



THE Pharmacologist

A Publication by The American Society for
Pharmacology and Experimental Therapeutics

Vol. 56 • Number 2 • June 2014

Stamping Out Drug Tampering

Inside:

EB 2014 In Review

Call for Award
Nominations

New ASPET Awards
for 2015

House Spending
Allocations Foretell
Limited Growth for NIH



Contents...

- 1** Message from the President
- 2** EB 2014 in Review
- 9** Call for 2015 Award Nominations
- 11** New ASPET Awards for 2015
- 12** Feature Story: *Stamping Out Drug Tampering*
- 21** Science Policy News
- 27** Education News
- 32** Journal News
- 33** ASPET Member Focus: Interview with
Dr. Charles (Chip) Rutledge
- 40** Members in the News
- 46** New ASPET Members
- 48** Division News
- 64** Upcoming Meetings & Congresses

THE PHARMACOLOGIST PRODUCTION TEAM

*Prateeksha Nagar
Suzie Thompson
Rich Dodenhoff
Judith A. Siuciak, PhD*

COUNCIL

President

Richard R. Neubig, MD, PhD

President-Elect

Annette E. Fleckenstein, PhD

Past President

John S. Lazo, PhD

Secretary/Treasurer

Sandra P. Welch, PhD

Secretary/Treasurer-Elect

Paul A. Insel, MD

Past Secretary/Treasurer

Edward T. Morgan, PhD

Councilors

Charles P. France, PhD

John D. Schuetz, PhD

Kenneth E. Thummel, PhD

Chair, Board of Publications Trustees

Mary E. Vore, PhD

Chair, Program Committee

Scott Waldman, MD, PhD

FASEB Board Representative

Brian M. Cox, PhD

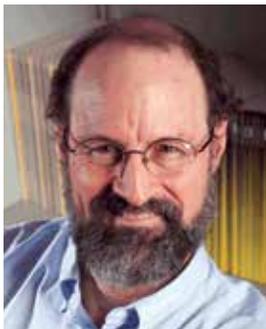
Executive Officer

Judith A. Siuciak, PhD

The Pharmacologist (ISSN 0031-7004) is published quarterly in March, June, September, and December by the American Society for Pharmacology and Experimental Therapeutics, 9650 Rockville Pike, Bethesda, MD 20814-3995. Annual subscription rates: \$20.00 for ASPET members; \$45.00 for U.S. nonmembers and institutions; \$70.00 for nonmembers and institutions outside the U.S. Single copy: \$20.00. Copyright © 2014 by the American Society for Pharmacology and Experimental Therapeutics Inc. All rights reserved. Periodicals postage paid at Bethesda, MD. GST number for Canadian subscribers: BN:13489 2330 RT.

ASPET assumes no responsibility for the statements and opinions advanced by contributors to *The Pharmacologist*.

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



Message from The President

My fellow pharmacologists,

It has been an exciting year as president of ASPET. With the dual challenges of the new chair position at Michigan State University and the ASPET presidency, it was a daunting prospect but one that turned out quite well. We had a successful transition in the executive officer position with Judy Siuciak stepping in for Christie Carrico. We have seen important changes in the website and communications strategy. The rebranding of ASPET's logo and the redesigned version of *The Pharmacologist* have provided a strong new image for ASPET. We also had a very successful fundraising effort with full endowment of the G&G award and two new fully endowed awards, the Lehr Research Award and the Reynold Spector Award in Clinical Pharmacology.

The 2014 Experimental Biology meeting had too many highlights to mention all but among which the joint meeting with the Chinese Pharmacological Society was notable in that it promises to blossom into more extensive interactions in the future. Professor Du, the President of CNPHARS, is working toward a 2016 joint meeting in China where ASPET members will play a key role. We also had an outstanding symposium on "Chemical biology in drug discovery" organized by Haiyan Fu from Emory University, who is a staunch ASPET member and past-president of the International Chemical Biology Society. Efforts are currently underway to enhance the interactions between ASPET and this important group to bring a distinct approach to the study of biology with chemicals (which, as we all know, is really pharmacology by a different name).

As you heard at the ASPET Business Meeting in San Diego, the society is doing well financially and we are interested in increasing ASPET's value for its members. A request for proposals for the BIG IDEAS initiative has gone out to our membership. Check the ASPET website and/or contact Judy Siuciak for more details. We look forward to hearing from you about different ways through which ASPET can help our members. We welcome all input and ideas, especially from our younger members. We have good programs for students and postdocs but would like to reach other groups as well—including early career investigators (e.g., assistant professor and equivalents) and perhaps "gap year" students who are working in pharmacology labs. All ideas are welcome. As I try to tell folks in my lab—there are no stupid questions—other than the ones that are kept silent. We look forward to hearing from you.

One other innovation that is on tap for the coming years is the "President's Symposium." The first one held by ASPET will be hosted by Annette Fleckenstein in Boston next year. It will be a follow-on from our interactions with NIH leaders over the past year. We hope that you will all come to take advantage of the opportunity to interact with key leaders from NIH to better understand their outlook and priorities.

It has been a pleasure serving as your president this year. I greatly appreciate the trust that you have put in me. I am looking forward to seeing you at the IUPHAR meeting in Cape Town, South Africa in July this year and then in Boston in March 2015.

All the best,

A handwritten signature in black ink that reads "Rick Neubig" with a stylized flourish at the end.

Rick Neubig

EB 2014

IN REVIEW

On April 26–30, 2014, ASPET members met as part of **Experimental Biology 2014** in San Diego, CA. With over 13,000 attendees, the meeting boasted an excellent scientific program and great networking opportunities.

The ASPET Business Meeting took place on Saturday, April 26. ASPET Members filled the room to capacity to hear President Rick Neubig present an update on the Society's current activities, programs, and initiatives. Highlights include the introduction of ASPET's new Executive Officer, Dr. Judith A. Siuciak; the newly elected ASPET officers, Dr. Ken Thummel, Dr. Dennis Marshall, and Dr. Margaret Gnegy; and new initiatives surrounding the launch of ASPET's new logo and brand. Dr. Neubig was also proud to announce

the success of ASPET's fundraising campaign for the Goodman & Gilman Award Endowment Fund, which is now fully endowed. And in even more exciting news, Dr. Neubig announced a brand new ASPET award, the David Lehr Research Award, which was made possible by an endowment from Mrs. Lisa Lehr to honor her husband, the late Dr. David Lehr. Following the reports on the state of ASPET's membership, finances, publications, and science policy, Dr. Neubig presented this year's award winners.



2014 ASPET Graduate Student Travel Award Winners



2014 SURF Travel Award Winners



2014 Washington Fellows Travel Award Winners



President-Elect **Annette Fleckenstein** thanks President **Rick Neubig** for his services



2014 ASPET Young Scientist Travel Award Winners



2014 ASPET Award Winners

Following the ASPET Business Meeting, members kicked off the start of the 2014 Annual Meeting with an opening reception. The opening reception featured carving stations, an open bar, and a lively atmosphere for members to catch up with old and new friends. Also at the opening reception, ASPET staff took pictures for a new “I am an ASPET member” marketing

campaign. This campaign aims to show the diversity of our membership. ASPET members work in a variety of different fields and they may sometimes refer to themselves as something other than “pharmacologists,” but their common bond is their membership in ASPET. There will be more to come with this campaign throughout the next year.

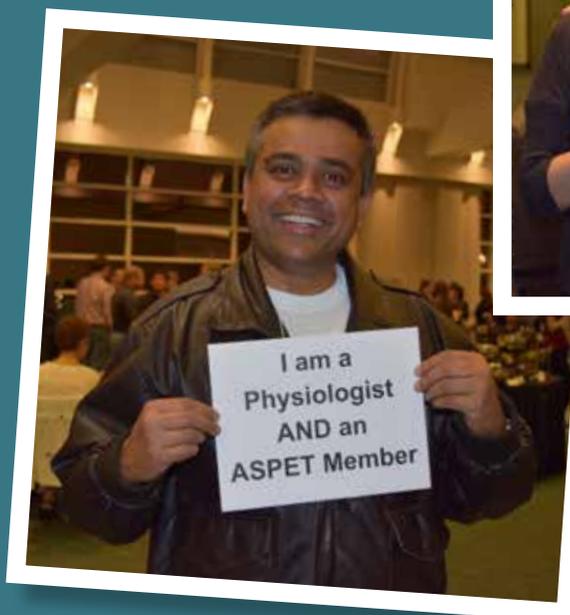


Pictures from the opening reception

“I am an ASPET member” Campaign

ASPET members work in a variety of different fields. ASPET members include neuroscientists, toxicologists, chemical biologists, pharmacists, cardiovascular scientists and many more. Furthermore, our members work for academia, government, large pharmaceutical companies, small biotech companies and even non-profit organizations. Though very diverse, our members have a common bond through their membership in ASPET. Show your support for ASPET membership and participate in the “I am an ASPET Member” campaign.

Fill in the blank “I am a _____ and an ASPET member.” You can get as creative as you would like. Make a sign with your statement, take a picture, and send it to sthompson@aspet.org. We will include your picture in our marketing campaigns and beyond, and you will be helping us showcase who our members are and what they do! ASPET logo’d prizes will be sent to the most creative pictures.





ASPET President **Rick Neubig** with the delegates from CNPHARS.

This year's annual meeting was held jointly with the Chinese Pharmacological Society (CNPHARS). On Sunday, April 27, we held a CNPHARS welcoming ceremony where gifts were exchanged between our two societies. Following the ceremony, Dr. Guan-Hua Du from the Institute of Meteria Medica, Chinese Academy of Medical Sciences & Peking Union Medical College delivered a lecture titled "Target-net based drug discovery for Parkinson's disease treatment by HTS/HCS." Later that evening, leadership from both societies enjoyed a Mexican dinner together.

If you had time to visit the exhibit hall this year, you will know that it was buzzing with lots of activity. The

ASPET booth had great traffic with both member and non-member visitors. We signed up 42 new members and showcased our newly branded marketing materials, brochures, flyers, and products. If you haven't already had a chance to view our new Guide to Member Benefits brochure, be sure to take the time to download it now at www.aspet.org/Guide_to_Member_Benefits. As part of our re-branding efforts, this new guide was created to make sure our members are taking full advantage of ASPET membership. Also at the booth, we sold t-shirts, hats, plush donkeys, lunch bags, and mugs featuring our new logo. If you didn't get an ASPET logo'd product, you can still make purchases online at www.aspet.org/store.



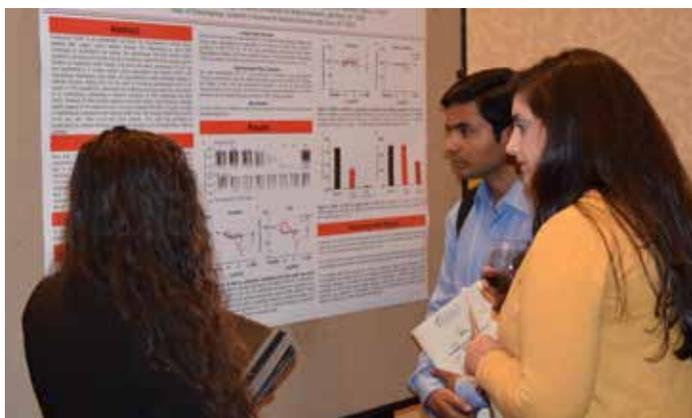
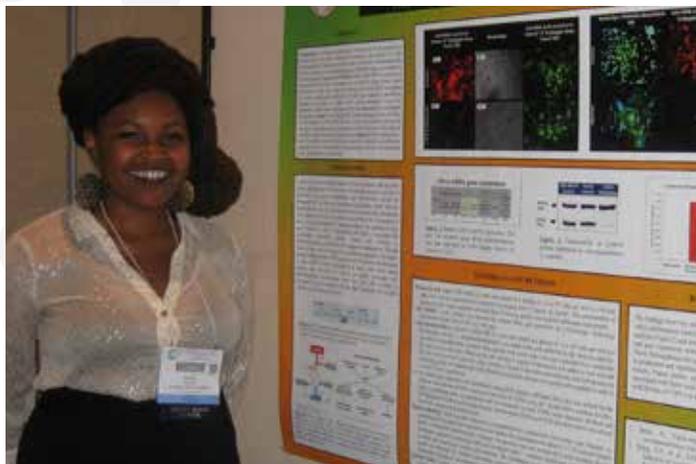
ASPET hosted a welcoming ceremony for visiting CNPHARS members.



ASPET Exhibit Hall Booth

With over 400 members attending, the Student and Postdoctoral Best Abstract Competition gave students and young scientists a chance to present their work in a lively and fun atmosphere. Each of the ASPET divisions held their competitions simultaneously. This year, many

of the judges indicated the difficulty in judging due to the very high level of great science and presentations. Not only was the competition fierce, but it was a great opportunity to talk and network with senior members, colleagues, and friends.



Pictures from the Best Abstract Competition.



Dr. Susan Ingram presents Fernando Moura with the 2014 Dolores C. Shockley Best Abstract Award

Also, award at the Student and Postdoctoral Best Abstract Competition was the 2014 Dolores C. Shockley Best Abstract Award. Dr. Shockley was the first African American woman to earn a PhD in pharmacology and the first black woman appointed to chair a pharmacology department in the U.S. In 2009, Dr. Shockley received the Distinguished Alumni Award from her alma mater, Purdue University. This award was given to Fernando Moura from the University of Texas Health Science Center at San Antonio for his abstract entitled "Differential generalization among nicotinic acetylcholine receptor agonists in nicotine, varenicline, and epibatidine drug discriminations in mice."

Following the poster competition, ASPET Students and Postdocs let their hair down at the Student/Postdoc mixer. Young members enjoyed drinks, dessert, and dancing!



ASPET Student/Postdoc Mixer

The ASPET Networking Walk took place on Tuesday, April 29. ASPET members gathered for a walk around San Diego. Members walked along the waterfront and enjoyed time talking and networking with each other. Walkers enjoyed a hearty breakfast afterward before heading off to more scientific sessions.

As the 2014 Annual Meeting drew to a close, ASPET members attended the closing reception, which was held poolside at the Marriott Marquis on Wednesday, April 30. With perfect weather and a great turnout, members enjoyed one last social event before heading home.

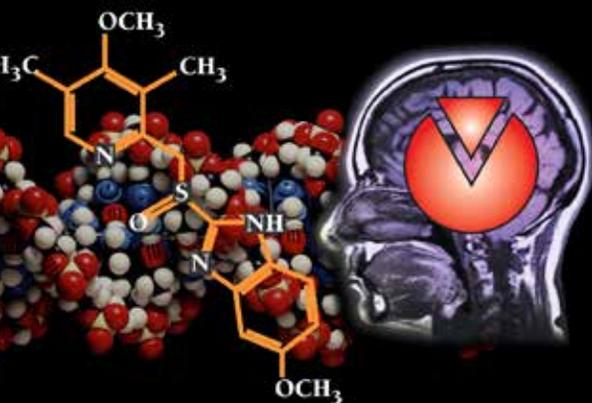


Members enjoy the closing reception poolside at the Marriott



Members enjoy a nice walk along the San Diego harbor

To view the full album of EB 2014 pictures, visit us online at: <http://bit.ly/SOfcAn>



Explore Pharmacology

Graduate Studies in Pharmacology

Promote your graduate program in our Special Graduate Program edition of *Explore Pharmacology*. This publication gives college students an overview of the fundamentals and applications of pharmacology.

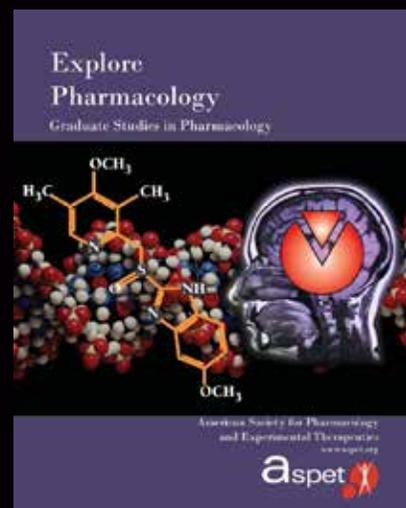
In addition, it describes the many employment opportunities that await graduate pharmacologists and outlines the academic path that they are advised to follow. There is no better place to advertise your graduate program!

Benefits of Advertising with Explore Pharmacology:

- Distributed to 1,100+ undergraduate students and ASPET Undergraduate Student Members who have a direct interest in pharmacology and related graduate programs
- Distributed at the Annual Biomedical Research Conference for Minority Students (ABRCMS), the Society for Advancement of Chicanos and Native Americans in Science (SACNAS) meeting, and the Society for Neuroscience Annual Meeting where over 30,000 attendees are expected
- Copies will be sent to each of the 21 universities that participate in ASPET's Summer Undergraduate Research Fellowship (SURF) program

Advertising Opportunities

- Advertise with a ¼ page, ½ page, or full page, 4-color display ad
- Enhance your visibility by advertising on one of the covers (inside front, inside back, or back cover) with a full page, 4-color ad
- Your ad will be highlighted on the ASPET Departments and Training Programs in Pharmacology webpage with a link to your website from September 1 - December 31, 2014



Act quickly, the Space and Materials deadline is Thursday, July 31.

If you have questions or would like to see sample ads, contact ASPET's advertising department:

Robyn B. Engelson
FASEB AdNet
adnet@faseb.org
800-43FASEB, ext. 7103
www.faseb.org/adnet/aspnet



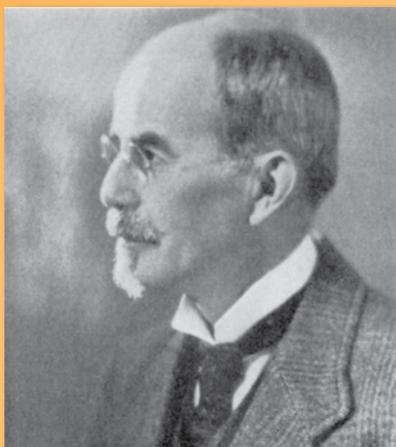


Call for 2015 Award Nominations

ASPET Scientific Achievement Awards

ASPET presents several major awards to recognize accomplishments either in specific areas of pharmacology or contributions to and accomplishments in the discipline in general. Please send us your award nominations for the following awards. The deadline is September 15, 2014.

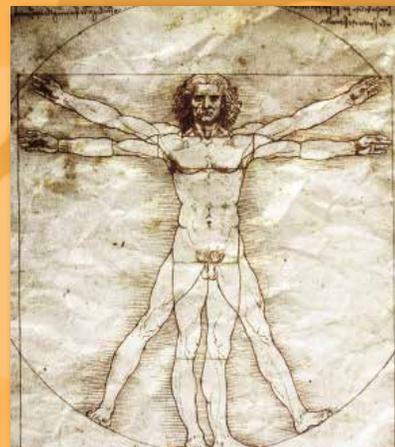
For more information on these awards, please visit: www.aspet.org/awards/.



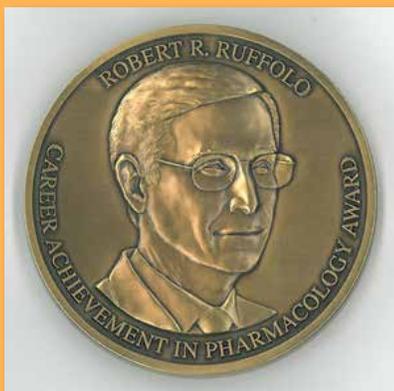
The **John J. Abel Award in Pharmacology**, named after the founder of ASPET, was established in 1946 to stimulate fundamental research in pharmacology and experimental therapeutics by young investigators.



The **Julius Axelrod Award in Pharmacology** was established in 1991 to honor the memory of the eminent American pharmacologist who shaped the fields of neuroscience, drug metabolism, and biochemistry and who served as a mentor for numerous eminent pharmacologists around the world. This award is presented for significant contributions to understanding the biochemical mechanisms underlying the pharmacological actions of drugs and for contributions to mentoring other pharmacologists.



The **Pharmacia ASPET Award in Experimental Therapeutics** recognizes and stimulates outstanding research in pharmacology and experimental therapeutics, basic laboratory or clinical research that has had, or potentially will have, a major impact on the pharmacological treatment of disease.



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



The **Torald Sollmann Award in Pharmacology** was established in 1960 to commemorate the pioneer work of Dr. Torald Sollmann in the fields of pharmacological investigation and education. This award is presented biennially in odd numbered years at the award ceremony during the ASPET Annual Meeting for significant contributions over many years to the advancement and extension of knowledge in the field of pharmacology.



ASPET Division Sponsored Award

The ASPET **Division for Drug Metabolism Early Career Achievement Award** has been established to recognize excellent original research by early career investigators in the area of drug metabolism and disposition. For more information for this award, please visit: www.aspet.org/Drug-Metabolism/Early-Career-Achievement-Award/.

Goodman & Gilman Award now FULLY FUNDED!



ASPET is pleased to announce that we have met our endowment goal of \$60,000 towards this award and thank all our donors who made it possible for us to reach our target goal. Your donations to this important award will recognize and support exceptional research in the pharmacology of biological receptors for many more years to come.

To learn more about this award and other award endowment fund needs, visit www.aspet.org/awards

New ASPET Awards for 2015

ASPET is pleased to announce two new Society awards for 2015, the David Lehr Research Award and the Reynold Spector Award in Clinical Pharmacology. The inaugural presentations for both of these awards will be at the ASPET Annual meeting at EB 2015 in Boston.

The David Lehr Research Award



The David Lehr Research Award is intended to extend funding for preclinical or clinical research directed towards improving human health. This biennial award is made possible by an endowment to ASPET from Mrs. Lisa Lehr in honor of her husband, the late Dr. David Lehr, Professor and Chairman

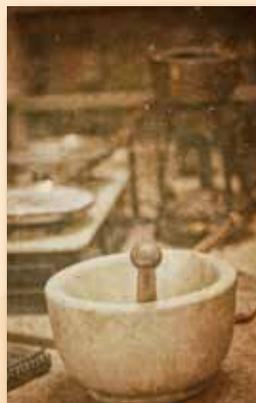
Emeritus of the Department of Pharmacology of New York Medical College.

David Lehr, MD (1910–2010) was born and educated in Vienna, Austria, where he became a renowned lecturer and scholar at the Medical school of the University of Vienna, positions from which he was immediately ousted by the Nazi takeover and Anschluss. As a survivor of the Holocaust, Dr. Lehr arrived in the United States in 1939 and joined the faculty of New York Medical College in 1940. As he rose through the ranks, Dr. Lehr achieved international recognition as a physician, scientist, educator, and scholar, and made very significant research contributions and discoveries in the fields of pharmacology and therapeutics. He taught generations of today's doctors and scientists and authored more than 370 scientific publications throughout his long and productive career.

Dr. Lehr was an active member and fellow of many medical and scientific societies, including ASPET, where he was a member for 66 years.

To honor Dr. Lehr's legacy, the David Lehr Research Award will provide \$100,000 to a principal investigator to help support research activities for which there is a gap in funding or for the purpose of acquiring preliminary data to support the submission of a new grant proposal. For more information on this award and the application process, please visit: www.aspet.org/awards/aspnet/lehr.

The Reynold Spector Award in Clinical Pharmacology



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

Dr. Spector was educated at Harvard ('62 AB, Chemistry and Physics), Yale Medical School ('66) and the Brigham in Boston (Internal Medicine; 1966–1971) with two years in the US Army. From 1971 to 1978, he served as instructor, assistant, and associate professor at Harvard and the Brigham. In 1978, Dr. Spector was appointed professor of Medicine and Pharmacology at the University of Iowa. Dr. Spector joined Merck in 1987 and rose to the rank of executive vice president in charge of drug development. Under Dr. Spector's aegis, 13 drugs and vaccines were developed and registered for sale including simvastatin, losartan, montelukast, and alendronate. Before retirement in 1999, Dr. Spector initiated the successful clinical trials of the herpes zoster and papilloma virus vaccines. Currently, Dr. Spector productively continues as adjunct professor of medicine at the Robert Wood Johnson Medical School in New Jersey and he is the author of over two hundred scientific papers and a successful *textbook*, *The Scientific Basis of Clinical Pharmacology* (1985). Dr. Spector's areas of scientific investigation included the functions of the choroid plexus, vitamin transport into brain and the treatment of the poisoned and overdosed patients with gastrointestinal dialysis. Dr. Spector has been a member of ASPET since 1980. For more information on this award and the application process, please visit: www.aspet.org/awards/aspnet/spector.

Stamping Out Drug Tampering

Rebecca J. Anderson

When Dennis and Jeanna Kellerman woke on Wednesday, September 29, 1982, they found their twelve-year-old daughter, Mary, unconscious on the bathroom floor (1-3). Paramedics rushed Mary from her home in Elk Grove Village, Illinois, to the hospital, where she was later pronounced dead. Initially, the doctors suspected she had died from a stroke (2).

That same morning, Adam Janus, a 27-year-old postal worker in Arlington Heights, Illinois, was feeling unwell at work and went home early (2-4). After eating a light lunch, he headed to the bedroom but collapsed before he got there. His wife called paramedics who desperately tried to save him. Adam's breathing was labored, his blood pressure was dangerously low, and his pupils were fixed and dilated. Nothing they did seemed to work, so they rushed Janus to the emergency room at nearby Northwest Community Hospital. He was pronounced dead at 3 pm, apparently from a massive heart attack (2-5).

Later that afternoon, paramedics were called back to Janus's home, where grieving family members had gathered to plan Adam's funeral. This time, they attended to Adam's 25-year-old brother, Stanley, who had suddenly collapsed. He was lying on the living room floor, his pupils fixed and dilated. One of the bewildered paramedics looked up at Charles Kramer, the fire lieutenant on duty, and said, "This is what happened to the first guy. It's the same thing as this morning. We're losing him" (3).

At that moment, they heard a groan in the living room, and Stanley's 19-year-old wife, Theresa, collapsed right in front of them. The Janus couple was rushed to the hospital, where Stanley died that evening. Theresa, who was brain-dead on arrival, was put on life support (3).

Helen Jensen, a village nurse in Arlington Heights, was eating dinner that evening when she received a call from Northwest Community Hospital (6). Hospital officials asked her to investigate the Janus' suspicious illnesses. Initially, she checked for a deadly bacteria or virus in the Janus house and also considered toxic gas, a poison introduced from some unknown source, and other causes. Listening closely to family members as they recounted the day's bizarre events, Jensen identified a common denominator.

Adam had stopped at a grocery store on his way home to buy a bottle of Extra-Strength Tylenol capsules and took two after eating his lunch. Later that day, Stanley took two capsules from the same bottle for back pain, and Theresa also took two for a medical condition.

Jensen located the opened Tylenol bottle in the Janus bathroom, took it to Northwest Community Hospital, and insisted that they test it (6). In parallel, a doctor at the hospital reported the suspicious Janus brothers' deaths to the Rocky Mountain Poison Center in Denver. The victims' symptoms pointed to cyanide poisoning (4).

Also on Wednesday evening, Phillip Capitelli, an off-duty Arlington Heights firefighter, was at home listening to the frenetic activity on his police scanner. He called Lieutenant Kramer at the fire station to ask for further details. When Kramer mentioned Tylenol, Capitelli recalled a conversation earlier in the day with his mother-in-law, who was a coworker of Jeanna Kellerman and had called him to ask if he knew anything about the mysterious Janus deaths (3, 4). He followed up with his friend, Richard Keyworth, a firefighter in Elk Grove Village, who told him that Mary Kellerman had taken an Extra-Strength Tylenol capsule for a runny nose and sore throat before collapsing.

One of the bewildered paramedics looked up at Charles Kramer, the fire lieutenant on duty, and said, "This is what happened to the first guy. It's the same thing as this morning. We're losing him"

By dawn on Thursday morning, the Cook County Medical Examiner's office had found cyanide in all four victims' blood, and the county's chief toxicologist found lethal concentrations of potassium cyanide in the remaining capsules of the Tylenol bottles retrieved from both the Kellerman and Janus homes (2, 4). Both bottles bore the same manufacturer's lot number MC2880 (1). But tracking down the source of the contamination would be challenging. Like all over-the-counter drugs at the time, Tylenol was displayed on retailers' shelves in unsealed bottles. The only protection was a wad of cotton inside the bottle. The two ends of the hard gelatin capsules could be easily slid open and reclosed.

In addition, potassium cyanide was readily available. It was used in industrial processes such as electroplating, film processing, fertilizer production, steel plating, and extracting gold and silver from low-grade ores. Medical and scientific laboratories also

regularly used potassium cyanide as a reagent, and drug peddlers used it to make street drug supplies of phencyclidine. Almost anyone, anywhere, could have spiked the Tylenol capsules with cyanide.

Putting Patient Safety First

At 9:30 am on Thursday morning, the first calls from Chicago authorities and the media reached McNeil Consumer Products Company, notifying executives that their best-selling product was linked to several deaths in Chicago (7-9). James Burke, CEO of Johnson & Johnson, McNeil's parent company, immediately dispatched an investigative team to the McNeil plant in Ft. Washington, Pennsylvania, where the MC2880 lot had been produced (9). Their highest priority was public safety, and they recalled all 93,400 bottles of the lot. By noon, they had also issued a half-million mailgrams to physicians, hospitals, and wholesalers, alerting them to the danger. McNeil also suspended all advertising for Tylenol (4, 7, 9).

Unfortunately, the situation in Chicago was growing more dreadful by the hour.

In parallel with Burke's initial actions on Thursday morning, Mary Reiner, a 27-year-old telephone company employee who was recovering from the birth of her son, was found dead in her home in Winfield, Illinois (1, 2, 4). Investigators found four cyanide-laced Extra-Strength Tylenol capsules in a bottle labeled Regular-Strength Tylenol. Unable to locate the original Extra-Strength Tylenol bottle, they could not determine the lot number of the tainted capsules (4).

On Thursday afternoon, Mary McFarland, a 31-year-old homemaker in Elmhurst, Illinois, was rushed to Good Samaritan Hospital in nearby Downers Grove but was dead on arrival from cyanide poisoning (1). Investigators found a bottle of contaminated Extra-Strength Tylenol capsules in her purse and another bottle at her home marked with lot 1910MD. An empty bottle in her trash was marked lot MC2738 (4).

Authorities in Chicago grimly feared



[CC-BY-SA-3.0-2.5-2.0-1.0 (<http://creativecommons.org/licenses/by-sa/3.0/>), via Wikimedia Commons]

more bodies might be found—shut-ins and single people being the most vulnerable—and they mounted an extraordinary effort to inform and protect the public. Chicago Mayor Jane Byrne ordered removal of all Tylenol products from Chicago stores (10). Police cruised neighborhoods, shouting a warning over loudspeakers not to take Extra-Strength Tylenol capsules (2, 4). Boy Scout troops went door to door gathering bags full of the bottles, and church groups launched telephone drives to reach elderly citizens and others who might not have heard the repeated broadcasts on radio and television. School officials sent notices home with children, and transit workers on buses and trains spread the word. Far into the night, police made the rounds to taverns, and all paramedic units received anti-cyanide kits (4, 10).

Illinois Gov. James Thompson declared, “We have a madman out there”

Although the information reaching Burke and his team in New Brunswick, New Jersey, was fragmentary, they quickly became convinced that the cyanide had not been introduced, either accidentally or intentionally, during the production or distribution of their product (7, 9). Lot MC2880 had been shipped from the Pennsylvania plant to 31 Eastern and Midwestern states. Lot 1910MD had been produced at McNeil’s plant in Round Rock, Texas, and distributed in Chicago and the West (4). Yet, the cyanide-laced capsules had been found only in the suburbs of

Chicago. The most likely explanation was that someone in the Chicago area had taken bottles of Extra-Strength Tylenol from retailers, filled the capsules with potassium cyanide, and then replaced the bottles on retailers’ shelves. Illinois Gov. James Thompson declared, “We have a madman out there” (4).

On Friday, October 1, and in view of the escalating tragedy, McNeil expanded its recall to include all 171,000 bottles of the 1910MD lot that had been produced in Texas (4). Johnson & Johnson also offered a \$100,000 reward for information leading to the arrest and conviction of whoever was responsible (10). Unfortunately, also on Friday, doctors at Northwest Community Hospital abandoned their efforts to save Theresa Janus, who became the sixth fatality (4). Late on Friday night, police found the body of the seventh and final victim. United Airlines flight attendant Paula Prince, 35, died in her near North Side apartment with a bottle of Extra-Strength Tylenol capsules nearby (4, 10). Prince’s bottle came from yet another lot, 1801MA, and she was the only victim found in Chicago, not the suburbs (4).

Even in those first hectic days, personnel at Johnson & Johnson’s headquarters fully cooperated with the media because reporters seemed to have the most up-to-date and accurate information about the poisoning incidents (8, 9). Burke and his staff also worked closely with local, state, and federal authorities on the criminal investigation. On Monday, October 4, Burke and his executives flew to Washington, DC, to meet with FBI Director William Webster and FDA Commissioner Arthur Hayes (7). Burke proposed a nationwide recall of all Extra-Strength Tylenol



Safety seal on a Tylenol bottle

Armor-Clad Packaging

Acetaminophen, the active ingredient in Tylenol, had been marketed by several drug firms since the 1960s as an over-the-counter analgesic and antipyretic. In 1975, McNeil launched an aggressive and highly successful advertising campaign, and by 1982, Tylenol had captured more of the analgesic market than the next three brands of acetaminophen combined (9).

While market analysts praised Johnson & Johnson for the company's quick and decisive actions—putting patient safety before corporate profits—they predicted that the Tylenol brand (the most recognizable over-the-counter product for pain-relief) was dead. Most consumers believed McNeil was not at fault, but they still associated the poisonings with Tylenol and were understandably hesitant to use it. One Madison Avenue advertising guru said, “I don't think they can ever sell another product under that name” (11).

Undeterred by the market analysts, Burke and his staff never considered retiring or replacing the Tylenol brand (7, 9). While dozens of McNeil employees manned banks of telephones and responded to thousands of inquiries from consumers and the media, all seeking information about Tylenol and the poisonings, Burke simultaneously set up several task forces to stage Tylenol's comeback. By Monday, October 11, he had finalized his re-launch strategy (9).

An easy solution would have been to abandon the capsule formulation in favor of tablets, which are much harder to contaminate, but consumers preferred Tylenol capsules. They were easier to swallow than tablets, and some consumers thought that they provided more potent pain relief—an unfounded, placebo-driven perception, presumably because capsules looked similar to prescription drugs (13). However, to reintroduce Tylenol capsules, Johnson & Johnson needed to win back consumer confidence, which in turn relied on an absolute assurance that the product was safe. Therefore, Burke's most critical task force was the one charged with developing new tamper-resistant packaging, and he assigned himself to head it (7). Various inventors had already developed more than a dozen protective-packaging methods, most of which were aimed at preventing children from opening drug bottles. Burke was determined to be the first in the industry to devise packaging that deterred willful tampering and to do more than anyone else in the industry—actions that were intended to reassure the nervous public (7).



[CC-BY-SA-2.0
(<http://creativecommons.org/licenses/by-sa/2.0/>), via
Wikimedia Commons

capsules. Although Webster and Hayes were initially concerned that such drastic action would inflame an already panicked nation, their opposition vanished when they received word of copycat strychnine-laced Tylenol capsules in California.

One Madison Avenue advertising guru said, “I don't think they can ever sell another product under that name”

On Tuesday, Johnson & Johnson announced the recall of 31 million bottles of Extra-Strength Tylenol capsules, and the FDA urged consumers nationwide not to take Extra-Strength Tylenol capsules of any lot number “until the series of deaths in the Chicago area can be clarified” (4, 7). Some retailers and government officials mirrored Mayor Byrne's directive and removed all Tylenol products from store shelves. On Thursday, October 7, and in an attempt to retrieve the millions of bottles of Tylenol capsules that had already been purchased and were sitting in consumers' medicine cabinets, Johnson & Johnson offered to exchange all those capsules for Tylenol tablets (9, 11). The company examined 1.5 million bottles of Tylenol and found three unopened bottles with tainted capsules—all retrieved from the Chicago area (12). Truckloads of the recalled capsules were eventually dumped into an incinerator in north New Jersey and burned (7).



**J&J CEO
James Burke**

Burke's task force quickly settled on a triple seal system: an outer box with glued flaps, a plastic shrink sleeve over the cap and neck of the bottle, and a strong foil seal over the mouth of the bottle (8, 14). They decided that the first product to be

produced and shipped with the new packaging would be the now infamous Extra-Strength Tylenol capsules. McNeil's executives and engineers went into overdrive, working three shifts, seven days a week to retool production (7). They had to reconfigure carton machinery to glue as well as fold the boxes, and they madly scrambled through Johnson & Johnson's affiliated drug companies for existing machines and material (7). For the plastic shrink sleeves, they searched in vain as far as Asia and Europe for enough equipment and finally resorted to mounting the shrink sleeves by hand. They designed new graphics and wanted to call the anti-tampering device the Tylenol "safety seal," but they first had to track down the man who owned the trademark to that phrase and negotiate a license to use it (7). On October 23, 1982, less than a month after Mary Kellerman's death in Chicago, Johnson & Johnson publicly announced its intention to reintroduce Tylenol capsules in "tamper-resistant containers" (14).

Burke's task force quickly settled on a triple seal system: an outer box with glued flaps, a plastic shrink sleeve over the cap and neck of the bottle, and a strong foil seal over the mouth of the bottle.

In parallel with re-engineering Tylenol's packaging, company officials were spending a lot of time in Washington, DC. They called on more than 160 Congressional offices, urging lawmakers to make

product tampering a federal crime (8). They also cooperated with FDA officials who were drafting the first regulations for tamper-resistant packaging. On November 4, 1982, Burke and several of his top executives met with Health and Human Services Secretary Richard Schweiker and FDA Commissioner Hayes (7). During the meeting, Burke pulled out a prototype of the newly packaged Tylenol capsules, and both officials had difficulty opening the bottle. Schweiker said, "Everybody else is going to have a package. You've got an armored tank" (7).

The next day, the FDA published the new regulations for tamper-resistant packaging of over-the-counter products in the Federal Register (47 FR 50442). With few exceptions, all OTC human drug products were required to have "an indicator or barrier to entry" and a statement on the label alerting the consumer to the specific tamper-resistant feature(s). The new Tylenol packaging, with three barriers, went far beyond those requirements. One week after the FDA regulations were published and less than six weeks after the first deaths were reported in Chicago, Tylenol capsules in the triple-seal packages began reappearing on store shelves (14). Sales quickly rebounded, and within three years, Tylenol was once again the dominant brand of acetaminophen (12).

On October 14, 1983, a year after the Chicago deaths, President Reagan signed the Federal Anti-Tampering Act, making it a felony to tamper and inflict harm with any consumer product (drug, device, food, or cosmetic).

Deja Vu All Over Again

On Friday, February 7, 1986, Diane Elsroth, 23, was visiting her boyfriend in his parents' home in Yonkers, New York. She complained of feeling ill, and her boyfriend opened a new bottle of Extra-Strength Tylenol and gave her two capsules (15, 16). Twelve hours later, he went to check on her and discovered Elsroth dead. On Monday, Elsroth's autopsy revealed evidence of cyanide poisoning, and the retrieved bottle of Tylenol contained three more capsules filled with potassium cyanide.

In a repeat of the Chicago crisis, Johnson & Johnson fully cooperated with FDA and local authorities, advised people in Westchester County, New York, not to take any Tylenol capsules, and suspended all television advertising (16). The company also retrieved the entire stock of Tylenol

capsules from all retail outlets within a three-mile radius of the store where the poisoned capsules had been purchased. On February 13, after testing 67,000 capsules, McNeil and FDA analysts discovered a second bottle with five cyanide-laced capsules (15). Realizing that Elstroth's death might not be an isolated poisoning, Johnson & Johnson issued a nationwide press release urging consumers not to take Tylenol capsules until further notice and requested retailers and wholesalers to remove all Tylenol capsule products from their shelves.

Stella had filled the Excedrin capsules with cyanide, repackaged them, and placed three of the bottles in area stores, making Bruce's death look like the work of a serial poisoner.

Despite Johnson & Johnson's "armor-clad" safety barriers, the compromised Tylenol packaging showed no visible signs of tampering. Burke and his staff rapidly concluded that they could no longer guarantee the safety of Tylenol in capsules. He announced that the company would stop manufacturing all over-the-counter capsule products, despite their popularity (13). Instead, Tylenol would be manufactured as caplets. Caplets are oval-shaped like a capsule but are solid like tablets and therefore extremely difficult to violate without leaving clear evidence of tampering. With a slick coating and smaller size, the new caplets were also easy to swallow (13). Other companies chose to continue manufacturing their acetaminophen products in capsules.

Other Corporate Headaches

A few months later, on June 11, 1986, Susan Snow, a 40-year-old bank manager in Auburn, Washington, woke with a headache. She took two Extra-Strength Excedrin capsules and went to take a shower. Forty minutes later, her 15-year-old daughter found Snow unconscious on the bathroom floor (2). With only a faint pulse, Snow was transported to Harborview Medical Center, where she later died without regaining consciousness. An astute medical examiner detected the distinct scent of bitter almonds during Snow's autopsy and determined that she had died from cyanide poisoning, which

was traced back to the innocuous looking bottle of Excedrin capsules. Taking a page from Johnson & Johnson's playbook, executives at Bristol-Myers Squibb, the makers of Excedrin, immediately recalled the product nationally, hoping to avert more deaths.

Following Bristol-Myers Squibb's highly publicized and massive recall, Stella Nickell called police to report her suspicions about her husband's death two weeks earlier (17). Bruce Nickell had died shortly after taking four Extra-Strength Excedrin capsules. Although his death was initially thought to be due to complications from emphysema, laboratory tests of his blood subsequently detected a lethal concentration of cyanide, and investigators recovered two bottles containing tainted Excedrin capsules from the Nickells' home in Auburn, Washington. In the months that followed, a total of five bottles of Extra-Strength Excedrin containing cyanide-laced capsules were retrieved from the Tacoma, Washington, area. It seemed odd that two of them had ended up in the Nickells' home. During detailed examination of the tainted material, an FBI analyst found minute specks of a green crystal substance mixed with the cyanide (2). He identified the green substance as an algaecide, Algae Destroyer, a product used in fishponds and home aquariums.

Law enforcement officials discovered that Stella Nickell owned a fish tank and had bought Algae Destroyer from a pet store prior to the deaths of Susan Snow and Bruce Nickell. She had also taken out three insurance policies on her husband in the year prior to his death (17). When she failed a lie detector test and investigators found substantial fingerprint evidence, police charged her with her husband's murder (2).

The names acetaminophen and Tylenol are both derived from the compound's chemical name, N-acetyl-para-amino-phenol, or APAP:

N-acetyl-para-amino-phenol → acetaminophen

N-acetyl-para-amino-phenol → Tylenol

Biosketch:



Rebecca J. Anderson holds a B.A. 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 be exploring the story about the Crohn legacy from halitosis to colitis and beyond. Don't miss the exciting September 2014 issue.

FBI agents and state police subsequently compiled evidence that indicated Stella had filled the Excedrin capsules with cyanide, repackaged them, and placed three of the bottles in area stores, making Bruce's death look like the work of a serial poisoner. On May 9, 1988, a jury found Stella guilty of murder under the new Federal Anti-Tampering Law, and she was sentenced to 90 years in prison (2).

Tightening Control

As the deaths in New York and Washington demonstrated, over-the-counter capsule products continued to be vulnerable to tampering because the two ends of the gelatin capsules could be easily opened and reclosed. Consequently, FDA amended and strengthened its requirements in 1989 (54 FR 5227), requiring all two-piece, hard gelatin capsules to have a minimum of two tamper-resistant packaging features. The regulations encouraged, but did not require, manufacturers to seal the capsules as one of the two tamper-resistant features. Examples of acceptable capsule-sealing technologies included sonic welding, banding, and sealing techniques that employed solvents or low temperature heating.

The new tamper-resistant packaging did not deter Joseph Meling. In February 1991, he opened capsules of Sudafed 12-hour decongestant that had been protected in blister packs and spiked them with cyanide, intent on killing his wife. To divert suspicion, he drove along a 30-mile stretch of Interstate 5 between Tacoma and Olympia, Washington, and deposited five of the tainted Sudafed packages on the shelves of retailers located near the interstate exits (2). After taking Sudafed, Mrs. Meling was rushed to the hospital in a coma. She survived—ironically because Joseph asked the emergency room doctors if they had considered the possibility that she had been poisoned (18). They immediately pumped her stomach. Unfortunately, two other victims

who purchased and consumed the cyanide-laced capsules died within the next two weeks.

Reaction to the cyanide-laced Sudafed capsules paralleled the earlier tampering incidents (18). Burroughs Wellcome, the manufacturer of Sudafed, and the FDA ordered a nationwide recall of the product and assayed thousands of capsules for cyanide. Local, state, and federal officials cooperated in conducting the criminal investigation and quickly narrowed the suspects to Meling. In 1993, he was convicted and sentenced to life in prison under the Federal Anti-Tampering Law (2).

Concerns about tampering, which once discouraged the use of those analgesics, have now been replaced by concerns about consumers unwittingly taking too much acetaminophen.

The tainted Sudafed packaging showed obvious signs of tampering (19). The lot numbers on the blister pack and outside carton did not match. The foil on the blister pack had been pulled back and then pushed back into place, and the cyanide-containing capsules were oversized and missing the purple band that otherwise sealed all Sudafed capsules. Citing the Sudafed incident, the FDA again strengthened the packaging requirements for over-the-counter drug products "to improve consumer protection by addressing specific vulnerabilities in the OTC drug market." The new requirements, which the FDA issued in 1998 (63 FR 59463), mandated that all two-piece, hard gelatin capsules of over-the-counter drugs must be sealed plus have at least one additional tamper-evident feature in the packaging. The product's label was required to highlight all tamper-evident features of the product,

including those on the box, the bottle or closure, and the sealed capsules.

The agency also changed the regulation terminology from “tamper-resistant” to “tamper-evident” packaging. Despite clear signs of tampering, the Sudafed victims had perhaps been complacent, falsely assured that they were buying a tamper-resistant product. Regulators, therefore, underscored the importance of sensitizing consumers so that they would be more alert and look for tampering; terminology that implied a particular package was difficult to breach or tamper-proof was no longer acceptable.

A Swing of the Pendulum

For more than two decades, no malicious tampering of over-the-counter drugs has been reported in the United States. The elaborate packaging features, though sometimes annoying and occasionally frustrating, have proven to be effective and fostered widespread use of acetaminophen. Tylenol continues to be the most recognizable and ubiquitous brand, but acetaminophen is now an analgesic ingredient in over 600 products, including Sudafed sinus tablets and Excedrin. Concerns about tampering, which once discouraged the use of those analgesics, have now been replaced by concerns about consumers unwittingly taking too much acetaminophen.

According to the FDA, acetaminophen toxicity accounts for 56,000 emergency room visits and an estimated 200 deaths from acute liver failure each year. Severe liver injury with acetaminophen occurs most frequently when patients take more than the prescribed dose of acetaminophen-containing drugs in a 24-hour period, take more than one acetaminophen-containing product at the same time, or drink alcohol while taking acetaminophen products.

In 2011, the FDA issued new guidelines on acetaminophen-containing prescription products (20). Some of the most popular prescription analgesics pair acetaminophen with an opiate: Tylenol with codeine, Percocet (with oxycodone), and Vicodin (with hydrocodone). The agency asked manufacturers to limit the amount of acetaminophen in prescription products to no more than 325 mg per tablet or capsule by January 2014.

Investigators testing recalled bottle of Tylenol for potassium cyanide



About half of the product manufacturers complied with the request. For those that have not, the FDA announced earlier this year that it would begin the process of withdrawing approval of the noncompliant prescription products. At the same time, the agency announced its intentions to start regulatory actions aimed at limiting the amount of acetaminophen in over-the-counter products as well.

Safety experts are most concerned about products such as Extra-Strength Tylenol, which has become so popular that some pharmacies no longer stock the regular strength product. Instructions for taking Extra-Strength Tylenol (a dose of 1000 mg, compared to the 650 mg regular strength dose) push the body burden of acetaminophen to the FDA's recommended limit of 4000 mg per day.

In October 2013, Johnson & Johnson became the first manufacturer of over-the-counter products to address the regulatory concerns about acetaminophen-induced liver toxicity. Tylenol bottles now sport a cap with bold red lettering: "CONTAINS ACETAMINOPHEN" and "ALWAYS READ THE LABEL." The eye-catching warning is specifically intended to alert consumers and hopefully discourage overdosing.

The packaging devices, anti-tampering laws, and FDA regulations that were launched in the wake of the Chicago murders have greatly improved the safety of all over-the-counter drugs and undoubtedly prevented many deaths. But the trail leading to the original Tylenol-tampering killer has gone cold, and Johnson & Johnson's \$100,000 reward remains unclaimed.

References

- Chicago Sun-Times (October 1, 1982) 5 die in Ill. after taking painkiller.
- Bell R. *The Tylenol terrorist*, Crime Library, www.crimelibrary.com/terrorists_spies/terrorists/tylenol_murders/index.html.
- Sotonoff J (September 20, 2002) Why cyanide deaths might go unsolved. *Daily Herald*.
- Beck M, Monroe S, Hager M, and LaBrequé R (October 11, 1982) The Tylenol scare. *Newsweek*.
- Steffen D (June 19, 2011) How regulation came to be: The Tylenol killings. *Daily Kos*, www.dailykos.com/story/2011/06/19/986589/-How-regulation-came-to-be-The-Tylenol-killings#.
- Huiras R (December 12, 2007) Nurse connected dots in Tylenol murders. *Nurse.com*.
- Atkinson R (November 12, 1982) The Tylenol nightmare: How a corporate giant fought back, *Kansas City Times*.
- Johnson & Johnson Public Relations (1982) The Tylenol comeback.
- Moore T (November 29, 1982) The fight to save Tylenol: The inside story of Johnson & Johnson's struggle to revive its most important product. *Fortune Magazine*.
- Malcolm AH (October 3, 1982) 100 agents hunt for killer in 7 Tylenol deaths. *New York Times*.
- Knight J (October 11, 1982) Tylenol's maker shows how to respond to crisis. *Washington Post*.
- New York Times (September 29, 1985) Tylenol slayings remain a mystery.
- McFadden RD (February 18, 1986) Maker of Tylenol discontinuing all over-counter drug capsules: Offers to replace them after woman's death from poisoned pills. *New York Times*.
- Giges N (November 15, 1982) New Tylenol package in national press debut. *Advertising Age Magazine*.
- Norman M (February 14, 1986) 2D tainted bottle of Tylenol found by investigators. *New York Times*.
- Waldhole M (February 12, 1986) Johnson & Johnson calls Tylenol case isolated incident. *Wall Street Journal*.
- Egan T (December 13, 1987) Victim's wife indicted for drug tainting. *New York Times*.
- Sahagun L (March 7, 1991) Cyanide-tainted Sudafed spawns wave of fear. *Los Angeles Times*.
- Cimons M (March 6, 1991) Sixth Sudafed pack with signs of tampering found. *Los Angeles Times*.
- Burgess S (January 13, 1991) FDA limits acetaminophen in prescription combination products; requires liver toxicity warnings. *FDA News Release*.



Science Policy



House Spending Allocations Foretell Limited Growth for NIH

In May, the House Appropriations Committee allocated the FY 2015 spending levels for each of the 12 Appropriations subcommittees. These allocations are called the 302(b) sub-allocations and limit the total spending for each of the 12 appropriations bills in the House (and Senate). The 302(b) spending limits are one of the most critical factors in determining funding levels for programs in any given year. Overall discretionary spending is capped at \$1.014 trillion, roughly split between defense (\$521 billion) and domestic programs (\$492 billion).

The FY 2015 302(b) for the Labor/HHS & Education Appropriations Subcommittee that funds NIH is \$155.7 billion. This level is \$1 billion below the FY 2014 allocation. A disappointing 302(b) for the House Labor/HHS subcommittee

was expected. To put this figure in perspective:

- The current FY 2014 allocation is already 17.1 percent less than the FY 2010 allocation.
- The FY 2015 allocation is lower than every year since 2001—the only year that was worse was FY 2013, when sequestration was in full effect.

Compounding this tight spending limit, the Labor/HHS subcommittee must also pay for other programs in the bill that essentially act as mandatory programs—such as student loan servicing costs and support for “unaccompanied alien children” from war torn countries. Taking these and other mandatory-type programs into account means that the FY 2015 House Labor/HHS

allocation has \$2.5 billion fewer dollars to spend on discretionary programs than it had in FY 2014. As *The Pharmacologist* goes to press, the Senate 302(b) allocations have yet to be released. It was expected that the senate would release their 302(b) allocations the week of May 19. The research community is cautiously optimistic to expect a more encouraging number from the senate when their allocations are made. If the Senate 302(b) allocations disappoint, it will make it extremely difficult for NIH to receive an increase in FY 2015. These developments reinforce the need for ASPET members to continue to contact their members of congress about the consequences of NIH's budget moving backward instead of forward.

Why are these spending allocations so limited? In FY 2015 there is only \$580 million more than in FY 2014 to spread across all non-defense discretionary programs within the existing budget caps previously agreed upon in last year's budget agreement. There will certainly be some winners and losers among

agencies and programs, but it is clear that an additional \$580 million cannot begin to address the needs of many science and other worthwhile discretionary programs.

However, not all house subcommittees received a cut from their FY 2014 levels and some received increases. For instance, the Agriculture/FDA subcommittee received the same spending allocation as in FY 2014. This does not mean FDA will receive an increase, especially since, like the Labor/HHS bill, some agricultural programs increase automatically. Three house subcommittees received an increase in their 302(b) allocation for FY 2015: Defense, Interior, and the Transportation-Housing & Urban Development.

In another development and indication of continued austerity pressures, federal agencies received instructions from the Office of Management and Budget (OMB) to prepare their FY2016 Budgets. OMB is asking agencies to write their budgets to 2 percent below current funding levels for all discretionary programs.

ASPET Submits Written Congressional Testimony in Support of the NIH FY 2015 Budget

Written Testimony of the American Society for Pharmacology & Experimental Therapeutics Submitted to the House and Senate Appropriations Subcommittee on Labor, Health and Human Services, Education & Related Agencies

Fiscal Year 2015 Appropriations for the National Institutes of Health

The American Society for Pharmacology and Experimental Therapeutics (ASPET) is pleased to submit written testimony in support of the National Institutes of Health (NIH) FY 2015 budget. ASPET recommends a FY 2015 NIH budget of at least \$32 billion.

Sustained growth for the NIH should be an urgent national priority. Congress showed bipartisan support for the agency in FY 2014 as evidenced by the \$1 billion increase above the FY 2013 sequestered level. While this 3.5% increase helps put NIH on the path to more sustainable funding levels, it does not begin to make up for a lost decade of funding. Adjusting for inflation, the FY 2013 budget for the NIH was less

than it was in 2003. For NIH to meet its vital role in improving public health, stimulating our economy, and improving global competitiveness, it is critical that the agency continue to receive steady and sustainable increases.

Currently, the NIH only can fund one in six grant applications, the lowest rate in the agency's history.

In addition, if funding for the next ten years is similar to that of the past decade, the nation will lose a generation of young scientists. Increasingly, these individuals, seeing no prospects for careers in biomedical research, will leave the research enterprise or look for employment in foreign countries. Not only are jobs increasingly limited in the academic sector, but the industry too is under stress. The “brain drain” of young scientific talent jeopardizes the nation’s leadership in biomedical research. A survey of ASPET’s own graduate students and post-doctoral researchers indicates that 45% of post-doctoral trainees and 25% of graduate students say they are no longer considering a career in biomedical research due to the restrictive funding environment; 50% of graduate students and 29% of post-doctoral trainees say they are willing to consider leaving the United States to pursue a career in biomedical research.

A \$32 billion budget for the NIH in FY 2015 is a start to help restore NIH’s biomedical research capacity. Currently, the NIH only can fund one in six grant applications, the lowest rate in the agency’s history. Furthermore, the number of research project grants funded by NIH has declined every year since 2004.

A budget of at least \$32 billion in FY 2015 will help the agency manage its research portfolio more effectively without having to withhold funding for existing grants to researchers throughout the country. Only through steady, sustained, and predictable funding increases can NIH continue to fund the highest quality biomedical research to help improve the health of all Americans and continue to make significant economic impact in many communities across the country.

There is no substitute for a steady, sustained federal investment in biomedical research. Industry, venture capital, and private philanthropy can supplement research but cannot replace the investment in basic, fundamental biomedical research provided by NIH. Neither the private sector nor the industry will be able to fill a void for NIH-funded basic biomedical research. Much of industry support is applied research that builds upon the discoveries generated from NIH-funded projects. The majority of the investment in basic biomedical research that NIH provides is broad, long-term, and provides a continuous development platform for industry, which would not typically invest in research that may be of higher risk and require several years to fully mature. In addition to this long-term view, NIH also has mechanisms in place to rapidly build upon key technologies and discoveries that have the ability to have significant impact on the health and well-being of our citizens.

Many of the basic science initiatives supported by NIH have led to totally unexpected discoveries and insights that have transformed our mechanistic understanding of and our ability to treat a wide range of diseases.

Diminished Support for NIH Will Negatively Impact Human Health

Continued diminishment of funding and loss of purchasing power will mean a loss of scientific opportunities to discover new therapeutic targets. Without a steady, sustained federal investment in fundamental biomedical research, scientific progress will be slower and potentially helpful therapies or cures will not be developed. For example, more research is needed on Parkinson’s disease to help identify its causes and develop better therapies; discovery of gene variations in age-related macular degeneration could result in new screening tests and preventive therapies; more basic research is needed to focus on new molecular targets to improve treatment for Alzheimer’s disease; and diminished support for NIH will prevent new and ongoing investigations into rare diseases that according to the Food and Drug Administration’s (FDA) estimate are almost 90% serious or life threatening.

Historically, our past investment in basic biological research has led to many innovative medicines. The

National Research Council (NRC) reported that of the 21 drugs with the highest therapeutic impact, only five were developed without input from the public sector. The significant past investment in the NIH has provided major gains in our knowledge of the human genome, resulting in the promise of pharmacogenomics and a reduction in adverse drug reactions that currently represent a major worldwide health concern. Several completed human genome sequence analyses have pinpointed disease-causing variants that have led to improved therapy and cures but further advances and improvements in technology will be delayed or obstructed with diminished NIH funding.

Investing in NIH Helps America Compete Economically

A \$32 billion budget in FY 2015 will also help the NIH train the next generation of scientists and provide a platform for broader workforce development that is so critical to our nation's growth. Many individuals trained in the sciences through NIH support become educators in high schools and colleges. These individuals also enter into other aspects of technology development and evaluation in public and private sectors to further enrich the community and accelerate economic development.

The U.S. share of global research and development investment from 1999–2009 is now only 31%, a decline of 18%.

This investment will help create jobs and promote economic growth. A stagnating NIH budget will mean forfeiting future discoveries and jobs to other countries.

The U.S. share of global research and development investment from 1999–2009 is now only 31%, a decline of 18%. In contrast, other nations continue to

invest aggressively in science. China has grown its science portfolio with annual increases to the research and development budget averaging over 23% annually since 2000, including a 26% increase in 2012. Russia plans to increase support for research by 65% over the next five years. The European Union, despite great economic distress among its member nations, has proposed to increase spending on research and innovation by 45% between 2014 and 2020.

NIH research funding catalyzes private sector growth. More than 83% of NIH funding is awarded to over 3,000 universities, medical schools, teaching hospitals, and other research institutions in every state. One national study by an economic consulting firm found that federal (and state) funded research at the nation's medical schools and hospitals supported almost 300,000 jobs and added nearly \$45 billion to the U.S. economy. NIH funding also provides the most significant scientific innovations of the pharmaceutical and biotechnology industries.

Conclusion

ASPET appreciates the many competing and important spending decisions the subcommittee must make. However, the NIH's contribution to the nation's economic and physical well-being should make it one of the nation's top priorities. With enhanced and sustained funding, NIH can begin to reverse its decline and help meet its potential to address many more of the promising scientific opportunities that currently challenge medicine. A budget of at least \$32 billion in FY 2015 will allow the agency to begin moving forward to full program capacity, exploiting more scientific opportunities for investigation, and increasing investigator's chances of discoveries that prevent, diagnose, and treat disease. NIH should be restored to its role as a national treasure, one that attracts and retains the best and brightest to biomedical research and provides hope to millions of individuals afflicted with illness and disease.

ASPET Washington Fellows Visit Congress

could not deter intrepid ASPET Washington Fellows as they made their visits to members of congress this past March and April. Delayed flights, ice storms, snow, and bitter cold weather were mere speed bumps to the 2014 class of Washington Fellows in their determination to advocate for increased funding for NIH and biomedical science.

This year, ASPET graduate students and postdoctoral fellows visited 24 congressional offices. They ably delivered common messages to members and their congressional staff: if NIH funding in the next decade is anything like the past ten years, there will be serious consequences

for America's leadership in biomedical research. A whole generation of aspiring and early career scientists will be lost. Fellows discussed how their departments are being consolidated because of dramatic funding cuts and the implications of these decisions for those congressional districts and states. The point made repeatedly was that once labs close and jobs are lost, it will be very hard to bring that infrastructure back to the home state in the future. In some states with a smaller research infrastructure, relative to other states, fellows made the point that they would not like to see their home state become a net exporter of biomedical research



Native Nebraskan Andrew Stothert discussing NIH funding with Sen. Johanns (R-NE) and Ally Mendenhall, Legislative Assistant.



Prasad Krishnan of Penn State meets with Sara Mabry, Legislative Assistant to Sen. Casey (D-PA).



Christopher Moore, University of Arkansas for Medical Sciences meets with Sen. Boozman (R-AR).



Colin Higgins, University of Iowa braves the cold before meeting with his Iowa delegation.

jobs. This point may have resonated with some but certainly not all congressional offices. Virtually all offices were receptive to these themes and all were very interested in hearing about the plight of early career scientists. All congressional offices noted how difficult the funding situation is but were only

cautiously optimistic about the potential of very modest relief for NIH in FY 2015.

ASPET would like to thank and acknowledge the commitment and great effort by the 2014 Washington Fellows for being great advocates for biomedical research!



Alex J. Brewer III
Baylor College of Medicine,
Houston, TX



Debra Cooper
University of Texas
Medical Branch (UTMB),
Galveston, TX



Melissa Geyer
University of Illinois College
of Medicine, Chicago, IL



Colin Higgins
University of Illinois College
of Medicine, Chicago, IL



Prasad Krishnan
Penn State University,
University Park, PA



Stephanie A. Mathews
National Institute on
Alcohol Abuse and
Alcoholism, Bethesda, MD



Christopher L. Moore
University of Arkansas for
Medical Sciences, Little
Rock, AR



Andrew Stothert
University of South Florida,
Tampa, FL

Qualifying ASPET members interested in applying for the 2015 Washington Fellows class can find additional information at: www.aspet.org/advocacy/grassroots/2015-washington-fellows-program/



Education News

AAMC-CFAS Meeting Report

Joe Blumer (MUSC) and Brian Cox (Uniformed Services U) attended the 2014 meeting of the Council of Faculty and Academic Societies (CFAS) of AAMC from 6–8 March as representatives for ASPET. This meeting was the first independent meeting of the reformed AAMC group, previously known as the Council of Academic Societies. Medical school faculties are now represented by two institutional representatives in addition to professional society representatives. As a result, the meeting size has increased from about 80–100 persons—with just 3 AAMC staffers present—to about 225 persons representing more than 70 academic societies and 114 (out of the approximately 150) eligible medical schools from the US and Canada (and we were told that 17 AAMC staffers attended because of the increased importance they now attach to the meeting). Other pharmacologists attending the meeting as representatives of their institutions included Gary Rankin (Marshall University), Kurt Varner (Louisiana State University Health Sciences Center), and Kent Vrana (Penn State University).

Discussions were wide ranging, but the emphasis was on the problems of graduate medical education, specifically, the limit on the number of residency slots supported by the Centers for Medicare & Medicaid (CMS)—a major source of support for residency training that is now creating a bottleneck in the production of physicians; the multiple challenges that are facing

academic health centers (AHCs) and medical education, including the fiscal challenges of supporting the basic science enterprise; and the implications of possible solutions to these challenges for medical school faculty and administrators.

The first plenary session addressed the challenges and opportunities facing the future of medical education in particular and their impact on the clinical and research enterprise of academic medical centers. Mark Yudof, from Berkeley Law School, introduced the idea of “cost disease” occurring in medical education and the challenges that educators face in addressing this issue. Among the potential solutions mentioned were increasing the student–faculty ratio, reducing the time required to obtain a medical degree based on competency and not “seat time,” and the use of online courses. Tika Benveniste (University of Alabama) followed with a short talk on the value of basic sciences as integral to the success of academic medical centers based on several factors including research and discoveries that help guide clinical and translational studies; education of graduate and medical students, fellows, and residents; increased branding and reputation for the medical center; and basic science as an economic engine, among others. However, the basic sciences do face a number of challenges, not the least of which are reductions in federal and state funding for research and the perceived “cost” of the research enterprise

(see below). An erosion of support for basic science would only serve to weaken academic health centers and the public as a whole, and we should be proactive and responsive to these changes.

A plenary session addressed health system transformations that are accompanying the implementation of the Affordable Care Act and the impact of these changes on faculty and students. Janis Orlowski, currently senior director for clinical transformation at AAMC and previously chief medical officer for Washington Hospital Center, outlined her view of what the AHCs of the future will look like. She described several critical features of a successful AHC: a large system-based structure—with an overall annual budget in the region of \$1.5 billion or more—that facilitates the development of strategic partnerships under an integrated governance system and provides access to adequate capital; strong and aligned governance, organization, and management with trust and commitment between the leaders of each constituency within the AHC; organizational flexibility and the development of different systems in different environments; transparency between different components of the system, so that it can be seen that financial stringencies are applied fairly to all constituent groups; recognition that the culture in the AHC must bend toward developing the most cost-effective system that lowers costs and facilitates the development of new skills for all personnel; an increasing emphasis on population health, expanding coverage to underserved populations with quality care for all; and candid assessment of the strengths and weaknesses of all AHC components in order to achieve change and to balance strengths with capital expenditures.

What do these features of an AHC have to do with the role of pharmacologists in a medical school? It is clear that to remain competitive, and therefore for survival, medical schools will have to exist as critical partners within AHCs, adjusting their mission and practices to align with the larger health delivery missions of the AHC. The financial challenges faced by medical schools and health care delivery systems (see comments by Darrell Kirch below) will mean that

in the future financial contingencies will be critical determinants in the careers of basic science faculty members, from hiring decisions to the support of all educational and research activities.

This presentation was followed by a report from the front line trenches in this war in the form of a discussion by Jeffrey Balser, Vice-Chancellor and Dean, Vanderbilt School of Medicine, of the changes recently made at Vanderbilt in response to an impending \$100 million shortfall in FY2014, requiring a reduction in costs of 15% overall, with greater shortfalls in the future. Vanderbilt eliminated 1700 positions over this period, wherever possible by attrition and retirements, but still requires more than 600 layoffs. He claimed that this was done as humanely as possible, with support from the university for temporary continuation of health benefits and in finding alternative employment, but it is clear that this was a very challenging experience both for those who lost positions and for those who were retained. Vanderbilt was able to do this without eliminating the positions of any faculty members (according to Balser), but it is by no means certain that other AHCs would protect faculty in this way if placed in a similar situation. In discussion after the presentation, a member of the audience noted that at her institution, Vanderbilt was now cited as the “awful warning”—they were being told that if we do not change to address fiscal reality by careful planning and the implementation of moderate cuts now, we will be faced with cuts similar to Vanderbilt in the future.

The challenges faced by AHCs that are necessitating these changes were summarized by Darrell Kirch, President and CEO of AAMC, and Atul Grover, AAMC Chief Public Policy Officer. The three sources of medical school incomes are all under pressure. For medical education, tuition charges no longer cover the cost of undergraduate medical education. The average graduate of a US medical school now leaves with a debt of \$142,000, making it impossible to significantly increase the tuition cost per student. Research that was previously supported by NIH funding is now not fully covered, even for those schools lucky enough to retain their NIH funding.

In real dollars, taking into account the inflation in research costs, the funding for NIH research has returned to the levels of 2001 (despite the doubling of support in 2003, now more than 10 years ago). Even when indirect cost charges are taken into account, data from more than 40 medical schools indicate that funding from the NIH does not fully cover the costs of conducting that research—for every dollar of research funding received, AHCs are now spending \$1.30 to support this research. Research has thus become a money-losing proposition. Income from clinical care is also facing unprecedented pressures. As we move from fee-for-service models to other payment models, insurers and other payers are looking for the cheapest options. The ACA imposes reductions in Medicaid support, and this contributes to the losses in clinical care income, but many of the changes would have occurred even without the ACA. If AHCs are not price-competitive, insurers will require patients to receive care from less expensive providers (i.e., not from AHCs), so clinical care charges cannot be increased. Losses at 100 major teaching hospitals have recently been estimated at about \$2.5 billion with concern that they could rise to \$3.5 billion in 2018 if changes are not made. A major concern, and a major focus of AAMC lobbying efforts in the near future, is the underfunding of graduate medical education. The recent expansion in the number of medical graduates and the creation of new medical schools following predictions that there would be a shortage of physicians with the expansion of Medicare and Medicaid has not been matched by an increase in the number of residency positions. If these are not increased in the near future, there will be a bottleneck in the supply stream of new physicians with a number of graduates failing to match available residencies.

What AHCs do have going for them is the perception that they offer the highest quality care—in the future, we will have to be able to document this. There are also opportunities for cost savings by improving the efficiency of delivery systems; the health care delivery system in the US is now a \$3 trillion/year business, and there are still many opportunities for reducing unnecessary care costs (as

Robert Bazell of NBC and Yale pointed out in another talk, at the point of graduation, medical students move from being users of unnecessary medications to being among those ordering unnecessary medications). Survival will depend in exploiting all opportunities available: avoiding wasteful, potentially dangerous, and unnecessary procedures and enhancing preventive care as well as changing from fee-for-service to value-based charging systems. The activities of medical schools will need to be evaluated with careful consideration of cost effectiveness. It is important that we develop ways to demonstrate the role of research in training the best doctors to justify continued expenditures by AHCs in support of basic research. Informal discussions with physicians from many specialties during the meeting indicated that clinicians still value basic research and recognize its critical role in innovation as they seek to improve the effectiveness of care. At least the enlightened clinicians who attend AAMC meetings are willing to support the concept that some small fraction of clinical care income might be directed to the support of basic research in order to maintain continued innovation in the treatment of disease.

To address these challenges for medical school faculty, CFAS is organizing a number of task forces charged with developing resources for faculty to help them survive the rapidly changing environment of medical education and research over the next decade. Task forces have been established in the following areas: advocacy, basic science, faculty identity and value, mission alignment and faculty values, and work-life balance for faculty. ASPET representatives will serve on the basic science and mission alignment/faculty values task forces. The immediate charge to the task forces is to consider ways of ameliorating the potential adverse consequences of the changing environment of medical education and research; developing a “toolbox” for faculty with resources to aid in advocacy for appropriate increases in funding; and for developing a cadre of members who will remain involved in addressing these issues and alerting AAMC leadership. We need to develop new metrics that reflect the value added in physician

training that comes from the active involvement of a faculty that is intimately involved in the research process and can teach the importance of inquiry and the continued questioning of the status quo.

As your representatives to CFAS-AAMC, we welcome your comments and suggestions. If you are interested in becoming more involved in the activities of the CFAS task forces, please let one of us or the ASPET office know of your interest. The changes that we are seeing in our working environment are challenging, but we need to become involved in

order to influence them in directions that support and enhance the critical role of pharmacology as a discipline in the advancement of medical education, and continued improvements in health care delivery. In the words of Darrell Kirch, you may not like change, but you will like irrelevance even less.

Joe Blumer (blumerjb@musc.edu)

Brian Cox (brian.cox@usuhs.edu)

March 2014

A Look into ASPET's Mentoring and Career Development Committee

Effective mentoring is both a gift and learned skill. Students benefit greatly from dedicated mentors. But if we are honest there are really too few great mentors and student's career development suffers as a result. To help remedy this situation and provide resources for early career biomedical scientists, a Mentoring and Career Development Committee was established.

In 2012, Dr. Delatte, a reviewer at the U.S. Food and Drug Administration, committed to serve as co-chair of the newly formed committee and immediately began thinking about ways to structure the mentoring program. Increasingly active, one unique feature of the committee is the book club. This effort began as part of a multi-prong approach to providing mentoring to ASPET members. A voracious reader himself, Marcus, along with ASPET member Remy Brim, currently health policy advisor to Senator Elizabeth Warren (D-MA), created the book club. It was a natural choice as Marcus frequently read and discussed books written by subject matter experts with mentees. The objective of the book club is to provide the mentee to read up on a particular skill and to hold discussions on how various elements from the book may be useful in their professional lives.

Last year, Marcus and Remy selected the first book *Never Eat Alone: And Other Secrets to Success*,

One Relationship at a Time by Keith Ferazzi for a discussion because it was helpful to Remy during her transition from graduate school to postdoctoral fellowship. Several students participated by teleconference in the first book club meeting, and it was a hit from the start. In fact at Marcus' urging, two of the participants, Girish Chopda, research scientist at Dicerna Pharmaceuticals, and Uyen Chu, a postdoctoral fellow in the Department of Neuroscience at the University of Wisconsin-Madison, joined the Mentoring and Career Development Committee because of their positive interaction with the book club. Both continue to contribute to the committee and have been actively involved in the second book club which formed this spring to discuss *Communication Skills: Stepladders to Success for the Professional* by Richard Ellis.

For Uyen, book club was admittedly "an unusual concept done by teleconference." But she was intrigued, and her initial skepticism was unfounded as she describes book club as "a fruitful experience for me." She says, "Etiquette and the processes of networking were foreign to me and I think for many others. From a standpoint of an introvert scientist, meeting people was difficult for me and stepping outside my comfort zone is a bit scary. But the *Never*

Eat Alone book club was an interesting experience, and I learned quite a bit on how to develop a professional relationship with others in a more authentic way. It really opened my eyes about the importance of making connections.”



Uyen Chu

Uyen feels that members of ASPET who are interested in mentoring should get more involved. She would like to see the book club expanded so that different perspectives are offered: “For networking to work and book club to be more beneficial to both students and mentors, it is important

to get different views and perspectives. ASPET is bigger than its membership, and not everyone serves on governance.” For networking with scientists in general, she believes, “since we all have a common interest in science, it should be quite easy to have something to talk about when we meet new people and most importantly not be afraid about doing so.” Uyen credits some of book club’s lessons with her becoming less inhibited about reaching out to others, especially faculty.



Girish Chopda

Girish thought his involvement with the Career Development and Mentoring Committee would be a good place to meet people and to “connect and talk about things that we don’t really talk about here.” He always wanted a career in industry and knew he needed more than

strong science to succeed. Shy and hesitant at first, he quickly realized that “many other scientists in the early stages of their career development were in the same boat. Even though we are in different stages of our careers, we all had the same problems interacting

and finding out how to network better.” It was relieving for Girish to discover at the book club that everyone was comfortable and willing to share their own experiences. He realized that “most of us had similar experiences and problems, and that was reassuring.” Some of the practical tips he took home from book club include having confidence to talk to someone even at a very senior level, and knowing your science gives you the confidence to do that. Girish discovered that follow-up is critical as you talk to people at meetings and that “people know who you are if you are interested in them and communicate with them more than once a year at the annual meeting.” Girish believes that you need to tell a story to people about your career goals and how your research is focused. That makes people “remember you and want to help rather than if you just show up looking for a job.”

Book club has been particularly helpful for Girish because “these are skills you really don’t learn in graduate school, and most of the time, you don’t realize how important these skills are, and you don’t get them in the lab. You really need to learn all other aspects of career development. It is good to be scientifically strong but one should also develop communication skills to present your scientific work to people. And it’s more important than ever to build your network to grow in difficult times. I’ve found that book club gives time to allow you to think about yourself and to focus on things beyond science.”

More recently, at the ASPET Annual Meeting in San Diego (EB 2014) last April, the Mentoring and Career Development Committee held two important sessions providing additional information and support to young scientists. The Diversity Mentoring Breakfast highlighted career development in medical communications and writing, and the Career Development Workshop on Establishing Individual Development Plans (IDPs) in your Graduate and Postdoctoral Training Programs highlighted the ins and outs of successful IDPs for career development.

Individuals interested in learning more about ASPET’s Mentoring and Career Development Committee can contact Susan Ingram at ingrams@ohsu.edu.



Journal News

New Editorial Board Members

Molecular Pharmacology added 16 new members to its editorial board. Thirteen new Editorial Advisory Board members joined the journal:

- Radu Aricescu (Oxford University)
- Xiadong Cheng (University of Texas Health Science Center, Houston)
- Meritxell Canals (Institute of Pharmaceutical Sciences, Melbourne)
- Mark Dell'Acqua (University of Colorado School of Medicine)
- Jerod Denton (Vanderbilt University School of Medicine)
- Costas Koumenis (University of Pennsylvania)
- Evi Kostenis (Institute of Pharmaceutical Biology, Bonn)
- Nevin Lambert (Medical College of Georgia)
- Nael McCarty (Emory University School of Medicine)
- Rita Nahta (Emory University School of Medicine)

- Jason Papin (University of Virginia)
- David Weinschenker (Emory University School of Medicine)
- Danny Winder (Vanderbilt University School of Medicine)

In addition, three new Associate Editors have been named to *Molecular Pharmacology*:

- Srikumar Chellappan (H. Lee Moffitt Cancer Center and Research Institute)
- Peter Houghton (Nationwide Children's Hospital)
- John Tesmer (University of Michigan)

Thomas Burris joined the *Pharmacological Reviews* editorial board. Dr. Burris is currently the William Beaumont Professor and Chair of the Department of Pharmacological and Physiological Science in the School of Medicine at Saint Louis University.

The Board of Publications Trustees welcomes these researchers to their respective journals and is grateful for their service.

Page Charge Waiver

At its April meeting, the Board of Publications Trustees voted to waive the page charges for each editorial board member for one paper in each three-year term. The waiver applies to the journal on which the author is a sitting editorial board member, and it is for associate editors and editorial advisory board members of *DMD*, *JPET*, and *Molecular Pharmacology*. (*Pharmacological Reviews* does not have page charges.) All editorial board members serve for renewable three-year terms. The page charge waiver goes into effect immediately. ASPET staff will revise our forms to remind editorial board members of the waiver. The editorial board member can be any author on a paper to qualify for the waiver.



ASPET Member Focus

Interview with Dr. Charles (Chip) Rutledge



Charles (Chip) Rutledge

Charles (Chip) Rutledge is Dean Emeritus of Pharmacy, Nursing, and Health Sciences and Vice President Emeritus for Research at Purdue University. A native of Topeka, Kansas, Dr. Rutledge received his bachelor's degree in pharmacy and his master's degree in pharmacology from the University of Kansas. He earned his PhD from Harvard University. Dr. Rutledge has served ASPET over many years on the Editorial Advisory Board of *JPET*; the Nominating Committee; and as ASPET secretary-treasurer, councilor, and president. At ASPET's Annual Meeting in San Diego this April, we sat down to talk about his life as a scientist and long-standing involvement in ASPET affairs.

What got you interested in Pharmacology?

My interest in science began when I was privileged enough to be in a science field club in high school. Our field club advisor took us on field

trips. One month we would study geology, maybe another month we would study ecology. We conducted a two-year study on mites commonly known as chiggers, and I built a trap to capture chiggers in a square yard of grass. My objective was to study the differences between the chiggers in the grass and those in the ears of field mice. I was able to publish a paper on a mounting media for mites in the Kansas Academy of Sciences at the age of 16.

On each of our field trips, I had to write a paper on my observations. My advisor said that if you want to be a scientist, you have to learn how to write. He sent me to my English teacher, Mrs. Timmer, to learn to write and she said "how badly do you want to learn to write?" I told her that I was really highly motivated. So she assigned me a one-page writing assignment each night. I did this for a whole semester and probably wrote 40 papers. Each day I received the paper with numerous corrections.

Join the ASPET Investment Subcommittee!

ASPET is looking for enthusiastic members with investment knowledge or financial experience to join the Investment Subcommittee to help guide the policies and direction of the ASPET investments. To express interest or to ask questions, please contact Matthew Hilliker at MHilliker@aspet.org.

But by the end of that semester, I knew how to write. That has served me well through college and graduate school and beyond. Being able to communicate in writing is essential to function as a scientist.

What was your early academic experience like?

I went to the University of Kansas to study pharmacology because I loved biology and chemistry. It was a matter of great curiosity to me to see how a drug substance, even a small amount, could have a tremendous biological effect. It must be acting on specific sites that I now know as receptors. Knowing more about this really appealed to me. I wanted to get involved in something that ultimately served mankind. My backup plan was to be a pharmacist. Pharmacy was my insurance policy if I did not do well in graduate school. My folks had been through the depression and World War II, and that influenced me to have a backup plan as a student of the '50s. I took a 4-year pharmacy program, and it was highly technical. I was one of the few students that completed the program in four years. I once took 12 chemistry hours and 5 hours of physics in one semester. In my junior year, Duane Wenzel, a pharmacologist, asked if anyone wanted to do undergraduate research on his project and I volunteered. I did a couple of projects, one of which led to my master's thesis and resulted in my second publication.

I applied to pharmacology PhD programs that I thought were the best in the country: Emory University, University of Washington, Ohio State, Boston University, and Harvard, where I ended up. To my surprise, I was accepted by all five programs. The reason I ended up in Cambridge is because my fiancée was at Harvard working on her Master of Arts degree in teaching. I interviewed on the snowiest day of the winter. Public transportation was shut down. The only way to get from Cambridge to the Medical School Quadrangle in Boston was to walk. So Jane and I walked over two miles in a foot of snow. Once there, I interviewed with Otto Krayer. He asked me what I liked to read. At that time, I was reading classics of the New England authors. We got into a discussion on *The House of the Seven Gables* by Nathaniel Hawthorne. But I really feel that I got into Harvard because I hiked through all that snow. Harvard was a great experience for me. There were about twenty mid-career faculty representing most of the sub disciplines of pharmacology. Most went on to head



Dr. Chip Rutledge in his office.

pharmacology departments throughout the world. I benefited greatly from the laboratory rotations. I did laboratory rotations with Werner Flacke, Jean Marshall, Roger Kelleher, Norman Weiner, and Otto Krayer. Three of these rotations resulted in a publication. The rotation with Otto Krayer involved learning many physiological assay methods used by physiologists and pharmacologists in Germany in the 1920s. I also had to improve my reading knowledge of German to complete the rotation. I still have the lab report with Dr. Krayer's notations on it.

Arvid Carlsson from Gothenburg, Sweden visited Harvard. Professor Carlsson was leading a large group on the study of biogenic amines in the central nervous system. In 2000 he received the Nobel Prize for making the connection between brain dopamine and Parkinson's disease. I asked Dr. Carlsson if I could join him, and he said yes if I found my own support. So I obtained a NATO Postdoctoral Fellowship to support me at the University of Gothenburg. I was able to collaborate with Dr. Jan Jonason and we wrote five papers together. In the meantime, Norman Weiner, who was my thesis advisor at Harvard, was moving to the University of Colorado to chair the pharmacology department in the medical school at Denver. He invited me to join him to help him build up the department. I was his first hire, and in the next

few years, he was successful in attracting many very productive pharmacologists to the department.

At Colorado, I started my own independent research program on biogenic amines and was there from 1967–1975. Then I got an offer to go back to Kansas to chair the Department of Pharmacology and Toxicology in the Pharmacy School in Lawrence. I had a number of productive students and fellows, and together we developed a model for the mechanism of action of amphetamine and described a mechanism by which lipids alter neuronal uptake by changing membrane fluidity in the microenvironment of the amine transporter. In 1987 I accepted the deanship at Purdue. I was involved as a research scientist until 1987, and at that time I began facilitating science as an academic research administrator.

Tell us about how you got involved in your longstanding commitment to ASPET

They had a different way of getting people involved back in those days. During the business meeting, there was a call for people to serve on the nominating committee. ASPET members would shout out names to be on the nominating committee. The first seven or eight names yelled out would be put on the nominating committee. These people would review names from among the membership for names to put on the ballot as officers of the society. Often members of previous nominating committees would be nominated. I don't know when they stopped doing this, but I became a member of the nominating committee in 1980. I don't even know who shouted out my name. I've been a member of ASPET since 1968. I won election to Council and a few years later became secretary-treasurer. I was very much into strategic planning as a dean at Purdue, so as ASPET secretary-treasurer, I felt that the society needed a strategic plan for finances to maximize revenue and to contain expenses. Then, I did other things. I served as a subcommittee on ethics and professional affairs. This would allow ASPET members to make an appeal to ASPET if they felt they were wronged at their home institution. I would ask for information from the institution concerning their situation largely based on the public record. Just addressing questions from a professional society often resulted in positive change. We modeled our approach after the program of the American Chemical Society.

In 1984, ASPET started sections, the precursors to our current divisions, and I was asked to be head of section on neuropharmacology. I also did some fun things too like serving as president of the Catecholamine Club. Julius Axelrod was its first president, and the club is still going strong.

On that note, you have established a legacy as a singer and songwriter. How did the Catecholamine Song come about?

As president of the Catecholamine Club in 1979, I was trying to get people to come to the club dinner

The Catecholamine Club Song

(Tune: Stout-Hearted Men)

Give me amines that are catecholamines that will bind
to the membrane receptor.
Start with tyrosine, dopa, dopamine and they'll soon
Give epi- and nor- for
Synthesis and storage, release and reuptake take
place as they' accomplish their chore.
When you need transmitters you can always count
on them.

When you walk with a shuffle and you can't move a
muscle and your life has been filled with remorse,
From the lab of Hornykiewicz it was clear that there
was damage which should a been enough to kill a
ho-orse.

What you need is dopamine that's a catecholamine
formed from levodopa, why of course.
When you need transmitters you can always count
on them.

It can be inhibition that shatters your vision 'cause in
war and in love we are blind.
When your firing rates go wacko and your instincts run
staccato excitations are the ones that come to mind.
Plus and minus are both seen for each catecholamine
in the cortex or in the brain stem.
When you need transmitters you can always count
on them.

When you're fighting or shouting or downright
knockout put your faith in the adrenaline
Orin good vibrations. It might well be true sensations,
you can trust what receptors have seen.
Though you act like a teen due to catecholamine don't
feel dizzy from collar to hem.
When you need transmitters you can always count
on them!

that was held during the *Experimental Biology* meeting. I told people that it is a fun event and that we have a club song. So I went to my hotel room to write a song. I remembered Sigmund Romberg's "Stout Hearted Men" from the operetta "The New Moon" and thought that it might work with words describing catecholamines. So I came up with the song and sang it that evening at the annual Catecholamine Club dinner. The next year I added a verse about dopamine and Parkinson's disease. At a Catecholamine Gordon Conference, Barry Hoffer wrote additional verses. *TIPS* published the song. My colleague at Kansas, Walter Dixon, suggested that we sing it in French. I said I can't sing in French but he had a postdoctoral fellow from France who translated the song and sang it in French into a tape recorder. I spent the afternoon listening to it, and it did sound pretty good in French. I got the group to sing it in French that evening, and the next year they wanted to sing both in English and in French. This has been going on for over 30 years.

Just do the best you can at whatever you are doing. Don't worry where you will end up. The opportunities will come if you work real hard.

How did you get interested ASPET's Investment Subcommittee?

While at Kansas, a group of us formed a stock club, and I was elected president for no good reason at all. I had no real background in investments. The stock club was just a small number of faculty and community leaders that invested in healthcare and pharmaceutical companies. There was no insider information, but we knew the pharmaceutical industry and used our knowledge to make informed investment decisions. The first rule we made was that there was no beer drinking until after we had made our buy and sell recommendations. That was my introduction to investments. Through this stock club, I became aware of the American Association of Individual Investors and took advantage of several of their educational programs. Eventually, I followed their model portfolio for my own investments. I used the honoraria that I received for various

professional activities to finance my investments. Then I worked with Jim Bain who was chairing ASPET's Investment Subcommittee. Jim followed ASPET's investments very closely and developed ASPET's Investment Guidelines.

Has there been a particular memory or experience in this role that has stood out for you?

In 2008, we were lucky. We had some changes with our professional money management team. One of them said we were too small of an account for them to handle. Because of this change, we sold a portion of our portfolio before the market crashed in 2008, and as a result we had about half our portfolio in cash. So the society was well served by serendipity, and we were able to get back into the market with those funds, with a new investment manager, as stocks began to rise again. I can't take credit for that, but ASPET certainly took advantage of the market rebound. Our investment guidelines have served ASPET well. The main thrust of the guidelines is that we maintain capital, and our goal for the stock portion of the portfolio is to earn five percent over the S&P 500 index. We also hold no investments in tobacco, clinical contract companies, or pharmaceutical companies. As chair of the Investment Subcommittee, I work closely with other subcommittee members to make sure that these guidelines are followed.

What is ASPET's financial strategy?

Our investments benefit ASPET in two ways. The first is that we budget revenue from interest and dividends for ASPET programs. In that way, we can keep dues lower than would be otherwise possible. The second way ASPET benefits, is in the utilization of realized gains. We have used these gains to establish a reserve to sustain the society in case of a sudden financial catastrophe. For many years that reserve was maintained at \$10 million which is about one and one-half times the annual budget. Some years there are sufficient realized gains for council to use to begin new programs to benefit ASPET members. For instance, many travel awards have been funded through realized gains. You can see those benefits at the ASPET business meeting where there are so many young people who have come to the meeting on travel awards.

What advice would you give aspiring and early career scientists?

Just do the best you can at whatever you are doing. Don't worry where you will end up. The opportunities will come if you work real hard. I think it is also important to use a moral compass in your decision making. There are going to be pressures to do the wrong thing. Ask yourself is this the right thing to do or not? If you don't know the answer to that question, then it is probably not the right thing to do. I think people get into trouble by not doing the right thing. This is because a wrong decision is expedient at the time and will not make waves or cause trouble. These short-term decisions often lead to long term trouble. All you need to do is read the *Chronicle of Higher Education* to see that.

I think that scientists are going to have to be stronger advocates for their enterprise.

I also really feel strongly about developing a multidisciplinary approach. When Martin Jischke became president of Purdue University in 2000, he recognized the tremendous potential for multidisciplinary research at Purdue and, together with Provost Sally Mason, he led us through a strategic plan that resulted in Discovery Park, a five building research institute. I was privileged to be the first director of Discovery Park, and it has grown so that, by now, in just 12 years, over \$1 billion in research grants have been administered through Discovery Park. Also the most productive and most fun projects to do are those which head in a certain direction and where you need a certain kind of data, maybe chemical data, maybe clinical data. But whatever direction the project is moving, you need to find a collaborator with interest in the project and with the expertise needed for the project to move forward. As the leader of the project, you need to develop a general background to understand the importance of the fields upon which the project depends. This requires much reading and discussion with experts in related disciplines.

Does "Team Science" mean the end of the R01?

I don't think that it means the end of the R01. There remain many interesting questions in pharmacology. New pharmacological tools being discovered and new mechanisms of action are being explored. "Team Science" adds another dimension and another opportunity for pharmacologists to contribute to medical science. We still need the R01 grants to explore the narrower but important new developments in pharmacology. The big program projects will be a more important and a growing source of support for our members. The number of pharmacologists who will run big labs is very few, but they train a lot of people. Team science is not the end of investigator initiated research. We are training so many scientists these days that not everyone can have their own lab. Skills developed while obtaining a doctoral degree can be used in many related and rewarding careers.

What is the future for pharmacology and science?

The future for pharmacology and for science in general is to continue to develop individual niches and areas of specific interest that will eventually be combined to address larger, important questions and ultimately allow alleviation of suffering caused by disease. I think that scientists are going to have to be stronger advocates for their enterprise. We have opponents, and those opponents are gathering strength and are stronger than they used to be. Our advocates in congress and even at the state level are feeling enormous amounts of pressure from our



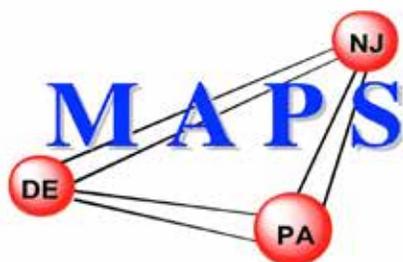
Dr. Rutledge leading the Catecholamine club song at the club dinner in June 2000.

opponents. Many of these opponents are in my view, anti-science, but they express it in terms of lower taxes or less government spending. We need to give our reasoned arguments and become stronger. The good news is we are training more people who can become outspoken advocates. The situation is not hopeless, but we need to support better those who are advocates on behalf of science.

How would you summarize your career in science?

I have had multiple careers in science, each building upon the ones preceding. I started out as a research scientist trained in pharmacology. With experience and with extensive reading, I became an educator of professional pharmacy students, graduate students, and postdoctoral fellows. I provided service to the discipline of pharmacology by reviewing papers for publication in our journals and by reviewing research grants for various funding agencies. I also provided service by serving as an officer in ASPET.

The same year that I was elected president of ASPET, I was also elected president of the American Association of Colleges of Pharmacy. Through that association, I provided leadership in helping to determine the evolution from the BS to the PharmD degree as the entry-level degree for the practice of pharmacy. This was part of my career as an academic administrator which I began as a department head followed by being dean and ended as vice president for research. Each career step led to increasing challenges and opportunities. All along the way, I met interesting people, traveled all over the world, and provided leadership to several international science-related activities. One thing that I always tried to do in all my capacities was to work hard, treat everyone with respect, have fun, and laugh with others at comic situations that constantly arise. I am particularly grateful to those who helped me along the way: my mentors, my students, and my colleagues.



**Mid-Atlantic Pharmacology Society
2014 ASPET Regional Chapter Annual Meeting
"Drug Discovery Innovations"
October 28, 2014 8:00 AM - 5:00 PM
Temple University School of Medicine
Philadelphia, PA**

Keynote Speaker: Jeffrey Conn, PhD
Vanderbilt University

Other Invited Speakers Include:

James Barrett, PhD
Drexel University

Wayne Childers, PhD
Moulder Center for Drug Discovery, Temple University

John Pascal, PhD
Thomas Jefferson University



Jeffrey Conn, PhD

The MAPS Annual Meeting will include a Keynote Presentation, invited speakers, the annual trainee (postdoctoral, graduate and undergraduate student) RESEARCH POSTER COMPETITION, with two trainees selected for oral presentations, and a PANEL DISCUSSION focused on "Bioventure Approaches to Drug Discovery", ending with a networking reception/award ceremony for all attendees.

VISIT THE **ASPET CAREER CENTER TODAY!**
WWW.ASPET.ORG/CAREERCENTER/



WHAT YOU NEED: **ASPET'S CAREER CENTER HAS IT**

Jobseekers:

- No registration fee
- Advanced search options
- Sign up for automatic email notifications of new jobs that match your criteria
- Free & confidential résumé posting
- Access to jobs posted on the National Healthcare Career Network (NHCN)
- Career management resources including career tips, coaching, résumé writing, online profile development, and much more

Employers:

- Searchable résumé database
- Hassle-free posting; online account management tools
- Reach ASPET's Twitter followers (over 650) and LinkedIn Members (over 1,500)
- Post to just ASPET or to entire NHCN network
- Sign up for automatic email notifications of new resumes that match your criteria
- Job activity tracking

ASPET is committed to your success:

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



9650 Rockville Pike, Bethesda, MD 20814-3995
Main Office: 301.634.7060
www.aspet.org



Members-in-the-News

Achievements, awards, promotions, and scientific breakthroughs

Nancy R. Zahniser, PhD

Nancy R. Zahniser, PhD, from University of Colorado, Denver received the 2014 Award in Excellence in Pharmacology/ Toxicology from the PhRMA Foundation honoring her career achievements in the field of dopamine regulation in drug addiction.

Dr. Zahniser's research has focused largely on better understanding the brain neurotransmitter dopamine (DA) and drugs that alter its function. Her work was the first to demonstrate that DA receptor binding is influenced by guanine nucleotides and that release-regulating presynaptic D2 DA autoreceptors exist on rat striatal neurons.

Dr. Zahniser received a bachelor's degree in chemistry from the College of Wooster in 1970, and then taught high school science in India for

a year. In 1977, she received her doctoral degree in pharmacology from the University of Pittsburgh, School of Pharmacy.

Dr. Zahniser has served as a regular member on two NIH study sections and editorial boards for three journals. She has mentored the research projects of 9 thesis students and 22 postdoctoral fellows and co-authored over 150 research articles, reviews, and book chapters. She served as ASPET secretary-treasurer in 2001–2002 and was selected as a fellow in the prestigious Executive Leadership in Academic Medicine (ELAM) program for women in 2005–2006. Throughout her career, Dr. Zahniser has been strongly committed to mentoring younger scientists. An ASPET member since 1982, Dr. Zahniser is primarily affiliated to the neuropharmacology division.



Nancy R. Zahniser, PhD
University of Colorado

Solomon H. Snyder, MD

Huntington's disease, a neurodegenerative genetic disorder that affects muscle coordination and leads to cognitive decline, has been known to be caused by a genetic mutation in a patient's DNA.

In a recent ground-breaking study published in *Nature* on March 26, 2014, Dr. Solomon Snyder and his team of researchers at Johns Hopkins University reported that a cellular mechanism in the genetic mutation causes the vast neurodegeneration that ultimately leads to Huntington's disease.

His theory proposes that the symptoms of the disease arise from a deficiency of the amino acid cysteine in the brain. The theory is based on experiments with mice that suffer from symptoms of Huntington's disease as well as cultured human tissue.

This research is a major milestone in the understanding and treatment of Huntington's disease and could potentially lead to a treatment plan that would decrease its onset with simple dietary supplementation.

Dr. Snyder received his undergraduate and medical training (MD) at Georgetown University (1962); Research Associate training with Julius Axelrod at the NIH (1963–1965); and psychiatric training at the Johns Hopkins Hospital (1965–1968).

He is the recipient of numerous awards and professional honors, a member of the United States National Academy of Sciences, and a Fellow of the American Academy of Arts and Sciences as well as the American Philosophical Society.

Dr. Snyder has authored more than 1000 journal articles and several books including *Uses of Marijuana* (1971), *Madness and the Brain* (1974), *The Troubled Mind* (1976),

Biological Aspects of Abnormal Behavior (1980), *Drugs and the Brain* (1986), and *Brainstorming* (1989). An ASPET member since 1966, Dr. Snyder is primarily affiliated to the neuropharmacology division.

William D. Atchison, PhD

William D. Atchison, PhD, from Michigan State University has been honored by the Society of Toxicology (SOT) with the 2014 SOT Undergraduate Educator Award. Dr. Atchison was formally presented with this award on March 23, 2014 at SOT's 53rd Annual Meeting and ToxExpo held in Phoenix, AZ.

Dr. Atchison, an associate dean for research and graduate studies at MSU's College of Veterinary Medicine, has made significant contributions to student success with a special emphasis on undergraduate research education for under-represented minority students. In collaboration with the University of Puerto Rico, in 2005 Dr. Atchison established an NIH and NINDS-funded R25-Diversity Education Grant that has provided 40 Latino students an opportunity to study toxicology. Nineteen of these students have pursued doctoral degrees in biomedical sciences with six in areas directly related to toxicology. He was recently awarded a National Science Foundation Research Experience for Undergraduates Grant to facilitate research experiences for undergraduate students.

Dr. Atchison has published 95 articles in peer-reviewed literature and 14 book chapters. He has been an ASPET member since 1987 and associated with the neuropharmacology, molecular pharmacology, and toxicology divisions.



Solomon H. Snyder, MD
Johns Hopkins University



William D. Atchison, PhD
Michigan State University



John A. Thomas, PhD
Indiana University



**Alphonse J. Ingenito,
PhD (Rtd.)**
East Carolina University

John A. Thomas, PhD

The Society of Toxicology (SOT) honored Dr. John A. Thomas, PhD, from Indiana University by presenting him with the 2014 SOT Founders Award for his pioneering contributions to human health and safety. Dr. Thomas was formally presented with his peer-nominated award on March 23, 2014 at SOT's 53rd Annual Meeting and ToxExpo held in Phoenix, AZ.

Dr. Thomas has made extensive contributions to the safety of pharmaceuticals and food ingredients through his long-term research that includes examining the pharmacologic and toxicological effects of xenobiotic chemicals such as pesticides, phthalates, and heavy metals on the male reproductive system; determining the safety of various sweeteners such as fructose; and testing biotherapeutic agents developed as substitutes for insulin and growth hormone.

In addition to his research, Dr. Thomas has served as a mentor to students and faculty members through several university positions, published 400 peer-reviewed articles, authored and edited several textbooks, and served on the editorial boards of multiple prestigious scientific journals. An ASPET member since 1964, Dr. Thomas is affiliated to the toxicology division.

Alphonse J. Ingenito, PhD

Dr. Alphonse J. Ingenito, PhD, retired from the East Carolina University School of Medicine, Greenville, NC in 2001 as Emeritus Professor of Pharmacology. During his active career he maintained membership in 8 different professional societies, serving for

many years as a member of the Board of Regents of the American College of Clinical Pharmacology.

His book titled *Drug Therapy: Yesterday, Today and Tomorrow—Basic Fundamentals for the Non-Scientist* was recently published by Dog Ear Publishing. The book is a primer of basic fundamentals of pharmacology and drug therapy intended for the average layperson lacking a scientific background but having some basic understanding of secondary school biology and chemistry.

The book covers everything from ancient origins of drugs and herbal medicines to drug discovery, principles of pharmacokinetics and pharmacodynamics, adverse effects, and patient safety. A final chapter evaluates current successes and limitations of contemporary pharmacotherapy and offers predictions on what changes and advancements we might expect in the decades ahead.

The target readership includes pre-professional health science students, nurses, home health aides and caregivers, government employees, drug salespersons, lawyers, legislators and/or anyone whose employment requires a general understanding of drug therapy. The book is not merely a listing of facts but instead explains concepts, expresses opinions, and evaluates the current and future status of therapeutic agents in practical understandable language.

Dr. Ingenito's book is available on www.amazon.com and at Barnes & Noble booksellers. He has been an ASPET member since 1970 and associated with the ISTCP and cardiovascular pharmacology divisions.

Division of Pharmacology Education Inducts Three New Fellows to the Academy of Pharmacology Educators

The Academy of Pharmacology Educators recognizes individuals who have made exemplary contributions to pharmacology education in one or more of the following areas: student-teacher interaction, innovative contributions, scholarly endeavors, and/or professional development and service. Three new members were inducted into the academy during the scientific business meeting for the Division for Pharmacology Education at EB 2014.



The first 2014 academy inductee is **Raymond R. Mattingly, PhD**, professor of Pharmacology, course director for Medical Pharmacology & Therapeutics, and deputy director of the T32-funded Cancer Biology Training Program at Wayne State University School of Medicine. Dr. Mattingly has been part of the graduate faculty at Wayne State University since 1998. From 2001–2007, he served as the graduate officer of the pharmacology PhD program at Wayne State, and in this role, was the course director

for numerous required graduate classes, journal clubs, seminars, rotations, and research credits. He has played an important role in developing and modernizing the basic science curriculum in the medical pharmacology program and has successfully implemented many of these improvements into the lecture material provided to his students. Dr. Mattingly is regarded as an excellent scientist-educator, directly mentoring 30 graduate students (MS, PhD, and MD/PhD students) and five postdoctoral trainees in his laboratory, in addition to teaching numerous graduate pharmacology courses. He consistently received the highest student ratings for his teaching and also won three Wayne State University College Teaching Awards that recognize dedication to excellence in teaching and contributions to students' professional development. In addition to his mentoring of pharmacology graduate students, Dr. Mattingly is a long-standing member of the Initiative for Minority Student Development at Wayne State, which is focused on training undergraduate students from under-represented minority populations. He has also focused his efforts on increasing the pipeline of pharmacology graduate students by recruiting into the lab interested high school students from the surrounding communities. To date, he has trained eight high school students in his laboratory; many of these students are currently enrolled in graduate pharmacology programs or medical schools.

Dr. Mattingly has been a member of ASPET since 1991, when he attended his first EB meeting as a pharmacology graduate student. In 2000, he received the PhRMA Foundation Faculty Award in Basic Pharmacology/Toxicology. He has been a full member of ASPET since 2002 with a primary affiliation in the molecular pharmacology division and a secondary affiliation in the Division for Pharmacology Education.

He served a three-year term (2003–06) on the Graduate Education and Recruitment Committee (GREC), and was involved in developing and issuing GREC's *Explore Pharmacology* brochure.



The second 2014 Academy inductee is **Reza Mehvar, PhD**, professor of Pharmaceutical Sciences, at Texas Tech University Health Sciences Center. Dr. Mehvar has been teaching various pharmacokinetics courses for the past 26 years, previously at Drake University College of Pharmacy in Des Moines, Iowa, and now at Texas Tech University Health Sciences Center (TTUHSC) School of Pharmacy in Amarillo, Texas. Dr. Mehvar is recognized for developing award-winning online modules for student-centered active learning of pharmacokinetics. These modules are used by instructors at numerous institutions in the United States, Canada, and in the Middle East. The American Association of Colleges of Pharmacy recognized Dr. Mehvar for the creation and implementation of these student-centered modules with three separate national awards. Additionally, he has received teaching awards from both Drake and Texas Tech; most notably, he received TTUHSC President's and Texas Tech System-Wide Chancellor's Awards in Teaching, which are based on faculty selection. He is actively engaged in

educational research and has published more than 18 peer-reviewed articles focused on education, curriculum, and assessment. He has mentored 11 graduate students and postdoctoral trainees, has served as a Graduate Advisory Committee member for more than 20 MS and PhD candidates, and has mentored 6 undergraduate students who all went on to complete undergraduate or graduate training in pharmacy or pharmacology programs. Dr. Mehvar's other professional activities include serving on the editorial board for *Pharmacy—A Journal of Pharmacy Education and Practice*, chairing several faculty development and mentoring committees, and being a member of numerous task forces related to educational outcomes and assessments. Dr. Mehvar has been a member of ASPET and affiliated to the Division for Pharmacology Education since 2010.



The third 2014 Academy inductee is **Georg Petroianu, MD, PhD, FCP**, professor and founding chair of the Department of Cellular Biology and Pharmacology and Associate Dean for Clinical Research at Herbert Wertheim College of Medicine at Florida International University. Dr. Petroianu has focused his career on pharmacology education and employing innovative formats of content delivery to

complement more traditional teaching approaches, achieve uninterrupted student-teacher interaction, and foster active knowledge acquisition by his students. In 1997, he was appointed chair of a task force charged with developing problem-based alternative curricula for medical education. The course resulting from this task force was implemented at the University of Mannheim, where Dr. Petroianu currently is an adjunct full professor. Dr. Petroianu also had a role in organizing and delivering special courses geared toward improving student scores on the United States Medical Licensing Examination. In 2002, he was selected as the chair of the newly established Department of Pharmacology and Therapeutics at the United Arab Emirates University in Al Ain, UAE. During his tenure at UAE University, Dr. Petroianu used problem-based and case-based teaching strategies to supplement traditional lectures in the medical sciences, organ sciences, clinical sciences, and resident and specialist training programs. His major contribution to the curriculum at UAE University focused on bridging the gap between basic and clinical sciences, which was recognized by UAE University with the 2004 Excellence in Teaching

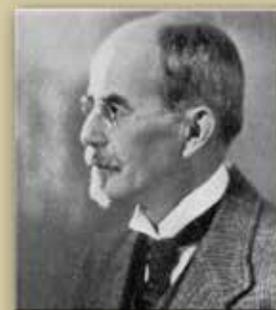
Award. Dr. Petroianu joined Florida International University in 2009. His major responsibility in the newly established Herbert Wertheim College of Medicine was to design the course curriculum for pharmacology. He has served as the course director and lead lecturer of this program since its inception. In 2012, FIU awarded Dr. Petroianu the Aesculapius Professor of the Year Award.

In addition to his educational activities, Dr. Petroianu has authored over 165 peer-reviewed papers and has co-authored several texts designed to help residents prepare for the Anesthesiology Board and the European Academy of Anesthesiology examinations. He is also board-certified in clinical pharmacology, a fellow of the American College of Clinical Pharmacology, and a diplomat of the American Academy of Pain Management. He is an honorary fellow of the Hungarian Society of Clinical and Experimental Pharmacology and was awarded the Issekutz Medal for his contribution to the advancement of knowledge in the field of esterase inhibitors. Dr. Petroianu has been a member of ASPET and affiliated to the Division for Pharmacology Education since 2011.

Featured Fund: John J. Abel Award Endowment Fund



Help the John J. Abel Award endowment fund grow. The Abel Award honors young investigators who are doing fundamental research in pharmacology and experimental therapeutics.



John J. Abel, PhD
Founder of ASPET

Donate today at www.aspet.org/awards/aspnet.abel



New Members

REGULAR MEMBERS

Siddig I. Abdeleahab

Jazan Univ, Saudi Arabia

Ahmad H. Al-Saffar

Uppsala Univ, Faculty of Medicine, Sweden

Ali R. Banijamali

Ironwood Pharmaceuticals, MA

Mary-Ann Bjornsti

Univ of Alabama-Birmingham, AL

W. Matthijs Blankestijn

Maastricht Univ Cardiovascular Research Inst Maastricht, Netherlands

Michael R. Braden

Univ of Montana, MT

Catherine Cahill

Univ of California-Irvine, CA

David Centurion

Cinvestav, Mexico

Suzie Chen

Rutgers Univ, NJ

Yaofeng Cheng

Bristol-Meyers Squibb, NJ

Carol Collins

Univ of Washington, WA

Pietro Cottone

Boston Univ School of Medicine, MA

Yiqun Deng

South China Agricultural Univ Col of Life Sciences, China

Delrae M. Eckman

Midwestern Univ, AZ

Christian Gaiddon

INSERM (French NIH), Strasbourg Univ, France

Randle M. Gallucci

Univ of Oklahoma Health Sciences Col of Pharmacy, OK

Justin L. Grobe

Univ of Iowa, IA

Josee Guindon

Indiana Univ, IN

Sahika Guner

Ufuk Univ, School of Medicine, Turkey

Anshul Gupta

AstraZeneca Pharmaceuticals LP, MA

Karen E. Hedin

Mayo Clinic Col of Medicine, MN

Adrian J. Hobbs

Barts & The London School of Medicine, UK

Eghosa Iyare

Univ of Nigeria, Nigeria

Sara R. Jones

Wake Forest Univ School of Medicine, NC

John H. Kehne

Nat Inst of Neurological Disorders & Stroke, MD

Rajesh Khanna

Univ of Arizona, AZ

Raj Kurupati

The Wistar Inst, PA

Sangkyu Lee

Kyungpook National Univ, South Korea

Derek Leishman

Eli Lilly, IN

Deqiang Li

Univ of Pennsylvania, PA

Yuru Liu

Univ of Illinois, IL

Michelle Mazei-Robison

Michigan State Univ, MI

Arun Mehnaatamai Mohanram

St. Matthew's Univ, Sch of Medicine, Cayman Islands

Mohammad Misbahuddin

Rabigh Col of Medicine, King Abdulaziz Univ, Saudi Arabia

Sreejayan Nair

Univ of Wyoming, WY

Ramanujam Narayanan

PSG Inst of Medical Sciences & Research, India

Faizan Niazi

Ferring Pharmaceuticals, NJ

Jeffrey P. Novack

Pacific Northwest Univ, WA

Syed M. Nurulain

United Arab Emirates Univ Col of Medicine & Health Sci, United Arab Emirates

Alessandro Provenzani

CIBIO - Univ of Trento, Italy
Lars C. Roenn, Lundbeck, Denmark

Amin Rostami

Univ of Manchester-Manchester Pharmacy School, UK

Oluwakanyinsola A. Salawu

Nat Inst for Pharmaceutical Research & Development (NIPRD), Nigeria

Yi Shi

Zhongshan Hospital Fudan Univ, China

S. Joshua Swamidass

Washington Univ, MO

Kim Tran

Des Moines Univ, IA

Kevin Wang

Northeastern State Univ, OK

Michael Z. Wang

Univ of Kansas, KS

Jermel Watkins

Cold Spring Harbor Lab & Dowling Col, NY

David Weinshenker

Emory Univ, GA

Tracy A. Womble

Florida A&M Univ, FL

Hui Xu

Yantai Univ School of Pharmacy, China

Ying Xu

SUNY Buffalo, NY

Charles R. Yang

Shanghai Chempartner Co Ltd, China

Ching-Hua Yeh

Da-Yeh Univ, Taiwan

Wei Yue

Univ of Oklahoma Health Sciences Ctr, OK

Maciej J. Zamek-Gliszczyński

Lilly Research Labs, IN

Jiang Zheng

Seattle Children's Research Inst, WA

Renping Zhou

Rutgers Univ, NJ

Michael A. Zientek

Pfizer, Inc, CA

AFFILIATE MEMBERS

Tamila Akhayevea

Kazakh Medical Univ, Kazakhstan

Katie A. Edwards

Univ of New England, ME

Scott A. Heyward

Bioreclamation/VT, MD

Justin E. LaVigne

Univ of New England, ME

Tetsuya Mitsui

Chugai Pharmaceutical Co Ltd,
Japan

Sajad Tareq

Univ of Baghdad, Col of Pharmacy,
Iraq

Lisa E. Young

Ferring Pharmaceuticals, Inc, MA

POSTDOCTORAL MEMBERS

Dipendra K. Aryal

Duke Univ, NC

Alessandra Castaldi

Univ of California-San Diego, CA

Lerin R. Chastain

Univ of Oklahoma Health Science
Ctr, OK

Miezan J. Ezoulin

Univ of Missouri-Kansas City, School
of Pharmacy, MO

Sarmed H. Kathem

Univ of Baghdad, Col of Pharmacy,
Iraq

Ming-wei Lin

Kaohsiung Chang Gung Memorial
Hospital, Taiwan

Daniel Pan

Univ of Pennsylvania, PA

Erzsebet Szabo

Univ of Tennessee HSC, TN

Yun Chen Tien

Univ of Connecticut School of
Pharmacy, CT

Wenyong Tong

Univ of California-San Diego, CA

Karen M. Wagner

Univ of California-Davis, CA

Natalie A. Ward

Univ of British Columbia, Canada

GRADUATE STUDENT MEMBERS

Maryam Agharahimi

Florida Agricultural & Mechanical
Univ, FL

Blessing Airhien

Univ of Nottingham, UK

Musaad A. Alshammari

Univ of Texas Medical Branch, TX

Tahani K. Alshammari

Univ of Texas Medical Branch, TX

Rakesh Awasthi

Univ of Iowa, IA

Sagar S. Bachhav

Inst of Chemical Technology (ICT)-
Former UDCT, India

Rohit Bisht

I S F Col of Pharmacy, India

Stephen M. Day

Wake Forest Univ, NC

Elizabeth Ennis

Vanderbilt Univ, TN

Alexander G. Hajduczuk

Univ of Rochester School of
Medicine & Dentistry, NY

Stella-Rita Ibeawuchi

Univ of Iowa, IA

Xin Luo

Univ of Hong Kong, China

Yina Ma

Univ of Buffalo, NY

Yohannes A. Mamo

Univ of Melbourne, Australia

Anberitha Matthews

Mississippi State Univ Col of
Veterinary Medicine, MS

Torez Moody

Clafin Univ, SC

Matthew J. Mulcahy

Brown Univ, RI

Ryan Patel

Univ Col London, UK

Ryan H. Purcell

Emory Univ, GA

Yanyan Qiu

Univ of Buffalo, NY

Meagan A. Quinlan

Vanderbilt Univ, TN

Sarah Schmeltzer

Univ of Cincinnati, OH

Joshua G. Travers

Cincinnati Children's Hosp Med Ctr,
OH

Ablat Tursun

Southern Methodist Univ, TX

Harika Vemula

Univ of Missouri-Kansas City, MO

Lingxin Zhang

Auburn Univ, AL

UNDERGRADUATE STUDENT MEMBERS

Lauren M. Ascherman

Michigan State Univ, MI

Daniel K. Burette

Clafin Univ, SC

Daniel J. Carlson

Univ of Arizona, AZ

Sungjin Kim

Sunchon National Univ, South Korea

Gloria T. Le

Univ of Arizona, AZ

Eric J. Lemister

Univ of Arizona, AZ

Mary I. McIntosh

Univ of Arizona, AZ

Daniel Nicoara

Washington State Univ, WA

Amy R. Nippert

Univ of Arizona, AZ

Joshua A. Yell

Univ of Arizona, AZ

Membership Benefits

Did you know that the ASPET office is available for use by members?

ASPET members are encouraged to come by the ASPET office located at 9650 Rockville Pike, Bethesda, MD 20814 on the FASEB campus when they are in the area to meet with ASPET staff, access the internet, or utilize the conference room. The ASPET office is open from 8:30 AM until 5:00 PM. If you are interested in stopping by when you're in town, contact us at membership@aspet.org to make arrangements.

In Sympathy

ASPET notes with sympathy the passing of the following members:

Alejandro Zaffaroni

William F. Waddell



Division News

Division for Behavioral Pharmacology

EB 2014 in Review

BEH Program Synopses

On April 27, a symposium titled “Animal Models of Polydrug Abuse” kicked off the scientific portion of the 2014 ASPET meeting. The symposium began discussing how polydrug abuse affects data generated during Phase I trials of potential medications for cocaine and methamphetamine abuse. Next, talks were given on studies of self-administration of mixtures of cocaine and nicotine in nonhuman primates, studies of interactions of orally consumed alcohol and intravenously self-injected cocaine in monkeys, interactions between nicotine and cannabinoids when they are self-administered by rodents, and finally, studies in which nicotine and alcohol are self-administered by rodents of different ages. Overall, data from rodents, monkeys, and humans indicate that drugs that are co-abused by humans influence each other’s effects in animal models of substance abuse. Because polydrug use and abuse is the norm in the clinical domain, animal models that incorporate multiple abused substances may, therefore, have greater predictive validity than models in which only one drug is studied. The Sunday morning symposium was well attended and well received with plenty of thought-provoking questions raised by the audience after each presentation.

There is a large unmet medical need to develop new and more effective smoking cessation treatment strategies. Thus, a timely symposium titled “New Preclinical and Clinical Perspectives for Smoking Cessation” was also presented on April 27. The symposium discussed current smoking cessation approaches and their limitations, and new evidence from pharmacological, immunological, and behavioral studies across different species (i.e., rodents, non-human primates, and humans) on novel potential smoking cessation treatments was presented.

On Monday, April 28, a symposium titled “Making the Right Choice: Translational Use of Choice Procedures in Understanding the Neurobiology and Development of Pharmacotherapies for Drug Addiction” discussed the utility of choice procedures to understand gender differences in rodent models of drug addiction. Next, the utility of choice procedures to understand drug mixtures in nonhuman primate models and in particular the use of choice procedures in the development of abuse deterrent formulations of drug mixtures was discussed and results from nonhuman primates described. The results from human laboratory studies where drug versus money choice procedures were used provided insight into the environmental and pharmacological mechanisms of drug choice. Finally, results from human imaging studies were used to elucidate the neurobiological mechanisms of drug preference. The symposium followed the Peter B. Dews Award Lecture given by J.H. Woods and preceded the division’s scientific program meeting.

Also on April 28, the symposium “Sleep Disruptions Associated with Neuropsychiatric and Degenerative Disorders: Implications, Preclinical Models and Development of Novel Pharmacotherapies” was held. The rationale for this symposium was based upon the following: current drug treatments for neuropsychiatric and degenerative disorders aim to alleviate primary clinical symptoms without sufficiently treating sleep disturbances such as restlessness, insomnia, sleep apnea, reduced rapid eye movement (REM) sleep, and excessive daytime sleepiness. Insomnia is now recognized not as a consequence of, but a predictor for and often mainstay throughout many neuropsychiatric conditions. Further, sleep disturbances are linked

to cognitive deficits, another untreated symptom associated with many neuropsychiatric and degenerative conditions. Thus, understanding causes and developing treatments for sleep disorders may present a novel approach to treat multiple symptoms associated with neuropsychiatric and degenerative disorders. This symposium described sleep disturbances across a range of clinical conditions, the effects of current treatments on sleep, and translational preclinical models employed to understand causes and develop novel treatments for sleep disturbances. This symposium discussed muscarinic acetylcholine receptor modulation of sleep/wake architecture, a novel-induced rodent model of Parkinson's disease, a neurodevelopmental model of sleep disturbances associated with Schizophrenia, insomnia as a predictor of psychological symptoms associated with post-traumatic stress disorder, and sleep disturbances associated with Alzheimer's disease.

On Wednesday, April 30, the Ray Fuller lecture in neurosciences titled "AMPA receptor potentiation: Implications for the discovery of medicines for treatment-resistant depression" was delivered by Jeff Witkin from Lilly Research Labs. The lecture traced the scientific discoveries on NMDA receptor blockade and AMPA receptor potentiation to the novel potential therapy of mGlu2/3 receptor antagonism and provided data on the *in vitro* and *in vivo* characterization of a novel orthosteric antagonist for these receptors that is predicted to be a rapidly acting antidepressant for treatment-resistant patients.

The Ray Fuller symposium, "Treatment-Resistant Depression (TRD): Biological Bases and Treatments," followed the lecture where the use of neurostimulation methods including deep brain stimulation for treatment-resistant patients and new data on defining the receptor subtypes of muscarinic receptors that might be relevant to the antidepressant efficacy of scopolamine in humans. An analysis of the findings in the clinic and in preclinical laboratories suggesting that all NMDA receptor antagonists might not generate equivalent biological and clinical outcomes in depressed patients was provided and preclinical findings with novel rodent models and the connection of clinical data on buprenorphine to kappa opioid receptor pharmacology that might drive clinical response were described.

2014 BEH Best Abstract Award Winners

Undergraduate Students



1st place winner
Michael Melson
*Univ. of South Carolina
School of Medicine*



2nd place winner
Douglas Smith
Virginia Tech

Graduate Students



1st place winner Sarah Kromrey, Wake Forest School of Medicine, and 2nd place winner, Brenda Marie Gannon, Univ. of Arkansas for Medical Sciences

Young Scientists



1st place winners Catherine M. Davis, Johns Hopkins Univ. School of Medicine, and David R. Maguire, Univ. of Texas Health Science Center at San Antonio

We Want to Hear From You!

Do you have suggestions for what you would like to see in the division section of *The Pharmacologist*, our website, or LinkedIn pages? We are always looking for ways to improve! Please send all comments, suggestions, and/or member news to the division communication officers listed below.

Brian Kangas

bkangas@mclean.harvard.edu – BEH

Rayna Gonzales

rjgonzal@arizona.edu – CVP

Robert Leadley

rleadley@schoolcraft.edu – DDD

Aiming Yu

aimyu@ucdavis.edu – DM

Ross Corriden

rcorriden@gmail.com – ISTCP

Ren Ostrom

rostrom@uthsc.edu – MP

Anil Kumar

kumaran@umkc.edu – NEU

Katie Davis

cdavis91@jhmi.edu – EDU

Monica Valentovic

valentov@marshall.edu – TOX

Mark your calendars:

Submissions for the September issue of *The Pharmacologist* must be received by Friday, July 25, 2014!

Other Annual Meeting News

Day of Service at the ASPET Annual Meeting at EB 2014

Since 2009, some attendees at the EB meeting have given a day of volunteer service in the local communities (New Orleans, Pasadena, Washington, DC, and San Diego). Volunteer activities have included home construction, painting, cleaning, stocking, food preparation, and service. BEH sponsored a volunteer opportunity again at EB 2014 in San Diego. On Friday, April 25, volunteers spent the day at St. Vincent de Paul Village. Volunteers arrived at Father Joe's at 6:00 AM, prepared and served breakfast, assisted with sorting donations, and contributed to general maintenance of the facility. The next ASPET Volunteer Day will be held at EB 2015 in Boston on Friday, March 27th. If you would like to join, please email Charles P. France at france@uthscsa.edu or call him at 210-567-6969 at your earliest convenience. Further details will follow to those who express an interest in volunteering.



Volunteer members at Father Joe's

Division for Cardiovascular Pharmacology

EB 2014 in Review

CVP Program Synopses

CVP had a very successful round of symposia at EB 2014. The “Hydrogen Sulfide: From Physiological Messenger to Pharmacological Target” symposium discussed the rapidly evolving area of the vasoactive mechanisms of hydrogen sulfide in vascular tissues. New findings were presented on hydrogen sulfide dependent mechanisms including novel pathways for synthesis, diminished hydrogen sulfide signaling in an animal model of sleep apnea, dissociation between tissue and plasma levels of hydrogen sulfide in human studies, and loss of hydrogen sulfide production in chronic renal disease. Approximately 60 scientists and students attended this symposium on Wednesday afternoon, April 30, and the audience enjoyed a good discussion on this interesting topic.

During an insightful and cutting edge symposium titled “Mitochondrial Fragments: A Novel Mediator between Inflammation and Cardiovascular Disease,” noteworthy lectures and research presented novel insights into mitochondrial fragments and mitochondria function in the induction of systemic inflammation and cardiovascular diseases. Approximately 100 scientists and students attended this symposium and the audience actively participated in discussions

on the hot topics presented late Monday afternoon at the San Diego Convention Center. The CVP division sponsored the 2014 Trainee Showcase Symposium on April 29th chaired by Dr. Amy C. Arnold (Vanderbilt University).

2014 CVP Best Abstract Award Winners

The top winners of the division’s best abstract competition were recognized with a cash award, certificate, and ribbon at the division mixer held at the San Diego Marriot Marquis and Marina Hotel. The winners are listed below:

Graduate Students

First Place – **Louise See Hoe**,
Griffith Univ.

Second Place – **Justine Abais**,
Virginia Commonwealth Univ.

Third Place – **Cameron McCarthy**,
Georgia Regents Univ.

Fourth Place – **Christopher Moore**,
Univ. of Arkansas for Medical Sciences

Fifth Place – **Chimène Charbel**,
Montreal Heart Inst.

Postdoctoral Fellows

First Place – **Jan Schilling**, *Univ. of California, San Diego*

Second Place – **Deepesh Pandey**,
Johns Hopkins Univ

2014 Paul M. Vanhoutte Distinguished Lectureship in Vascular Pharmacology



Dr. Sue P. Duckles delivered this year’s Paul M. Vanhoutte Distinguished Lectureship in Vascular Pharmacology titled “Vascular Mysteries: More Than the Sum of the Part.”

Due to space limitations, we were unable to include all pictures and lists of all winners in this issue. Pictures of award winners and additional information will be made available on individual division websites.

Division for Drug Discovery and Development

EB 2014 in Review

2014 DDD Program Synopses

DDD sponsored a symposium at EB 2014 titled “Productive Public Private Partnerships for Pharmacological Progress.” The symposium, which was organized by ASPET Past President John S. Lazo, was intended to highlight the evolving nature of relationships among academic institutions, pharmaceutical companies, biotechnology companies, foundations and governmental agencies, most notable the National Institutes of Health. All of the speakers have worked in academia and industry and brought to the symposium a valuable prospective on drug discovery and development paradigms.

Chris Austin, the director of the National Center for Advancing Translational Sciences (NCATS), outlined the role of his institute in fostering public-private partnerships with unique programs assisting the repurposing of drugs that are safe but have

failed in clinical trials for their primary indication. He also reviewed the Clinical and Translational Science Awards (CTSA) and Therapeutics for Rare and Neglected Diseases (TRND) programs at the NIH.

Chas Bountra, head of the Structural Genomics Consortium (SGC), University of Oxford Professor of Translational Medicine and an associate head of Medical Sciences, provided a lucid description of the challenges and inefficiencies we have with the current drug discovery and development models. He described the innovative approach the SGC has taken to foster open access to precompetitive information and reagents that are vital for the future of efficient drug discovery.

Bob Abraham, senior vice president and chief scientific officer for oncology research at Pfizer Worldwide Research and Development, outlined Pfizer’s strategies to access external innovation through partnerships with academia. In particular, he discussed the new Pfizer Centers for Therapeutic Innovation program, which fosters multi-institutional regional hubs focused on target validation and lead compound identification.

Carrie Jones, director of the In Vivo and Translational Pharmacology Program at the Vanderbilt Center for Neuroscience Drug Discovery and an assistant professor of Pharmacology at Vanderbilt, provided a comprehensive review of Vanderbilt’s remarkable infrastructure for academic drug hunting and the extensive interactions they have developed with the NIH, industry and foundations. She also presented developments from Vanderbilt on identifying novel allosteric modulators of GPCRs that may emerge as innovative drugs for the treatment of a variety of CNS disorders.



DDD sponsored symposium on Productive Public Private Partnerships for Pharmacological Progress. **Don Mattison** (chair of DDD); **Rick Neubig** (president of ASPET); speakers **Chas Bountra**, **Bob Abraham**, and **Carrie Jones**; and **John Lazo** (past president of ASPET). Not pictured is speaker **Chris Austin**.

2014 DDD Young Investigators Award

Eight excellent posters were presented for consideration for the DDD Young Investigator Abstract Award. Members of the DDD executive committee who judged the competition found the scientific content, presentation, and interpretation by the investigators to be the best seen in several years. Since all of the posters presented were very good, it was difficult to determine the winners. First place went to Jenaye Robinson (Texas Southern Univ.), a relatively new graduate student and with a remarkable mastery of

scientific knowledge at this stage in her career. As a result of her winning this award, she is now a member of the executive committee and has already made contributions to the selection of our programming for next year's meeting.

Second place went to Adebowale Ogunjirin from Gallaudet University, a federally chartered private university for the education of the deaf and hard of hearing located in Washington, DC. The judges were impressed with the poster and data but were even more impressed as we talked with Ogunjirin and came to understand his excellent grasp of the material and the significance of his findings.

Sujay Kharade from Vanderbilt University won the third prize. Kharade is a repeat winner from last year and has been an active member of the executive committee this past year. He has great energy and enthusiasm for ASPET and generated two complete proposals for symposia for next year's meeting. Honorable Mention went to Shu Zhou from the University of California-San Diego for her work on GPCRs as potential therapeutic targets in pancreatic cancer. All of the presentations provided us a glimpse of the great science being conducted by these bright, young investigators.



1st place winner **Jenaye Robinson**, Texan Southern Univ., and 3rd place winner **Sanjay Kharade**, Vanderbilt Univ. with the division chairs.

ASPET BIG IDEAS INITIATIVE

ASPET is looking to fund new projects that will directly benefit our members. If you have a BIG IDEA, we want to hear from you!

Submit your proposal to jsiuciak@aspet.org by June 30, 2014!

For more information about submitting your proposal, visit: www.aspet.org/ASPET_Big_Ideas



Division for Drug Metabolism

EB 2014 in Review

DM Program Synopses

In addition to the platform session, DM sponsored three symposia. The first symposium, titled “Role of (Drug) Transporters in Imaging in Health and Disease,” opened with a presentation on “The role of transporters for diagnostic probes.” After this, a presentation on cutting edge diagnostic methodology using OATP substrates for hepatic imaging and as MRI contrast agents, and an exciting update titled “Quantification of drug transporters to understand interindividual variability in drug disposition and drug response” followed. The novel LC-MS methods used to quantify drug transporters in human tissues and cells and demonstrate how this methodology can be used to explain interindividual variability in drug disposition, including the effects of genetics on transporter expression was described. A unique presentation titled “PET imaging of ABC efflux transporters at the blood-brain barrier in humans and animal models” comprehensively described the various studies done in humans and in animal models to characterize the role of ABC efflux transporters in brain disposition and to better understand the interspecies differences and therapeutic implications of efflux transporters at the blood-brain barrier. The session concluded with a presentation on “New radiopharmaceuticals for PET renography utilizing OAT1” that detailed the use of an OAT substrate in conjunction with PET imaging to follow renal function and pathology.

The “Target-Site Drug Metabolism and Transport” symposium demonstrated emerging evidence that drug metabolizing enzyme and transporter activity at the site of therapeutic action can affect the efficacy, safety, and metabolic properties of a therapeutic drug with potential outcomes including altered dosing regimens, stricter exclusion criteria, or even the failure of a new chemical entity in clinical trials. The symposium began with a brief overview of the importance of target-site metabolism and transport. The overview was followed by presentations from

five experts in the field of drug metabolism and transport. A study discussed how drug metabolism within the brain changes drug response in vivo and focused on the activity and function of P450 enzymes in the brain and how they contribute to metabolic activation of therapeutic drugs such as codeine as well as the elimination of potential neurotoxins in the brain. Another presentation discussed how OAT3 is involved in the pathogenesis of pancreatic β -cell dysfunction and gestational diabetes and a potential mechanism of how uremic toxins enter pancreatic β -cells by OAT3 and contribute to the pathogenesis of gestational diabetes. The attendees then heard about the expression and activity of drug metabolizing enzymes in the lung. The presentation provided a comprehensive overview of the expression levels of phase I and phase II enzymes in the lung and recent findings of the metabolism of resveratrol in the lung. The next presentation focused on the effects of tumor metabolism on the pharmacokinetics and efficacy of antibody-drug conjugates and covered the analytical methods used for characterization of metabolism and disposition of antibody-drug conjugates. The session concluded with a presentation selected from submitted abstracts. This presentation was on how the ABC transporter Mrp4/Abcc4 is required for Leydig cell protection from chemotherapeutic drugs.

The last symposium, “Improving Maternal Therapeutics: Drug Metabolism and Transport During Pregnancy and Lactation,” addressed the issues surrounding the pregnancy-related changes in drug metabolism and transport and the subsequent difficulty of predicting these changes in pregnant women from data extrapolated from men and non-pregnant women. Increased scrutiny by the FDA and NIH on therapy for pregnant women has resulted in a considerable increase in the amount of research generated in the area of drug disposition during pregnancy. The symposium had four key speakers and

a panel discussion highlighting the breadth of tools that are currently used to investigate drug disposition in pregnant women. The symposium opened with an overview of the importance of characterizing changes in drug metabolism and the related clinical and toxicological implications during pregnancy. The overview was followed by a presentation that described the use of physiologically-based pharmacokinetic models in predicting and interpreting changes in drug disposition during pregnancy and elegantly explained the integration of the plethora of pregnancy-related physiological changes together with mechanistic changes in expression of drug metabolizing enzymes into complex PBPK models. The next presentation described exciting new findings on mechanisms of CYP2D6 regulation during pregnancy and how pregnancy-related changes in the expression of nuclear receptors and their ligands contribute to the altered expression and activity of P450 enzymes during pregnancy. The audience then heard about how hepatic transporter expression and activity is altered during pregnancy and lactation and how estrogens (specifically ethinyl estradiol) affect the development of cholestasis. The final speaker described his group's exciting research on how the disposition and efficacy of antimalarial agents is altered during pregnancy. He provided a comprehensive presentation of the strengths of population-based modeling in evaluating drug disposition during pregnancy and in guiding therapeutic regimens in the treatment of malaria and gave the audience a detailed look into the clinical trials conducted in pregnant women in countries with high rates of malaria. The session concluded with a panel discussion that included extensive participation from the audience. The panelists and audience discussed the ethical issues relating to studies in pregnant women and discussed the various mechanistic explanations of the observed changes in pregnancy.

Six posters were also selected to present at this platform session that included:

- “CYP3A5 genotype impacts maraviroc pharmacokinetics in healthy volunteers” by Yanhui Lu from Johns Hopkins University
- “Application of physiologically-based pharmacokinetic modeling in hepatic impairment

populations” by Jennifer Sager from University of Washington

- “Gestational age-dependent maternal-fetal glyburide disposition in pregnant mice” by Diana Shuster from University of Washington
- “The orally active male contraceptive agent H2-gamendazole interacts with organic anion transporting polypeptides expressed in human hepatocytes” by Jessica Shoop from University of Kansas Medical Center
- “The potent inhibition of human SULT1A1 by 17 α -ethinylestradiol (EE2) is due to interactions with ILE89 in loop 1” by Katie Rohn-Glowacki from University of Alabama at Birmingham
- “Intracellular chloride concentration and its impact on dichloroacetate metabolism” by Stephan Jahn from University of Florida at Gainesville.

2014 DM Best Abstracts Award Winners Graduate Student



1st place winner
Alex Wu
The Hospital of Sick Children



2nd place winner
John Connick
Louisiana State Univ. HSC



3rd place winner
Ji Won Park
Louisiana State Univ. HSC

James Gillette Best Paper Award

The James Gillette Best Paper Awards are presented annually for the best papers published in the ASPET journal *Drug Metabolism and Disposition*. Awards were presented in the areas of (a) drug metabolism and (b) drug transport and pharmacokinetics.



Dr. Amarjit S. Chaudhry accepted the award in drug metabolism and presented the paper entitled "Genetic variation in Aldo-Keto reductase 1D1 (AKR1D1) affects the expression and activity of multiple cytochrome P450s."



Dr. Toshiyuki Kudo accepted the award in drug transport and pharmacokinetics and presented the paper entitled "Analysis of the repaglinide concentration increase produced by gemfibrozil and itraconazole based on the inhibition of the hepatic uptake transporter and metabolic enzymes."

Division for Integrative Systems, Translational, and Clinical Pharmacology

ISTCP Division Year in Review, 2013–2014

The year leading up to EB 2014 was an exciting one for the ISTCP division. As part of an effort to enhance recruitment and retention efforts, the division established a trainee-focused task force led by executive committee member David Dahdal. Among the initiatives driven by the task force was the sponsorship of the UCSD Postdoctoral Association's first career symposium, which was held shortly before the EB 2014 meeting in San Diego. ASPET was highly visible at the event, and in addition to being a valuable recruitment opportunity for the society, it inspired future division content for our trainee members. The symposium highlighted the many career paths available to PhD scientists; based on its participation in the event, ISTCP plans on capitalizing on its diverse membership of academic, industry, and government scientists to offer career-focused content to trainees through the division's web page and LinkedIn group.

The division also welcomed Pamela Hornby, the incoming chair, and Benedict Green, the incoming secretary/treasurer, and wishes to thank Ismail Laher and Michael Holinstat for their tremendous contributions over the last year.

Many opportunities exist for ISTCP members, particularly trainees, to become more involved in the division. We strongly encourage all members to keep an eye on the division webpage and join our LinkedIn group, both of which will be regularly updated over the next year. We are currently developing new types of content, with an emphasis on career development resources that we hope will be of use to our trainee members. If you would like to suggest content for these sites, or are interested becoming more involved, please contact the division communications officer, Ross Corriden (rcorriden@ucsd.edu).

EB 2014 in Review

2014 ISTCP Best Abstracts Award Winners

Poster Award Winners

(Graduate Students)

First Place – **Amanda Stolarz**, *Univ. of Arkansas Medical Sciences*

Second Place – **Aravind Gade**, *Virginia Commonwealth Univ.*

Third Place – **Garrett Ainslie**, *Univ. of North Carolina, Chapel Hill*

Oral Presentation Award Winners

(Graduate Students)

First Place – **Allyson Marshall**, *Wake Forest University Baptist Medical Center*

First Place – **Jacqueline Reilly**, *University of Iowa*

Second Place – **Shravan Sriraman**, *Northeastern University*

Oral Presentation Award Winners

(Postdoctoral Fellows)

First Place – **Benjamin Tourdot**, *Thomas Jefferson University*

Second Place – **Ozhan Ocal**, *UT Southwestern Medical Center*

Division for Molecular Pharmacology

EB 2014 in Review

2014 MP Best Abstract Award Winners

Graduate Students



1st place winner
Andrew Haak

First Place – **Andrew Haak**, *University of Michigan*

Finalist – **Ryan Canatsey**, *University of Arizona*

Finalist – **Kristin Hicks**, *Loyola University-Chicago*

Finalist – **Anna Mazur**, *University of Arkansas for Medical Sciences*

Finalist – **Nikhil Panicker**, *Iowa State University*

Postdoctoral Fellows



First Place – **Kristoff Homan** (center), *Univ. of Michigan*

Runners up – **Andreia Chignalia**, *Univ. of Illinois-Chicago*

Runners up – **Aaron Overland**, *Univ. of California, San Diego*

Division for Neuropharmacology

EB 2014 in Review

NEU Program Synopses



Athina Marku (UC San Diego) was the keynote speaker for the Postdoctoral Scientist Award Symposium. Dr. Marku gave an inspirational presentation titled “Glutamate and nicotine dependence: The route to medication development with advise from Chiron, the centaur” that wove her personal quest for

scientific discovery across continents with advise for achieving excellence.

Division member Dr. Craig Lindsley (Vanderbilt Univ.) and recipient of this year’s J. J. Abel Award delivered a stimulating award lecture titled “Exploiting allosteric sites for target modulation” to a packed audience.

The NEU and BEH divisions hosted a joint mixer again this year. Winners of the NEU division awards for the best student and best postdoctoral fellow presentations were announced to a room filled with enthusiastic and appreciative division members and friends.

NEU will be at the Society for Neuroscience 2014 annual meeting in San Diego. Come by and visit the ASPET booth #3217 and learn about how you can make a difference in determining future programming at the ASPET meeting! Details about the mixer will follow on our website at www.aspet.org/Neuropharmacology/Home/.

2014 NEU Best Abstract Award Winners Graduate Students



1st place winner **Karen Tonsfeldt** (right), Oregon Health & Science Univ., 2nd place winner **Nathan Mitchell** (second from right), Univ. of Texas HSC-San Antonio, and 3rd place winners **Robert Laprairie** (second from left), Dalhousie Univ., and **Cody Siciliano** (left), Wake Forest Univ. School of Medicine

Postdoctoral Fellows



1st place winner **Abigail Schindler** (right), Univ. of Washington, 2nd place winner **Amy Moritz** (center), National Inst. of Neurological Disorders, and 3rd place winner **Erin Bobeck** (left), Icahn School of Medicine at Mount Sinai

2015 NEU Awards Information

The Career Investigator Award for 2015 will now be open to primary members of the division. Details regarding eligibility and deadlines will be posted on the NEU website by July with an anticipated deadline of September 30, 2014.

NEU will again offer incentive travel awards to encourage the submission of abstracts from post-doctoral and graduate student trainees. The division will sponsor a two-tier competitive early trainee award. The first awards will be based upon abstract and will be given in the form of a travel award. The second award will be given based upon poster presentation (graduate students) or speaker presentation (postdoctoral fellows). Abstracts from students and fellows that are members of NEU will be evaluated at the first stage of submission based on composition as well as CV, letter of intent, and letter of recommendation.

Six postdoctoral and six predoctoral incentive awards (\$300) will be granted to facilitate travel to compete in the poster or symposium format. Winners of the best poster and best abstract symposia competition will receive additional prizes. An individual could therefore receive the travel award as well as win the competitive award. First place winners receive \$750, second place gets \$500, and third brings home \$250. All winners of the poster and speaker competitions win complementary registration for next year's meeting. An additional benefit of winning this competition is that the first place winner automatically becomes part of the Neuropharmacology Executive Committee and gets the opportunity to lead our division for a three-year appointment. Details for submission will be posted on the NEU website (the deadline for submission is generally mid-November).

Division for Pharmacology Education

EB 2014 in Review

EDU Program Synopses

The Division for Pharmacology Education (EDU) was the primary sponsor for several symposia at EB2014. The objective of DPE's first symposium, "Career Opportunities Beyond the Bench: Education as a Viable Path," was to provide options for training and employment for pharmacologists with an interest in education as a career path. Dr. Jayne S. Reuben presented information about educational prospects at various health professions schools (medical, pharmacy, and dental). She discussed her graduate coursework and postdoctoral experiences/training in pedagogy as well multiple career development opportunities (degree programs, online workshops, conferences) that can be used to develop the

necessary skills in pharmacology education. Dr. Antonio T. Baines discussed the NIH IRACDA teaching/research postdoctoral fellowship programs across the country and explained how his past experiences in the IRACDA program (SPIRE) at UNC Chapel Hill facilitated his transition and success into a tenure-track faculty position. The last speaker, Dr. Karen Marcdante, demonstrated that the scientific method could be applied to an individual's work as an educator. During this session, she reviewed the "science" of education as illustrated by its various components (e.g., curriculum development, learner assessment, and program evaluation). Elements of the AAMC summary report on defining

the components and evidence for educational scholarship were also reviewed. She concluded her presentation with an example of a portfolio of evidence that could be useful in promotion decisions.

The second symposium focused on the “Collaborative Role of Pharmacology in Education of Healthcare Professions” with discussion of the history of medical education and a personal incident illustrating the dramatic need for collaboration and communication interprofessionally to improve the effectiveness and safety of healthcare delivery. The next presentation provided a summary of the nursing profession, how the profession continues to be involved in developing knowledge, and skills to improve collaborative education and delivery of healthcare to patients. Dr. Yiannis Koutalos presented on his experiences in incorporating IPE into the medical school curriculum dealing with medical and pharmacy school students. He emphasized the importance of incorporating pharmacology into the institutional content of the program to assure everyone’s needs were met and the importance of having teamwork in development and analysis of outcomes. Last, Dr. Lynn Wecker finished the symposium with a presentation on how to develop an IPE program and avoid some common, and some unusual, pitfalls. She summarized the “musts for

success” as: recognize that learning with, from, and about each other will improve collaboration and quality of care; appreciate the expertise brought to the table by all involved – and not who does what and the nature of their role; and embrace differences among team members and recognize that these differences are critical for ensuring the success of IPE.

The third symposium, “Addressing Prescribing Errors through Medical Student Education and Assessment” highlighted the importance of medication safety education and assessment in undergraduate medical education (UME) curricula. Dr. David Nierenberg described the various parts of the report and sought attention to the fact that our entering residents (new residents) are not prepared to prescribe on their first day of residency. He concluded by saying more should be done in UME to address this. The next speaker, Dr. Simon Maxwell, shared his leadership experience in developing a nationwide initiative on assessing prescribing competence. He shared the early results of the assessment and the ways in which the assessment could be a tool to better to prepare medical students for medication safety. Dr. Rajasekaran concluded the session by sharing his experience in designing a four-year longitudinal curriculum on medication safety. He also shared the preliminary results of

2014 EDU Honors



Dr. Herman Gottlieb



Dr. Senthil Kumar Rajasekaran



Dr. Abu Bakar Al-Medhi



Dr. Mark Hernandez

EDU members were honored for their dedicated service at the division’s executive committee meeting.

the medication safety curriculum survey that was distributed to all the US medical students through the American Medical Student Association. During the open panel discussion and one-on-one interactions with faculty, there was a significant interest in exploring collaborative efforts in addressing this topic in UME.

The 2014 Teaching Institute, “Practical Technologies for Effective Teaching,” included four scientist-educators with talks focused on enhancing pharmacology education with various in-class and online technologies. Dr. Rodney Murray opened the institute by discussing the use of interactive teaching technologies in the classroom. He employed some of these technologies during the session, asking participants to use their smartphones or tablets to answer questions that appeared on the presentation screen. Answers were revealed on the presentation screen in real time. The second

presentation, by Dr. Danton O’Day, focused on using software programs that most educators already have, such as PowerPoint, to create easy-to-watch educational movies. He stressed the usefulness of these movies in other areas of biomedical science education and provided instructions to participants so they could begin to create their own educational movies following the session. Dr. A. Laurel Gorman presented a slightly different talk that focused on using games and gaming technology in the classroom. The fourth speaker, Dr. Robert Stephenson, focused on the development of learning modules, where some content is delivered in the face-to-face classroom and additional content, including reading materials, study guides, demonstrations, and quizzes, are delivered online, where the student can review the material at his or her own pace.

Merger of EDU and GREC Approved by ASPET Council

At the April 25, 2014 ASPET Council meeting, Council approved a proposal from the Division for Pharmacology Education (EDU) and the Graduate Research and Education Committee (GREC) to join forces, effective July 1, 2014. Congratulations to both! Discussion of a merger began in October 2013 when Carol Beck, EDU chair, and William Jackson and Kelly Karpa, GREC co-chairs, attended the ASPET Council Strategic Planning Retreat to consider strategies to enhance ASPET’s impact on pharmacology education. Jim Bernstein, ASPET director of Government and Public Affairs; Rick Neubig, ASPET president; Sandi Welch, ASPET secretary/treasurer; and

Brian Cox, EDU-Council liaison also participated in the brainstorming sessions. Analyses of the work of each group revealed significant overlap in purpose and activities. The group designed a mission statement for a merged group. The retreat was followed by multiple conference calls, emails, and draft merger proposals. The news and plans were shared with EDU and GREC at EB 2014. Members of the GREC Executive Committee will be offered the opportunity to join the EDU Executive Committee. The merged Division for Pharmacology Education wants to support pharmacology training and include healthcare education at all levels.

Division for Toxicology

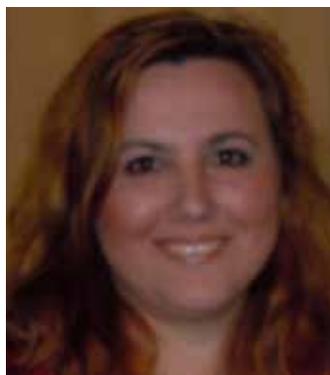
EB 2014 in Review

TOX Program Synopses

The Division of Toxicology (TOX) cosponsored a joint symposium at EB 2014. Based on the number of attendees (~160), one would have to conclude that this symposium was of broad interest to ASPET members and likely members from other societies attending EB. The four senior speakers and two student speakers made wonderful presentations that were diverse and covered the spectrum oxidative stress pathways. There were talks on evaluation of therapeutic potential in animal models as well as talks focused on chemistry and biochemistry. It could be argued that the presentation on small molecule chelators by Dr. Kayla Green (Texas Christian Univ.) generated the most interest. Dr. Green was exactly the kind of presenter this type of symposium by ASPET needed. She is a chemist and not an ASPET member, so inviting her to this meeting has encouraged her to join the society. At the very least she will be talking about her experience to students, who will hopefully now consider pharmacology and toxicology for graduate training. At least several attendees spoke with her after her presentation to begin the process of developing collaboration, and she conveyed to the organizers how pleased she was

with reception she received. Overall, the symposium achieved its goal by presenting talks that covered mechanism and application. There seemed to be something of interest for everyone in attendance.

2014 TOX Best Abstract Winners Graduate Students



1st place winner
Marina Popovska-Gorevski,
*UB Department of
Pharmacology and Toxicology*

Postdoctoral Fellows



1st place winner
Yanlong Liu
Univ. of Louisville



2nd place winner
Jessica Morgan
*St. Jude Children's
Research Hospital*



3rd place winner
Sudip Banerjee
*Univ. of Arkansas for
Medical Sciences*

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



Help ASPET stay strong by recruiting your fellow colleagues, students, and friends!



A growing ASPET means greater recognition for the field of pharmacology, more resources and support for our members, and a louder voice with policy makers.

Tell them to apply online at www.aspet.org

27th Great Lakes Chapter ASPET Annual Meeting *Stem cells: Current and future use in pharmacology*

Friday, June 13, 2014

Rosalind Franklin University of Medicine and Science
North Chicago, IL



Duncan Stewart, MD, FRCP

Keynote Speaker: Duncan Stewart, MD, FRCP
CEO & Scientific Director, Ottawa Hospital Research Institute,
University of Ottawa

Other Invited Speakers Include:

Brenda Russell
University of Illinois at Chicago

Eric Lagasse
University of Pittsburgh

Daniel A. Peterson
Rosalind Franklin University of Medicine & Science

The Annual Meeting will also include a career workshop, a poster session, and the annual graduate student and postdoctoral research competition. Postdoctoral fellows and junior scientists will give a presentation addressing the theme "Stem cells: Current and future use in pharmacology" in a mini-symposium.



Meetings & Congresses

June 2014

Drug Metabolism Disc. Group: Methods for Bioanalysis & Metabolism

www.dmdg.org/events

June 2014, Loughborough, UK

FASEB Sci. Res. Confs.: Phospholipid Cell Signaling & Metabolism in Inflammation & Cancer

secure.faseb.org/FASEB/meetings/summrconf/selecttopic.aspx

June 1–6, Niagara Falls, NY

FASEB Sci. Res. Confs.: Retinoids

secure.faseb.org/FASEB/meetings/summrconf/selecttopic.aspx

June 1–6, Chicago, IL

FASEB Sci. Res. Confs.: Trace Elements in Biology & Med.

secure.faseb.org/FASEB/meetings/summrconf/selecttopic.aspx

June 1–6, Steamboat Springs, CO

Phospholipid Cell Signaling & Metabolism in Inflammation & Cancer

www.aeplan.co.jp/h2s2014/

June 4–6, Kyoto, Japan

Frontiers in Metallobiochemistry III symposium.psu.edu/

June 4–7, University Park, PA

FASEB Sci. Res. Confs.: G Protein-coupled Receptor Kinases: From Molecules to Diseases

secure.faseb.org/FASEB/meetings/summrconf/selecttopic.aspx

June 8–13, Steamboat Springs, CO

Intl. Behavioral Neurosci. Soc. Ann. Mtg.

www.ibnsconnect.org/event/id/345988/Ann.-Meeting-2014.htm

June 10–15, Las Vegas, NV

Amer. Diabetes Assn. 74th Sci. Sessions

professional.diabetes.org/Congress_Display.aspx?TYP=9&CID=93229

June 13–17, San Francisco, CA

NY-Presbyterian/Columbia Dept. of Surgery Continuing Med. Edu. Mtg.

www.columbiasurgery.org/cme/event_lung_cancer_20140613.html

June 13, New York, NY

76th Annual Meeting of College on the Problems of Drug Dependence

<http://www.cpdd.vcu.edu>

June 14–19, San Juan, Puerto Rico

International Study Group Investigating Drugs as Reinforcers (ISGIDAR) Meeting

http://www.cpdd.vcu.edu/Pages/Links/Links_PDFs/CPDD2014MeetBrochure.pdf

June 14, San Juan, Puerto Rico

DIA 2014 50th Ann. Mtg.

www.diahome.org/en-US/Flagship-Meetings/DIA2014.aspx

June 15–19, San Diego, CA

FASEB Sci. Res. Confs.: Immunoreceptors

secure.faseb.org/FASEB/meetings/summrconf/selecttopic.aspx

June 15–20, Steamboat Springs, CO

Intl. Soc. for Stem Cell Res. 12th Ann. Mtg.

www.isscr.org/home/2014Ann.meeting

June 18–21, Vancouver, BC, Canada

11th ISOPT Clinical Symp. on Ocular Pharmacology & Therapeutics

isopt.net/

June 19–22, Reykjavik, Iceland

16th Intl. Cong. of Endocrinology/ ENDO 2014

www.endocrine.org/endo-2014

June 21–24, Chicago, IL

4th Intl. Regional (North America) Stress & Behavior Conf.

stressandbehavior.com/Years/2014/NOLA/nola2014.html

June 22–24, New Orleans, LA

2014 Worldwide Innovative Networking Symp.

www.winconsortium.org/symposium.jsp?id=400

June 22–24, Paris, France

FASEB Sci. Res. Confs.: Genome Engineering: Cutting-Edge Res. & Application

secure.faseb.org/FASEB/meetings/summrconf/selecttopic.aspx

June 22–27, Nassau, The Bahamas

6th Intl. Oxford Molpharm Workshop

www.oxfordbonepharm.org/

June 28–July 2, Oxford, UK

Physiological Soc.

www.physoc.org/physiology2014/

June 30–July 2, London, England, UK

July 2014

Cong. of the Intl. Union of Microbiological Socs. 2014

www.montrealiums2014.org/

July 27–Aug. 1, Montreal, Quebec, Canada

9th Fed. of Europ. Neurosci. Socs. Forum of Neurosci.

fens2014.neurosciences.asso.fr/

July 5–9, Milan, Italy

FASEB Sci. Res. Confs.: Biological Methylation: Reg. of Chromatin, Epigenetics, & Disease

secure.faseb.org/FASEB/meetings/summrconf/selecttopic.aspx

July 6–11, Nassau, The Bahamas

FASEB Sci. Res. Confs.: Liver Biology: Fundamental Mechanisms & Translational Applications

secure.faseb.org/FASEB/meetings/summrconf/selecttopic.aspx

July 6–11, Keystone, CO

28th Intl. Cong. of Appl. Psychology

www.icap2014.com/

July 8–13, Paris, France

41st Ann. Mtg. & Expo. of the Controlled Release Soc.

www.controlledreleasesociety.org/meetings/Ann./Pages/default.aspx

July 13–16, Chicago, IL

17th World Cong. of Basic & Clin. Pharmacology

www.wcp2014.org/

July 13–18, Cape Town, South Africa

FASEB Sci. Res. Confs.: Translational Neuroimmunology: From Mechanisms to Therapeutics

secure.faseb.org/FASEB/meetings/summrconf/selecttopic.aspx

July 13–18, Big Sky, MT

2014 International Narcotics Research Conference
<http://www.inrcworld.org/2014/2014mtg.htm>
 July 13–18, Montreal, Canada

Soc. for Develop. Biology 73rd Ann. Mtg.
www.sdbonline.org/2014MTG/2014OnlineFlyer.pdf
 July 16–17, Seattle, WA

14th Intl. Fragile X Conf.
www.fragilex.org/community/international-fragile-x-conference/
 July 16–20, Orange County, CA

9th Adrenoceptor/GPCR - James Black Conf.
www.bps.ac.uk/meetings/AdrenoceptorsGPCRs
 July 19–23, Kruger National Park, South Africa

Intl. Soc. for Eye Res. XXI Biennial Mtg.
www.iserbiennialmeeting.org/
 July 20–24, San Francisco, CA

FASEB Sci. Res. Confs.: Protein Kinases, Cellular Plasticity, & Signal Rewiring
secure.faseb.org/FASEB/meetings/summrconf/selecttopic.aspx
 July 20–25, Snowmass, CO

FASEB Sci. Res. Confs.: Protein Phosphatases
secure.faseb.org/FASEB/meetings/summrconf/selecttopic.aspx
 July 20–25, Nassau, The Bahamas

Intl. Conf. & Exhibition on Cosmetology & Cosmetics
cosmetology2014.conferenceseries.net/
 July 21–23, Las Vegas, NV

Selye Intl. Inst. for Advanced Studies & IUPHAR GI Sec. Stress Edu. Mtg.
www.stresseducation.org/
 July 21–25, Zagreb, Croatia

Intl. Pediatric Endosurgery Group 23rd Ann. Cong. for Endosurgery in Children
www.ipeg.org/meeting/
 July 22–26, Edinburgh, Scotland, UK

Intl. Acad. of Cardiology Ann. Sci. Sessions 2014/19th World Cong. of Heart Disease
www.cardiologyonline.com/wchd2014/index.html
 July 25–28, Boston, MA

AACR/ASCO Methods in Clin. Cancer Res.
www.aacr.org/home/scientists/meetings--workshops/meetings--workshops-calendar.aspx
 July 26–Aug. 1, Vail, CO

28th Symp. of the Protein Soc.
www.proteinsociety.org/symposium/
 July 27–30, San Diego, CA

FASEB Sci. Res. Confs.: Lipids & Lipid Regulated Kinases in Cancer
secure.faseb.org/FASEB/meetings/summrconf/selecttopic.aspx
 July 28–Aug. 1, Steamboat Springs, CO

August 2014

Amer. Psychological Assn. Ann. Conv.
www.apa.org/convention/
 Aug. 7–10, Washington, DC

Clin. Project Mngmnt.
www.diahome.org/en-US/Meetings-and-Training/Find-Meetings-and-Training/Meeting-Details.aspx?productID=2904811
 Aug. 18–19, Boston, MA

EMBO Conf. Series: Chem. Biol. 2014
www.embl.de/training/events/2014/CHB14-01/
 Aug. 20–23, Heidelberg, Germany

9th World Cong. on Alternatives & Animal Use in the Life Sci.
www.wc9prague.org/
 Aug. 24–28, Prague, Czech Republic

September 2014

66th Clin. Endocrinology Update
www.endocrine.org/meetings/clinical-endocrinology-update-and-board-review/san-francisco
 Sept. 4–6, San Francisco, CA

Eurotox: 50th Cong. of the Europ. Socs. of Toxicol.
www.eurotox2014.com/
 Sept. 7–10, Edinburgh, UK

11th Intl. Symp. on Resistance Arteries
www.isra2014.org/
 Sept. 7–11, Banff, Canada

4th Intl. Conf. on Pharmaceutical Regulatory Affairs
regulatoryaffairs2014.pharmaceuticalconferences.com/
 Sept. 8–10, Raleigh, NC

5th Intl. Cong. on Cell Membranes & Oxidative Stress: Focus on Calcium Signaling & TRP Channels
www.cmos.org.tr/2014/
 Sept. 9–12, Isparta, Turkey

37th Ann. Mtg. of the Japan Neurosci. Soc.
www.neuroscience2014.jp/en/information/index.html
 Sept. 11–13, Yokohama, Japan

Amer. College of Clin. Pharmacology Ann. Mtg.
www.accp1.org/2013_meetings_welcome.shtml
 Sept. 14–16, Atlanta, GA

5th RSC / SCI Symp. on GPCRs in Medicinal Chemistry
www.rsc.org/ConferencesAndEvents/conference/alldetails.cfm?evid=115797
 Sept. 15–17, Basel, Switzerland

ACORD–Australia & Asia Pacific Clinical Oncology Res. Dev. Workshop
www.acord.org.au/downloads/ACORD_2014_FLYER.pdf
 Sept. 14–20, Queensland, Australia

14th Intl. Cong. of Ethnopharmacology
14ise-slf.atalca.cl/
 Sept. 23–26, Puerto Varas, Chile

Soc. for Women's Health Res. X Conf.: What A Difference an X Makes
www.womenshealthresearch.org/site/PageServer?pagename=2014XconferenceDC
 Sept. 23, Washington, DC

8th Intl. Symp on Cell/Tissue Injury & Cytoprotection/Organoprotection
www.congressline.hu/isctico2014/
 Sept. 24–26, Budapest, Hungary

7th Santorini Conf. Biologie Prospective
www.santorini2014.org/santorini_accueil.php
 Sept. 25–27, Thira, Santorini, Greece

13th Ann. Intl. Conf. on Frontiers in Cancer Prevention Res.
www.aacr.org/home/scientists/meetings--workshops/meetings--workshops-calendar.aspx
 Sept. 28–Oct. 1, New Orleans, LA

12th Ann. Intl. Conf. on Neuroprotective Agents
www.neuroprotective.org
 Sept. 28–Oct. 1, Charlottesville, VA

FASEB Sci. Res. Confs.: AMPK: Biological Action & Therapeutic Perspectives
secure.faseb.org/FASEB/meetings/summrconf/selecttopic.aspx
 Sept. 28–Oct. 3, Lucca, Italy

October 2014

APS Intersociety Mtg.: Comparative Approaches to Grand Challenges in Physiology

www.the-aps.org/mm/Conferences/APS-Conferences/2014-Conferences/Comparative

Oct. 5–8, San Diego, CA

2014 SACNAS Nat. Conf.

sacnas.org/events/national-conf

Oct. 15–19, Las Vegas, NV

27th ECNP Cong.

www.ecnp-congress.eu/

Oct. 18–21, Berlin, Germany

Soc. for Women's Health Res. X Conf.: What A Difference an X Makes

www.womenshealthresearch.org/site/PageServer?pagename=2014XconferenceDC

Oct. 17, Atlanta, GA

2014 Amer. Soc. of Human Genetics Ann. Mtg.

www.ashg.org/2014meeting/

Oct. 18–22, San Diego, CA

14th Ann. Mtg. of Safety Pharmacology Soc.

www.safetypharmacology.org/

Oct. 19–22, Washington, DC

19th North Amer. ISSX Mtg./29th JSSX Mtg.

www.issx.org/?page=Upcoming

Oct. 19–23, San Francisco, CA

2014 Soc. of Forensic Toxicologists Ann. Mtg.

www.soft-tox.org/future_SOFT_meetings

Oct. 19–24, Grand Rapids, MI

5th European Workshop on Lipid Mediators

workshop-lipid.eu/

Oct. 23–24, Istanbul, Turkey

2014 Intl. Psychogeriatric Assn. Mtg.

www.ipa-online.org/ipaonlinev4/main/meetings/meetings_education.html

Oct. 23–26, Beijing, China

Translational Cancer Res. for Basic Scientists Workshop

www.aacr.org/home/scientists/meetings--workshops/meetings--workshops-calendar.aspx

Oct. 26–31, Boston, MA

Intl. Conf. & Exhibition on Biowaivers & Biosimilars

www.pharmaceuticalconferences.com/biowaivers-biosimilars-2014/

Oct. 27–29, Hyderabad, India

Intl. Conf. & Exhibition on Pharmacovigilance & Clinical Trials

www.pharmaceuticalconferences.com/pharmacovigilance-clinical-trials-2014/

Oct. 27–29, 2014 Hyderabad, India

November 2014

2014 Ann. Mtg. of Amer. Assn. of Pharmaceutical Scientists

www.aaps.org/

Nov. 2–6, San Diego, CA

2014 HIV Drug Therapy Conf.

www.hivglasgow.org/

Nov. 2–6, Glasgow, UK

Amer. Soc. of Nephrology: Kidney Week 2014

www.asn-online.org/education/kidneyweek/archives/future.aspx

Nov. 11–16, Philadelphia, PA

5th Ann. Mtg. of Soc. for Social Neuroscience

s4sn.org/2014-annual-meeting-washington-dc/

Nov. 13–14, Washington, DC

24th Neuropharmacology Conf. - Elsevier

www.neuropharmacology-conference.elsevier.com/

Nov. 13–14, Arlington, VA

62nd Ame. Soc. of Cytopathology Ann. Scientific Mtg.

cytopathologymeeting.org/2014/future-meeting-dates-2/

Nov. 14–17, Dallas, TX

Neuroscience 2014

www.sfn.org/annual-meeting/neuroscience-2014

Nov. 15–19, Washington, DC

EORTC-NCI-AACR Intl. Symp. on Molecular Targets & Cancer Therapeutics

www.aacr.org/home/scientists/meetings--workshops/meetings--workshops-calendar.aspx

Nov. 18–21, Barcelona, Spain

December 2014

3rd Intl. Conf. on Obesity & Weight Management

obesity2014.conferenceseries.net/

Dec. 1–3, San Francisco, CA

Amer. Assn. for Cancer Res. Mtg. on Tumor Immunology & Immunotherapy

www.aacr.org/home/scientists/meetings--workshops/meetings--workshops-calendar.aspx

Dec. 1–4, Orlando, FL

2nd World Cong. on Clinical Lipidology

clinical-lipidology.com/

Dec. 5–7, Vienna, Austria

2014 Amer. Soc. for Cell Biology Mtg.

www.ascb.org/index.php?option=com_content&view=article&id=596&Itemid=9

Dec. 6–10, Philadelphia, PA

53rd Ann. Mtg. of Amer. Coll. of Neuropsychopharmacology

www.acnp.org/annualmeeting/dates.aspx

Dec. 7–11, Phoenix, AZ

San Antonio Breast Cancer Symp.

www.sabcs.org/

Dec. 9–13, San Antonio, TX

2014 British Pharmacological Soc. Mtg.

www.bps.ac.uk/meetings/Pharmacology2014

Dec. 16–18, London, England, UK