Pharmacology to Physiology (separate fee)
Tuesday, April 7	4:00 pm - 6:00 pm	Division for Molecular Pharmacology Postdoctoral Award Competition
Tuesday, April 7	6:00 pm - 6:30 pm	Annual Division Meeting - Division for Molecular Pharmacology
Tuesday, April 7	6:30 pm - 8:30 pm	Mixer: Division for Molecular Pharmacology

Monday, April 6	6:30 pm - 8:30 pm	Joint Mixer: Divisions for Neuropharmacology and Behavioral Pharmacology
Tuesday, April 7	4:00 pm - 6:00 pm	Division for Neuropharmacology Early Career Award Lecture and Postdoctoral Fellow Showcase
Tuesday, April 7	6:00 pm - 6:30 pm	Annual Division Meeting - Division for Neuropharmacology

Tuesday, April 7	4:00 pm - 5:30 pm	Symposium: Methodologies for Integrating Basic and Clinical Sciences in Pharmacology Education
Tuesday, April 7	5:30 pm - 6:30 pm	Annual Division Meeting - Division for Pharmacology Education
Tuesday, April 7	6:30 pm - 8:30 pm	Joint Mixer: Divisions for Pharmacology Education, Drug Metabolism and Disposition, and Toxicology

Tuesday, April 7	4:00 pm - 6:00 pm	Highlights and Advances in Toxicology
Tuesday, April 7	6:00 pm - 6:30 pm	Annual Division Meeting - Division for Toxicology
Tuesday, April 7	6:30 pm - 8:30 pm	Joint Mixer: Divisions for Toxicology, Drug Metabolism and Disposition, and Pharmacology Education



Monday, April 6	4:00 pm - 6:00 pm	Division for Translational and Clinical Pharmacology - Young Investigator Awards Platform and Early Career Faculty Showcase
Monday, April 6	6:00 pm - 6:30 pm	Annual Division Meeting - Division for Translational and Clinical Pharmacology
Monday, April 6	6:30 pm - 8:30 pm	Joint Mixer: Divisions for Translational and Clinical Pharmacology, Cancer Pharmacology, and Drug Discovery and Development

ASPET Meetings

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

Thursday, April 2, 2020	
1:00 pm – 4:00 pm	Finance Committee Meeting
5:00 pm – 9:00 pm	Council Meeting
Friday, April 3, 2020	
7:30 am – 1:00 pm	Council Meeting
11:00 am – 8:00 pm	Mentoring Network: Coaching for Career Development (mentors)
2:00 pm – 8:00 pm	Mentoring Network: Coaching for Career Development (mentees)
6:30 pm – 9:00 pm	Council Dinner
Saturday, April 4, 2020	
8:30 am – 12:00 pm	Mentoring Network: Coaching for Career Development (mentors and mentees)
12:00 pm – 1:30 pm	Mentoring Network Lunch
1:00 pm – 2:00 pm	Science Policy Committee Meeting
1:00 pm – 2:00 pm	Division Communication Officers Meeting
4:30 pm – 6:00 pm	ASPET Business Meeting and Awards Presentation
8:30 pm – 10:00 pm	President's Reception (*by invitation only*)
Sunday, April 5, 2020	
7:00 am – 8:00 am	Executive Committee – Div. for Drug Metabolism and Disposition
7:00 am – 8:00 am	Executive Committee – Div. for Translational and Clinical Pharmacology
7:00 am – 8:00 am	Fellows Review Committee Meeting (tentative)
7:30 am – 9:30 am	*JPET* Editorial Board Meeting
7:30 am – 9:30 am	Diversity and Inclusion Breakfast (RSVP required)
12:00 pm – 1:00 pm	Executive Committee – Div. for Cancer Pharmacology
12:00 pm – 1:00 pm	Executive Committee – Div. for Behavioral Pharmacology
12:00 pm – 1:00 pm	Executive Committee – Div. for Cardiovascular Pharmacology
12:00 pm – 2:00 pm	Board of Publications Trustees Meeting
12:15 pm – 2:00 pm	Undergraduate Networking and Career Development Luncheon (RSVP required)
7:30 pm – 10:00 pm	Board of Publications Trustees Joint Editorial Boards Dinner
Monday, April 6, 2020	
7:00 am – 8:00 am	Mentoring and Career Development Committee Meeting
7:00 am – 8:00 am	Nominating Committee Meeting
7:00 am – 8:00 am	Executive Committee – Div. for Toxicology
7:30 am – 9:30 am	*Molecular Pharmacology* Editorial Board Meeting
12:00 pm – 1:00 pm	Executive Committee – Div. for Drug Discovery and Development
12:00 pm – 1:00 pm	Executive Committee – Div. for Molecular Pharmacology
12:00 pm – 1:00 pm	Young Scientists Committee Meeting
12:00 pm – 2:00 pm	*Pharmacological Reviews* Editorial Board Meeting
2:00 pm – 4:00 pm	*Pharmacology Research & Perspectives* Editorial Board
6:30 pm – 9:00 pm	Past President's Dinner
Tuesday, April 7, 2020	
7:00 am – 8:00 am	Executive Committee – Div. for Neuropharmacology
7:00 am – 8:00 am	Executive Committee – Div. for Pharmacology Education
7:30 am – 9:30 am	*Drug Metabolism and Disposition* Editorial Board Meeting
12:00 pm - 1:00 pm	Council of Division Chairs Meeting
3:00 pm – 5:00 pm	*Pharmacology Research & Perspectives* Management Committee
Wednesday, April 8, 2020	
8:00 am – 12:00 pm	Program Committee Meeting

Give a Day of Service to San Diego at EB 2020

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

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

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

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

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

Missed out on abstract submission? It's not too late!

Maybe your results were not available in time for the EB deadline. There's still time to showcase your cutting-edge science by submitting a Last Chance Abstract. If accepted, your research will be programmed as a poster presentation. High scoring submissions can earn designation as Program Committee Blue Ribbon Picks and be invited to give a Datablitz talk (travel and poster awards are not available). For more information, please visit: www.aspet.org/eb2020-abstracts-dec-tpharm

Last Chance Abstract Submissions are due by **Thursday, January 30, 2020**.

Friday, April 3 - Saturday, April 4, 2020
San Diego Convention Center

Register now. Space is limited for this satellite meeting to EB 2020. Visit www.aspet.org/gpcr-colloquium-2020 and add a GPCR Colloquium ticket to your EB registration.

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

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

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

Nobel Laureate Keynote Lecture

Brian Kobilka, Stanford University
"Structural Insights into the Dynamic Process of G protein-Coupled Receptor Activation"

Speakers

- **Mark Knepper,** *Multi-systems Approaches to Define Vasopressin Action*
- **Nina Wettschureck,** *Signal Cell Analysis of GPCR Expression: Implication for Physiology and Pathophysiology*
- **Kirill Martemyanov,** *Charting GPCR Signaling Network by Unbiased Approaches*
- **Sriram Kosuri,** *Assessment of GPCR Function Using Multiplex Approaches with Next-generation Sequencing*
- **Chris Tate,** *Molecular Basis for High-affinity Agonist Binding at the Beta1-adrenoceptor*
- **Bryan Roth,** *Talk Title Pending*
- **Minghong Ma,** *G protein-Coupled Olfactory Receptors: Novel Insights into Responsiveness and Mechano-sensitivity*
- **Laura Wingler,** *Molecular Mechanisms of Biased Signaling at the Angiotensin Receptor*
- **Jerold Chun** *SIP, LPA and Their Receptors in CNS Disorders*
- **Kathleen Caron,** *Novel Regulatory Functions of GPCRs in Vascular Growth and Remodeling*
- **Willis (Rick) Samson,** *Novel Peptide-activated (Orphan) GPCRs: New Insights and Therapeutic Opportunities*
- **Lora Heisler,** *Targeting GPCRs to Improve Obesity*

GPCR Colloquium Sponsors

Learn how your organization can support the colloquium. Contact meetings@aspet.org or (301) 634-7060. Visit the GPCR Colloquium webpage for updates at www.aspet.org/gpcr-colloquium-2020

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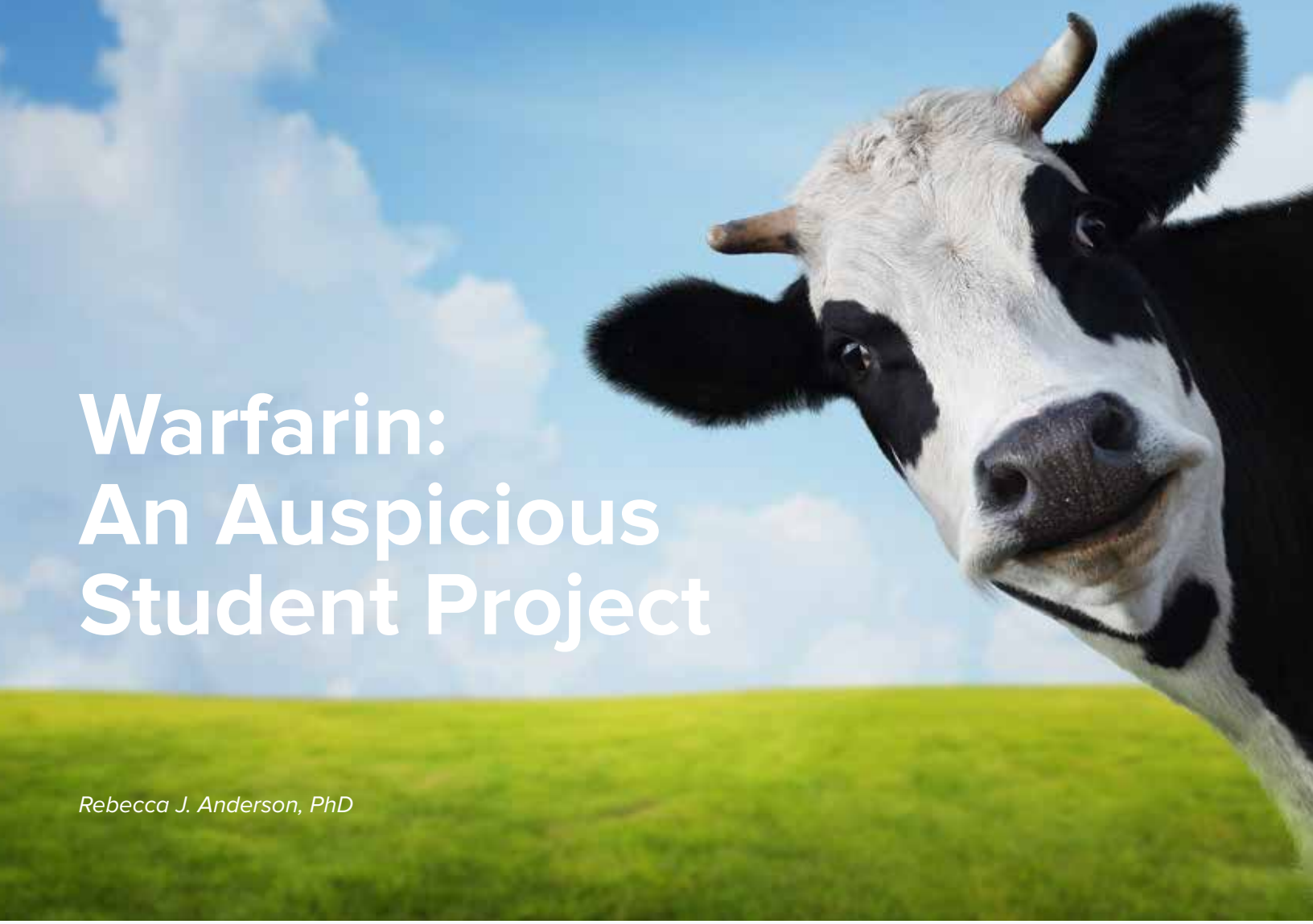

Warfarin: An Auspicious Student Project

Rebecca J. Anderson, PhD

On a frigid Saturday morning in February 1933, Ed Carlson hoisted a dead cow into his pickup truck—the latest in a series of cattle losses on his farm that winter. In December, two of his young heifers had died. In January, his favorite old cow had developed a massive hematoma on the thigh. When it was lanced, the bleeding proved fatal. Then, on a Friday in February, two more cows died, and Carlson's bull was oozing blood from its nose *(1, 2)*.

To the local veterinarian in Deer Park, Wisconsin, the problem was all too familiar. He told Carlson there was a hemorrhagic toxin in his hay. Carlson doubted that explanation. He had been feeding the same sweet clover hay to his cattle for years with no ill effects. He decided to get another opinion—from state experts *(1-3)*.

So, on that Saturday in February, Carlson drove 190 miles through a blizzard to the Agricultural Experiment Station in the state capital. Unfortunately, when he arrived, the State Veterinarian's office was closed *(1, 2)*.

But in the Biochemistry Building of the University of Wisconsin, Karl Paul Link and his student assistant, Eugen Wilhelm Schoeffel, were still at work. Carlson hauled in the dead cow, along with a milk can of unclotted blood and about 100 pounds of hay *(1-3)*. Link listened intently as Carlson related his sad saga. Although Link was not a veterinarian, he recognized the symptoms. They fit "perfectly with the classical sweet clover poisoning picture" *(2)*.

Sweet Clover Turns Sour

Link first heard about sweet clover disease just two months before Carlson's arrival. Ross Gortner, the chairman of biochemistry at the University of Minnesota, had invited Link for an interview *(2)*. Gortner gave him publications by the original researchers of sweet clover disease, which was also a problem in Minnesota. He invited Link to join the lab's efforts to identify the substance in the hay that was causing the bleeding.

This hemorrhagic disease was first characterized in the 1920s by two veterinarians, Lee M. Roderick in North Dakota and Frank W. Schofield in Alberta,

Canada *(1, 4, 5)*. They systematically excluded a pathogen or nutritional deficiency as the cause *(1, 2)*. The bleeding was sporadic, but they found that it correlated with years when the summer and autumn were unusually wet. Hay that was stored while still damp turned moldy.

Sweet clover disease appeared within 15 days of ingestion of the spoiled hay and killed the animal within 30-50 days *(1-3)*. But Schofield and Roderick found that the symptoms could be reversed by removing spoiled hay from the animals' diet and transfusing sick cows with fresh blood from healthy animals *(1-3, 5)*.

Link gave Carlson the same advice. Sadly, though, he and Schoeffel both knew the poor farmer could not afford to discard his only stacks of hay nor pay for transfusions. The economic hardship of the Great Depression forced farmers to feed moldy hay to their cattle *(1, 3, 5)*. After a disheartened Carlson left for his long journey back to Deer Park, Schoeffel could contain his rage no longer.

Schoeffel came to the US in 1926 from southern Germany with a diploma in agricultural chemistry *(1, 2)*. He joined Link's laboratory as an assistant in 1929. Energetic and loyal, he frequently quoted Goethe and Shakespeare and spoke with an earthy, guttural Swabian-German accent *(2)*.

Schoeffel paced back and forth, shouting 'Get some good hay.' Ach!! Gott, how can you do dat ven you haf no money?" *(2)*.

He dipped his hands repeatedly into the milk can, muttering, "Dere's no clot in dat blook!" *(2)*. That same afternoon, at Schoeffel's urging, they began searching for the cause of sweet clover disease.

An Analytical Showman

Of all the researchers investigating sweet clover disease, Karl Link was uniquely positioned to succeed. A generous, kind, and thoughtful person, Link was also a prolific and analytical notetaker. The heading of even his personal letters, for example, included specific meteorological data: "Temp. 30F., B.P. 29.93", overcast-snow is predicted. IX/26/67 at 5:00 A.M. C.S.T." *(6)*.

Link obtained his PhD in agricultural chemistry from the University of Wisconsin in 1925, studying the carbohydrates in corn seedlings. Postdoctoral work in Europe introduced him to microchemical analysis, which he soon mastered. Returning to the University of Wisconsin as an assistant professor in

Karl Paul Link

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agricultural chemistry, Link continued researching the carbohydrates in plants and set up a state-of-the-art microchemical analysis unit *(6)*.

Link dressed to attract attention, wearing large bow ties, flannel shirts, and shorts. He taught with a flair, holding the students' attention like a showman. They loved him, and he always had their back *(6)*.

Link had already established himself as one of the outstanding carbohydrate chemists of his day when his attention was drawn to sweet clover hay. He had decided to stay in Madison, rather than accept the Minnesota position, and his first sweet clover research had nothing to do with hemorrhagic disease. In January 1933, R.A. Brink and W.K. Smith asked for his assistance with their sweet clover husbandry studies *(2)*.

Coumarin gives new mown hay its characteristic scent, but it tastes bitter. Taste tests in cattle and rabbits showed that they preferred sweet clover plants (*Melilotus alba* and *M. officinalis*) that have low coumarin content *(1-5, 7)*. Brink and Smith, in the university's genetics department, wanted to develop a strain of sweet clover that was low in, or free from, coumarin and that would thrive in Wisconsin's climate *(1, 2)*.

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M. officinalis

Catching the Big Fish

Link and his genetics colleagues expanded their studies of sweet clover after Ed Carlson's visit. To isolate the hemorrhagic agent, they needed to measure the extent of blood clotting in each fraction they extracted from the spoiled hay. Unfortunately, all of the published assay methods gave unreliable results.

Link had no previous experience with blood coagulation, but this was a good student project. Starting from scratch, Schoeffel and another student, Willard L. Roberts, began developing a quantitative bioassay, taking full advantage of Link's microanalysis facilities *(2)*.

In May 1937, when Schoeffel moved to a lab of the American Medical Association in Chicago, the assay development work was transferred to another student, Harold A. Campbell *(6)*. Because of wide variations in clotting of blood from individual rabbits, Campbell (with the assistance of geneticist Smith) bred and reared a colony of susceptible rabbits specifically for the assay. Using blood from those rabbits, Campbell succeeded in developing a reliable bioassay in 1938 *(2)*.

In parallel, Link, Smith, Roberts, and especially Campbell labored to extract, separate, and isolate the hemorrhagic substance from spoiled sweet clover hay *(2, 7)*. After many dead ends, Campbell finally succeeded. At dawn on June 28, 1939, after working all night, he peered through his microscope and saw the crystalline substance. Two hours later, he had collected about 6.0 mg of it *(2, 6)*. He worked nonstop for two more days to collect data on its anticoagulant effect.

Campbell was a no-nonsense worker, not inclined to show his emotions, but when he presented Link with a vial of the crystalline substance and his bioassay results, he was "as happy as a boy who had just caught his first big fish" *(2)*. They sent a telegram to Schoeffel, who, employing his unique wordsmithing, immediately replied that he had "complete confidence in Nature, Fate, and [you]" *(2)*.

Campbell isolated the compound three more times before receiving his PhD in October 1939. Then, another graduate student, Mark A. Stahmann, assumed leadership of the project. Stahmann had been working in Link's lab since 1936, studying plant disease resistance *(2, 6)*. Although he had almost completed his thesis work, he turned his attention, at Link's request, to large-scale extraction of the substance Campbell had isolated *(2)*.

More Student Projects

Stahmann acquired a number of oak barrels and drew on the large supply of spoiled sweet clover hay

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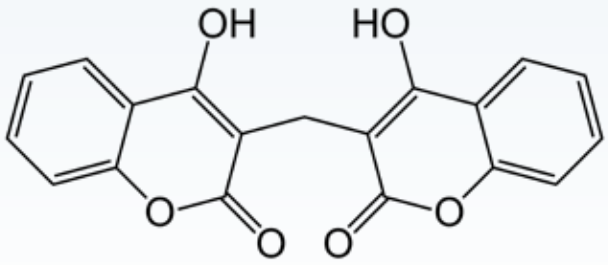
Mark A. Stahmann and Karl Paul Link

that Willard Roberts had gathered and stored in the campus horse barn *(2, 6)*. Knowing the compound's chemical properties, he was able to develop a shorter and more efficient extraction procedure *(7)*.

After 4 months' effort, Stahmann had extracted about 1.8 grams of the crystalline compound *(2, 6, 7)*. This was enough material to dose rabbits and confirm that the substance's anticoagulant effect was identical to that obtained by Campbell when his rabbits were fed spoiled hay samples *(7)*.

They were also able to elucidate the compound's chemical structure. Charles F. Huebner, a sensitive, brilliant, and deft student researcher with a lively imagination, conducted most of that work *(6)*. In short order, he arrived at the correct structure: 3,3'-methylenebis (4-hydroxycoumarin). It was an oxidized form of coumarin, in which two hydroxycoumarin molecules were fused together.

Knowing the chemical structure, Link thought it plausible that both of the undesirable properties of sweet clover (the bitterness of green hay and the tendency to cause hemorrhage when improperly cured) derived from a common source: coumarin *(2, 7)*. So, Link called this "double-coumarin alcohol" dicumarol.



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Chemical structure of dicumarol

In January 1940, Huebner began efforts to synthesize dicumarol, using simple starting materials including acetylsalicylic acid *(6)*. He succeeded on April 1, 1940 *(1, 2)*. Huebner's synthetic compound had chemical and physical properties identical to the natural product that Campbell and Stahmann had extracted from spoiled sweet clover *(2, 6)*.

In reviewing the literature, they found that two German chemists, Anschutz and Fresenius, had synthesized the compound in 1903, but those chemists did not realize that it had anticoagulant properties *(6)*. Campbell was the first person to extract dicumarol from a source in nature.

On April 5, 1940, Ralph Overman, another student in Link's lab, confirmed that the synthetic and naturally extracted compounds were biologically equal when tested in the rabbit bioassay *(2, 6)*. Eventually, investigators determined that molds such as *Penicillium nigricans* and *Penicillium jensi* convert the coumarin in damp sweet clover hay to dicumarol *(3, 8)*.

Stahmann and Link found that the molds convert only a very small fraction of the total coumarin in sweet clover to dicumarol. They concluded that it was impractical to control the hemorrhagic action by developing sweet clover strains with low coumarin content *(7)*. The most efficient way to manage sweet clover disease remained discarding the spoiled hay and transfusing affected animals with fresh blood.

Roderick and Schofield had reported that the hemorrhagic syndrome does not cause permanent injury. Eating spoiled hay, even for long periods (short of death), caused no permanent functional change, no morphologic change, and in the liver, no detectable pathologic changes *(2, 3)*.

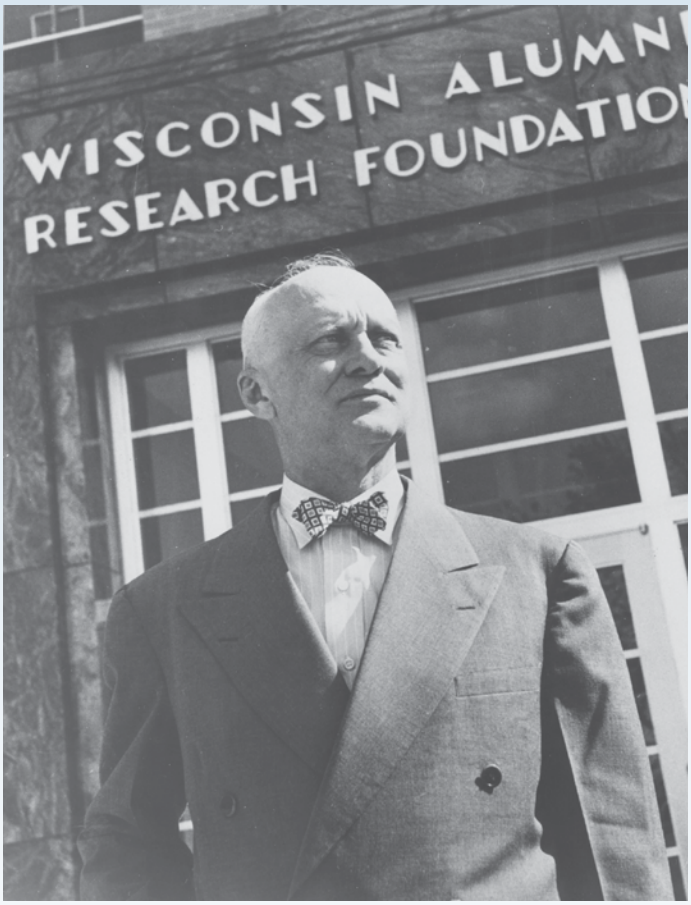
Similarly, Stahmann and Link found that a single massive dose of dicumarol—although, predictably, affecting blood clotting—did not produce gross signs of injury. Even subjecting rabbits repeatedly to dicumarol more than 100 times (with a rest period in between) did not cause permanent injury, immunity, or increased susceptibility to dicumarol—despite causing a large reduction in clotting activity after each dose *(7)*.

To cause fatal hemorrhages, they concluded, dicumarol needed to be administered repeatedly and aggressively. "The spread between the detectable and lethal dose, together with the relative ease with which it may be synthesized and administered," they said, gave dicumarol favorable properties that might be useful to both physiologists and clinicians *(7)*.

On April 9, 1940, Link proudly reported to the dean of the College of Agriculture that all of this work to isolate and synthesize dicumarol had been conducted by graduate students in training for their PhD degrees. He also said that they were preparing analogs that were more potent and worked more rapidly than dicumarol, as well as exploring whether those analogs would be useful clinically *(6)*.

The WARF Path

Into the 1930s, most universities (as nonprofit institutions) concentrated on basic research and saw ethical difficulties with controlling intellectual property and earning profits from their scientific discoveries. Few managed their own patents *(9, 10)*. The University of Wisconsin was a rare exception.



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Harry Steenbock

In the early 1920s, Harry Steenbock, a professor of biochemistry, discovered that certain dietary fats could be fortified with vitamin D when exposed to ultraviolet light *(9-11)*. Vitamin D was a relatively unknown substance at the time, but the financial potential of vitamin D as a dietary supplement was huge *(11)*. Unfortunately, the president of the University of Wisconsin was reluctant to support Steenbock's efforts to apply for patents *(10)*. He was concerned that the potential benefits would not justify the expense. Also, University-sponsored patenting was controversial, and unorthodox, especially among Progressives in the state government *(10)*.

In a creative move, Steenbock, along with the deans of the College of Agriculture and the Graduate School, proposed—and the university's regents endorsed—creation of an independent, nonprofit corporation run by alumni trustees. This corporation, the Wisconsin Alumni Research Foundation (WARF), was the first university-affiliated patenting office *(9, 10)*. It managed the university researchers' patents and invested the resulting revenue in faculty research projects *(9, 11)*.

WARF's first initiative was to patent and commercialize Steenbock's vitamin D discoveries, which contributed to the virtual elimination of rickets (caused by vitamin D deficiency). Vitamin D sales also generated millions of dollars for university research *(11, 12)*.

Subsequently, WARF managed the patents of other university researchers *(11)*. Among them were Link and Stahmann, who, with the assistance of WARF, filed a patent for dicumarol in 1941 *(3, 5, 12)*. The co-inventors assigned their patent rights to WARF, and in exchange they received 15% of the net income *(10)*.

Therapeutic Limitations

From 1940-1942, Link's group characterized the pharmacology of dicumarol. The onset of anticoagulant action lagged 12-24 hours after dicumarol administration, but the effect accumulated with repeated dosing *(2)*. Efficacy varied, based on species (rabbit, rat, guinea pig, mouse vs. dog blood), age, nutritional status, interactions with other drugs, hepatic and renal function, and pregnancy *(2, 7)*.

Dicumarol is structurally similar to vitamin K and acts as a competitive inhibitor, preventing fibrinogen from forming clots *(1, 5, 8, 13)*. Link found that vitamin K counteracted the anticoagulant action of dicumarol so effectively that he was certain it could serve as an antidote in cases of excessive bleeding *(2)*.

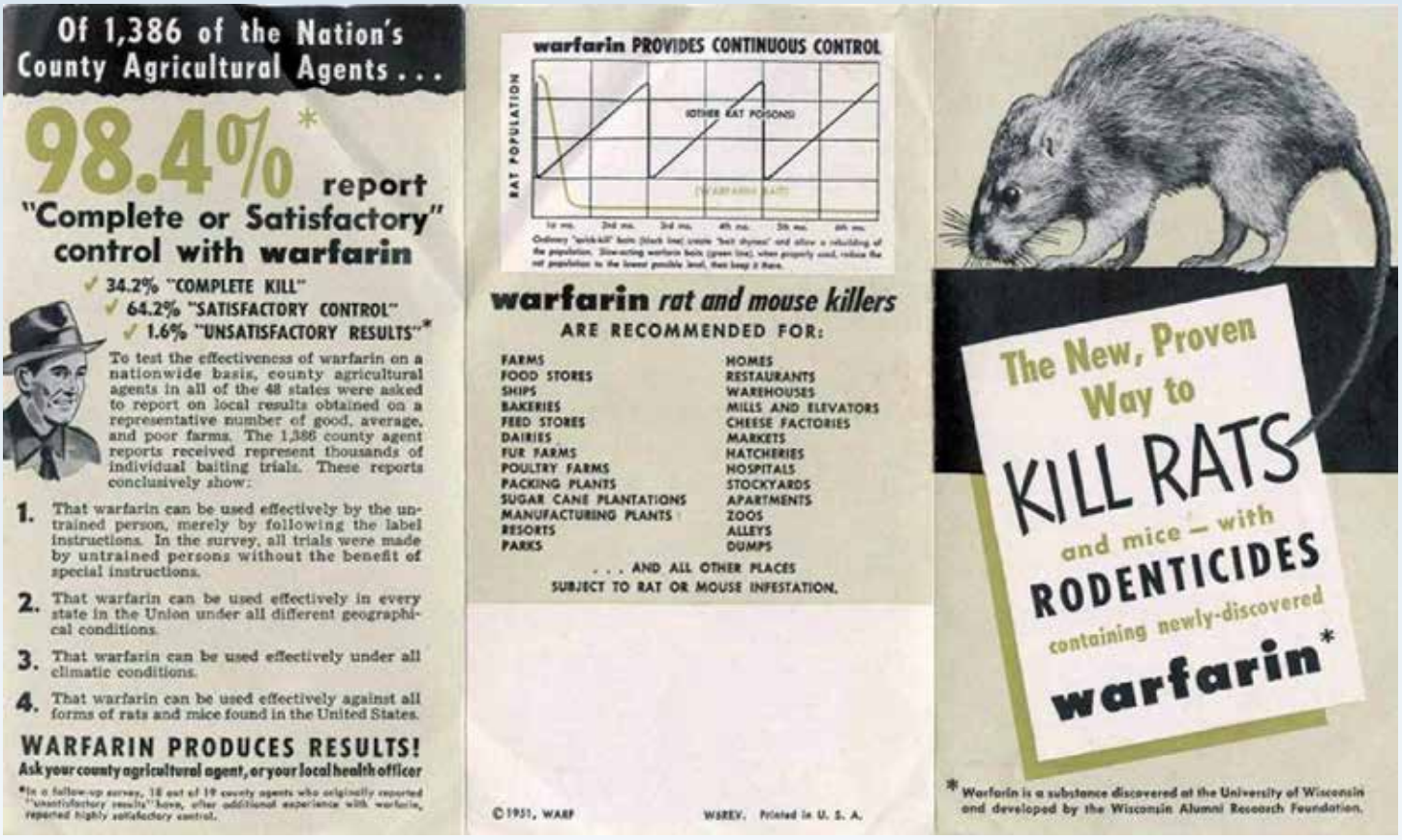
Studies in patients at the Mayo Clinic and Wisconsin General Hospital in the early 1940s confirmed that dicumarol delayed coagulation and prolonged prothrombin time *(2, 6)*. Vitamin K counteracted the anticoagulant effect, and unlike heparin, dicumarol was effective when given orally. These observations facilitated dicumarol's acceptance in clinical practice *(6)*.

But because of the long lag time before onset of the therapeutic effect and the long excretion time, the drug was less than ideal *(1, 2, 5)*. Clinicians would have preferred an oral anticoagulant with better pharmacokinetics *(2)*.

A Perfect Poison

In the two years after Huebner first synthesized dicumarol, Link's students made over 150 analogs *(1, 2)*. Some exhibited a slower but more sustained anticoagulant action, while others had a shorter duration than dicumarol. Some were more potent, and their solubility varied *(1, 6)*.

As World War II proceeded, work in Link's laboratory slowed to a crawl because many of his students were serving in the armed forces *(2)*. In September 1945, still awaiting their discharge from service, Link took a rare



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1951 warfarin advertisement

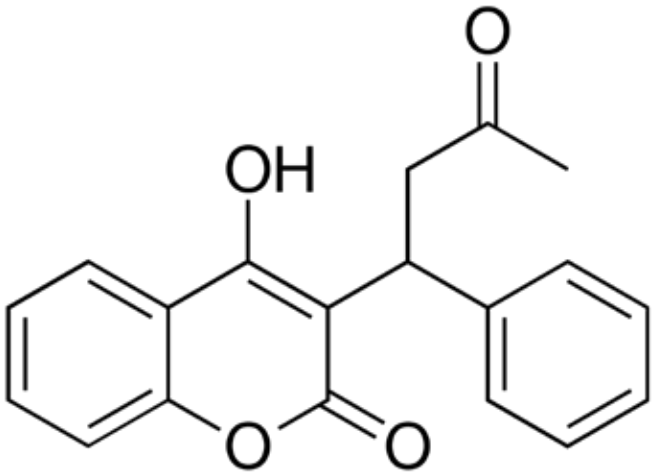
break from the laboratory. While on a canoe trip with his family, he was caught in a rainstorm. Soaked and chilled, he suffered a recurrence of tuberculosis, which he had first contracted during his postdoctoral training in Europe *(2)*.

Link spent two months in Wisconsin General Hospital and then six months recuperating at the Lake View Sanatorium *(6)*. Stahmann, who had taken a position at Rockefeller Institute in 1942 after receiving his PhD, returned to Wisconsin to supervise Link's lab during his absence.

To keep his mind occupied while his body recovered, Link reviewed the accumulated data on the dicumarol analogs. He was looking for compounds with favorable chemical properties: a high degree of purity, absence of taste and odor, low cost of goods, and the ability to be easily converted to stable water-soluble salts *(2)*. He also read a book on the control of rodents from ancient to modern times.

When Lester D. Scheel returned from military service in the spring of 1946, Link asked him to collect more data on the anticoagulant activity of analogs numbered 40-65. Those compounds had been made by Miyoshi Ikawa in 1942-1943 *(2)*. Scheel reported that compound no. 42 was much more potent than dicumarol in rat and dog blood, and it produced a more uniform anticoagulant response *(2, 6)*. It had been so potent in the original rabbit bioassay that Link—concerned about toxicity—had made no move to patent it *(6)*.

Despite Link's reservations, Mark Stahmann thought no. 42 had potential. In February 1945, he contacted WARF to initiate a patent application *(6)*. WARF's attorney filed the patent on compound no. 42 in April



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Chemical structure of warfarin

1945, with Link, Stahmann, and Ikawa as co-inventors *(6, 14)*. Later, they also patented the sodium salt, which was more water-soluble.

When Link returned to the lab, he proposed using no. 42 as a rodenticide *(2)*. Field tests confirmed that the compound was effective *(15)*. Unlike other rat poisons, no. 42 was toxic only after accumulation of multiple small doses over 3-6 days *(2, 8, 15)*. The rodents ate the bait until hemorrhage set in—just like the cattle that ate spoiled sweet clover hay—and died without awareness that they were sick. They neither refused nor avoided the bait, making it an ideal poison *(2, 15)*.

Link coined the name for no. 42. By combining WARF's initials with "arin" from coumarin, he came up with "warfarin" *(2)*. He consulted WARF attorneys and scientists, who assisted with development of warfarin as a commercial rodenticide. The concentrated product contained 0.5% warfarin in cornstarch. Customers prepared bait by cutting the warfarin-concentrate with a grain (usually cornmeal) to a final ratio of 1:4,000 *(15)*.

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A d-CON can

One popular warfarin product, d-CON, also contained a vegetable oil that rodents were fond of *(15)*. Through WARF's intensive promotional efforts, warfarin, in short order, revolutionized rodent control *(2, 10)*.

From Poison to Patients

Link also re-examined the accumulated data on the dicumarol analogs from a physician's perspective. He hoped to find one that retained the virtues of dicumarol but overcame its clinical limitations.

Warfarin stood out. Like dicumarol, its anticoagulant effect could be reversed with vitamin K *(2, 3, 5, 6)*. But compared to dicumarol, warfarin had greater water solubility, higher oral bioavailability, and a faster onset of action *(2, 5)*.

Link knew that anticoagulant potency varied widely between species, and from what he saw in the warfarin data, he concluded that the toxicity in rats was not a reliable indicator of how patients would respond. In late 1950, he suggested to Ovid Meyer at the University of Wisconsin and Shepard Shapiro at New York University that they should try the water-soluble sodium salt of warfarin in their patients. But convincing clinicians to prescribe a rat poison "was a bit more than they could accept with real enthusiasm" *(2)*.

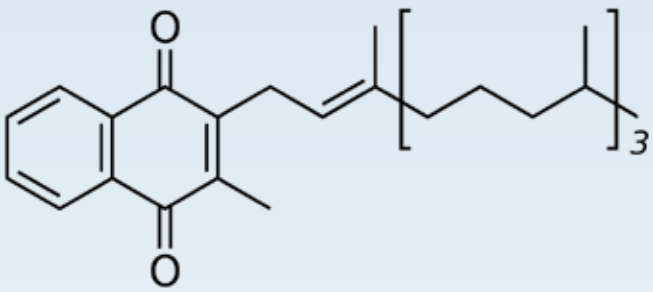
Then, on April 5, 1951, Link received support from an unexpected and unlikely source. Captain Julian Love in the US Naval Medical Corps called and described a case of attempted suicide using warfarin *(2)*.

On March 26, 1951, a 22-year-old man (depressed at being drafted into the US Army and destined for Korea) ate a small portion of concentrated d-CON. It tasted somewhat sweet, like marshmallow, and caused no unpleasant sensations *(15)*. Because that single dose failed to produce the intended results, he continued taking equal daily amounts, consuming an entire 4-ounce canister of d-CON over 6 days—a total of 567 mg of warfarin (100 times the therapeutic dose) *(15)*.

He finally began experiencing symptoms: abdominal pain, nose bleeds, and an episode of vomiting. Frustrated and increasingly uncomfortable, he went to the Naval Hospital in Philadelphia, where he was admitted on April 4, 1951 *(15)*.

The marked decrease in blood clotting, along with the patient's confession that he had eaten d-CON, established a diagnosis of warfarin poisoning. Physicians in the Naval Medical Corps administered daily transfusions of fresh whole blood and intravenous vitamin K. After 1 week of treatment, the

patient's prothrombin time returned to normal, and he made a complete recovery *(15)*.



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Chemical structure of vitamin K1

This case study, published in 1952, was the first evidence of warfarin's wide safety margin in humans. It also confirmed the effectiveness of reversing warfarin overdose with blood transfusions and vitamin K. The Naval officers concluded that "taking the drug for suicidal purposes would require marked perseverance and a continued desire..." *(15)*.

This incident made it easier to convince clinicians that warfarin was safe. Meyer and Shapiro conducted meticulous studies and confirmed that warfarin was superior to dicumarol and the other anticoagulants they had tried *(2, 16)*. In addition to its greater potency and good bioavailability by any route, warfarin acted faster than dicumarol. They also confirmed that vitamin K readily controlled bleeding.

Link convinced his friend, S. M. Gordon, at Endo Laboratories in Richmond Hill, NY, to produce the water-soluble salt of warfarin for clinical use. Endo Laboratories marketed it under the tradename, Coumadin Sodium®, which was approved for human use by the FDA in 1954 *(2, 4, 5, 12)*.

A Presidential Boost

In 1955, another event raised the standing of warfarin even further *(6)*. In August, President Dwight Eisenhower arrived in Denver for a working vacation at the home of his in-laws *(17)*. After a round of golf at the Cherry Hills Golf Club on Friday, September 23, he complained of indigestion and retired at 10 pm *(17, 18)*. He awoke at 2:30 am with a dull pain in his chest and took milk of magnesia, his usual remedy for indigestion *(18)*. As a precaution, Mrs. Eisenhower contacted his personal physician, Major General Howard Snyder, who arrived at the Doud home at 3:00 am.

Snyder gave Eisenhower amyl nitrite, papaverine, morphine (for his pain and possible angina), and heparin (for possible thrombosis) *(18)*. While Eisenhower slept that morning, Snyder summoned cardiologists from nearby Fitzsimons Army Hospital. They brought an electrocardiograph, and the EKG indicated a left anterior infarction.

Eisenhower was informed that he had suffered a heart attack, and he was transported to Fitzsimons in a Secret Service car. After admission to a suite of rooms on the hospital's eighth floor, Eisenhower was placed in an oxygen tent and continued taking heparin *(17, 18)*.

Eisenhower had confidence in the army specialists at Fitzsimons and Walter Reed Army Hospital, whom Snyder consulted. But the president's advisors thought the public would be reassured and perhaps have more confidence, "however unwarranted," in a civilian heart specialist *(18)*. So, Snyder contacted Paul Dudley White, chief of cardiology at Massachusetts General Hospital and famous for his collaborations to describe the Wolff-Parkinson-White syndrome. White arrived in Denver by Air Force plane on Sunday morning *(18)*.

Aware of criticism surrounding coverups of previous presidents' illnesses, Eisenhower instructed his staff to tell the public everything. At a press conference on Monday, White detailed the president's condition, down to his bowel movements *(18)*. A few days later, Eisenhower's press secretary issued an update, announcing that Coumadin (warfarin) had replaced heparin, and "the present prothrombin level has been well maintained" *(2)*.

"the most important man in the world today was being anticoagulated via warfarin sodium"

In Madison, after reading the press release in the newspaper, Link was pleased that "the most important man in the world today was being anticoagulated via warfarin sodium" *(2)*. Eisenhower continued taking warfarin for years *(18)*.

Clinical Success

By the late 1950s, considerable anecdotal evidence had accumulated that heparin and/or warfarin were effective in reducing venous thrombosis and pulmonary embolism, but complicating factors clouded interpretation of this evidence *(19, 20)*. Physicians identified pulmonary embolism through a combination of signs and symptoms, but they rarely could make a

definitive diagnosis before death *(19)*. Also, despite some strong advocates, many physicians and surgeons were still reluctant to use anticoagulants routinely because of the risk of hemorrhage.

In 1957, British investigators began enrolling patients in the first randomized, placebo-controlled clinical trial *(19)*. Treatment with heparin and the warfarin analog, acenocoumarol, completely prevented deaths and non-fatal recurrences from pulmonary embolism, whereas 5 of 19 patients in the placebo group died and 5 others had non-fatal recurrences *(19, 20)*. With such a dramatic effect, the investigators changed the trial protocol, asserting that it was unethical to withhold treatment. All of the next 54 patients in the trial received the heparin-acenocoumarol combo, and none of them died from pulmonary embolism *(19, 20)*.

This landmark study, which was published in 1960, provided the first conclusive evidence that anticoagulant treatment was effective in thromboembolic patients. It also paved the way for additional randomized clinical trials *(20)*. Among other things, those clinical trials showed that warfarin can reduce the chance of stroke by half *(8)*. By the end of the 1970s, long-term treatment with warfarin was the standard of care for preventing recurrence of venous thromboembolism *(21)*.

Warfarin became the most widely used anticoagulant in the world *(3, 4)*. It is viewed by many as the best medication to prevent and treat deep-vein thrombosis and pulmonary embolism, and to prevent stroke in patients who have atrial fibrillation, valvular heart disease, or a prosthetic heart valve *(3, 8)*. As the size of the elderly population increased, warfarin use also increased, from 21 million outpatient prescriptions in 1998 to nearly 35 million in 2010 *(22)*.

Getting the Dose Right

From the beginning, warfarin dosing was a challenge because of large variations in individual responses *(23)*. A 40-fold inter-patient variation in dose has been recorded—among the highest individual variation on record for any drug *(1)*. Contributing factors include dietary vitamin K, interactions with other drugs, and patient compliance.

Because this variation leads to a high incidence of bleeding complications in sensitive patients, regular lab monitoring was needed *(1)*. Prothrombin time, first developed in 1935, was the earliest blood test for oral anticoagulant activity *(23)*. But its drawbacks included inter-lab variability and inconsistent methods of data reporting (i.e., time, ratio, or percent activity). And, the commercial reagents supplied for the assay varied in their sensitivity *(1, 23)*.

In 1977, recognizing the need for a standardized measure of prothrombin time, the Expert Committee on Biological Standardization of WHO proposed a scheme for calibrating thromboplastin reagents. In 1983, with further improvements in the methods, the WHO Expert Committee approved a revised scheme, giving rise to the International Normalized Ratio (INR). All manufacturers were required to provide an "international sensitivity index" for their thromboplastin reagents, which is needed to calculate the INR *(3, 23)*.

INR expresses the prothrombin time measured with any reagent as a normalized ratio *(3)*. The average person's INR is around 1.00. The American College of Chest Physicians recommends an INR range of 2.0 to 3.0 for patients at risk of recurrent venous thromboembolism or patients with atrial fibrillation and a medium-to-high risk of stroke *(1, 23)*. For a minority of conditions with a high thrombotic risk (such as mechanical heart valves), the INR is maintained between 2.5 and 3.5 *(1, 23)*.

"It is a shining example of student research productivity"

By 1995, most labs in the US were reporting INR values, and it is still used to monitor patients taking warfarin *(3, 23)*.

Dogged Dosing Difficulties

Still, optimal dosing remains a challenge. Even at the best clinical centers, doctors find calibrating the clinical dose based on INR tedious and difficult *(1)*. A recent survey showed that patients taking warfarin were within their INR target range only 50% of the time *(1, 4)*.

The main risk associated with warfarin continues to be bleeding complications, which are responsible for about 30,000 emergency room visits a year in the US *(4, 22)*. Except for insulin, warfarin is the prescription drug most frequently implicated in emergency room visits *(24)*.

In addition to long-established factors (dietary vitamin K, age, gender, overall health, and concomitant medications), approximately one-third of patients receiving warfarin have genetic variants of CYP2C9 and VKORC1 and are at a higher risk of bleeding *(4, 22, 24)*. Those genetic variants affect the metabolism and inhibition of warfarin and account for 55% of the variation in warfarin's effects *(4)*.

In 2007, the FDA approved the first of several diagnostic tests that detect both of these genetic variants in patients *(24, 25)*. A recently published study reported that genotype-guided dosing significantly reduced the risk of adverse events from warfarin, compared with clinically-guided dosing alone *(26)*.

Link's Legacy

Even with genetic testing, the use of warfarin is complicated by the need for frequent INR monitoring and dose adjustments, and patients must still be mindful of potential drug interactions and foods containing vitamin K *(27)*. To address these drawbacks, a new class of anticoagulant drugs was developed.

Four next-generation drugs have been approved for managing various thromboembolic disorders: dabigatran (Pradaxa®), rivaroxaban (Xarelto®), apixaban (Eliquis®), and edoxaban (Savatsa®). They are at least as effective as warfarin and do not require routine prothrombin monitoring, dietary restrictions, or frequent dose adjustments *(27)*. Their convenience has resulted in a reduction of warfarin prescriptions to about 19 million in 2016.

Despite their advantages, though, the newer anticoagulants are much more expensive than warfarin, which remains the most frequently prescribed oral anticoagulant *(3, 4, 23)*.

Karl Link was elected to the National Academy of Sciences in 1946. He also received Lasker Awards in 1955 and 1960 for basic research and clinical research, respectively *(6)*. But he always credited his graduate students for their key role in the discovery of dicumarol and the development of warfarin. It is a shining example of student research productivity. "They never cease to wonder, they kept on trying, and they were on a project directed toward doing mankind some good" *(2)*. Indeed, many millions of patients have benefitted. And WARF's anticoagulant patents generated $16.8 million ($150 million in today's currency) for the university *(10)*.

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Biosketch:

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

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

Dr. Anderson will share the story of metformin

Don't miss the March 2020 issue.

Meeting News

AACR-NCI-EORTC International Conference on Molecular Targets and Cancer Therapeutics

October 26 – 30, 2019

Hynes Convention Center, Boston, MA

ASPET exhibited for the first time at the 2019 AACR-NCI-EORTC meeting held in Boston. The meeting presented an opportunity to engage with a new audience of attendees interested in cancer pharmacology, molecular pharmacology, and drug discovery and development. ASPET staff shared information about ASPET's membership benefits, publishing opportunities, and divisions with attendees. ASPET members Mary-Ann Bjornsti, PhD (current ASPET Secretary/Treasurer-elect and Past Chair of the Division for Cancer Pharmacology) and Megan Zavorka Thomas, PhD (Junior Communications Officer for the Division for Cancer Pharmacology) also helped answer questions about ASPET to prospective members.

ASPET members Mary-Ann Bjornsti and Megan Zavorka Thomas at the ASPET booth

Winners of the ASPET booth raffle

Secretary-Treasurer-elect, Mary-Ann Bjornsti and Executive Officer, Judy Siuciak

Science Policy News

Recapping the Year in ASPET Advocacy

Though the year isn't over yet—and appropriations for FY20 are still ongoing—the December issue of *The Pharmacologist* gives us an opportunity to look back at the year in advocacy and take stock of where we stand on our core issues: appropriations, animal research, and controlled substances.

Appropriations

The federal government's fiscal year runs from October 1st to September 30th. Under "regular order," the House and Senate will each vote on appropriations bills and then resolve any differences in a conference committee before the beginning of the next fiscal year. However, it has been many years since Congress has completed the appropriations process on time, and FY20 is no different. As of this writing, the government has passed its fiscal year deadline of October 1st and is operating at FY19 funding levels under a continuing resolution. This resolution is set to expire in mid-November, but there is already talk of passing another.

For FY20, ASPET in conjunction with FASEB and its member societies agreed to funding recommendations of $41.6 billion for the National Institutes of Health (an increase of $2.5 billion over FY19) and $9 billion for the National Science Foundation (an increase of $900 million over FY19). ASPET and its partners pushed for these increases at hill days, through fellowship programs, in testimony, and in correspondence with congressional leadership.

While final FY20 numbers are not available, there are encouraging signs that point to funding boosts for agencies that conduct scientific research. In the House, NIH received funding of $41.1 billion (an increase of $2 billion over FY19) and NSF received funding of $8.64 billion (an increase of $540 million over FY19). The House has also already voted on and approved these increases. On the Senate side, things are moving slower, but several appropriations bills have been released and there is more good news for biomedical researchers: NIH is slated for a $3 billion increase, and NSF receives an increase of $300 million. If these numbers are approved, a conference committee will iron out the differences between the two chambers. Assuming the process doesn't get derailed by any number of thorny issues (e.g., funding for a border wall, impeachment), it appears as if NIH and NSF are in line for funding increases.

ASPET also works with coalition partners like the Alliance for a Stronger FDA to advocate for general increases to the budget of the U. S. Food and Drug Administration. On the House side, the FDA received an increase of $184 million over FY19 funding. On the Senate side, the FDA received an increase of $80 million over FY19.

Parallel to appropriations issues, ASPET also worked on the issue of raising the budget caps for 2020 and 2021. A campaign spearheaded by coalition partners Research!America and NDD United asked Congress to raise the statutory caps on discretionary funding so that harsh cuts to spending would not go into effect as required by the Budget Control Act of 2011. ASPET promoted action alerts on the issue, had its Washington Fellows advocate for raising the caps as part of their program, and signed on to numerous letters to Congress endorsing lifting the budget caps. In July, an agreement was reached and the caps were raised which allowed for the types of funding increases mentioned above to be possible.

Animal Research

On animal research issues, ASPET continues to be active with the goal of carving out a space as a leader in defending research with animal models. During the early stages of the appropriations process, ASPET objected to language in a House appropriations bill and in a report accompanying an appropriations bill.

The first, the Military Construction-Veterans Affairs funding bill, contained language that would have ended certain types of canine research at the U.S. Department of Veterans Affairs. ASPET and other leaders in the science policy community wrote letters to the Senate Appropriations Committee requesting that the language be excluded in their bill. As of this writing, that bill has not been revealed yet. The second, the Labor-HHS funding bill, contained language in its accompanying report that would eliminate intramural nonhuman primate research at NIH. ASPET endorsed letters opposing the language and sent action alerts hosted by the National Association for Biomedical Research to membership encouraging researchers to contact Congress and request removal of the language. That language was not included in the Senate bill.

More recently, ASPET issued a statement opposing the Environmental Protection Agency's recent directive from Administrator Andrew Wheeler that instructed the agency to reduce and ultimately eliminate mammalian toxicological testing by 2035. As our statement noted, there are not currently adequate substitutes for many types of animal models and the directive did not appear to consult stakeholders in the science community. ASPET also sent a message to membership advertising an opportunity for individual researchers to sign on to a letter hosted by the international science advocacy group Speaking of Research. That letter, which has 600+ signatories and counting, was recently delivered to Administrator Wheeler.

Controlled Substances

ASPET's foray into controlled substances advocacy is still young but already yielding impressive results. Seeking to build on last year's victory of amending and then defeating the Stop the Importation and Trafficking of Synthetic Analogues (SITSA) bill, ASPET has continued to work with committee staff in the House and Senate to provide input on a range of new bills that have the potential to impact research with controlled substances. Recently, ASPET members provided input to the Senate Judiciary Committee's majority staff on the Stop Overdoses of Fentanyl Act (SOFA). Staffers are working to incorporate the perspective of ASPET members so that the bill does not unduly burden research with fentanyl and its analogues.

Taking a wider scope, ASPET also urged the House and Senate Labor-HHS Appropriations Subcommittees to include language in its accompanying reports that directs the National Institute on Drug Abuse (NIDA) to produce a report on the barriers to research with Schedule I drugs. The College of Problems on Drug Dependence was successful in getting the language into the House subcommittee bill, and ASPET endorsed the language and asked that the Senate subcommittee include it as well, which it did. A report from NIDA on those barriers will provide much needed data to legislators as they wrestle with the best ways to respond to the ongoing opioid crisis while not inhibiting research.

Though work on all of these issues is far from over, ASPET's advocacy on these issues in 2019 has been fruitful and beneficial to our membership. And ASPET's advocacy doesn't stop at appropriations, animal research and controlled substances. In addition to those issues, ASPET's Public Affairs department tackled foreign research collaboration, Patent Act issues, Plan S, and Title IX and sexual harassment. ASPET is looking forward to even stronger results and greater impact in 2020.

CORRECTION: On page 160 of the September 2019 issue, a quotation in the right column was misattributed to Senator Mark Warner (D-VA). When Dr. Toma and Julie Meade reached out to Senator Warner, he in turn contacted the embassy of the Republic of Iraq. It was the embassy that stated: "Mr. Botros [sic] can certainly contact HCED directly to make the payment in full." Senator Warner's office notified *The Pharmacologist* of the incorrect attribution and noted that this international issue is out of Senator Warner's jurisdiction.

Education News

Individual Summer Undergraduate Research Fellowship (SURF) Program

Applications Due Monday, February 3, 2020 for Summer 2020 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 10 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 https://www.aspet.org/awards/SURF/. For questions, please contact Catherine L. Fry, PhD at cfry@aspet.org.

The ASPET SURF program is not possible without continued support from our members. Funds are used solely for student support in the form of stipends and housing during the summer research period. For more information about donating to the ASPET SURF fund, please turn to page 207 or donate online at www.aspet.org/donate.

Health Professions Week 2019: Thanks to Our ASPET Member Volunteers

ASPET participated for the third time in Health Professions Week (HPW), November 16-21, 2019. This free, virtual outreach event for high school and college students attracted more than 5,900 registrants interested in learning about careers in health professions.

ASPET focused on increasing the visibility of pharmacology careers as it joined 20 other professional societies in educating students about opportunities in the biomedical sciences. This kind of outreach is part of ASPET's strategic plan, and allows us to more broadly share resources such as the Explore Pharmacology booklet and the "What is Pharmacology?" video. We also encourage members to share these resources, which can be found at: https://www.aspet.org/aspet/education-careers/about-pharmacology.

This year, HPW included panels on self-care and financial literacy, a webpage treasure hunt, a twitter chat on mentoring and job shadowing, and a virtual fair. ASPET members volunteered during the fair, answering questions about college coursework to prepare for pharmacology graduate degrees, career opportunities in the field, ways to get involved in research, and how pharmacologists interact with other professions.

We thank the following members for volunteering to answer questions in the virtual ASPET booth:

Edwin Arauz
Albert Li
Ashim Malhotra
Erickson Paragas
Yadira Perez
Adam VanWert
Ana Vergara

Journals News

New Manuscript System Coming

In early January, ASPET's wholly owned journals will move to a new online manuscript submission and peer review system, eJournal Press (eJP). Although new to ASPET, eJP will be familiar to our authors, editorial board members, and reviewers. It is used for the journals of the Society for Neuroscience, American Physiological Society, American Society for Cell Biology, Nature Publishing Group, American Society for Microbiology, the journal *PNAS*, and many others.

eJP will allow us to eliminate many of our PDF forms and collect information online instead. It will solve a number of workflow issues that require workarounds outside our current system, and it offers a number of features that should save time and effort on the part of authors, reviewers, editors, and staff.

Our goal is to have the new system operational and ready to accept new submissions in January. Our current system will operate through March or April 2020 to finish the peer review process for manuscripts submitted before January.

In addition to the manuscript system, we are implementing eJP's online billing and payment system to provide an easier and secure way for authors to pay manuscript submission fees and page charges. The URLs for the new submission site will be announced via email, the ASPET *NewsBrief*, social media, and on the websites for ASPET, the journals, and the old manuscript system.

New BPT Member

Dr. Gary O. Rankin was recently appointed to the Board of Publications Trustees by ASPET's Council. He will fill the at-large position on the BPT being vacated by Emily Scott when she becomes chair on January 1, 2020. Dr. Rankin is vice dean for basic sciences and professor and chair of the Department of Biomedical Sciences at the Joan C. Edwards School of Medicine at Marshall University. He has been an active member of the Society, serving on the Program Committee and the Science Policy Committee, as chair of the Division for Toxicology, and was ASPET's representative to the Council of Faculty and Academic Societies. He is currently an associate editor for *JPET*.

Beyond ASPET, Dr. Rankin has served as secretary and president of the Association of Medical School Pharmacology Chairs and has been active in the Society of Toxicology. He has served on numerous medical school, department, and university committees. Dr. Rankin has served as an editorial board member or associate editor for several journals such as *Toxicology and Applied Toxicology*, *Chemico-Biological Interactions*, *European Journal of Toxicological Sciences*, *Toxicology*, *Biomedicine & Pharmacotherapy*, and others. He has served as an ad hoc reviewer for dozens of journals.

Dr. Rankin has been an ASPET member since 1985 and is a member of the Division for Drug Metabolism and the Division for Toxicology.

Call for Papers – *DMD*

A special section on the pharmacokinetics, pharmacodynamics, and drug interaction potential of natural products is being planned for publication in the September 2020 issue of *Drug Metabolism and Disposition*.

The submission deadline is March 1, 2020.

Original research manuscripts pertaining to the pharmacokinetics, pharmacodynamics, and drug interaction potential of natural products, including (but not limited to) herbal and other botanical dietary supplements, traditional medicines, and foods, will be considered for this special section. Manuscripts describing innovative in vitro/ex vivo, bioanalytical, -omics, modeling, and/or clinical research approaches to advance the understanding of the ADME properties, in vivo disposition, or drug interaction potential of these complex products in humans are highly encouraged. Manuscripts describing animal models to address any of these topics may be considered and must clearly demonstrate the translation to humans. Authors must refer to the journal Instructions to Authors, where specific guidelines on research articles are located under the heading "Herbal Medicines/ Natural Products".

Review articles addressing any aspects of the pharmacokinetics, pharmacodynamics, or drug interaction potential of natural products will also be considered. Proposals for such articles should be sent to the guest editor, Mary Paine (mary.paine@wsu.edu), for approval prior to submission.

Call for Papers – *Molecular Pharmacology*

A special section on opioid research to celebrate 50 years of the International Narcotics Research Conference (INRC) is being planned for publication in the June 2020 issue of *Molecular Pharmacology*.

The submission deadline is December 31, 2019.

Original research manuscripts that provide new insights into molecular mechanisms that are broadly relevant to opioid biology will be considered for this special section. Manuscripts describing research on opioid receptor signaling, opioid pharmacology, and mechanisms of regulation of opioid physiology are encouraged. All manuscripts will be fully peer reviewed. Authors should refer to the Instructions to Authors on the journal website (https://bit.ly/3242PnL) for the guidelines and policies of the journal.

To help with the planning of the special issue, please email your manuscript title and a draft abstract or an outline to the special section guest editor, Manoj Puthenveedu (puthenve@umich.edu).

New *JPET* Editorial Advisory Board Members

In June, the Board of Publications Trustees approved Dr. Piyali Dasgupta and Dr. M.N.V. Ravi Kumar to serve on the *JPET* Editorial Advisory Board.

Dr. Dasgupta is an associate professor with the Department of Biomedical Sciences, Joan C. Edwards School of Medicine, Marshall University, Huntington, WV. She has been an ASPET member since 2009 and received the ASPET-Astellas Award for Translational Pharmacology that year.

Dr. M.N.V. Ravi Kumar is a professor with Texas A&M University in College Station. Dr. Kumar is the guest editor of the September *JPET* special section on drug delivery technologies. The special section includes minireviews and original research articles totaling 34 manuscripts.

The Board of Publications Trustees welcomes these newest editorial board members and thanks them for their service to *JPET* and the Society.

Piyali Dasgupta

M.N.V. Ravi Kumar

Recently Published Special Sections

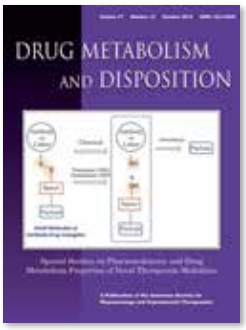
DMD, *JPET*, and *Molecular Pharmacology* published special sections over the last few months. ASPET makes special section articles freely accessible to all for 90 days. ASPET members enjoy access to all journal content as a member benefit. Contact info@aspet.org if you need help using your member subscription. The most recent special sections are described below.

JPET Special Section on the Opioid Crisis

An opioid crisis has taken hold in North America, unfortunately highlighted by over 47,600 overdose deaths due to opioid use in 2017 in the United States. The trans-National Institutes of Health (NIH) initiative called the NIH HEAL (Helping to End Addiction long-term) has two primary therapeutic aims: (1) decreasing opioid-induced overdoses and opioid use disorder (OUD); (2) developing novel non-opioid and non-addictive based therapeutics for the treatment of chronic pain. The special section on the opioid crisis found in the *JPET* November 2019 issue (https://bit.ly/2PywcvK) addresses both preclinical and clinical aspects needed for a scientific response to this escalating crisis. Gerard J. Marek, Kathryn A. Cunningham, and Kurt Rasmussen served as guest editors.

DMD Special Section on Pharmacokinetic and Drug Metabolism Properties of Novel Therapeutics Modalities

Recent trends in drug discovery and development suggest a shift away from a small molecule–dominated approach to a more balanced portfolio that includes small molecules, monoclonal antibodies, engineered proteins, and gene therapies. The research presented in the October special section of *Drug Metabolism and Disposition* (https://bit.ly/2MZh7I7) serves to highlight advancements in the understanding of the mechanisms that govern the pharmacokinetic and drug metabolism properties of the novel therapeutic modalities.



The past decade has witnessed a heightened focus on identifying and developing protein therapeutics with the ability to elicit increasingly complex pharmacology. In parallel, our ability to study the pharmacokinetic and drug metabolism properties has followed suit, with new tools and approaches being rapidly developed. This special section of *DMD* highlights many of those recent advancements.

The minireviews and original research articles in the special section were organized by guest editors Robert S. Foti and Brooke M. Rock.

Molecular Pharmacology Special Section on Computational Analysis of GPCRs

Is there anything new to be known about GPCRs? Of course there is! Here in this cluster of *Molecular Pharmacology* articles the use of computational approaches to tease apart some of the more recent and exciting aspects of GPCR function are discussed. The reviews cover the impact that the cell membrane environment can exert on ligand binding to GPCRs, the current status of ligand bias with a focus on opioid receptors, and the nature of peptide binding to class A GPCRs. The cluster of articles appears in the November issue (https://bit.ly/34kf01n).

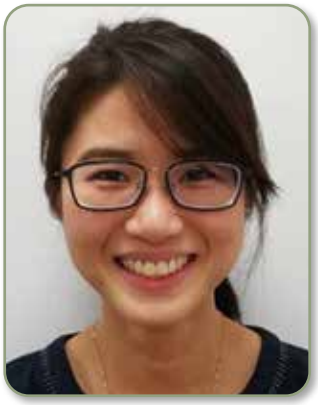
JPET Special Section on Drug Delivery Technologies

Engineering next generation medicines: It's all about delivery. Effective delivery strategies, wherein the nonconventional delivery vehicles such as nanoparticles, microparticles, microneedles, etc., are constantly explored to overcome poor physicochemical attributes of drugs (small and large), combined with the biological barriers, the immune system, and the disease in question. This *JPET* special section on drug delivery technologies is an attempt to cover the length and breadth in the delivery space. It includes 17 minireviews and 17 original research articles. M.N.V. Ravi Kumar was the guest editor. The special section is in the *JPET* September issue (https://bit.ly/330uya1).

Highlighted Trainee Authors

DMD

Congratulations to Eleanor Jing Yi Cheong (National Univ. of Singapore) for being selected as the first *DMD* Highlighted Trainee Author (HTA). *DMD* added HTAs with the November issue.



Jing Yi Cheong

JPET

Robert C. van Wijk (Leiden Univ.) and T. Lee Gilman (Univ. of Texas Health Science Center at San Antonio) were the first and second HTAs for *JPET*, having been selected from the October and November issues, respectively.

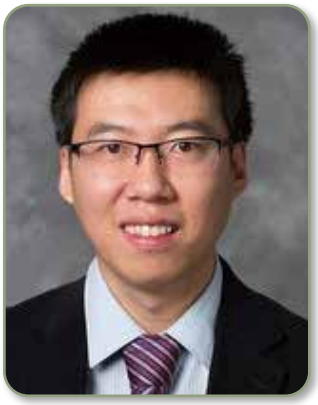
Robert C. van Wijk

T. Lee Gilman

Molecular Pharmacology

Zsuzsanna Édua Magyar (Univ. of Debrecen), Xu Liu (Emory Univ.), and Doyoung Kwon (Univ. of California at San Francisco) were selected as the HTA for the September, October, and November issues, respectively.

Zsuzsanna Édua Magyar



Xu Liu

Doyoung Kwon

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

Membership News

Renew Your ASPET Membership for 2020

Thank you for choosing to be a member of ASPET! We hope you are enjoying all the great membership benefits as much as we appreciate having you as a member.

Continuing your membership is important to the success of ASPET and the pharmacology community. Don't forget to renew your membership soon so that you don't miss any exciting opportunities to grow your connections and advance your career.

Renew now at http://www.aspet.org/renew**.**

The Value of ASPET Membership

Everyone at ASPET headquarters 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. Last issue we featured Ryan Staudt, a graduate student, and Brad Andresen, an assistant professor. This month, ASPET is featuring two other members who would like to speak about the value of belonging to the Society:

Pamela Hornby is a Senior Scientific Director for Janssen Research. She joined ASPET in 1995.

Why did you join ASPET?

PH: In all honesty, I joined because I was advised to! The chair of my Pharmacology & Experimental Therapeutics Department at LSU-HSC expected that the department faculty would support the society that represented us. More importantly, I have stayed a member for many years. I appreciate how ASPET is changing the way we communicate with each other and to other scientists. *The Pharmacologist* gives perspectives on how our community has delivered amazing medicines to patients through persistence founded on great observations. The Young Scientists Committee is bringing new ideas and formats to the annual meeting – look out for the "Guppy Tank Translational Science Pitch Showcase" symposium at EB in 2020!

What advice would you give members who want to get more involved in ASPET?

PH: The structure of ASPET with a Council and different divisions allows scientists to affiliate with the specialty with which they have most affinity. The members of these division committees are very welcoming. It offers a safe place for trainees and early career scientists to gain experience and to have the opportunity to shape their field. A good example of this

is putting together an outline for a symposium. Doing this alone would be daunting; however, by teaming up with a more experienced colleague it becomes very rewarding and, if selected for a future meeting, all the hard work of making it happen is done by ASPET staff. This is really like having your cake and eating it too! Members can explore more than scientific direction; they can learn the way a non-profit has responsibility for handling their budget and how to develop strategic initiatives. Also, within my own Translational and Clinical Pharmacology Division, members are exposed to the many different careers and the day-to-day lives of colleagues pursuing translational research. This spans pharmacogenomics to personalized medicine, academic drug discovery to regenerative medicine. All this starts by making contact through the ASPET website or membership directory!

How has membership in ASPET benefitted your career?

PH: When I was a graduate student, I sometimes walked along a corridor of the Pharmacology Department. I felt alienated for not understanding the underlying messages in the graphs displayed, and the language in the posters was intimidating. It was only when I became a member of ASPET that I realized that I could be part of a community. A community that seeks to improve the human condition by applying the principles of drug action to molecules that were, or could become, therapeutic treatments. Once I identified with this group, I started to understand the language of pharmacology, and it opened the door for me to obtain my first independent funding through the PhRMA organization. It enabled me to make connections with scientists in the pharmaceutical industry and throughout academia. This directly led to multiple year funding and successful research collaborations while I was part of the pharmacology faculty at LSU-HSC, and has continued to help me throughout my career in pharmaceutical R&D at Janssen, J&J.

As someone who works in industry, what advice would you give to someone who is interested in a career in pharmacology?

PH: There is a growing gap of trainees available to meet the demands of drug discovery. From MCATS to academic centers, biotechnology to contract research organizations, it is apparent that there is an increasing need for pharmacologists. Scientists who can reduce a scientific observation to practice on an integrated systems level, as well as understand the molecular signaling involved. I don't know the reason for the reduced number of trainees in pharmacology. I do know from leading workshops and mentoring, where I promote pharmacology as a set of skills applicable to many different careers, that trainees and their PIs are often insufficiently exposed to non-academic careers. To get experience, trainees should consider an industry post-doc or to work with a PI who is actively collaborating on industry-related projects. This not only provides a connection to people in pharma but the possibility of a job – successful external industry collaborations can lead to building an internal strategy. This requires hiring of experts in that area, and the first place managers look for these scientists is through their academic collaborations. Also, keep track of industry trends – where is a new site being built, who is expanding a footprint in what region of the country? A new building has to be populated fast with scientists to meet aggressive timelines. Talk to scientists in pharma/biotech at the annual meeting and become LinkedIn with them, since positions are often posted there. Finally, apply for jobs based on the skills required and responsibilities listed, rather than the level/title of the position. If you are the best candidate, the job may be reposted at a different level to balance that with the value you bring to the program.

Why do you think it is important to attend the ASPET Annual Meeting at EB?

PH: Networking is probably the most invoked reason to attend any annual meeting, including ASPET. However, I am relatively shy and have never been very skilled at striking up conversations with esteemed scientists in the field. That said, I have learned to be comfortable engaging others to share their work while I ask questions. Thus, I have networked and benefited through listening, too! For example, at my poster years ago, I listened to what the sole interested person who came by my poster had to say. This rapidly led to a multi-year, multi-lab joint scientific venture on brain-gut neuropharmacology. The ASPET difference is the emphasis on mentoring and increasing the representation of trainees and early career scientists in the society, which has been evident for almost a decade. Now, new members are reaping the benefits of a cadre of emerging leaders for whom the meeting is a venue for interaction and are keen to "pay it

forward" to the next generation. Finally, it's really an enjoyable meeting, and I always learn a lot from attending symposia, which I can apply to my day job.

Where do you see pharmacology going in the future and why is it important to be an ASPET member?

PH: The future of pharmacology for me is three things – enhanced communication, support for ideas that can have a path for assessment as potential therapeutics, and increased application of pharmacological principles in experimental research beyond small molecules. The latter is important because, to date, approximately 80 monoclonal antibodies have been granted marketing approval, and yet academia has been slow to use them as tools compared to small molecules. From relatively straightforward targeting of soluble cytokines, there is increasing complexity of these large protein molecules which can target membrane proteins or multiple proteins. Furthermore, more complex biotech molecules employ alternative scaffolds, antibody drug conjugates, and highly engineered antibody variants. Increased awareness of these advances within ASPET may help to increase their use in exploratory research and further understand and characterize their pharmacological properties.

Stephanie Davis is an AAAS Science and Technology Policy Fellow at NIH. She joined ASPET in 2016.

Why did you join ASPET?

SD: I originally joined ASPET during the first year of my postdoc because I was looking forward to meeting and building relationships with other pharmacology trainees. As a postdoc, I was in a clinical department and the only postdoc, so life at my institution was getting pretty lonely. Thankfully, I have built several amazing relationships with other ASPET members that I never would have made if I had not joined. Also, I joined because ASPET provides so many fantastic opportunities for professional and career development that are aimed at postdocs and graduate students. Other societies I had previously joined in the past were not particularly generous with travel awards and did not have workshops aimed at trainees, but I have always felt supported and appreciated as a member of ASPET.

Why do you attend the ASPET Annual Meeting at EB?

SD: Attending the Annual Meeting at EB is not only a fantastic opportunity to share one's research with other pharmacologists, but it also feels like a big family reunion. A lot of the colleagues that I have met through ASPET live far away from me, so the annual meeting is the time of year when we all get a chance to visit, catch up, and discuss ideas. Last year, I participated in the ASPET Mentoring Network, which not only introduced me to a wonderful new mentor figure in my life (former TCP Division Chair Pam Hornby), but allowed me to grow close with the other members in my group. We had monthly conference calls to catch up with each other, but that isn't always the same as seeing everyone in person. Luckily, most of us were able to make this year's meeting, so it was fun to see everyone.

What do you think is the best way to get involved in ASPET?

SD: Perhaps I am biased, but being a member of the Young Scientists Committee is a great way to get involved in ASPET as a grad student or postdoc. This committee meets once a month and we try to plan several activities at EB, including our annual outreach event, the Grad Student/Postdoc Colloquium, and scientific symposia. Although it is not a huge time commitment, participation is a great way to add leadership experience to your CV. I would also recommend anybody who would like to get involved with ASPET to apply to the Mentoring Network. Not only is this a great opportunity to connect you with other trainee members, but you have the opportunity to receive training and advice from senior ASPET leaders, who are also great resources for finding ways to increase your involvement.

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

SD: Make sure you learn those suffixes for each drug class! But seriously, I was always drawn to pharmacology because it combines many different disciplines (biochemistry, cell biology, and physiology, for instance) and because it is all about solving real health problems. While new discoveries are exciting no matter what, pharmacological discoveries mean that we are one step closer to helping improve the lives of patients and people struggling with diseases. Personally, I can't think of a better goal to work towards as a scientist!

Renew by December 31, 2019

You should have received your renewal notice by email this Fall. If you have not received it, please check your email spam folder and make sure you add all @aspet.org email addresses on your safe sender list. If you need a new invoice, please contact Member Services at (301) 634-7060 or membership@aspet.org. You may also complete your renewal online by visiting www.aspet.org/renew .

Thank you for your valued support of ASPET. We look forward for another amazing year!

New Members

Regular Members

Wissam A. AbouAlaiwi, Univ of Toledo, OH
Arun Anantharam, Univ of Michigan Med Sch
Olga Chaim, Univ of California San Diego
Colin Combs, Univ of North Dakota Sch of Med & Hlth Sciences
Alexander H. Danser, Erasmus MC, Netherlands
James A. Fishback, Ovid Therapeutics, NJ
Maxine D. Gossell-Williams, Univ of West Indies, Jamaica
Pooja Gupta, All India Institute of Med Sciences
Frank S. Hall, Univ of Toledo, OH
Ruedee Hemstapat, Mahidol Univ, Thailand
Aaron J. Janowsky, Oregon Hlth & Science Univ
Keiko Kanamori, Western Univ of Hlth Sciences, CA
Simeon O. Kotchoni, California Northstate Univ
Sangmin Lee, High Point Univ, Fred Wilson Sch of Pharmacy, NC
Chol Seung Lim
Jiyuan Ma, PTC Therapeutics, NJ
Jasna Marjanovic, St Louis Coll of Pharmacy, MO
Lori McGrew, Belmont Univ, TN
Patrick M. McNutt, USAMRICD, MD
Islam Mohamed, California Northstate Univ
May C. Morris, Institut des Biomolecules Max Mousseron, France
Koji Nobe, Showa Univ, Japan
Arthur C. Riegel, Univ of Arizona
Youssef Sari, The Univ of Toledo, OH
Michael M. Scott, Univ of Virginia
Blythe D. Shepard, Georgetown Univ, DC
Roxanne A. Vaughan, Univ of North Dakota Sch of Med & Hlth Sciences
Bhupinder Vohra, William Jewell Coll, MO
Shaomeng Wang, Univ of Michigan
Jun Julius Zhu, Univ of Virginia Sch of Med

Postdoctoral Members

Lais F. Berro, Univ of Mississippi Med Center
Daniela G. Dengler, Sanford Burnham Prebys, CA
Indiwari Gopallawa, Univ of Pennsylvania
Ibrahim Hassen, Sr, Alexandria Univ, Egypt
Wannipat B. Herz Igomedix, Inc., WA
Nagendra S. Yarla, The Univ of Oklahoma HSC

Affiliate Members

Shannon Worthen, Janssen R&D LLC, CA

Graduate Student Members

Tarek M. Abdelghany, Newcastle Univ/ Cairo Univ, UK
Noor Abdulkareem, Univ of Houston
Kaveri M. Adki, SVKM's NMI, India
Ashraf-Uz-Zaman, Texas Tech Univ HSC
Shiyan Chen, National Univ of Singapore, Singapore
Melissa M. Clemens, Univ of Arkansas for MedSciences
Bayli DiVita Dean, Univ of Florida
Osaze Esuyi, Univ of Benin, Nigeria
Olufunke O. Falayi, Univ of Ibadan, Nigeria
Lindsey K. Galbo, Wake Forest Univ Graduate Sch of Arts & Sci, NC
Ajay Gupta, Ohio State Univ
Omar Hamed, Univ of Calgary, Canada
Nora Hegazy, Zagazig Univ, Fac of Pharmacy, Egypt

Olivia R. Hoffman, Univ of Wisconsin-Madison
Austin House, Southern Illinois Univ Edwardsville
Chunxiang Jiang, Central South Univ, GA
Veronica J. Kim, Duke Univ, NC
Kathleen O. Kind, Wake Forest Schof Med, NC
Ankit P. Laddha, SVKM's NMI, India
Clarence E. Locklear, Univ of Tennessee Knoxville
Taran S. Lundgren, Emory Univ, IL
Nicole M. Maddie, NYIT College of Osteopathic Med, NY
Eliza R. McColl, Univ of Toronto, Canada
Harrison J. McNabb, Purdue Univ Lib TSS, IN
Thanh Thanh L. Nguyen, Mayo Clinic, MN
Ashley N. Nilson, Univ of Texas Med Branch
Angela Olson, Univ of Texas Hlth at San Antonio
Nicole Prodan, Univ of Houston, TX
Hanan Qasim, Univ of Houston, TX
Saranya Radhakrishnan Purdue Univ, IN
Casey Radice, Temple Univ HSC, PA
Chris Reeb, Southern Illinois Univ Edwardsville
Zeyuan Wang, Temple Univ HSC, PA
Trevor S. Wendt, Univ of Arizona
Joshua C. Wilkinson, Univ of Iowa, IA
Melissa L. Wilkinson, Rutgers Univ, NJ
Fan Zhang, Virginia Commonwealth Univ, VA

Post-Baccalaureate Members

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

Undergraduate Student Members

Nickolas Almodovar, John Jay College, NY
Kodi W. Harris, Morehouse Sch of Med, GA
Monica Haughan, Purdue Univ, IL
Brandon E. Smith, Univ at Buffalo, NY
Hong Kai Teo, Natl Univ of Singapore, Singapore
Mackenzie Turner, Xavier Univ, OH

In Sympathy

ASPET notes with sympathy the passing of the following members:

Craig Beeson
Jeffrey Blumer
Edward Carr Jr.
Joyce Goldstein
John Oates
Henry Strobel
Barry Wolfe

A Tribute to Paul M. Vanhoutte (1940-2019)

Submitted by N.J. Rusch, R.C Webb, & T.J. Verbeuren

On Friday, August 23, 2019 the discipline of pharmacology, ASPET, and the International Union of Basic and Clinical Pharmacology (IUPHAR) lost a remarkable scientist and mentor with the death of Dr. Paul Michel Georges Vanhoutte.

A native of Belgium, Dr. Vanhoutte obtained his BS, MS, and MD degrees at the University of Gent, and he was awarded his PhD from the University of Antwerpen. During his rise to fame as a renowned vascular pharmacologist, Paul sequentially held faculty positions at the University of Gent (1969–1971), the Mayo Clinic (1972–1973), the University of Antwerpen (1973-1981), the Mayo Clinic (1981–1989), and Baylor College of Medicine (1989–1995). Paul's reputation as a pharmacologist did not go unnoticed by the private sector, and from 1992 to 2002, he served as vice-president for research and discovery at the Institut de Recherches Internationales Servier in Courbevoie, France. He returned to the academic world in 2003 as the distinguished visiting professor and founding director of the Biopharmaceutical Development Centre at the Medical School of the University of Hong Kong. At this institution, he held a number of leadership positions in pharmacology until his recent death. He also held honorary or visiting professor status at many other institutions in Europe, South Korea, China, Kuala Lumpur, and the Middle East.

Vanhoutte was an active member in many national and international scientific organizations, including ASPET and IUPHAR. He chaired the IUPHAR Committee for Receptor Nomenclature from 1989 to 1998. He was secretary general of IUPHAR from 1998 to 2002, and president from 2002 to 2006. He also was the founder and past-president of the International Society for Serotonin Research and of the Asian Society of Vascular Biology. He was the editor-in-chief of the *Journal of Cardiovascular Pharmacology* from 1989 to 2007 and was an associate editor or served on the editorial board of many scientific journals, including the *Journal of Pharmacology and Experimental Therapeutics*. In the United States, he served on many review committees for the National Heart, Lung, and Blood Institute. His legacy includes his drive to leverage his administrative skills and international reputation to elevate the discipline of pharmacology for the benefit of pharmacologists and pharmaceutical scientists worldwide.

Dr. Vanhoutte's life-spanning interest in the mechanisms of vasodilation was launched during his postdoctoral research at the Mayo Clinic in Rochester, Minnesota, under the direction of the famed cardiovascular physiologist Dr. John T. Shepherd and subsequently as a professor at the University of Antwerpen. His early research focused on exploring the mechanisms by which acetylcholine inhibits sympathetic neurotransmission to induce relaxation of isolated arteries and veins. The findings of Dr. Vanhoutte and his colleagues contributed importantly to the discovery of endothelial factors as the mediators of endothelium-dependent vasodilator responses, including those induced by neurotransmitters and platelet-derived factors. The discoveries in Dr. Vanhoutte's laboratory and other laboratories worldwide set the stage for characterizing defects in endothelium-mediated vasodilation during cardiovascular pathologies, identifying endothelium-derived contracting factors, and exploring mechanisms of flow-mediated vasodilation. At every step of discovery, the administration of pharmacological compounds to modify vascular reactivity responses provided preclinical rationale for drug discovery efforts. Collectively, Dr. Vanhoutte's highly cited work and intellectual contributions reside in nearly 1300 original research publications, editorials, reviews, and book chapters. He co-authored or edited 36 books. He also participated and instituted several scientific symposia on the topics of his research and was especially fond of the "Mechanisms of Vasodilatation" meetings in which scientists of all over the world discussed, with Dr. Vanhoutte's collaborators, the newest research in the field. A few days before his passing away, he was still very occupied by the organization of the next vasodilatation meeting planned to take place in Hong Kong.

Dr. Vanhoutte was a remarkable mentor, and his enthusiasm for research helped to launch the careers of many graduate students, postdoctoral fellows, and clinical fellows. As he developed into a renowned international leader in pharmacology, his former trainees, colleagues, and scientific followers began to populate pharmacology departments and pharmaceutical sectors across the world, many of them eventually assuming leadership roles in research departments and institutes. Although he expected research excellence from his trainees, Dr. Vanhoutte had a legendary wit and sense of humor, which could brighten up the bleakest laboratory meeting, otherwise dominated by discussions of experimental snags. At scientific meetings, he routinely ensured that his trainees had the opportunity to network with respected scientists during society receptions and special dinners often hosted by him.

Despite an incredibly strenuous work schedule, and devotion to a wonderful family, Dr. Vanhoutte carved out time to support his trainees, know them as individuals, and ensure their career progression. His charismatic personality enabled him to launch successful research teams in Belgium, the United States, France, and Hong Kong as a citizen of the world, and serve as a consultant at institutions in many other countries. In 2008, former trainees and colleagues from these institutions and many others honoured him by raising funds in partnership with the Cardiovascular Pharmacology Division of ASPET to endow the Paul M. Vanhoutte Distinguished Lectureship in Vascular Pharmacology. The lectureship recognizes Dr. Vanhoutte's "lifelong scientific contributions to our better understanding and appreciation of the importance of endothelial cells and vascular smooth muscle function in health and disease and his mentoring of countless prominent endothelial and vascular biologists and pharmacologists." This distinguished lectureship is given every two years at the Experimental Biology (EB) meeting, and traditionally offered a reunion opportunity for Dr. Vanhoutte with his former trainees. Sadly, the Paul M. Vanhoutte Distinguished Lectureship in Vascular Pharmacology at the EB meeting in 2020 will represent the first *memorial* lecture. However, this lecture and those into the future offer the opportunity to pay tribute to Dr. Vanhoutte's memory, honor his impact on the discipline of pharmacology, and to remember him as a remarkable scientist and mentor.

To support the Paul M. Vanhoutte Distinguished Lectureship in Vascular Pharmacology, contribute online at the ASPET.org website, or for more information, telephone (301) 634-7060.

Members in the News

Achievements, Awards, Promotions, and Scientific Breakthroughs

Michael A. Rogawski
University of California, Davis

Dr. Michael A. Rogawski, professor of neurology and pharmacology at the University of California, Davis received the UC Davis Chancellor's Innovator of the Year Award on May 30, 2019. Rogawski's research encompasses cellular neurophysiological studies of ion channels (with a focus on the mechanisms of action of antiepileptic drugs); animal models of epilepsy, migraine, and nerve agent intoxication; and clinical studies on new treatments for seizures, epilepsy, migraine, traumatic brain injury, and neurodevelopmental disorders. His laboratory studies on AMPA receptors and neurosteroids have led to new treatment approaches for seizures and epilepsy, and the marketed treatment for postpartum depression brexanolone (Zulresso™)

Dr. Rogawski has been a member of ASPET since 1982 and is a member of the **Division for Neuropharmacology.**

Bruce Hammock
University of California, Davis

Dr. Bruce Hammock, distinguished professor of entomology at the University of California, Davis and CEO of the pharmaceutical startup EicOsis LLC, shared the announcement that the U.S. Food and Drug Administration (FDA) has approved EicOsis's Investigational New Drug application to initiate Phase 1 clinical trials for their drug candidate, EC5026, a first-in-class, small molecule inhibitor of the soluble epoxide hydrolase (sEH) enzyme for the treatment of pain. EicOsis anticipates starting Phase 1 clinical trials in healthy volunteers before the end of this year.

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

Jeffrey Paul
Drexel Medical College

Dr. Jeffrey Paul from the Division for Translational and Clinical Pharmacology has recently authored a chapter in the *Handbook of Behavioral Neuroscience*, series editor Joseph P. Huston. Dr. Paul is a clinical pharmacology consultant, and has focused on early clinical development of drugs targeting the central nervous system and pain; he is an expert in drug delivery. Dr. Paul is also an adjunct faculty member at Drexel Medical College in Philadelphia, as well as an active member of the TCP Division of ASPET. The chapter, "Experimental Medicine Approaches in CNS Drug Development" will be an important tool for those developing novel targets and treatments in clinical pharmacology.

Dr. Paul has been a member of ASPET since 2006 and is a member of the **Divisions for Translational and Clinical Pharmacology and Neuropharmacology.**

Paul Czoty, PhD

Wake Forest School of Medicine

Dr. Paul Czoty was promoted to professor with tenure in the department of physiology and pharmacology at Wake Forest School of Medicine. Recently, Dr. Czoty received a 5-year grant from the National Institute on Drug Abuse (NIDA) to study how long-term ethanol drinking alters the abuse-related effects of cocaine and vice versa in nonhuman primate models of substance use disorders. Dr. Czoty's lab focuses on the use of behavioral pharmacology and non-invasive brain imaging techniques to assess the effects of drugs of abuse on neurobiological targets associated with cocaine and alcohol use disorders, with the overall goal of identifying new pharmacotherapies for clinical populations that demonstrate polydrug use. Dr. Czoty also serves as Director of the Integrative Physiology and Pharmacology (IPP) Program at Wake Forest.

Dr. Czoty has been a member of ASPET since 2001 and is a member of the **Divisions for Behavioral Pharmacology and Neuropharmacology**.

Susan Wood

University of South Carolina School of Medicine

Dr. Susan Wood was recently promoted to Associate Professor with tenure as of August 16, 2019. Tenure and promotion is afforded to University of South Carolina School of Medicine faculty who demonstrate excellence and recognition in research, medical/graduate teaching and service. After a successful funding history, highlighted most recently by a funded R01 in 2018, Dr. Wood then won the Breakthrough Star Award from the University of South Carolina School of Medicine's Office of Research. Dr. Wood received her PhD from the University of Michigan's Department of Pharmacology. Her research program uses animal models to identify pharmacological targets to treat stress-related psychiatric disorders. A long-standing member of the Division for Behavioral Pharmacology (BEH), Dr. Wood serves as BEH Secretary/Treasurer and Associate Editor for the *Journal of Pharmacology and Experimental Therapeutics*.

Dr. Wood has been a member of ASPET since 2005 and is a member of the **Divisions for Behavioral Pharmacology and Neuropharmacology.**

Kyle Palmer, PhD

Opertech Bio., Inc.

Dr. Kyle Palmer received the Distinguished Alumni Award from University of Michigan's Department of Pharmacology in October. Dr. Palmer earned his PhD in Pharmacology at the University of Michigan under Dr. Steven Fisher and began a career in drug discovery and biotech. He is co-founder of Opertech Bio, a service-based business utilizing a pioneering approach to measure taste, a multi-billion dollar market covering the food and beverage, flavor ingredients, pet food, and pharmaceutical industries. Dr. Palmer is the inventor of its technology platform which enables pharmacologic analysis of taste which has resulted in eight patents.

Dr. Palmer has been a member of ASPET since 2003 and is a member of the **Division for Behavioral Pharmacology**.

Chinenye Jane Ugwah-Oguejiofor

Danfodiyo University

Dr. Chinenye Ugwah-Oguejiofor was promoted to the rank of senior lecturer effective from 1st January 2019. She has a published over 25 articles in reputable local and international journals. She has taught classes and supervised research works of both undergraduate and postgraduate students. Dr. Ugwah-Oguejiofor has held many administrative positions and participated in several academic committees. She has been involved in research and community development in Nigeria. She belongs to several professional organizations such as BPS, ASPET, Pharmaceutical Society of Nigeria (PSN) and others.

Dr. Ugwah-Oguejiofor has been a member of ASPET since 2019 and is a member of the **Divisions for Drug Discovery and Development, Cancer Pharmacology, Cardiovascular Pharmacology, Molecular Pharmacology, Pharmacology Education, and Toxicology.**

Division News

2020 Division Elections

The 2020 election includes nominees for ASPET Council (president-elect, secretary/treasurer-elect, and councilor), as well as officers for the following divisions: 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 Toxicology (TOX), and Division for Translational and Clinical Pharmacology (TCP). The election will open on January 6, 2020 and eligible voting members will receive an email with instructions.

Division for Cancer Pharmacology

Nominees for Chair-Elect

David A. Gewirtz, PhD
Professor, Department of Pharmacology and Toxicology, Massey Cancer Center, Virginia Commonwealth University

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

Nominees for Secretary/Treasurer-Elect

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

Markos Leggas, PhD
Associate Professor, Pharmaceutical Sciences, College of Pharmacy; Division Director, Pharmacology and Experimental Therapeutics; and Core Leader, Translational Studies, Center of Pharmaceutical Research and Innovation, University of Kentucky

Division for Drug Discovery and Development

Nominees for Chair-Elect

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

Nominees for Secretary/Treasurer-Elect

Sujay Kharade, PhD
Research Instructor, Vanderbilt University Medical Center

Division for Drug Metabolism and Disposition

Nominees for Chair-Elect

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

Haojie Zhu, PhD
Associate Professor, University of Michigan College of Pharmacy

Nominees for Secretary/Treasurer-Elect

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

Manish Shah, PhD
Assistant Professor, Albany College of Pharmacy and Health Sciences

Division for Molecular Pharmacology

Nominees for Chair-Elect

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

David Siderovski, PhD
Professor of Pharmacology, West Virginia University School of Medicine

Nominees for Secretary/Treasurer-Elect

Shelley Hooks, PhD
Associate Professor, Associate Vice President for Research, University of Georgia

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

Division for Neuropharmacology

Nominees for Chair-Elect

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

Habibeh Khoshbouei, PharmD, PhD
Professor of Neuroscience, Department of Neuroscience, University of Florida

Nominees for Secretary/Treasurer-Elect

Catalin M. Filipeanu, MD, PhD
Associate Professor with tenure, Department of Pharmacology, College of Medicine, Howard University

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

Division for Toxicology

Nominees for Chair-Elect

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

Nominees for Secretary/Treasurer-Elect

Kenneth McMartin, PhD
Professor of Pharmacology, Toxicology, and Neuroscience, LSU Health Sciences Center

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

Division for Translational and Clinical Pharmacology

Nominees for Chair-Elect

Ross Corriden, PhD
Associate Principal Scientist, Merck

Nominees for Secretary/Treasurer-Elect

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

Division for Neuropharmacology

Mixer at the 2020 Society for Neuroscience Annual Meeting

The Division for Neuropharmacology hosted a mixer at the Society for Neuroscience Annual Meeting in Chicago on Sunday, October 20, 2019. The mixer offered an opportunity for members to socialize at the neuroscience meeting as well as recruit new members to learn more about ASPET and the NEU division. A total of 65 attendees gathered to network and exchange ideas. Dr. Kelly Standifer, NEU division chair, offered a warm welcome to the attendees and updated them on division benefits, as well as encouraged everyone to attend the EB 2020 Annual Meeting in San Diego.

Attendees at the Division for Neuropharmacology mixer

Division for Drug Metabolism and Disposition

Interview with an ASPET DMDD Member - Dr. Jeff Stevens: A Career in Service

Submitted by D. Fernando Estrada

Dr. Jeff Stevens earned his BS in biology from the University of Notre Dame, an MS in toxicology, and a PhD in pharmacology and toxicology from the University of Arizona while training under Dr. James Halpert. Jeff then embarked on a successful career in the private sector, where he began as a postdoc in the Department of Drug Metabolism at Eli Lilly and Company. Jeff's ensuing career as an industry scientist has led him to become a senior research fellow with Rhône-Poulenc Rorer, an associate research fellow at Pharmacia, and a senior director for pharmacokinetics, dynamics, and metabolism with Pfizer. Jeff currently works as a consultant in the areas of drug metabolism, scientific strategy, and publishing.

Jeff has also enjoyed a long-standing relationship with ASPET and its member community. He began his service in 1997 as a reviewer for *Drug Metabolism and Disposition*. In 2004 he became an associate editor for the journal, and began his tenure as its editor as of 2018. Additionally, Jeff has served as an associate editor for the *Journal of Pharmacology and Experimental Therapeutics*, he has been a member of the ASPET Board of Publications Trustees since 2016, a member of the Brodie Award Committee and the Program Committee, and has served as chair of the ASPET Division for Drug Metabolism. His publication record includes 30 research articles, 7 invited book chapters and articles, and over 50 abstracts, presentations, and invited talks.

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

JS: Well, "journey" is certainly an appropriate term. I was always exposed to medicine and biology, as my father was a physician and my mother had a degree in microbiology. But it wasn't until I participated in an undergraduate research project that I decided to apply to graduate school and see if my interests would translate to a career in science. Then some combination of fate and serendipity created my first milestone as a graduate student at the University of Arizona. Before my first semester I was finishing a summer course and had to select a research advisor in the pharmacology and toxicology program. One morning, I was reading the bulletin board material in the hall outside of the labs and trying to make some sense of the publications that were posted by the department faculty (remember this is long before the internet...). A young faculty member came up and introduced himself as Jim Halpert and asked me if I wanted to know more about his research on drug metabolizing enzymes. I was hooked from the first day in the lab - it was this great combination of learning, fun, and motivation.

Based on some discussions I had with former graduate students about the pharmaceutical industry, I decided that a postdoctoral fellowship at Eli Lilly would give me a chance to continue in drug metabolism but also have a final check on my industry career aspirations. Two years later I started as a research scientist in a drug metabolism group at Rhone-Poulenc Rorer. During the next 6 years I usually felt like I was drinking from a fire hose, as I juggled lab and project work while learning drug discovery approaches from chemists and pharmacologists. Due to company mergers, I moved on to Pharmacia and then to Pfizer, while taking on more management responsibility. Although the mergers involved several relocations, I saw them as opportunities to learn and work with many smart people. I was fortunate to have been given a lot of freedom to start research collaborations with several

leaders in drug metabolism, and to also pursue editorial board work with ASPET's journals. Finally, the milestone of being named editor of *Drug Metabolism and Disposition* in 2018 was a very proud moment, given the long history of distinguished editors and the influence of the journal on the drug metabolism community.

As an industry scientist in the field of drug metabolism, you have likely experienced a few hurdles in your career. Which challenges would you consider most significant and what did you do to overcome them? What advice do you have for young scientists who might experience these or similar challenges?

JS: The biggest challenge I faced, and that most young scientists in industry will eventually face, is organizational change that requires quickly building new skills and relationships. It is highly likely that every few years your manager, or scientific focus, or even the entire organization will change. From my experience, it is critical to be flexible and adapt quickly to the new environment. The pace of change is only going to accelerate as companies work to be more efficient with increasingly difficult research problems. Always remember that, despite organizational change, you are in charge of building your professional network and profile. Stay in touch with trusted friends from former jobs, as down the road you are likely to find them both personally and professionally supportive.

What advice do you have for students and young scientists who are interested in working in industry or those who may be unsure about which path to pursue?

JS: I would encourage them to learn more about careers in the pharmaceutical industry while they are finishing their undergraduate degree or early in their graduate programs. Many universities have alumni networking or mentoring programs where students can request career advice. It is important to think one step beyond your current career decision when trying to map out a profession in science. For example, some graduate programs and faculty have a comparatively high percentage of students who are hired into the biotech and pharmaceutical industry. This may be due to established collaborations between those programs or faculty and some companies, and possibly internships. If the program and research seem to match to a student's interest, it would be smart career planning to seriously consider programs where students are often recruited by industry. However, it is understandable that graduate students may be undecided about their next career move. In that case, simply develop a strong research skill set matched with well-regarded publications, combine that with a professional network such as ASPET, and you are very likely to have many career options.

What do you feel have been the most rewarding aspects of being involved with ASPET/DMD and what advice do you have for new members?

JS: For both ASPET and my journal work, it is extremely rewarding to work with the best scientists in drug metabolism and pharmacology. I was fortunate to have Drs. Jim Halpert, Eddie Morgan, and Mike Jarvis as past editors who provided opportunities and were extremely generous with their time and advice. Now as editor, I am very fortunate to have a dedicated editorial board that maintains a high scientific standard. So, for new members, take advantage of the numerous opportunities provided by ASPET. Particularly in the last 5-10 years, ASPET has made significant new investments to involve the next generation of scientists--travel and publication awards, scientific program design, committee memberships, fellowships, professional networking--just to name a few. Attend the annual meeting and support the journals with your publications and efforts as a reviewer. Stay involved--the time invested will be well worth it.

You have witnessed the growth and change that have come along in the field of drug metabolism. What new frontiers are you most excited about for the coming decade?

JS: The evolution of drug metabolism over the last 30 years has been absolutely amazing. In the drug industry, data that involve drug metabolism and pharmacokinetics are not only required for regulatory approval but are also critical for developing the most efficient clinical development plans. As much of the drug discovery screening and the bioanalytical development work has been streamlined and therefore outsourced, more emphasis has shifted to pharmacokinetic modeling and simulation and technical challenges associated with biologics and other novel modalities (the subject of the October 2019 special issue of *Drug Metabolism and Disposition*). New modalities mean additional challenges in understanding the causes of pharmacokinetic inter-individual variability and why drugs fail in some people. There is no shortage of job opportunities for the next generation of scientists who can attack these questions.

Chapter News

Mid-Atlantic Pharmacology Society

MAPS 2019 Annual Meeting in Review

Submitted by Bradford Fischer

The Mid-Atlantic Pharmacology Society (MAPS) held its 2019 Annual Meeting on October 3rd at Temple University's Student Faculty Center in Philadelphia, PA. As in years past, the meeting highlighted recent pharmacological advances through a diverse and interactive program. The agenda included research presentations by both academic and industry experts, roundtable discussions by a panel of biotech leaders, invited talks, posters covering diverse areas of pharmacology by up-and-coming trainees, and awards to both mentors (distinguished career) and mentees (best posters).

The research presentations focused on this year's theme, *Therapeutics for Neurodegenerative Disorders*, and featured recent advances into small molecules and other medicinal agents in development to treat neurodegenerative disorders, including Alzheimer's disease, Parkinson's disease, spinal muscular atrophy, and amyotrophic lateral sclerosis. The keynote address by Richard Silverman, PhD (Northwestern University) shed light on protein aggregation and the development of rationally designed therapeutics for the treatment of amyotrophic lateral sclerosis. Podium presentations by researchers at the cutting edge from the mid-Atlantic area fueled discussions on the use of small molecule therapeutics for the treatment of spinal muscular atrophy (Matthew Butchbach, PhD, Alfred I. duPont Hospital for Children), the cellular and molecular aspects of cell oxidative biology and their role in Alzheimer's disease and related tauopathies (Domenico Praticò, MD, Temple University), and the relationship between glycolipids and α-synuclein pathology in preclinical models of Parkinson's disease (Mali Cosden, MS, Merck and Co. Inc.).

The biotech roundtable discussion featured representatives from local biotech companies at various stages of development. The session was moderated by Maria Stewart (Opertech Bio), and participants included Alexandria Chadwick (Associate Director, Preclinical R&D, Verve Therapeutics), William Kinney (Chief Scientific Officer, Kannalife), and Joost Wagenaar (Vice President, Scientific Applications, BlackFynn). Questions from meeting attendees probed into biotech operations, investor targeting phases, and career turning points.

The annual George B. Koelle Award was presented to Julie Blendy, PhD (University of Pennsylvania) who emulates the outstanding qualities of Dr. Koelle, including "profound commitment to teaching, fondness for encouraging students, excellence in research, and strong devotion to the science of pharmacology". Congratulations to Dr. Blendy! Continuing the commitment to foster trainee development, MAPS selected Invited Trainee Talks by graduate student

Kyle Saitta (Rutgers University) and postdoctoral researcher Pooja Jadiya, PhD (Temple University). Poster topics covered broad areas of pharmacology. Poster awards were given to undergraduate students Alyssa Sanders (Rowan University) and Erik Fleischel (Temple University); graduate students Laura Puentes (University of Pennsylvania), Marco Carpenter (University of Pennsylvania), Luciana Leo (Temple University), and Emily Nickoloff-Bybel (Drexel University); and postdoctoral fellow Maria Cimini (Temple University). Congratulations to all the trainees!

Thank you to all our sponsors, attendees, and presenters from the MAPS Officers and Councilors (Bradford Fischer, President; Thomas Keck, Vice President; Marlene Jacobson, Past President; Linda Console-Bram, Treasurer; Catherine Moore, Secretary; and Councilors Carol Beck, Julie Blendy, Kyle Palmer, Doug Tilley and Ellen Unterwald). See photos and more at @MAPS_ASPET on Twitter!

See you next year!

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We wish you a warm holiday season and a happy new year!

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