American Society of Pharmacognosy

Fall 2022

Discovering Nature's Molecular Potential

ASP Newsletter: Fall 2022, Volume 58, Issue 3

ASP President Wright Addresses Members

By Amy Wright, PhD

I am very honored to have been elected as the president of ASP. I hope that I can live up to your expectations.

At our recent annual meeting, we heard a huge amount of inspiring science. Thanks to the organizers and presenters for providing us with such an excellent program. A few of the highlights for me were that griffithsin is looking promising as a treatment to prevent viral infection, both for HIV and for SARS-CoV-2. I look forward to the day when I can take a dose of this marine natural product, hop on a plane and come to an ASP meeting with no worries of getting COVID-19 (or the next one that comes along). We saw advances in using multiomics to design and carry out carefully conducted clinical trials on well-defined botanical mixtures following distinct biological readouts; this is moving more botanicals towards clinical proof of efficacy.

Genes to Molecules has clearly arrived. We saw huge advances in informatics tools and platforms, large scale heterologous expression of natural products, identification of enzymes that can be used in green chemistry and many examples of multiomics studies tying genes to compounds to biological activities. We heard about advances in finding biosynthetic gene clusters for animal-derived compounds and in finding biosynthetic genes in organisms with very large genomes, like diatoms, and using these to study and maybe even control production of toxins in harmful algal blooms. We also heard how human microbiome-derived compounds can initiate and acerbate disease, but also ideas of how we can use this in treatment and prevention. These are just a few of the exciting things that were presented.

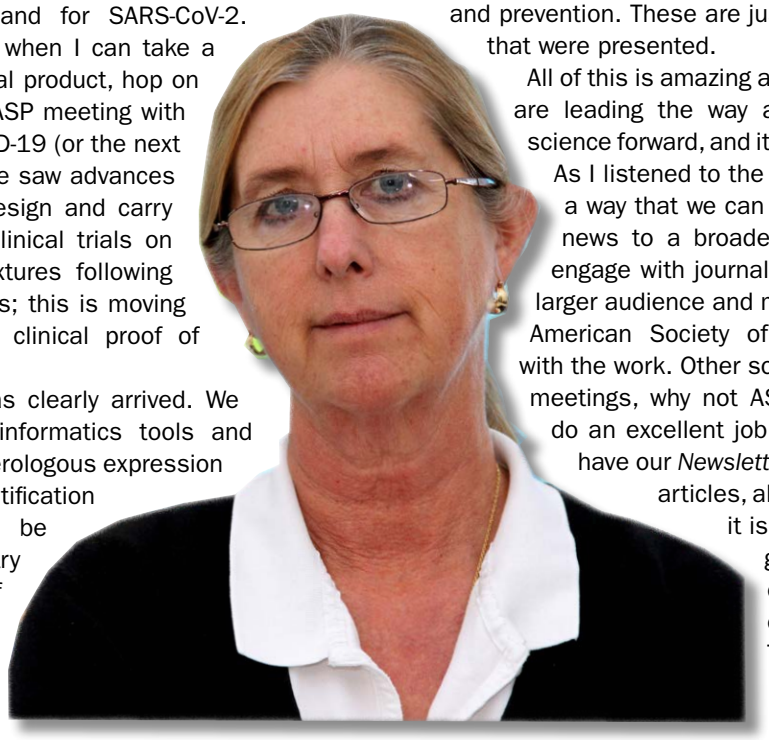

PHOTO: BRIAN COUSINS

All of this is amazing and GOOD news. Our members are leading the way and moving natural products science forward, and it is a field that can help people. As I listened to the talks, I wondered if there was a way that we can better convey all this positive news to a broader audience. Perhaps we can engage with journalists who can help us reach a larger audience and make sure they hear the name American Society of Pharmacognosy associated with the work. Other societies do this at their annual meetings, why not ASP? Many of our universities do an excellent job with press releases; and we have our *Newsletter,* our website and our AS(A)P articles, all of which are great, but I think it is important for us to share our good news and highlight the outstanding contributions that our community is making. The world needs more GOOD news. Our Corporate

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I would like to make increasing outreach and growing the ASP brand one goal of my presidency.

American Society of Pharmacognosy

Discovering Nature's Molecular Potential

***ASP Newsletter*: Fall 2022, Volume 58, Issue 3**

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Hung-wen (Ben) Liu

ASP Rockville, MD. 2023

Ray Cooper

Employment Service

The Society offers a placement service to aid our members in seeking positions or employees. This service is available only to ASP members and is free to both the applicant and the employer.
For more information see the services website.

www.pharmacognosy.us/jobs/

Newsletter Staff

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Spring: Feb. 15; Summer: May 15
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Editor's Corner

American Society of Pharmacognosy

By Edward J. Kennelly, PhD

This issue of the *ASP Newsletter* recaps many of the important events of the summer. The society welcomes new ASP President Amy Wright, who wrote the cover article for this issue. She discusses the many scientific highlights of the annual meeting and provides her vision for the future of the society. I was particularly interested in her ideas about communication of what we do as scientists and as a society with a broader group of people. I look forward to working with her and other ASP members as we look to ways to communicate our work more effectively.

Mark Hamann recaps the scientific successes of the 2022 ASP Annual Meeting that he chaired. We also cover some of the major 2022 awardees in this issue, including Farnsworth award recipient Professor Hung-wen (Ben) Liu and Tyler awardee Professor Djaja Djendoel (Doel) Soejarto (who will present his award lecture in 2023). Due to the pandemic, awardees for 2021 and 2022 were all invited to speak at the Charleston conference. The 2021 awardees (Dr. Brad Moore for the Farnsworth; Dr. John Cardellina II for the Tyler; and Dr. Jason Crawford for the Suffness) were profiled in recent past issues of the *Newsletter*. We will cover 2022 Suffness award winner, Laura Sanchez, in the next issue of the *Newsletter*. We congratulate all awardees and other speakers for presenting their work in person, after an almost three-year conference hiatus.

Despite all the planning that went into the Charleston meeting, a number of participants tested positive for COVID during the conference or shortly after returning home. President Wright summarized the results of the ASP COVID survey that was administered, and you can review them in her sidebar to the conference article. Although the sample size was limited, the number of reported cases was significant (84). President Wright has vowed to implement new health protocols for future ASP annual meetings. The 2022 organizing committee addresses the issue of COVID in their recap article as well and suggests some ways future meetings could be safer. Speaking as someone who was directly impacted by this issue in Charleston, I hope ASP can find ways that we can meet in an environment that is as healthy as feasible.

We are sad to report that long-time ASP member Dr. Ray Cooper passed away. I knew Ray well from his enthusiastic submissions to the *ASP Newsletter* on various topics, to our overlapping times working in Hong Kong and visiting each other there. Although I attended his 2014 Tyler award lecture, I did not fully appreciate the breath of this career until I read the lovely tribute by his colleagues Doel Soejarto and C.T. Che.

ASP's flagship publication, the *Journal of Natural Products*, continues to be an important force in the natural products community. The *Journal* has now reached its highest impact factor ever of 4.803. This is a reflection of the outstanding authors, including many ASP members, as well as the dedicated editing of Phil Proteau and his assistants. Congratulations to everyone involved in this landmark achievement. The *Journal* also announced its 2021 Schwarting and Beal awards for best publications.

I am writing this on Canadian Thanksgiving weekend, here on my sabbatical at Simon Fraser University in Vancouver with ASP colleague Roger Linington. As I reflect on all the things I am grateful for, they include the great colleagues and friends I have made from ASP and all the help they have provided me in my career. When I approached Roger about spending part of my sabbatical with him, I was touched by his enthusiastic positive response. I feel fortunate to have gotten to know him and so many other helpful ASP colleagues over the years. I hope you have a great autumn, wherever you are! ■

ASP President Wright Addresses Members

“Discovery is easy, but development is hard.” Dr. Craig Hopp from the National Center for Complementary and Integrative Health (NCCIH) gave a great talk outlining the funding opportunities at NCCIH and let us know that there is money for clinical development, including SBIRs and STTRS.

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Relations Committee recommended that we hire a marketing firm to help us with branding and communication to raise recognition and awareness of all the contributions that natural products researchers make. I would like to make increasing outreach and growing the ASP brand one goal of my presidency.

At the meeting we heard more than one person say “Discovery is easy, but development is hard.” Dr. Craig Hopp from the National Center for Complementary and Integrative Health (NCCIH) gave a great talk outlining the funding opportunities at NCCIH and let us know that there is money for clinical development, including SBIRs and STTRS. After I was elected as vice president, I was talking with Dr. Fred Valeriote from the Henry Ford Cancer Institute, and he suggested the idea of building a virtual pharma/biotech company that could help move our discoveries forward. Many of you have been brave enough to start your own companies, but for those of us who aren’t, maybe this is a way to tap into the STTR and SBIR grants to move our discoveries into development. I would guess that almost every lab has a favorite compound that you believe has clinical potential. Across our society we have many of the skills to conduct preclinical and clinical work, so perhaps, if we band together and collaborate using the huge brain trust available in the ASP, we can move more things forward towards development and bring new medicines to the clinic. I think we should at least talk about it.

The vice president of ASP is the chair of the Membership Committee, and, during my time as vice president, the committee discussed many things that could help bring our community together and add value to being a member. One of the ideas was to create a community bulletin board. Maybe you have a compound you would like to have tested in a specific type of assay, or maybe you need help getting a CD spectrum or you are stuck in MZmine and can’t find your way out. Perhaps you have a piece of equipment for sale or a student internship opportunity available or need a postdoc. You could post a message and see who responds. The more people who post, the more use it will be to our community. Some societies call these knowledge boards, and if people use them, they can be extremely helpful. We are going to try to make this a reality (hopefully, without sending tons of spam to your inbox).

Another thing we discussed to bring people together is to try some informal virtual “coffee breaks.” These would be short Zoom meetings where people bring a cup of coffee or a soda and join the meeting; we break into smaller groups and just talk with each other. My university holds science speed meet and greet events, and it has been both interesting and fun. This can be a non-threatening way to meet each other, encourage diverse participation and build friendships and collaborations. This in turn could lead to new grant ideas, help us build strong teams and go after larger PO1-type grants. For me, the key to success has always been through collaboration. As a postdoc, I was able to work with many of the top marine natural products chemists as part of SeaPharm, and I continued that through my career. Maybe we can help others have a similar experience.

One final thing we are working on is creating student chapters. Dr. Melany Puglisi-Weening is leading this effort along with student Maggie Hill from the University of Rhode Island. If you are interested in having a student chapter or finding out more, there is a link under membership on the ASP website. We are hoping to get this happening informally over the next year and more formally after that.

I am filling vacancies in our committees. It would be great to have some new faces, so please reach out to myself or Laura Stoll, our business manager, and I will see if we can find a committee for you to serve on.

One last topic is the recent meeting and COVID-19. We are taking this seriously and will be developing a plan for future meetings. Our past president Dr. Kerry McPhail has sent out a survey and has suggestions on what we can do differently in the future. I will make this a priority in the year to come.

In conclusion, I think we will have a busy year. I look forward to working with and for all of you. I thank you in advance for your help and support. A huge thank you to all our officers, committee members, volunteers and Business Manager Laura Stoll. Without all of you I would be lost. ■

The more people who post, the more use it will be to our community. Some societies call these knowledge boards, and if people use them, they can be extremely helpful.

2022 ASP Annual Meeting: Successes and Challenges

By the 2022 ASP Organizing Committee

The 2022 Organizing Committee of ASP would like to thank all of the 441 attendees for making the meeting an amazing success. The presentations and discussions were extremely enlightening, and the engagement of many young investigators brought an unprecedented level of energy. However, despite precautions, a number of attendees contracted COVID.

A century has elapsed since the roaring 1920s and the Broadway hit "Running Wild" popularized the dance craze called the "Charleston." It was a delight to see folks laughing, drinking, dancing, and partying in downtown Charleston during off-hours and highlights the energy and personality that this group generates. By day the meeting presenters covered a set of diverse and timely topics related to climate change, emerging infectious diseases and new technologies and discoveries, in addition to featuring presentations by many of our younger members.

The unique commitment to nurturing students and young investigators is hallmark of the ASP community, and the meeting left us with a renewed energy to address the challenges of the future. A series of pre-meeting workshops on Saturday provided informative presentations and training in proteomics, MS, NMR and computational approaches.

The meeting unwittingly also provided a forum for transmission of the BA.5 subvariant of the omicron strain. Despite a near 100% vaccination rate for participants and the extensive use of masks, the virus passed through the attendees at alarming rates. Future efforts to provide open-air and spacious environments during breaks and

TOP: **Ben Shen with 2022 Farnsworth awardee Ben Liu and 2021 awardee Brad Moore** PHOTO: AMY KELLER

CENTER: **Barbara Adaikpoh presented her results at the Young Investigators symposium with Ben Naman serving as chair.** PHOTO: MARK HAMANN

LOWER: **The ASP gavel was passed from past president Nick Oberlies to Kerry McPhail** PHOTO: AMY KELLER

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COVID-19 SURVEY RESULTS FROM THE ANNUAL MEETING

By Amy Wright, PhD

Thank you to all attendees of the 2022 ASP Annual Meeting (Charleston, SC, July 23-28) who took time to complete either the during-conference or post-conference Covid-19-related surveys. The information gathered from attendee responses is helpful to develop health-related protocols for future ASP conferences.

For the "During-conference survey":
95 (21.5%) out of 441 attendees responded.

Of those:

35.8% (34) reported a positive test result

56.8% (54) reported a negative test result

5.3% (5) reported that they did not test but had symptoms

2.1% (2) reported that they did not test and did not mention having symptoms

For the "Post-conference survey":
125 (28.3%) out of 441 attendees responded.

Of those:

60.8% (76) reported a positive test result

29.6% (37) reported a negative test result

6.4 % (8) reported that they were positive but had already responded to the first survey.

3.2% (4) responded but with only a comment (no indication of positive or negative test).

These data along with comments provided by those who responded to the survey will be utilized to develop hygiene and safety plans for future meetings.

social gatherings is clearly a must. Additionally, COVID testing of attendees seems like an essential addition to near future in-person meetings. It is noteworthy that the annual conference of the American Society for Mass Spectrometry (ASMS), held two months earlier in the twin cities, suffered from the same challenges: 34% of those who voluntarily completed a health survey tested positive for COVID within seven days after returning from the conference. This issue clearly needs to be addressed for the benefit for all conferences going forward. While we are fortunate that it does not appear anybody was seriously ill, the transmissibility of this virus requires thoughtful planning and more effective controls.

We would like to extend our very special thanks to Advion Interchim Scientific, Agilent, Anest Iwata, Aveda, Bruker, CAMAG, Crila Health, Corteva Agriscience, JEOL, Marine Drugs, NCCIH, PhytoLab, Proctor and Gamble, and Waters for their generous support which helped 70 students and young investigators attend and present at the meeting. We would also like to say a special thanks to those that traveled from abroad to participate in the meeting, realizing the herculean effort required for international travelers due to wars, strained international relations and COVID. After several years of Zoom meetings, it was enlightening to see people in person, allowing us to reconnect with colleagues, develop new relationships and enjoy the many sites Charleston had to offer. We hope you enjoyed the food, art galleries and historical sites as much as we did.

For those of you that did not attend the meeting, we are happy to announce that the meeting was recorded, and with permission of the presenters, each presentation will be available to ASP members on the ASP website for review; or if you attended and missed something, you will have the option to go back and review the data and presentation at any point in the future.

Despite the COVID issues, the meeting was truly intellectually stimulating and provided a rich and engaging opportunity to enjoy the local flavors, and we look forward to hosting the meeting again in this part of the country. The future role of natural products in human health, scientific developments and petroleum replacements provides an unprecedented foundation for optimism and enthusiasm for the role of natural products moving forward. This is clearly exemplified by the tremendous number of student attendees, unique presentations by venture capital and investment bankers as well as scientific leaders from outside of our field.

Finally, we would also like to congratulate the ASP award winners for their informative presentations and tireless commitment to our field, young investigators and improvements to global health. We look forward to seeing all of you at ASP 2023 in Rockville, Maryland and wish you a safe and productive year. ■

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2022 ASP Annual Meeting: Successes and Challenges

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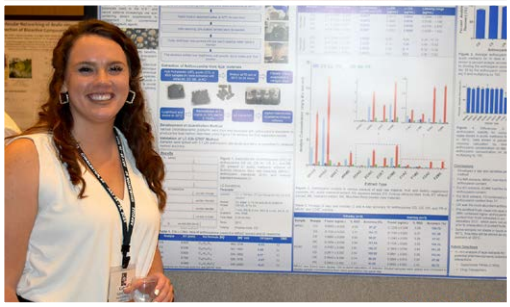
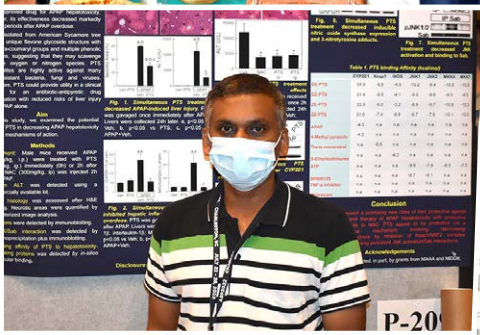
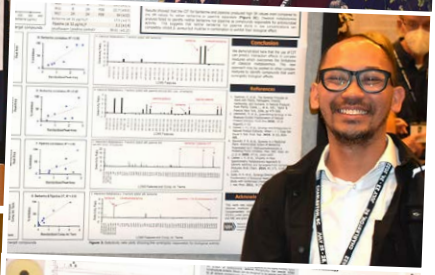
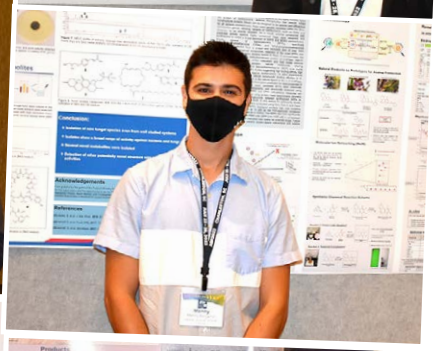
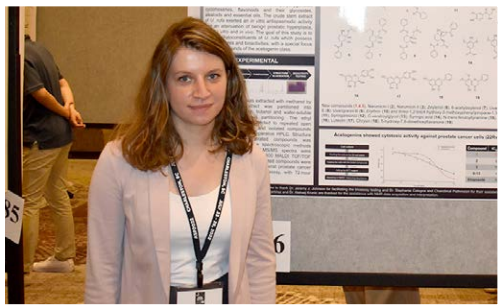
PHOTOS: MARK HAMANN

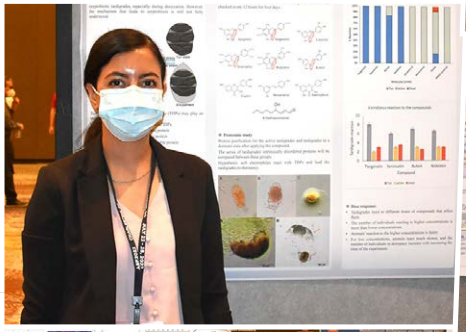


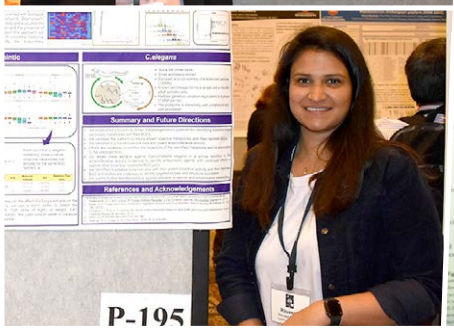












Hung-wen (Ben) Liu

Liu Receives 2022 Farnsworth Award

By Christian P. Whitman, PhD

Professor Hung-wen (Ben) Liu, the George H. Hitchings Regents Chair in Drug Design in the College of Pharmacy at the University of Texas at Austin, has received the 2022 Norman R. Farnsworth ASP Research Achievement Award. His award lecture was delivered at the 2022 ASP Annual Meeting in Charleston, South Carolina in July.

Liu's extensive scientific contributions over the past four decades have had a profound impact on the modern fields of both natural products biosynthesis and mechanistic enzymology. As ASP Past President Kerry McPhail stated, "The award to Dr. Liu of the 2022 Norman R. Farnsworth ASP Research Achievement Award recognizes his research accomplishments and creative contributions to natural product chemistry." Liu's work has focused on elucidating the pathways and catalytic principles that underlie the biosynthesis of numerous complex chemical structures in nature, and his contributions have helped to lay the foundation for a number of modern approaches to drug discovery and development. In addition, his work has illuminated many subtle, but general principles that govern enzyme catalysis.

Upon learning of the award, Liu responded, "I am flattered to be chosen this year as the recipient of the prestigious Farnsworth Award. I am truly grateful for the honor bestowed by the ASP. My special appreciation goes to my nominators, Professors K. H. Lee, David Cane and Craig Townsend, for their gracious support. I feel humble to follow in the footsteps of many great natural product scientists who received this award before me."

Liu earned his undergraduate degree in chemistry from Tunghai University in Taiwan. While his primary interest at that time was history, he was "arm-twisted" to select chemistry as his major due to his family's concerns about his job prospects after graduation with a history degree. Fortunately, he met a number of great chemistry professors, especially Dr. Lewis Fikes, who was a source of inspiration leading to a fascination with organic chemistry that has followed him throughout his career. More importantly, he also met his wonderful wife, Yung-nan, who was a biology major in Tunghai at the time. After two years of compulsory military service, Liu came to the United States to pursue his graduate studies.

He joined the laboratory of the late Professor Koji Nakanishi, the first awardee of the Farnsworth Award, at Columbia to study for his PhD As a graduate student, Liu worked on the isolation and structural characterization of bioactive compounds from East African medicinal plants. He was also involved in the development of a microanalytic method to determine the glycosidic linkages of natural products based on the exciton chirality principle using circular dichroism. Nakanishi played a significant role in introducing Liu to the interesting world of scientific research, instilling within him an appreciation for the elegance of biochemical processes and inspiring him to approach scientific questions with enthusiasm and rigor. Liu considered Nakanishi not only a mentor but a lifelong friend as well.

After receiving his PhD, Liu accepted a postdoctoral position with Professor Christopher Walsh, who was then at MIT. With Walsh, Liu studied the chemical mechanism of ACC deaminase, which is a pyridoxal 5'-phosphate (PLP) dependent enzyme that catalyzes opening of the cyclopropane ring of 1-aminocyclopropyl-1-carboxylate (ACC). This reaction competes with the conversion of ACC to ethylene, the biosynthesis of which formed another component of Liu's studies at MIT. The experiences in Walsh's laboratory stimulated Liu's interest in complicated biological systems, equipped him with the necessary tools for biochemical research and helped

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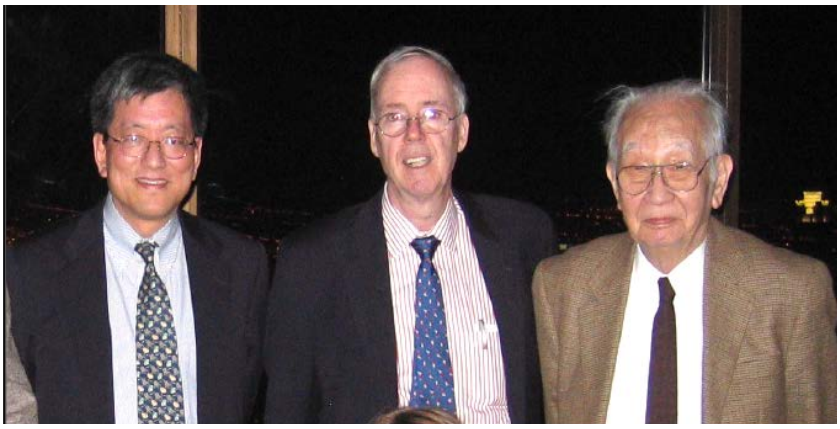
him develop his own professional identity. Walsh remains a lasting role model for Liu.

After completing his postdoctoral studies, Liu began his independent career as an assistant professor at the University of Minnesota in 1984. He asked a simple question, "How are dideoxyhexoses constructed in nature?" At the time, very few researchers were interested in this puzzle. The enzymes could only be isolated in very small quantities, and they were difficult to handle to the point that working with them was often intractable. Moreover, the topic also seemed to be more of a scientific curiosity with little practical use. However, Liu was one of the first to realize the potential of molecular biology and the role it would eventually play in the field of chemistry as a whole. Thus, he was one of a small but growing new generation of chemists who would go on to fully exploit the coupling of molecular biology and organic synthesis with the classical approaches to biochemistry and enzymology.



Ben Liu with Koji Nakanishi (far right) and Christopher Walsh (middle), taken at the 2007 American Chemical Society fall meeting in Chicago when Liu received the Nakanishi Prize.

Consequently, Liu and his team succeeded in cloning six of the genes required for the biosynthesis of ascarylose, a 3,6-dideoxyhexose produced by *Yersinia*. With sufficient enzyme in hand, Liu's laboratory utilized organic synthesis to develop targeted experimental assays to uncover the catalytic mechanisms of these enzymes. These accomplishments ushered in an exciting era of mechanistic study and discovery in the Liu laboratory, thereby establishing a paradigm for how one investigates not only the enzymes of deoxysugar biosynthesis but secondary metabolic enzymes in general. These studies also provided Liu with the framework for his eventual characterization of the biosynthetic pathways for a host of deoxysugars including paratose, tyvelose, yersiniose, colitose, digitoxose, mycarose, mycaminose, desosamine and forosamine.

Although it was not immediately obvious at the time, these studies would ultimately form an essential foundation on which the methods of glycodiversification in the biotechnology sector would later be built. As we have learned more about the biology of natural products decorated with deoxysugars, such as the clinically important antibiotic erythromycin, we have discovered that the sugar moieties are essential to their biological activity. Moreover, different sugar moieties can impart different pharmacological profiles in response to the type, position and number of sugars on the core, undecorated structure. Thus, with the emergence of antibiotic-resistant bacteria, Liu's work on the biosynthesis of these sugars has taken on far greater importance. There is now much interest in generating new macrolide antibiotics via their glycodiversification. thereby introducing new sugar moieties not found in nature in order to overcome the problems of resistance.

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Thus, he was one of a small but growing new generation of chemists who would go on to fully exploit the coupling of molecular biology and organic synthesis with the classical approaches to biochemistry and enzymology.

Liu Receives 2022 Farnsworth Award

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Recognizing this, Liu has concentrated a significant component of his efforts on the mechanisms of the glycosyltransferases, which are used to attach sugars to core molecular scaffolds such as polyketides. His work in this area was paradigm-shifting because it changed how everyone was thinking about using glycosyltransferases in the combinatorial biosynthesis of polyketide antibiotics. Liu demonstrated that some of the glycosyltransferases required a second subunit that everyone else in the field had simply overlooked, and his laboratory was thus the first to demonstrate enzyme-catalyzed glycosylation of a macrolide with an amino sugar *in vitro*. He also discovered that some polyketide glycosyltransferases are quite flexible accommodating significant structural variations in both the sugar and scaffold substrates. These findings opened the door for more extensive engineering of biosynthetic pathways both *in vivo* and *in vitro* in order to generate new antibiotics. His work moved the whole field forward and opened a new arena, allowing the manipulation of biosynthetic machineries to engineer novel glycosylated compounds. Thus, Liu's work has raised natural products research to a new level, and his group is widely recognized as the laboratory responsible for our current understanding of atypical sugar biosynthesis.

In the course of these studies, Liu made four discoveries in the enzymology of deoxysugar biosynthesis that really stand out. First, he demonstrated for the first time that a multienzyme electron transfer pathway and free radical chemistry underlie C-3 deoxygenation. Second, he was the first to show that coenzyme B_6, previously known only to play a role in enzyme catalyzed group transfer reactions, can directly participate in the stabilization of radical intermediates. Third, he established the mechanism of C-2 deoxygenation during the biosynthesis of L-mycarose, a 2,6-deoxysugar, and forosamine, a 3-dimethylamino-2,3,4,6-tetradeoxysugar, and showed that it is distinctly different from other routes of deoxygenation. Finally, he discovered that C-4 deoxygenation depends on *S*-adenosylmethionine (SAM) and proceeds via a complex radical mediated process following the reductive homolysis of SAM by an active site iron-sulfur cluster. The details of the mechanism are still emerging and quite fascinating. This work collectively established the position-specific mechanisms of hexose deoxygenation, thereby showcasing the natural diversity of biological C-O bond cleavage events.

Work in the Liu Lab, however, has by no means been limited to deoxysugar biosynthesis. Liu is also an expert on radical mechanisms of enzyme catalysis. Notable examples of his work include the non-heme, mononuclear, iron-dependent enzyme (*S*)-2-hydroxypropylphosphonate epoxidase (HppE), which catalyzes a unique mode of epoxidation during the biosynthesis of fosfomycin, and the radical SAM enzyme (DesII), which catalyzes an unusual deamination reaction in the biosynthesis of desosamine. More recently, his group has pioneered the study of radical-SAM enzymes that are also dependent on cobalamin. These highly unusual enzymes catalyze a diverse array of reactions at unactivated carbon centers in the biosynthesis of secondary metabolites, such as aminocoumarin antibiotics, aminoglycosides and ladderane lipids. Despite challenges in studying this group of enzymes, Liu's laboratory has made notable progress in characterizing the methyltransferase GenK from gentamicin biosynthesis as well as OxsB, which

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Members of the Liu group: photo taken in the summer of 2022 at the University of Texas.

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catalyzes a highly unusual oxidative ring contraction during oxetanocin biosynthesis. These studies have provided critical and formative insights into how highly reactive radical intermediates are controlled within enzyme active sites.

Liu's interest in radical chemistry also led him to study the role of flavins in the isomerization of both sugars and the isoprenoid building blocks of terpenes. Paradoxically, however, these studies instead led to the discovery of a previously unrecognized role for flavin as an acid-base catalyst. Since then, acid-base catalysis by flavins has been implicated in several other biosynthetic reactions including proton-initiated cyclization of isoprenoid compounds. Other contributions to the fields of mechanistic enzymology include elucidation of the mechanisms of aziridine ring formation, as in the case of azicemicin, as well as the mechanisms of sulfur incorporation into the thiosugar moieties of the angucycline antibiotic BE-7585A. However, one of his most noteworthy discoveries includes the first description of a dedicated [4+2]-carbocyclase during the biosynthesis of the insecticide spinosyn A. For well over four decades, there had been a worldwide quest to find an enzyme that catalyzes a biological Diels-Alder reaction. However, these efforts were frequently thwarted by the observation that most of the prospective enzymes instead catalyze a preceding activation step rather than the cyclization itself. In a highly cited *Nature* paper that has gone on to become a landmark in the field, Liu showed that SpnF is a dedicated cyclase that accelerates a formal electrocyclization reaction by 500-fold. These studies also led to the discovery of an enzyme that catalyzes the first known example of the Rauhut-Currier reaction, a vinylogous variant of the more common Morita-Baylis-Hillman reaction, which is another important reaction in the organic chemist's toolbox.

His list of research accomplishments has earned him international acclaim, numerous invited lectures and awards from around the world. The quality, importance and impact of his research are attested to by over 300 papers, many of which have appeared prominently in the *Journal of the American Chemical Society, Angewandte Chemie*, the *Proceedings of the National Academy of Sciences USA, Science* and *Nature*. He is a recipient of the Horace S. Isbell Award and the Claude S. Hudson Award from the Division of Carbohydrate Chemistry of the American Chemical Society, the Nakanishi Prize from the Division of Organic Chemistry of the American Chemical Society and the Repligen Award from the Division of Biological Chemistry of the American Chemical Society. He was recently awarded the Arthur C. Cope Late Career Scholar Award from the American Chemical Society as well as the A. I. Scott Medal.

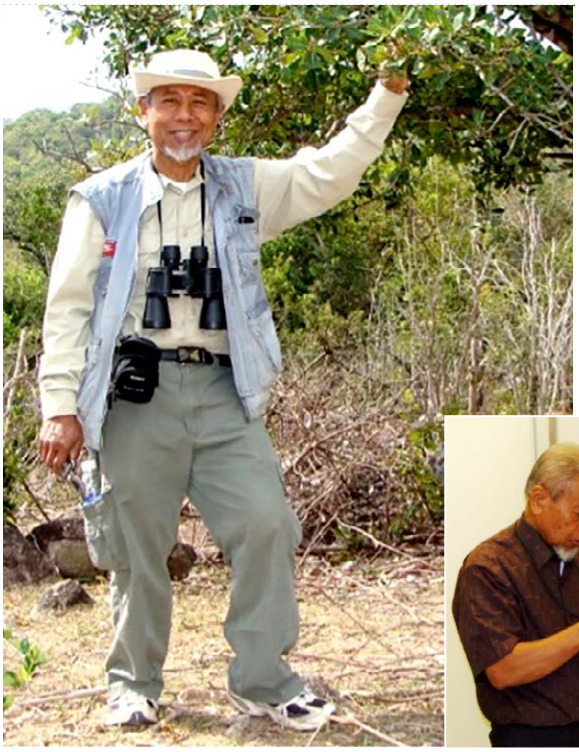
Liu's impact on the field of natural product chemistry goes beyond his scientific accomplishments. His laboratory has been a prolific training ground for future scientists with nearly 120 junior researchers working with him over the years, many of whom have since gone on to successful careers of their own in academia and industry. These students share his passion for chemistry and for carrying out rigorous, competitive research. In addition, he serves on the editorial boards of many journals and was an associate editor of *Organic Letters*, where he handled most of the manuscripts dealing with natural product chemistry. Finally, Liu was one of the two editors-in-chief of the multivolume series, *Comprehensive Natural Products II: Chemistry and Biology*, published in 2010 and again in 2020. In this capacity, he played a critical role in promoting research at the interface of chemistry and biology. Liu's long history of scientific contributions serves as inspiration for other investigators in the field and will continue to have impact long into the future.

Professor Craig Townsend, the A.H. Corwin Professor of Chemistry at Johns Hopkins University, eloquently summed up how he and all of Liu's colleagues feel about him. Townsend said, "I have the highest regard for him as a scientist, which is matched in equal measure by my respect for him as a person. He is a model of professional and personal correctness and integrity. Results are not hyped or over claimed, and they come from experiments that are beautiful in conception and execution. The science speaks for itself. Liu has an impressive and meritorious record of accomplishment and service that exemplifies the attributes honored by this award, and he richly deserves it." ■

Liu's impact on the field of natural product chemistry goes beyond his scientific accomplishments. His laboratory has been a prolific training ground for future scientists with nearly 120 junior researchers working with him over the years, many of whom have since gone on to successful careers of their own in academia and industry.

Soejarto Named 2022 ASP Varro E. Tyler Award Winner

By A. Douglas Kinghorn, PhD



LEFT: Soejarto in the field at Niu Chua, Vietnam, 2011. PHOTO: TRAN NGOC NINH

RIGHT: Soejarto examining herbarium specimens at the Field Museum of Natural History, Chicago. PHOTO: BETHANY ELKINGTON

Dr. Djaja Djendoel (Doel) Soejarto, Emeritus Professor, College of Pharmacy, University of Illinois at Chicago (UIC), has been recognized with the 2022 ASP Varro E. Tyler Award for his decades of outstanding botanical excellence relevant to his plant taxonomic and drug discovery studies. He will give his award talk at the 2023 ASP annual meeting in Bethesda, Maryland.

ASP President Dr. Amy Wright wrote, "The Varro E. Tyler Prize is awarded to an individual who has made outstanding contributions to the field of botanical supplements, phytochemistry, pharmacognosy and pharmacology. Doel Soejarto's contributions to phytochemistry, drug discovery, ethnopharmacology and biodiversity conservation of medicinally valuable plants from around the world embodies the exceptional achievements envisioned by the Varro E. Tyler prize. Congratulations to Soejarto on being the 2022 recipient of this prestigious award!"

Born in Indonesia, Soejarto earned his MA degree (Biology/Botany) in 1965 and his PhD degree (Biology/Botany) in 1969 from Harvard University. He was a fellow of the Latin American Teaching Fellowships, Fletcher School of Law and Diplomacy, Tufts University, Medford, MA, in a mission assignment at the Department of Biology, University of Antioquia, Medellin, Colombia (1969-1972). He then joined this university, first as an assistant professor and then an associate professor in biology (1972-1976). In October 1969, he founded the Herbarium of the University of Antioquia (HUA), which is now the second largest herbarium institution in Colombia. Next, he was a postdoctoral fellow in ethnopharmacology at Harvard, working with the late Prof. Richard E. Schultes.

Soejarto joined the College of Pharmacy, UIC in 1979, where he was promoted to associate professor (1983-1989) and then full professor (1989-2015). He was involved in research on medicinal and other plants under a multidisciplinary setting led by the late Prof. Norm Farnsworth at UIC and travelled extensively in many countries (1979-2020) to collect plant material for research. He served as the principal investigator of a National Cancer Institute (NCI) plant exploration and collection contract (1986-2004) and also as the PI of a multinational, multidisciplinary International Cooperative Biodiversity Groups (ICBG) project of the Fogarty International Center, NIH (1998-2010). The research focus of this ICBG group was on drug discovery, biodiversity conservation, and economic development in Vietnam and Laos. With further grant funding from the California Community Foundation (2013-2014; 2019-2021), Soejarto carried out research on medicinal plants of Laos and on medicinal plant conservation in collaboration with his colleagues at UIC and in Laos (Ministry of Health, Vientiane).

Soejarto received the Senior University Scholar Award from UIC (1996-1999) and an honorary plaque from the Colombian Association of Botany in April 2006, for his contribution to "the development of botanical science in Colombia." He is a recipient of the Distinguished Economic Botanist Award from the Society for Economic Botany and the Norman Farnsworth Excellence in Botanical Research Award from the American Botanical Council, both in 2012. Soejarto served as the editor of the *Journal of Ethnopharmacology* from 1996 to 2004. Also, he has been a research associate and adjunct curator, and,

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Doel, together with the PIs from Missouri Botanical Garden and New York Botanical Garden, who collected plants for the NCI program from Africa and Central and South America, respectively, was instrumental in stressing the importance of protecting source country rights when carrying out their collections.

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since 2020, an adjunct curator in perpetuity in Science and Education at the Field Museum of Natural History, Chicago. He has authored and co-authored more than 200 peer-reviewed articles, with a focus on plant taxonomy, medicinal plant studies, plant-derived sweetening agents, drug discovery from plants, and conservation of medicinal plants, as well as 22 book chapters and 26 symposium proceedings articles.

Dr. Gordon Cragg, formerly chief of the Natural Products Branch, NCI, Frederick, MD comments, "It has been a pleasure and privilege to have been closely associated with Doel as a friend and colleague since 1986, when UIC was awarded a contract for the collection of terrestrial plants in Southeast Asia for the NCI program screening natural products, aimed at the discovery and development of novel anticancer and anti-HIV agents. Doel served as principal investigator (PI) and showed outstanding leadership, establishing collaborations with local botanists and botanical organizations in many S.E. Asian countries. The contract led to the collection and identification of literally thousands of plant samples, and these contributed to the establishment of the NCI Natural Products Prefractionated Library. Doel, together with the PIs from Missouri Botanical Garden and New York Botanical Garden, who collected plants for the NCI program from Africa and Central and South America, respectively, was instrumental in stressing the importance of protecting source country rights when carrying out their collections. This led to the formulation of the NCI Letter of Collection (LOC) in the late 1980s, guaranteeing equitable collaboration and benefit sharing between the NCI and source country organizations. Considerable credit goes to Doel and his colleagues for promoting these important collaborative agreements that served as models for agreements later promoted by the Rio Convention on Biodiversity (CBD). The above contributions, together with his outstanding record of research and his dedicated commitment to multidisciplinary collaboration in serving the natural products community, make him a most worthy recipient the 2022 Varro E. Tyler Prize of the ASP."

Soejarto's faculty colleague at the College of Pharmacy, UIC, Dr. Chun-Tao (CT) Che, Harry H.S. Fong Professor of Pharmacognosy, adds: "I met Doel when I arrived at UIC as a graduate student in 1977 and I took his botany courses. His devotion to teaching students was immediately evident, and he showed patience by explaining every detail of plant structure and classification. He placed much emphasis on the ethics of medicinal plant research, such as conservation and the sustainable use of biodiversity as well as the protection of intellectual property rights of indigenous peoples. In recent years, I have had the pleasure of collaborating with him and am always amazed by his determination to excel with an enormous energy and dedication. As a scientist, Doel always strives to do the very best and go the extra mile. It is a privilege for me to know him as my teacher, friend, and colleague."

Dr. Esperanza Carcache de Blanco, associate professor, College of Pharmacy, Ohio State University (OSU), adds further, "I met Doel Soejarto for the first time as a graduate student at UIC in 1995. My first impression as a student was that he was a highly dedicated faculty member. After graduation, I was able to collaborate with him in a foreign plant collection project, which was completed successfully largely due to his extreme patience in obtaining the necessary official permission. After I moved to OSU, we have continued collaborating as members of our P01 project team funded by NCI, NIH. He has always shown great energy and dedication so that he excels in all his different activities. It is an honor for me to have had Doel as a professor in my courses and then later as a collaborator in our joint research projects."

Doel Soejarto is an exceptional scholar who is a most eminent addition to the list of outstanding natural products scientists who have received the Tyler Award previously. It is a very great pleasure for me to write this article concerning this award to my long-term faculty colleague. I first started working with Doel in 1980, when we were awarded a NIDCR-NIH contract to study sweet-tasting plants, and more recently we have collaborated on phytochemical work to discover potential new anticancer agents from southeast Asian plants as part of an NCI-NIH-funded program project. For the many collaborative papers I have shared with Doel, my phytochemist associates and I always know that the botanical aspects are invariably impeccable. I consider myself extremely fortunate that the late Norm Farnsworth introduced me to Doel all those years ago. ■

Doel Soejarto is an exceptional scholar who is a most eminent addition to the list of outstanding natural products scientists who have received the Tyler Prize previously.

ASP Award Winners

Norman R. Farnsworth Research Achievement Award

Bradley Moore
University of California at San Diego (2021)
Hung-wen (Ben) Liu
University of Texas at Austin (2022)

Varro E. Tyler Prize

John H. Cardellina II
ReevesGroup (2021)
Djaja Djendoel Soejarto
University of Illinois at Chicago (2022)

Matt Suffness Young Investigator Award

Jason Crawford
Yale University (2021)
Laura Sanchez
University of California, Santa Cruz (2022)

Undergraduate Research Award

Margaret Hill
University of Rhode Island
YanZhe Liu
University of California, San Diego

Research Starter Grant

Jie Li
University of South Carolina

Active Member Travel Grant

Barbara Adaikpoh
University of Illinois at Chicago
Jeffrey Rudolf
University of Florida
Nassifatou Koko Tittikpina
University of Lome (Togo)

D. John Faulkner Travel Award

Carla Menegatti
Virginia Tech

Student Research Award

Ethan Older
University of South Carolina

David Carew Student Travel Award

Richard Tehan
Oregon State University

Jerry McLaughlin Student Travel Award

Hannah Fernandez
University of Illinois at Chicago
Jared Wood
University of North Carolina at Greensboro

Lynn Brady Student Travel Award

Margaret Paige Banks
Virginia Tech
Márcio Barczyszyn Weiss
University of São Paulo
Sandra Bennett
University of North Carolina Wilmington
Ama Boamah
University of Utah
Susan Egbert
University of Manitoba
Kelli McDonald
Auburn University
Zarna Atul Raichura
Auburn University
Emma Stowell
University of Florida
Alex Taylor Swystun
University of North Carolina Wilmington
Kara Talbott
University of the Pacific

President's Travel Award

Sarah Barr
University of North Carolina Wilmington
Kabre Heck
Auburn University
Caitlin McCadden
University of Florida

Waqar Bhatti Student Travel Award

Erin Marshall
University of Florida

2022 Arthur E. Schwarting Award

Ma, Hongyan; Liang, Huiyun; Cai, Shengxin; O'Keefe, Barry R.; Mooberry, Susan L.; and **Cichewicz, Robert H.** An integrated strategy for the detection, dereplication, and identification of DNA-binding biomolecules from complex natural product mixtures. *J. Nat. Prod.* **2021**, *84* (3) 750-761.

2022 Jack L. Beal Award

Risinger, April L.; Hastings, Shayne D.; and Du, Lin.
Taccalonolide C-6 analogues, including paclitaxel hybrids, demonstrate improved microtubule polymerizing activities. *J. Nat. Prod.* **2021**, *84* (6) 1799-1805.

Fabulous Younger Members Casino Night Event

By C. Benjamin Naman, PhD and Karen M. VanderMolen, PhD

At the 2022 ASP Annual Meeting, there were games, prizes, food and drinks, but, most importantly, a diverse crowd of 175 ASP younger members (YMs) gathered together in-person at a casino night event for networking, forming new friendships and new collaborations.

An important part of the stellar success of this event came from the overwhelming interest of YMs this year which represented about 1/3 of all conference goers. "Compare this to the dozen people that attended the first YM event at the meeting in Oaxaca, Mexico in 2001," said ASP Past President Dr. Nicholas Oberlies, "and recognize just how far the Society has come in a relatively short time." The YM crowd truly highlighted the future strength of the field and the ASP, representing an array of human, scientific, and geographic diversities. Everyone looked and sounded like they were having a great time!

This event also provided YMs with lower pressure introductions to some current and past leaders in the field and the Society through the informal and enjoyable game night. The YM committee invited more experienced ASP members, further along in diverse career paths, to join the festivities and be dispersed throughout the event room, available for conversations at or away from gaming tables. All of them shared unique career perspectives and advice from the vantage points of their diverse positions in small and large academic institutions, start-up through multi-national scale industries, government agencies, and non-profit non-government organizations. All who shared their time and wisdom with the YMs at this event are sincerely thanked! Rumor has it that some of our YMs also managed to get job offers after talking to more-seasoned folks. Kudos!

Toward the closing of the casino night, with the largest YM crowd gathered to date, there was an announcement of commitment to the transition of power from outgoing YM committee co-chairs, Drs. Karen VanderMolen and Benjamin Naman, to incoming YM committee co-chairs, Drs. Joseph Egan and Skylar Carlson. Egan and Carlson have both been dedicated YM committee members, and we are excited to see where these up-and-coming leaders take the YM committee and its events in future years!

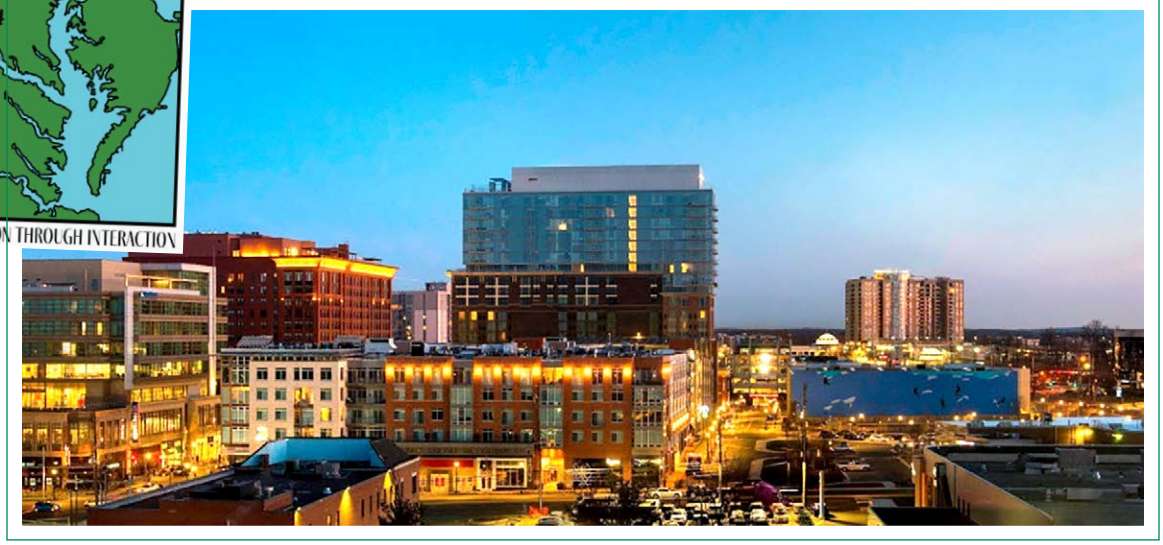
ASP member and former YM committee chair, Dr. Jackie Winter, is sincerely appreciated for previously arranging this inspirational event for the 2020 annual meeting. With everything canceled in 2020 and 2021, the idea lingered until we could reunite in July 2022. A primary factor in the smooth execution of the evening was Laura Stoll, ASP business manager, who found and helped manage a games and dealers' vendor. ■

TOP RIGHT: **Table games with YMs bringing people together.**

CENTER: **Outgoing and incoming ASP YM committee co-chairs, from left to right, Skylar Carlson, Karen VanderMolen, Joseph Egan, and Benjamin Naman.**

BELOW: **ASP Past President Barry O'Keefe shuffling a vintage 2006 deck of ASP past-presidents playing cards.**

2023 ASP Annual Meeting: Metro Washington, DC



By The 2023 ASP Local Organizing Committee

Mark your calendars for **July 22–26, 2023!**
That's when next year's ASP annual meeting will be held in the Washington, DC metro area.

The meeting logo illustrates the Chesapeake Bay area which includes the Rockville, MD location of the meeting as designated by the star. The Chesapeake Bay's ecosystem is a large estuary that impacts the health and safety of thousands of species of animals and plants, as well as the 18 million people who live in the Chesapeake Bay watershed. Thanks to Dr. Barry O'Keefe, NIH, and his connections for their help in designing and making the logo.

True to the spirit of Washington, DC, which houses government, academic/research institutes, non-profits, and trade associations, the theme for the meeting is:
Innovation through Interaction. Let us know what topics you want covered!
Besides the continuing themes, such as the Younger Members symposium and various awards symposia, some of the potential topics for the meeting include the following:

- Interactions between natural products groups
  - Molecular collaborations: natural product extracts
- International collaborations
- Bridging the gap: collaborations with predominantly undergraduate institutions
- New scientific partners: new technologies/disciplines getting into natural products
  - Digital solutions/AI/machine learning/benchtop qNMR
- Where chemistry and biology meet: chemical biology and NP
- Public/private partnerships
  - Botanical Safety Consortium
  - FDA talk – How can ASP science help the FDA? What botanical research is the FDA doing?
- Cross discipline collaborations
  - Old molecules/new purposes

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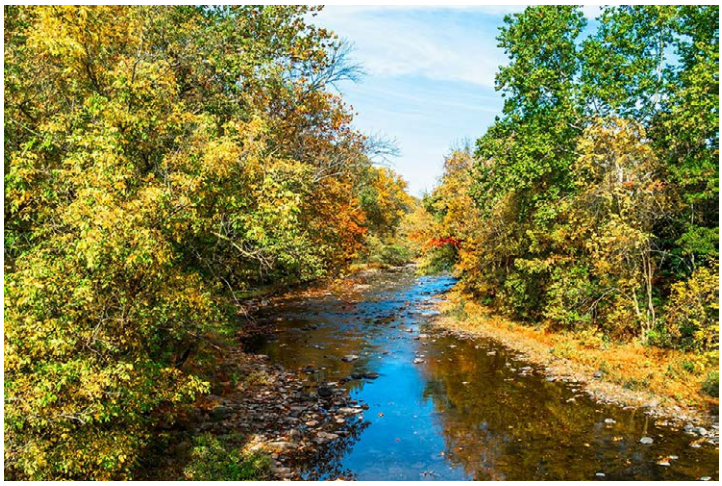
- Cannabis/delta8-THC and synthetic impurities
- Anti-virals immunomodulators
- Microbiome/probiotics
- New approaches in target-based discovery and optimization of bioactive natural products
- Fungal natural products and their biosynthesis
- Immunomodulators for health (healthy aging, metabolic health, bone health)

The meeting venue at the North Bethesda Marriott is in a neighborhood with multiple restaurants and bars. It is also well connected to the regional attractions in DC, Maryland and Virginia through metro trains, including multiple free Smithsonian museums (come with family!), many Federal buildings, the National Mall and associated memorials, US Botanical Gardens, etc. Rockville is about a 45-minute commute to DC (by road or train) and well served by three major international airports (IAD, DCA and BWI).

Shenandoah National Park NATIONAL PARK FOUNDATION



Montgomery Trails COMMUNITY HEALTH MAGAZINE

Historic Annapolis: www.annapolis.org

Harpers Ferry: www.nationalparks.org/explore/parks/harpers-ferry-national-historical-park

Shenandoah National Park: www.nps.gov/shen/index.htm

and the rich Montgomery county trails: montgomeryparks.org/parks-trails/trails/

…are just a few of the other attractions within a short distance.

The Local Organizing Committee is comprised of: Drs. Craig Hopp, NIH (co-chair); Nandu Sarma, USP (co-chair); Carole Bewley, NIH; Amit Chandra, Amway; Lin Du, NIH; Ikhlas Khan, NCNPR; Emily Mevers, VT; Barry O'Keefe, NIH; Tim Ramadhar, Howard University; and Barbara Sorkin, NIH.

We look forward to seeing you in Rockville!

Kennelly and Newman Welcomed as New ASP Honorary Members

By William Gerwick, PhD

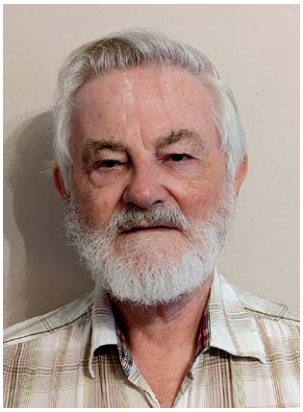
At the 2022 ASP Annual Meeting in Charleston, the Honorary Members Committee welcomed Drs. Edward Kennelly and David Newman to Honorary Membership in the Society.

This honor is bestowed upon members of the Society who have a distinguished record in the field of natural products science and are also recognized for their service to the ASP. It is one of the highest forms of recognition that the Society confers on members who have been exceptional ambassadors of the Society through their research, service, and communication.

The Honorary Members Committee, comprised of Drs. Barbara Timmerman, James Gloer, and me (Chair), receives nominations through a transparent process. We welcome nominations from the ASP membership at large. The deadline for annual nominations of candidates is in mid-February of each year, coinciding with the deadlines of other major ASP award nominations.

In 2022 we received nominations for Kennelly and Newman, both of whom we concurred as deserving Honorary Membership in the ASP. This was also approved with enthusiasm by the Executive Committee as exceptional nominations for Honorary Membership.

Kennelly is a professor of biological sciences at Lehman College, a part of the City University of New York. He has provided exceptional service to the Society in many diverse ways, including as ASP president (2015-2016) where he presided over the international occurrence of the 2016 joint meeting in Copenhagen, Denmark. He is well known to the ASP by his enormous contributions to the *ASP Newsletter*, taking it forward to become a very timely, insightful, useful publication of the Society. He has been at the helm of the *Newsletter* for 17 years and, during that time, turned it into a much more scholarly publication. He has initiated several new regular features, such as "Hot Topics in Pharmacognosy," "News from Washington," and a resurrection of "From the Archives." The *ASP Newsletter* is now a highly respected publication of the Society that the members look forward to receiving quarterly and catching up with wide-ranging topics in the natural products sciences. He has also been an exceptional scholar in the natural product sciences, having published over 145 scientific papers, mainly on the topic of botanical drugs. In this regard, he has been an advisor to the FDA on food and botanical safety issues. He also has had strong international engagement, especially with the People's Republic of China and Hong Kong.



ABOVE: **Dr. Edward Kennelly**
BELOW: **Dr. David Newman**

Newman has had a long and distinguished career on both sides of the Atlantic. He began his scientific career as a research technician at age 17 in England, and he continues today in no less than three positions: full professor (honorary), Department of Molecular Sciences, MacQuarie University, Sydney, Australia; NIH Special Volunteer in the Natural Products Branch; and principal, Newman Consulting LLC. This is what Newman does in retirement! He has been highly active in a diversity of positions, both in the private sector and academia, including several positions with Smith Kline & French, a group leader at SeaPharm Inc., principal research microbiologist at Lederle Laboratories, and was chief of the Natural Product Branch at the National Cancer Institute from 2005-2015. He has been an author of approximately 175 papers on diverse topics in natural products and organic chemistry. Notably, these have included a series of very important and scholarly reviews with ASP Fellow and Honorary Member Gordon Cragg on natural product sources of pharmaceutical agents. These are some of the most highly cited publications of all time in the *Journal of Natural Products*. Newman is also the author of the widely read and regular feature in the *ASP Newsletter* "Hot Topics in Pharmacognosy." He is also a Fellow of both the Royal Society of Chemistry and the Royal Society of Biology as well as a Fellow of the American Society of Pharmacognosy, and he served as our ASP president in 2012-2013. ■

Journal of Natural Products Recognizes Outstanding 2021 Papers

Robert Cichewicz PHOTO: LAURA CLIFFORD

April Risinger
PHOTO: MATT MORILAK, UT HEALTH SAN ANTONIO

By Vanessa Nepomuceno, PhD

The *Journal of Natural Products*, published jointly between the ASP and the American Chemical Society, has announced the winners of the Arthur E. Schwarting and Jack L. Beal awards for best papers published in 2021. Dr. Robert Cichewicz is the recipient of the Arthur E. Schwarting Award, and Dr. April Risinger is the recipient of the Jack L. Beal Award.

SCHWARTING AWARDEE Cichewicz earned his BS in biology and anthropology at Grand Valley State University. He attended the University of Louisiana, Monroe for an MS degree in pharmaceutical sciences before pursuing his doctorate at Michigan State University. Cichewicz then moved to the University of California, Santa Cruz to complete his postdoctoral studies in bioactive marine-derived natural products. In 2005, Cichewicz began at the University of Oklahoma as an assistant professor in the department of chemistry and biochemistry. Currently, he is a professor at the university, in addition to serving as the Director of the University of Oklahoma, Institute for Natural Products Applications and Research Technologies (INPART). His research focuses on the exploration of fungal metabolites for applications aimed at enhancing the human condition.

"Fungi are an immensely diverse group of organisms that have proven to be the source of some of the most inspiring chemistry on earth."

Cichewicz commented on his research, "Fungi are an immensely diverse group of organisms that have proven to be the source of some of the most inspiring chemistry on earth. Our team is grateful for the opportunities that fungi have afforded us to work with fantastic collaborators while identifying small molecule solutions for a range of problems impacting humans, animals, and agriculture."

He further noted that, "The *Journal of Natural Products* is the number one, most trusted source for scientific reports covering a range of natural products research activities. As such, it is both humbling and an incredible privilege for our paper to have been chosen as the Schwarting Award winner. What a tremendous joy it is to share this honor with my Natural Products Discovery Group members and colleagues who participated in these studies."

BEAL AWARDEE Risinger is an assistant professor at the University of Texas Health Science Center at San Antonio in the department of pharmacology. Risinger earned a BS in biochemistry at Texas A&M University and completed her doctorate in cellular biology at MIT. Risinger's research

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Risinger's research endeavors involve the preclinical evaluation of anti-cancer natural products.

Journal of Natural Products Recognizes Outstanding 2021 Papers

continued from page 19

endeavors involve the preclinical evaluation of anti-cancer natural products, and she noted, "As a cancer pharmacologist, I have long recognized the importance that natural products have in the understanding and treatment of disease."

Specifically, her lab has isolated and analyzed a class of compounds called taccalonolides which act as microtubule stabilizing agents. She commented that, "My coauthors and I are honored to receive the Beal award from the natural products community. Collaborations with natural products chemists, such as my coauthor Dr. Lin Du, provide an opportunity to push forward the boundaries of the pharmacological treatment of human disease and have made a significant impact on my research."

In 2001, the ASP Foundation began a new initiative to recognize the best papers in the *Journal of Natural Products*, resulting in the Arthur E. Schwarting and Jack L. Beal awards. In this manner, two former distinguished editors of the journal are fondly remembered. The Schwarting Award is open to all papers published in the *Journal* within a given year (either in print or electronically). In turn, the Beal Award is awarded to younger investigators, i.e., persons within 12 years of receiving their PhD degree or within 10 years of gaining their first professional appointment (e.g., assistant professor or an equivalent position in industry or government).

A two-tier process was used to select the winners of the best papers published in the *Journal of Natural Products* in 2021, with editors Philip J. Proteau, A. Douglas Kinghorn, Roberto G. S. Berlinck, Joanna E. Burdette and Cedric J. Pearce having nominated two papers each for the Schwarting Award and one each for the Beal Award. ASP President Kerry McPhail appointed an ad hoc committee comprised of Drs. Tim S. Bugni (University of Wisconsin-Madison), Chair; Marcy J. Balunas (University of Connecticut), Roger Linington (Simon Fraser University), and Avena Ross (Queen's University), to make the final selections. ■

The Schwarting Award is open to all papers published in the *Journal* within a given year (either in print or electronically). In turn, the Beal Award is awarded to younger investigators, i.e., persons within 12 years of receiving their PhD degree or within 10 years of gaining their first professional appointment.

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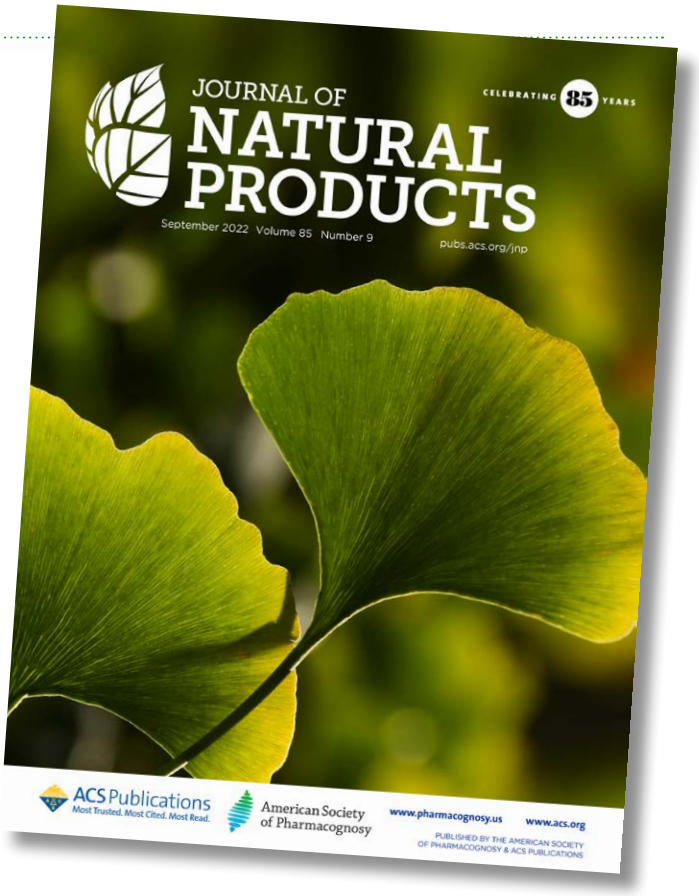
Ma, Hongyan; Liang, Huiyun; Cai, Shengxin; O'Keefe, Barry R.; Mooberry, Susan L.; and **Cichewicz, Robert H.** An integrated strategy for the detection, dereplication, and identification of DNA-binding biomolecules from complex natural product mixtures. *J. Nat. Prod.* **2021**, *84* (3) 750-761. (Arthur E. Schwarting Award)

Risinger, April L.; Hastings, Shayne D.; and Du, Lin. Taccalonolide C-6 analogues, including paclitaxel hybrids, demonstrate improved microtubule polymerizing activities. *J. Nat. Prod.* **2021**, *84* (6) 1799-1805. (Jack L. Beal Award)

Journal of Natural Products Update: Record-high Impact Factor and Other Changes

By Edward Kennelly, PhD



The *Journal of Natural Products*, the flagship publication of the American Society of Pharmacognosy, has achieved its highest-ever impact factor of 4.803. The journal has also been undergoing other changes from monthly cover art to transitioning to fully open access in the near future.

Journal of Natural Products editor-in-chief, Dr. Phil Proteau wrote, "The editorial team is elated *Journal of Natural Products* has achieved a new high for the impact factor. It is rewarding to know that the efforts of the authors, reviewers and editors are appreciated by the wider scientific community. While many excellent articles have contributed to the new all-time high IF, special recognition is needed for Drs. David Newman and Gordon Cragg, whose 2020 review article has received many citations that have helped to raise the profile of *Journal of Natural Products.*"

The *Journal of Natural Products* began publication as *Lloydia* in 1938 by the Lloyd Library and Museum of Cincinnati. In the 1960s ASP joined forces with the Lloyd to publish, and since 1996 the journal has been co-published with the American Chemical Society (ACS). The *Journal* received its first impact factor score of 1.852 in 2000.

"The editorial team is elated *Journal of Natural Products* has achieved a new high for the impact factor. It is rewarding to know that the efforts of the authors, reviewers and editors are appreciated by the wider scientific community."

Christina McLaughlin of ACS wrote, "As an ACS Managing Editor working on *Journal of Natural Products*, I would say that ACS highly values the partnership with ASP, and is proud to be co-publishing the journal. *Journal of Natural Products* is actually one of 40 ACS journals to achieve their highest-ever IF this year, so this is a very exciting opportunity to expand to many new author and reader communities across the chemical sciences. For *Journal of Natural Products* specifically, we want to use this opportunity to highlight to potential new audiences that *JNP* is the highest quality journal focused on publishing in the area of natural products. I look forward to continuing to work with Prof. Proteau and the editorial team in pushing the journal to new heights, and investing in both ASP and ACS!"

When Editor Proteau announced the journal's new IF at the ASP Executive Committee meeting in July, applause erupted from those in attendance. ASP President Dr. Amy Wright later wrote, "Congratulations to the Editors, Associate Editors and all the authors who have submitted their high impact papers to the *Journal of Natural Products* bringing its impact factor to an all-time high of 4.8. This is an outstanding achievement."

The concept of impact factor was first developed by Eugene Garfield in the 1950s as a measure of the citation frequency of an average article in a given year.[1] The *Journal of Natural Products* impact factor for 2021 was 4.803, calculated by determining the number of citations

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Journal of Natural Products Update: Record-high Impact Factor and Other Changes

The *Journal of Natural Products* has been certified as a transformative journal, meaning it has committed to a transitioning to fully open access in the near future.

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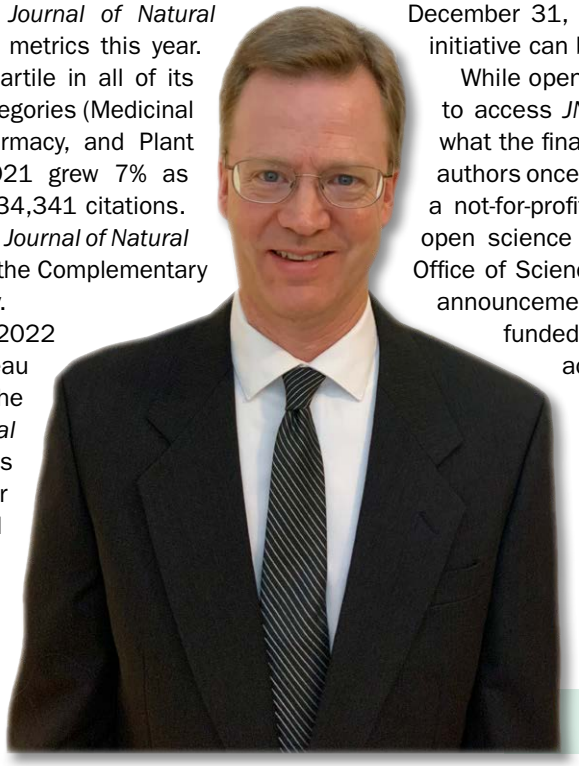
in 2021 in the scientific literature of papers published in the journal in 2019 and 2020, divided by the total number of source items published in the journal in those two years.

The heavy reliance on impact factors by various parties has been called into question, but they continue to be an important consideration as to where authors publish. As the impact factor increases, the number of submissions to a journal typically follow suit. ACS is a signatory to the Declaration on Research Assessment (DORA) supporting the movement to using a more holistic view for evaluating journal quality and research impactfulness including a combination of multiple performance metrics rather than relying solely on Clarivate's Two-Year Impact Factor.

In addition to impact factor, *Journal of Natural Products* performed well in other metrics this year. The *Journal* ranks in the first quartile in all of its Journal Citation Indicator (JCI) Categories (Medicinal Chemistry, Pharmacology & Pharmacy, and Plant Sciences). Total citations in 2021 grew 7% as compared to 2020 for a total of 34,341 citations. CiteScore increased to 7.1 placing *Journal of Natural Products* in the 93rd percentile in the Complementary and Alternative Medicine category.

In his editorial in the January 2022 issue of the journal, Editor Proteau highlighted other changes the journal is undergoing. The *Journal of Natural Products* cover has changed now to monthly, rather than quarterly. Proteau noted in his editorial, "This higher frequency will allow more authors to have their work highlighted on the cover during the year. It should be noted that there are no costs associated with cover art that is selected for the main cover. The cover art and a caption can be submitted along with the revised manuscript."[2]



Editor Proteau

The *Journal of Natural Products* has been certified as a transformative journal, meaning it has committed to a transitioning to fully open access in the near future. This concept is part of Plan S developed by cOAlition S, an international consortium of research funding and performing organizations. Plan S requires that, from 2021, scientific publications that result from research funded by public grants must be published in compliant Open Access journals or platforms. *Journal of Natural Products* authors whose research funder has signed Plan S may have their open access charges covered by their funder through December 31, 2024. More information about this initiative can be found at www.coalition-s.org/.

While open access will allow more researchers to access *JNP* articles freely, it is not clear yet what the financial costs will end up being for *JNP* authors once this policy is fully implemented. ACS, a not-for-profit organization, is acting to support open science in various ways. The White House Office of Science and Technology Policy August 25 announcement mandates that all US federally-funded research must be published open access starting in 2026.

Other upcoming changes in *JNP* involve how data is reported for cell lines and NMR spectra. Beginning in January 2023, the *Journal* will require the mandatory deposit of all raw NMR data for new natural products in a publically accessible database. ■

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In Memoriam: Ray Cooper

By Djaja Doel Soejarto, PhD and Chun Tao Che, PhD

ASP member Dr. Ray Cooper, PhD, born in the United Kingdom on March 26, 1949 and a visiting professor at the Hong Kong Polytechnic University, died on May 28, 2022 in his residence in Defiance, MO, next to a window with a forest view that provided him with immense peace. A beloved member of the ASP community, he frequently attended ASP meetings and was known for his good humor and melodic British accent. And although he suffered from colon cancer for more than five years, he always maintained his jovial and good-natured spirit.

ASP Fellow Dr. Geoff Cordell noted Cooper's remarkable productivity in natural product development. "It strikes me that from a product perspective Ray may have been involved in getting more natural products onto market shelves than any other member of the ASP. Ray was highly dedicated to natural products for human health, especially those from the TCM system. His energy was infectious and persuasive, and his background and vast experience in diverse industrial settings will be sorely missed. A gentle English man, affable, funny, very knowledgeable, and passionate for spreading the word about the benefits of natural products."

Cooper was indeed an accomplished natural product chemist with a long track record of major accomplishments, including the discovery of new antibiotics related to the monobactams as a research investigator at the Squibb Institute for Medical Research in the early 1980s. He went on to work in drug discovery at Schering-Plough Corporation and Sterling Winthrop Pharmaceuticals Research Division. As director at the ethnobotanically-driven biotech company Shaman Pharmaceuticals from 1994-1996, he discovered ten new anti-diabetic compounds. He continued working on botanicals as executive director for research and scientific affairs at Pharmanex LLC (1996-2002), bringing several proprietary traditional Chinese medicines to the market, and launching over 30 botanicals to the marketplace. As vice president of research and health sciences at Shaklee Corporation (2002-2003), he introduced five new products to the consumer market in the areas of cardiovascular health, weight loss, stress, glucose regulation, and pain. Later in his career, he worked at Herbalife International (2004-2006), founded PhytoScience Inc., and served as visiting professor at the Hong Kong Polytechnic University.

Ray Cooper giving his Tyler Award presentation at the 2014 ASP Annual Meeting in Oxford, MS.

Cooper earned his PhD in organic chemistry from the Weizmann Institute in Israel. After completing a postdoctoral fellowship at Columbia University, New York, with the late Professor Koji Nakanishi, Cooper researched drug discovery from plant and microbial natural products in the pharmaceutical and biotechnology industries. He then moved to the nutraceutical and dietary supplements industry to develop botanical products from traditional sources. He was a Fellow of the Royal Society of Chemistry in the United Kingdom and an honorary visiting professor at the College of Pharmacy, University of London.

Dr. Jeff Deakin, also a Fellow of the Royal Society of Chemistry and co-author with Cooper on their 2016 book entitled *Botanical Miracles: Chemistry of Plants That Changed the World* wrote, "Ray and I had enjoyed an enduring friendship since our days at school in the UK. Ray was eager

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"It strikes me that from a product perspective Ray may have been involved in getting more natural products onto market shelves than any other member of the ASP."

In Memoriam: Ray Cooper

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LEFT: Cooper with his family. **RIGHT: Cooper with colleagues.** PHOTO: HILARY LAFOE.

to pass on knowledge, skills and understanding in natural products chemistry to subsequent generations of young scientists. So it was that in recent years we collaborated on books and articles for the educational press aimed at high school students and university undergraduates. Links to the chemistry curriculum and relevant context provided effective stimuli for good teaching and learning in the subject. Ray remained genial, generous and positive to the end."

Cooper was an active and formative member of the ASP, where he served as program chair and conference chair for three ASP meetings: the Asilomar State Park meeting in California in 2002; the Portland, Maine meeting in 2007; and the St. Louis Annual ASP Meeting in 2013. ASP Past President and Fellow Dr. Cedric Pearce reflected, "Ray was a friendly and serious guy who I met mostly at ASP meetings and stayed in touch with by email. When I was ASP president Ray provided some very helpful input on topics that he thought needed attention. He kept me informed about his book activity, and I really enjoyed his talk at the ASP meeting where he was awarded the Varro Tyler Prize. I'm sad when I think we won't see him at future ASP meetings."

In 2014, ASP awarded Cooper the Varro E. Tyler Prize named in honor of ASP's first president, the late Dr. Varro E. Tyler, in recognition of his outstanding contributions to the discovery and development of bioactive natural products with an emphasis on botanicals. When asked by the *ASP Newsletter* how he felt about winning the Tyler Prize, Cooper stated, "Delightfully surprised, very humbled to be selected, and very honored. For the Society to give me the award is personally a thrill, but I wish to thank friends and colleagues that I have had the privilege and pleasure to work with over the years."

ASP Fellow Dr. Guido Pauli, who received the 2018 Tyler Prize, recalled, "Ray was not only eager to promote the value of medicinal and dietary plants but also natural products for human health benefits in general. He lived with a dedication in contributing immensely to ASP in a leadership role for meetings. His sincere interest in the subject matter is not only reflected in his publications and contributions to industrial workflows, but also in the admirable spirit in which he helped shape many ASP conferences and events."

From the pharmacognosy perspective, Cooper was a distinguished natural product scientist and a dedicated writer, who published several books and more than 90 scientific papers. Three of his books are: *Natural Products Chemistry: Sources, Separations and Structures* (CRC Press, 2014); *Botanical Miracles: Chemistry of Plants That Changed the World* (CRC Press, 2016); and *Chinese and Botanical Medicines* (CRC Press, 2017). Cooper also served as associate editor of the *Journal of Alternative & Complementary Medicine*.

Cooper worked extensively with Hilary LaFoe (Taylor and Francis-CRC Press Publisher) on his book series, and she commented, "Ray's article in the summer 2021 *ASP Newsletter* says it all. He wrote a wonderful account on the series and every word was from the heart! He and I had been working together for years, met at many meetings, and collaborated on several book projects together. He will be sorely missed by everyone; of that I am sure."

ASP Past President Dr. Kerry McPhail stated, "We spoke of writing and teaching and food as medicine. The joy that

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Ray was eager to pass on knowledge, skills and understanding in natural products chemistry to subsequent generations of young scientists.

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Ray derived from traveling to and teaching at Hong Kong Polytechnic University was palpable, and his passion for botanicals research was uplifting. His list of book projects was also admirable, and it is inspiring to see so many come to fruition for current and future generations of natural products scientists."

Cooper also wrote for the ASP's flagship *Journal of Natural Products*, and Editor Emeritus Douglas Kinghorn noted, "Over the years, Raymond Cooper frequently published in *J. Nat. Prod.* and provided both interesting research articles on a wide variety of topics and book reviews. He published these with a number of different co-authors, and it was always a pleasure to deal with him concerning his submissions. His last research article was in 2019, and this described the use of the HSQC NMR technique to determine the lignan content of the plant *Sambucus williamsii*, a species used in Traditional Chinese Medicine. The natural products community has lost an outstanding colleague who was extremely knowledgeable on medicinal plants, and Ray will be greatly missed, not only for his research contributions, but also as a book editor."

Cooper had immense interest and passion in promoting Chinese herbal medicines and their modern applications. At the same time, he was committed to his teaching roles in presenting an introductory course in pharmacognosy. With the goal of filling the void of a textbook-type reference, one of us (CTC) had the privilege of co-authoring a book with him on the traditional uses and modern scientific approaches of Chinese and botanical medicines in 2018. Sadly, due to the COVID pandemic-related restrictions in travelling to Hong Kong, he unfortunately did not get a chance to use the book in his lectures.

One ongoing project Cooper was involved with at the time of his death was serving as the chief editor of a book series published by Taylor & Francis/CRC Press titled *Natural Products Chemistry of Global Plants*, with eight books already published (www.taylorfrancis.com/series/natural-products-chemistry-global-plants-raymond-cooper/CRCNPCGP?context=ubx). In the fall of 2020, Cooper invited one of us (DDS) to publish the 9th book in the series with the title of *Medicinal Plants of Laos*, and by May 2022, he had completed editing Chapter 7 of the manuscript and was awaiting the last chapter, Chapter 8. A week later we were shocked and greatly saddened to receive an email from Cooper's daughter, Orly Sharma, informing us of the passing of her father. It was a friendship and an author-mentor relationship established through the internet during the planning and writing of the draft of the book.

ASP Fellow Dr. Gordon Cragg noted, "Ray and I were friends for many years, and recently we had been in regular contact about the book series on *Natural Products Chemistry of Global Plants* that he was editing. To me, Ray exemplified a great 'all-round' natural products scientist. While serving in prominent positions in academia and the pharmaceutical and nutraceutical industries, he devoted his career of some 40 years to the discovery and development of conventional pharmaceutical drugs as well as high-quality botanical products for the promotion of better global health, both in the human and veterinary areas. I was greatly saddened to hear of his passing…, and I extend my deepest sympathy to his family on their great loss. He will be sorely missed by his many friends and colleagues."

In concert with his religious beliefs, Cooper was buried in Israel in a Jewish funeral ceremony. He is survived by his wife, Shuly; son, Daniel Cooper (daughter-in-law, Beth); daughter, Orly Sharma (son-in-law, Amit Sharma); and grandchildren Sophia, Miles, Maya, Lila and Asher. The authors of this obituary, along with the ASP, offer sincere condolences to the Cooper family. He will be greatly missed by all who had the pleasure to know him. ■

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Taking Action: Two Years after the ASP Diversity, Equity and Inclusion Committee's Call to Action

By the ASP DEI Committee

The three main goals of the ASP Diversity, Equity and Inclusion Committee are to (1) build a pipeline that overcomes structural barriers of entry for underrepresented groups of scientists who wish to engage in natural products research, (2) work with members of the ASP to create a more equitable, inclusive, and supportive community, and (3) recognize and highlight the contributions that members from underrepresented communities make to the ASP. In the summer of 2020, we published an article for the *ASP Newsletter* that described a series of actions to support these three goals. Here we provide an update on what the committee, the society, and the community have accomplished together in 2021–2022 under the leadership of co-chairs Drs. Lesley-Ann Giddings and Christine Salomon.

BUILD A PIPELINE TO OVERCOME STRUCTURAL BARRIERS OF ENTRY

- We accepted our second cohort of students to our ASP Summer Research Fellowship (SRF) program to increase the representation of Black, Indigenous, and Latinx (BIL) scientists in natural products research. This program funds summer research experiences for undergraduates from historically underrepresented groups in our membership. The ASP Fellows and the ASP Foundation generously provided funds to support this program. Our second cohort was comprised of four fellows, and Dr. Giddings continued to lead weekly professional development workshops with the assistance of several ASP members (meeting virtually for 11 weeks) to help foster community and provide a series of training seminars and exercises designed to prepare the cohort for applying to graduate school. We also procured funding through an anonymous donation for travel for fellows (from 2021 and 2022 cohorts) to the annual ASP meeting in Charleston, SC, and six students attended. Three fellows presented research posters, and we also organized a SRF reception on July 24, 2022 with former and current fellows and the DEI committee. We also took advantage of the meeting being in person to advertise the program to potential mentors and students in the poster sessions. The program concluded this summer with a highly successful webinar on August 11, 2022, in which each of the trainees presented their summer research to the ASP community (more than 80 participants). To ensure that the program continues, we are submitting a National Science Foundation Research Experiences for Undergraduates (REU) grant to secure three-year funding to support fellow stipends, travel, housing, and lab materials. Drs. Brian Murphy (PI) and Marcy Balunas (Co-PI) will be taking the lead to fund ten fellows. This has been a collaborative effort with the PIs as well as Drs. Christine Salomon, Eduardo Caro, and Lesley-Ann Giddings.

- At the ASP meeting in the summer of 2019 (Madison, Wisconsin) we launched the ASP Ambassador's Program. Three ASP Ambassadors (Drs. Salomon, Katherine Zink, and Sandra Loesgen) were appointed for a three-year term and are working (with support from the ASP) to increase the participation of individuals from underrepresented groups in our society. The ASP Ambassador program has been extended due to the pandemic, and although outreach has been somewhat hampered by the conditions of the pandemic, ambassadors have attended virtual conferences, such as the Annual Biomedical Research Conference for Minoritized Scientists (ABRCMS), Society for Advancement of Chicanos/Hispanics and Native Americans in Science (SACNAS), and American Indian Science and Engineering Society (AISES); they also have given seminars (University of Mississippi and Microbiology & Cell Science, IFAS University of Florida).

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Two Years after the ASP Diversity, Equity and Inclusion Committee's Call to Action

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CREATE AN EQUITABLE COMMUNITY/EDUCATE

- Our committee has requested to become a standing ASP committee as equity and inclusion are principles that must be maintained throughout the duration of a society's existence. This will be voted on by our membership in the upcoming year.
- We hosted a webinar titled "Managing Inclusive Excellence in Academia" led by Dr. Rigoberto Hernandez from Johns Hopkins University. The recording is freely available to members at this link. A summary of the seminar was written as an article in the summer 2022 *ASP Newsletter* (volume 58, issue 2).
- Arguably the most important factor that determines success and persistence in science is mentorship, which is particularly important for individuals from routinely marginalized groups. As part of our ongoing efforts to promote diversity, equity, and inclusion (DEI) in the natural product sciences, the DEI committee organized a lunch session on mentorship on July 26, 2022 at the ASP annual meeting. This session was generously sponsored by Proctor & Gamble. Drs. Shanina Sanders-Johnson (Spelman College) and Marvella Ford (Medical University of South Carolina) shared their research findings and personal experiences as they relate to the mentorship of students and faculty. We plan to continue to organize DEI workshop sessions at future ASP meetings.
- We surveyed our membership via an e-mail to members and a link posted on the front page of the ASP website to assess how we could improve support for childcare. As of July 18, 2022, we had 34 responses to the survey. To date, one-fourth of the respondents stated that lack of childcare has affected their decision to attend a meeting. About half stated they would be very likely to use free childcare services but were less likely if this was at a cost to the member. Affordable, family-friendly hotel rooms seemed most important to the respondents as well as adjusting the format of networking events. We are continuing to look at ways we could support our members with childcare. Please let us know if you have any suggestions, and plan to fill out the survey if you haven't yet done so.

RECOGNIZE AND HIGHLIGHT CONTRIBUTIONS FROM UNDERREPRESENTED GROUPS

- Over the past year, we have written articles for each ASP newsletter as part of the "Taking Action" column. We will continue this column in the coming year. Anyone interested in writing about DEI topics can contact Lesley-Ann Giddings (**lgiddings@smith.edu**).
- The ASP DEI Committee is working with conference organizers to ensure that the presenters at ASP meetings include sufficient representation of women, people of color, and others from historically underrepresented groups. We are also encouraging the use of the meeting guidelines we drafted in 2020–2021 to accomplish this. We welcome suggestions for speakers at future meetings!

The ASP Diversity, Equity and Inclusion Committee is comprised of Drs. Lesley-Ann Giddings (co-chair; **lgiddings@smith.edu**); Christine Salomon (co-chair and ambassador; **csalomon@umn.edu**); Nadja Cech (member and former co-chair); Esther Guzmán (member and former co-chair); Brian Murphy (member); Katherine Rose Watts (member); Jackie Winter (member); Wendy Strangman (member); Sandra Loesgen (ambassador); Eduardo Caro (member); Laura Stoll (member); Kevin Tidgewell (member); Katherine Zink (ambassador); and Glenroy Martin (member)

We are grateful for the contributions, support, and partnership from the ASP Executive Committee, the ASP Fellows, and the ASP community that allowed us to do this important work. While we are proud of the accomplishments described above, we recognize that there are many more endeavors that our society could undertake toward the goal of creating a more inclusive and equitable ASP. We invite all of you, members of our community, to reach out to us (contact information above) with ideas and to work with the committee on future initiatives. ■

Hot Topics in Pharmacognosy

(Bio)chemical Ramblings through Some Recent Papers

By David J. Newman, DPhil

As most of you know, I consider that microbes are the origin in one way or another (direct biosynthesis and/or whether cultivatable or not) of a significant number of drugs and drug candidates that have been developed over the last 60 plus years. These not only include the obvious antibiotics but also antitumor and antiviral agents. One only has to consider the arabinose nucleosides, through to the agents that "power" most of the warheads for current antibody-drug conjugates (ADCs), as they certainly are the source of most of the current warheads. One can also argue that some currently plant-sourced antitumor agents also have "microbes in their background" as commented on in more general terms by Daly and Cordell[1] in *J. Nat. Prod.*, who prior to that recent paper considered that "plants produced agents such as Taxol first."

Some of the earliest ADCs, though none as yet that are approved drugs with a number in clinical trials, utilized an old microbial compound though not usually as a monomer. This base structure was pyrrolobenzodiazepine (PDB) which was derived from the naturally occurring antitumor agent anthramycin (**1**). In a recent *J. Med. Chem*. paper, Lai et al.[2] demonstrated how, by taking a PDB monomer (**2**) and then combining it with azonafide (**3**), a mono naphthalimide first synthesized in 1973 and is a DNA-intercalating agent, they derived an optimized hybrid warhead (**4**) with sub-nanomolar potency which linked to the anti-Her2-antibody trastuzumab. They used a cathepsin-labile linker via the left-hand amino group to the mAb and had significant *in vivo* activity in mouse assays with 95% growth inhibition figures at 10 mg/kg^{-1} without weight loss.

Thus, by utilizing suitable combinations of a microbial-sourced agent and a synthetic compound series, a novel and potent ADC series was developed. To date, one PDB-warhead has been approved by the FDA, "Zynlonta" in May of 2021, and other complexes related to PDB structures have entered into early trials, but their current data is not yet published.

The second paper is one from Squibb Professor Bonnie Bassler's group at Princeton. For people who may not know of her, she has spent her career studying the quorum sensing systems in microbes, and to show her capabilities, in 2012 she was elected a Foreign Member of the Royal Society, and this year she was awarded the Wolf Prize in Chemistry in 2022 (considered to be just below the Nobel Prize).

The article is in *Biochemistry*[3] and describes the synthesis and utility of small molecule inhibitors of the *P. aeruginosa* quorum sensing protein PqsE. This microbe is a major infective agent with its principal "route of attack" being the production of biofilms, which may not sound too dangerous until one realizes that a "favorite site" is on any catheter in a patient, so anyone with assisted breathing, tracheal intubation where it can migrate to the lung tissues, etc., to say nothing of urinary catheters, are prime sites for such infections and treatments are sparse.

From elegant studies on amino acid substitution on the PqsE protein and their effect on structural characteristics and virulence, they developed a series of small molecules based on earlier work that produced BB584 (**5**), a relatively simple "pseudo peptide" that bound to and inhibited PqsE at its active site with an EC_{50} figure of 34 nM, plus

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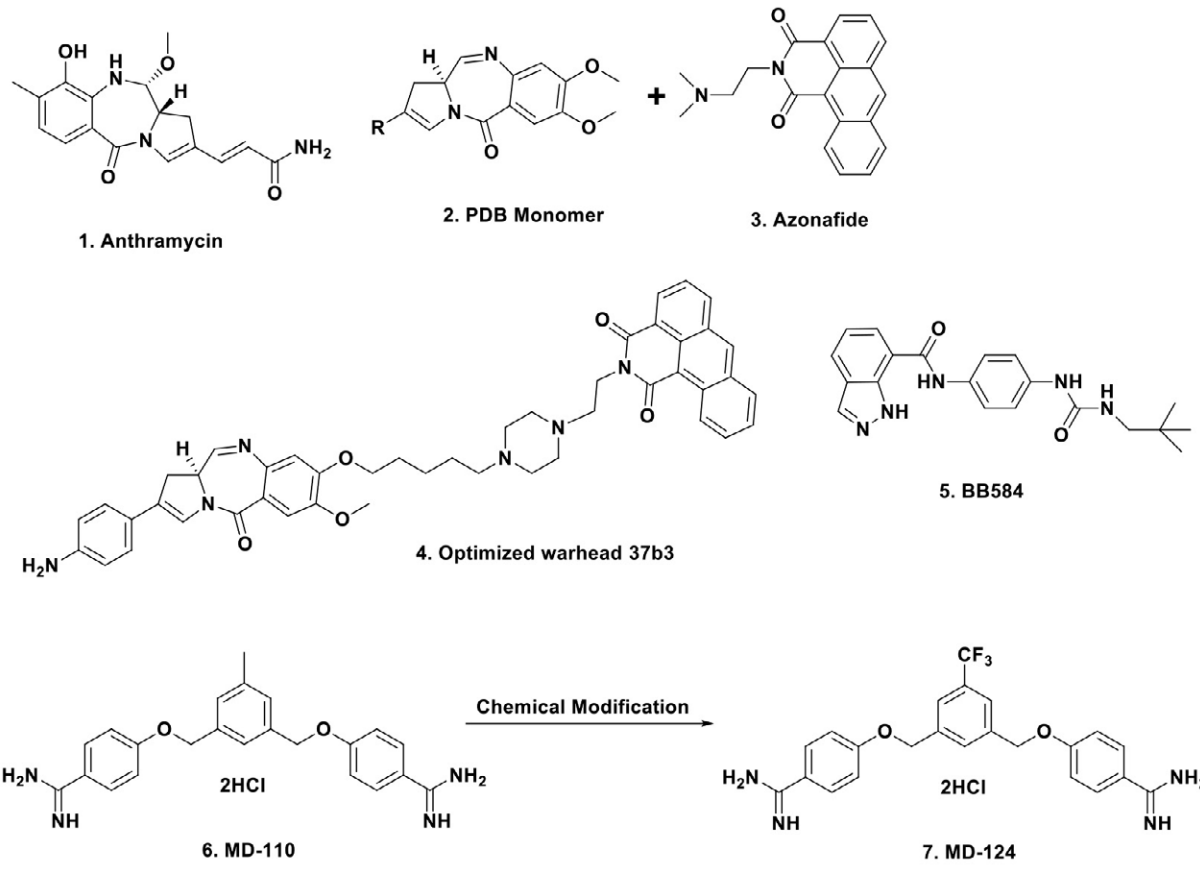
STRUCTURES



Some of the earliest ADCs, though none as yet that are approved drugs with a number in clinical trials, utilized an old microbial compound though not usually as a monomer.

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they also showed a "stick diagram" of the binding characteristics at the active site of PqsE.

The final paper for this issue is one by Yu et al.[4] demonstrating that one can develop small, charged molecules that act as adjuvants when regular antibiotics are failing against drug-resistant Gram-negative bacteria. The molecules that they derived are relatively simple linked guanidino-containing small synthetic molecules. This idea is similar in concept to the use of multi-charged polymyxin-like molecules that have been considered for use with glycopeptide-based antibiotics, but the adjuvants are much smaller.

Starting with approximately 2500 cationic compounds, they reduced the initial number to be tested to 150 and then to 4 "active" simple compounds with MD-100 (**6**) being an example of the four. Further optimization with the relatively simple switch of a methyl group for a trifluoromethyl substituent led to MD-124 (**7**) which gave a 512 times sensitization at 10 micromolar. Using Kaplan-Meier survival curves, they demonstrated that in an *ex vivo* skin infection model and an *in vivo* systematic model in mice highly significant life span extensions were shown in both cases when MD-124 and novobiocin were used together with $P < 0.001$ versus antibiotic or MD-124 alone.

MD-124 is a significant advance as it sensitizes Gram-negative bacteria by binding to the LPS, thus disrupting the outer membrane thus leading to increased uptake. What is also significant is that it also works on the ESKAPE pathogens and, in particular, sensitizes *mcr*-1-expressing, *E. coli,* as this particular plasmid is a potential major problem as it makes bacteria resistant to colistin. Though MD-124 is at the early stage of drug development, it certainly has potential. ■

I consider that microbes are the origin in one way or another (direct biosynthesis and/or whether cultivatable or not) of a significant number of drugs and drug candidates that have been developed over the last 60 plus years.

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Meet a New ASP Member

Dr. Deepa Acharya

Dr. Deepa Acharya *is our featured new member in this issue of the* Newsletter.
After receiving her PhD from the University of Wisconsin Madison with Professor Tim Bugni and postdoctoral research with Professors Jo Handelsman and Pieter Dorrestein, she now works as a Natural Products Bioanalytical Scientist at Corteva Agriscience in the Biologicals and Natural Product group within the Crop Protection R&D department. We are pleased to be able to officially welcome Dr. Acharya to ASP!

By Wendy Strangman, PhD

What is your scientific background?

I had a winding path to the destination that was natural products research. I did my undergraduate studies in a very interdisciplinary pharmacy program at BITS-Pilani in India. I had initially planned to research nanoparticle drug delivery, but two years later, I found myself interested in LCMS metabolomics and how I could use it to understand bacterial secondary metabolite biosynthesis. Working with Prof. Tim Bugni at UW-Madison, we were able to probe the mechanism of interspecies communication in a co-culture of symbiont-associated marine bacteria. I had the opportunity to lead the collaborative investigation to study the role of small molecules in activation of biosynthetic gene clusters and production of novel natural products in co-culture. After obtaining my PhD, I went on to do a postdoc with Prof. Jo Handelsman where I applied all I had learned in my graduate degree to the Tiny Earth program – a fantastic platform for crowd-sourcing antibiotic discovery. This was a very inspiring and collaborative experience where I spent several months in Prof. Pieter Dorrestein's lab at UCSD. Together we explored the metabolomes of a few hundred bacterial species and utilized many new metabolomics workflows to study them in detail. I always knew I wanted to be in industry and when I learnt that Corteva was doing leading work in multi-omics discovery of natural products, I realized I had found the perfect place to start my career.

Deepa Acharya PHOTO: SHAURYA CHANANA

My current research interests focus on discovering new natural products from microbes for important agrichemical applications.

My current research interests focus on discovering new natural products from microbes for important agrichemical applications. Natural products are a significant source for us at Corteva to find new crop protection compounds in our areas of interest, which include management of weeds, insects, and crop diseases. As a result, my research involves collaborating with our group to utilize high-throughput genomics and metabolomics from both fungal and bacterial sources to identify metabolites of interest. My primary focus is applying the latest metabolomics techniques for dereplication and prioritization of metabolites. I am also involved in utilizing microbial biotransformation to diversify the analogs of the metabolite of interest using a panel of talented microbes.

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Meet a New ASP Member: Dr. Deepa Acharya

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My primary focus is applying the latest metabolomics techniques for dereplication and prioritization of metabolites.

How did you hear about the ASP?
The ASP annual conference was the meeting of choice as a graduate student in the Bugni lab; I have been fortunate enough to attend meetings almost every year since 2017. I have always enjoyed how welcoming the society is of its younger members and is overall a great professional membership in our field.

Why did you decide to join ASP?
The ASP meetings are always a great mix of stellar research presentations and collaboration opportunities. At Corteva, we greatly value our close ties with different academic labs and our ability to collaborate on cutting-edge science. The ASP membership is an excellent way to stay connected with the advancements in the field and potentially find new talent.

What would you like to achieve through your membership?
I would like to build more collaborative and professional ties with the natural products research community, create awareness around applications of natural products in the agriculture industry, and shine a light on the breadth and depth of industrial research to the students in the field.

What other scientific societies do you belong to?
I also belong to the American Chemical Society (ACS).

What do you like doing in your spare time – movies, activities, etc.?
One of my favorite things to do is to travel and experience new places. Last year I hiked in six different national parks, and this year's total should be three! Travel also helps to meet my friends, who are now spread across the country, and gives me a chance to try new food in new cities. And I really enjoy bringing home new ideas to experiment with my own cooking. Since moving to Indy two years ago, I have also explored a whole host of new activities: pottery, Latin dance (particularly salsa), DIY furniture upcycling, crafts, and learning about cocktails.

Is there anything else you would like other ASP members to know about yourself?
I am also very interested in the business of science. I spent a couple years during my PhD working with WiSolve, consulting for local Madison biotech companies to do market research, lead generation, and learning about the start-up world. ■

I would like to build more collaborative and professional ties with the natural products research community, create awareness around applications of natural products in the agriculture industry, and shine a light on the breadth and depth of industrial research to the students in the field.

New Members of ASP Fall 2022

ASP would like to welcome our new members. The Society's main objectives are to provide the opportunity for association among the workers in pharmacognosy and related sciences, to provide opportunities for presentation of research achievements, and to promote the publication of meritorious research. New members include 10 full members and 34 associate members. We look forward to meeting you and learning more about you and your work.

FULL MEMBERS

Dr. Mohammed Aldholmi
Imam Abdulrahman Bin Faisal University
Saudi Arabia
Assistant Professor

Dr. Aljawharah Alqathama
Umm Al-Qura University
Saudi Arabia
Assistant Professor

Dr. Shaurya Chanana
Enveda Biosciences Inc.
United States

Dr. Frank Fang
Eisai
United States
Deputy President and Head of Precision Chemistry

Ms. Hannah Fernandez
University of Illinois at Chicago
United States
PhD Student

Dr. Ahmed Foudah
Prince Sattam Bin Abdulaziz University
Saudi Arabia
Senior Oracle Application Consultant

Dr. Brent Friesen
Dominican University
United States
Professor

Dr. Stefan Sarafianos
Emory University
United States
Professor

Mr. Ayoola Smith
University of North Carolina at Greensboro
United States
PhD Student

Dr. Daniel Swartling
Tennessee Tech University
United States
Associate Professor

ASSOCIATE MEMBERS

Dr. Anham Abbasi
China Medical University Taiwan
Taiwan

Mr. Andy Elorm Agbakpo
East Tennessee State University
United States
Graduate Student

Dr. Irshad Ahmed
Chamber of Psychology and Counseling
Sri Lanka
Founder and CEO

Mr. Victor Ajumobi
Bayelsa Medical University
Nigeria
Graduate Assistant

Mr. Kancharla Bhanukiran
Indian Institute of Technology (BHU)
India
Research Scholar

Ms. Danika Boltz
Pennsylvania State University
United States
Undergraduate Researcher

Mr. Lee Bum Soo
Sungkyunkwan University
Republic of Korea

Ms. Adela Cmokova
Czech Academy of Sciences
Czech Republic
Research Scientist

Dr. Mamdouh Eskandar
Minia University
Egypt
Assistant Professor

Mr. Opeyemi Fasina
Zhejiang University
China

Mr. Brandon French
Research Associates

Ms. Carlismari Grundmann
Universidade de São Paulo
Brazil
PhD Student

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New Members of ASP Fall 2022

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Ms. Raveena Gupta
Northwestern University
United States
Graduate Student

Mr. Yoon Seo Jang
Sungkyunkwan University
Republic of South Korea

Mr. Se Yun Jeong
Sungkyunkwan University
Republic of Korea

Ms. Damla Kirai
Anadolu University
Turkey
Research Assistant

Ms. Naiara Lebron
University of Puerto Rico
Puerto Rico
Undergraduate Researcher

Dr. Elizabeth Mathew
University of Botswana
Botswana
Lecturer

Mr. Anthony Mena
Lehman College
United States
PhD Student

Dr. Elizabeth Ogbeh
Federal University of Health Sciences, Otukpo
Nigeria

Dr. Akingbolabo Daniel Ogunlakin
Bowen University, Iwo
Nigeria
Research Fellow/Lecturer

Dr. Funsho Oyetunde-Joshua
South Africa

Prof. Pradeep Kumar Prajapati
All India Institute of Ayurveda
India
Professor

Dr. Candelario Rodriguez
Scientific Station COIBA
Panama
Researcher

Ms. Karon Rowe
Oregon Health and Science University
United States

Mr. Eric Sanchez
iTrade and Invest, Inc.
Puerto Rico
President

Dr. Rajani Srivastava
Sam Higginbottom University of Agriculture, Technology and Sciences
India
Assistant Professor

Mr. Ankur Tanwar
National Institute of Pharmaceutical Education and Research
India
PhD Scholar

Ms. Adeola Tejumade
University of Ibadan
Nigeria
Student

Dr. Courtney Thomas
South Carolina State University
United States
Assistant Professor

Dr. Huyen Tran
Vietnam National University HCM City
Vietnam
Lecturer

Dr. David Turner
Virginia Commonwealth University
United States
Associate Professor

Mr. Gaurav Upadhyay
MIT College of Pharmacy
United States
Assistant Professor

Ms. Jennifer Williams
University of South Florida
United States
Student

Conference Calendar

The *Newsletter* is pleased to announce the following upcoming conferences and meetings.
The events portrayed here reflect what listings and notices the *Newsletter* has specifically received.
For a more extensive calendar, please visit the ASP website at www.pharmacognosy.us. If you have a conference or event you would like mentioned, please send us relevant information, including any graphics, at **asp.newsletter@lehman.cuny.edu**.
A number of scientific conferences have been delayed or canceled due to the COVID-19 pandemic.
Please check with conference organizers about the status of any in-person conferences.

2023 ASP Annual Meeting

July 22-26, 2023

Rockville, Maryland

aspmeetings.pharmacognosy.us

ASP Natural Product Sciences Webinar

Zoom Seminars

Thursdays 4 PM ET / 1 PM PT

www.pharmacognosy.us/natural-product-sciences-webinar/

C&EN Webinars

Various Days and Times

cen.acs.org/collections/webinars.html

Pfizer Chemistry Connect: A Virtual Symposium for Organic Chemists, Analytical Chemists and Chemical Engineers

November 8 and 9, 2022

No cost to attend.

www.PfizerChemistryConnect.com

SIMB 4th International Conference on Natural Product Discovery and Development in the Genomic Era

January 8-12, 2023

San Diego, California

www.simbhq.org/np/

Gordon Research Conference: Natural Products and Bioactive Compounds

July 30-August 4, 2023

Andover, New Hampshire

www.grc.org/natural-products-and-bioactive-compounds-conference/2023/

71st International Congress and Annual Meeting of the Society for Medicinal Plant and Natural Product Research (GA)

July 2-5, 2023

Dublin, Ireland

www.gadublin2023.com

American Society of Pharmacognosy

Capital Communiqués

Natural Product-related News from NIH and Beyond

By Barbara C. Sorkin, PhD

INTERNATIONAL NEWS

The US House of Representatives has passed the National Defense Authorization Act for fiscal year 2023 (October 1, 2022 through September 30, 2023; H.R. 7900). This bill contains language that would provide special immigrant status as a pathway to remain in the US for qualified scientists and engineers who are considered essential to promoting and protecting the "national security innovation base."

NEWS FROM THE US

Dr. Arati Prabhakar with the press.

Dr. Arati Prabhakar's nomination to serve as the next director of the US Office of Science and Technology Policy (OSTP), having been approved by the US Senate, fills the last empty position in President Biden's cabinet. According to MSN, Dr. Prabhakar will be the first woman, the first immigrant, and the first person of color to serve as OSTP director. She began her career as an AAAS Science and Technology Policy fellow and has both private sector and nonprofit experience supporting technology and solutions-focused R&D. She was also the first woman to lead the National Institutes of Standards and Technology and served as the director of the Defense Advanced Research Projects Agency (DARPA).

- Graduate students – the US Congress is expressing interest in you. US Representatives Mike Doyle (D-PA), Gus Bilirakis (R-FL), Zoe Lofgren (D-CA) and Stephanie Bice (R-OK) have launched the Graduate Research and Development Caucus, or GRAD Caucus, to focus on issues of interest to graduate student researchers.

- On Earth Day (April 24, but we didn't catch this in time for the summer newsletter) the **Biden-Harris administration announced several initiatives to "better understand, account for, and find solutions in nature."** Among these are 1) the US National Nature Assessment (NNA), a periodic assessment which will build on existing data and evidence, as well as indigenous knowledge to create a holistic picture of America's…ecosystems and the benefits they provide to our economy, health, climate, environmental justice and national security. "This information will enable us to identify opportunities for nature to help achieve our societal and economic goals, including the America the Beautiful Initiative." The NNA will also provide information to guide, e.g., decisions regarding the use of ecosystem restoration funds for

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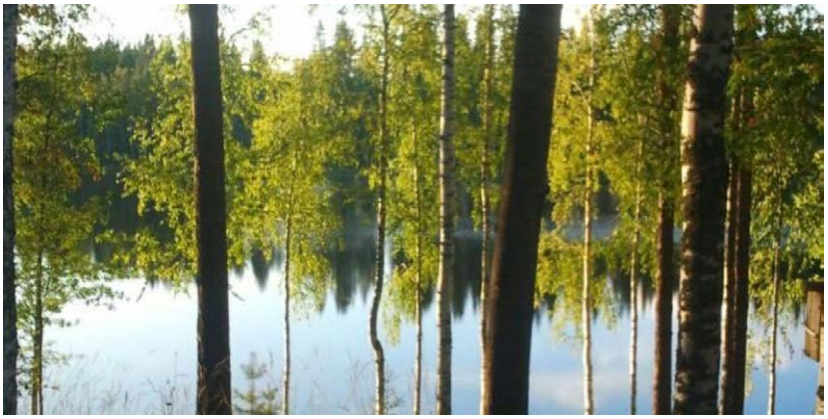

the protection of species, providing information on which investments could make infrastructure more resilient at shorelines or in watersheds. The first NNA "begins immediately, under the auspices of the US Global Change Research Program" and is to be delivered in 2026. It is anticipated that NIH will be represented at the Inter-Agency NNA Steering Committee. 2) The Natural Capital Accounts (NCAs) is an initiative to connect changes in nature with changes in economic performance. NCAs 'will work with our standard national accounting to measure the economic value that natural assets provide to society,' reflecting the economic value of forests, fish stocks, urban parks to air and water quality, and thus to our national balance sheet. Our gross domestic product (GDP) calculations do not currently include this value. NCAs will allow us to better assess the contribution of nature to risks and potential benefits related to activities ranging from agricultural production through outdoor recreation. This initiative will involve collaboration between the White House Office of Management and Budget and the Department of Commerce. 3) "We will identify prime opportunities to vastly accelerate our use of solutions that are grounded in nature. Called 'nature-based solutions,' these solutions include actions to protect, conserve, restore, sustainably use, and manage terrestrial, freshwater, coastal, and marine ecosystems to improve nature and our quality of life. Investments in nature-based solutions are already being catalyzed inside and outside of government, but much more can –and must—be done. Communities are clamoring for marsh restoration to protect coasts, shade trees to cool homes and reduce energy costs, greenspaces to revive communities and improve health, wetlands and forests to filter water and reduce sewerage needs and pollution, and native plants to protect our food supplies." Over the next year the Office of Science and Technology Policy will provide progress updates on these initiatives and identify ways for communities, organizations, businesses, and governments to participate. "We intend to focus intensively on the ways that nature can reduce climate change and provide us with opportunities for adaptation. We will also pay special attention to…how nature-based investments can reduce future pandemic risks."

✦ The Department of Energy's National Energy Technology Laboratory's (NETL) Carbon Utilization Program works with universities, national laboratories, industries, and regional partners to advance technologies that meet the objectives of the program. The Carbon Utilization Program is actively funding carbon utilization projects and continues to seek further collaborations and partnerships. Utilization projects of interest may include the use of carbon to grow algae; algal biomass may be "converted to fuels, chemicals, fish and animal feeds, human dietary supplements, soil amendments, and other products. The Carbon Utilization Program is working to develop economical adoption of biomass cultivation practices that consume CO_2 that would otherwise be emitted to the atmosphere. Current focus is on the cultivation of microalgae or blue-green algae (cyanobacteria) in outdoor ponds or photobioreactors. Ongoing R&D addresses CO_2 capture,

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conditioning, transport, and transfer to the algal medium in order to maximize CO_2 uptake and minimize the cost of CO_2 delivery." Also of interest is microbially mediated conversion of waste carbon into higher-value products. Additional information about program and funding opportunities can be found on NETL's Carbon Utilization Program website.

UPDATES FROM THE NIH

- The NIH National Center for Complementary and Integrative Health (NCCIH), with the participation of seven other NIH Institutes, is seeking "information from the scientific community" on interests "in and barriers to research on the health effects of cannabis and its constituents" with an October 15, 2022 deadline for receipt of comments. Please see NIH Guide Notice NOT-AT-22-026 for the full text of the Request for Information.

- The new **NIH Data Management and Sharing (DMS) Policy** will take effect on January 25, 2023. DMS plans will be required in relevant applications; NIH program staff will assess whether the required DMS plan elements are reasonably addressed (see NIH Notice **NOT -OD-22-189**). NIH has released a preview version of an optional **DMS Plan format page** that walks investigators through the **Elements of a DMS Plan**. A final, fillable version of this format page, along with detailed instructions for preparing DMS plans, will be incorporated into the FORMS-H NIH Application Instructions, available this fall (see below).

- **The new NIH Scientific Data Sharing website** is now available. **This new public-facing website will serve as a central portal for resources on NIH-sharing policies.** The site includes resources to help address questions such as which NIH-sharing policies apply to a particular research project, how to share and submit data, how to access data from NIH-supported repositories, and more. (Yes, this is from the last issue – and still true.)

- Are you a Principal Investigator on an NIH award? When it's time for your progress report/competitive renewal, you may find the newly revised **Research Performance Progress Report (RPPR) Instruction Guide** useful.

- Do you report inventions to iEdison? iEdison's move from the NIH electronic research administration (eRA) to the National Institute of Standards and Technology (NIST) presaged in the spring issue of "Capital Communiqués" took place as planned. All existing accounts should have been transferred, but users must have a GSA Login.gov account to access the new iEdison system. The **NIST Edison website** includes information on using the new system including information on **training sessions**, **user manuals**, and links to subscribe to **NIST updates**.

- Applicants applying to NIH-funding opportunities with due dates on or after January 25, 2023 must use updated application forms and instructions identified with a Competition ID of "FORMS-H."

- The NIH Office of Dietary Supplements (ODS) staff teamed up with program staff from several NIH components with significant investments in natural product (NP) research (the National Center for

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Yousong Ding
PHOTO: UNIVERSITY OF FLORIDA

Complementary and Integrative Health, National Cancer Institute and National Institute of General Medical Sciences), as well as extramural investigators and ASP members Drs. Nadja Cech (UNC Greensboro), Yousong Ding (U FL), and Brian Murphy (U of IL at Chicago) to present a grantsmanship workshop as a satellite to the 2022 ASP meeting. The participating NIH staff presented a brief description of the NIH grant application process and provided an annotated list of resources for those submitting applications for support of natural products research (a partial version of this list is available here).

✦ The webpages for the NIH Consortium Advancing Research on Botanicals and Other Natural Products (CARBON) now include a database of over 100 different plant products studied by researchers in the Consortium since its inception in the late 1990s, with references describing the preparation(s) studied as well as some study outcomes. You might want to check out the new publications at the webpages of some of the Consortium Centers while you're there.

FUNDING OPPORTUNITIES

NIH OFFICE OF DIETARY SUPPLEMENTS (ODS)

NIH National Institutes of Health
Office of Dietary Supplements

The ODS supports research to strengthen understanding of dietary supplements. NOT OD-22-202 expresses ODS' interest in applications for administrative supplements for certain NIH awards in order to support the performance of formal validation studies of quantitative analytical methods that can be used to identify and quantify dietary supplement constituents, contaminants, adulterants, and their metabolites in relevant contexts (products, tissues). In a formal validation study, an analytical method's performance characteristics such as accuracy, precision, applicability, and sensitivity are systematically evaluated. The use of validated methods enhances the reliability and consistency of analytical measurements, and the dissemination of validated methods strengthens the value and impact of research in which the methods are used.

US DEPARTMENT of AGRICULTURE (USDA) National Institute on Food and Agriculture (NIFA)

The closing date is October 27, 2022 for applications to the **Agriculture and Food Research Initiative Competitive Grants Program Education and Workforce Development Program: www.nifa.usda.gov/sites/default/files/2022-03/FY22-AFRI-EWD-RFA-508.pdf**

NATIONAL INSTITUTE OF GENERAL MEDICAL SCIENCES (NIGMS)

The National Institute of General Medical Sciences is interested in providing up-to-date information to applicants who are interested in pursuing research within the NIGMS mission as well as those playing key roles in research training and capacity building. Below is information regarding a webinar series and funding opportunity announcements that may be of interest. Please contact the program officer associated with the event/opportunity or Dr. Michelle R. Bond should you have questions.

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Grant Writing Webinar Series for Institutions Building Research and Research Training Capacity

Please join NIGMS program staff for a series of three webinars designed for faculty and sponsored programs/research development personnel at institutions building research and research training capacity. Briefly, topics covered will include faculty readiness and submission considerations (**8/16/22**), determining whether a funding opportunity is right for you (**9/26/22**), and writing a competitive application (**11/1/22**). For more information on topics covered and to register, visit the webinar series webpage.

Registration is required to attend. The webinars will be recorded and made available for on-demand viewing after the event. You may also register if you're unable to attend but would like to be notified when the recordings are posted.

Support for Research Excellence (SuRE) Program (R16)

In 2021, NIGMS announced the SuRE program to support research capacity building at institutions that enroll significant numbers of students from backgrounds nationally underrepresented in biomedical research (see NOT-OD-20-031), award baccalaureate and/or graduate degrees in biomedical sciences, and receive limited NIH Research Project Grant funding. Two SuRE R16 Funding Opportunity Announcements (FOAs, PAR-21-169 and PAR-21-173) have been published to support investigator-initiated research projects. Please visit the NIGMS SuRE webpage for more information, including a webinar describing the program's purpose, goals, and eligibility.

ODDS AND ENDS

- Carnivory, carbon and jobs:

  PhysOrg reports that Cornell and Johns Hopkins Universities estimate the trend away from meat toward plant-based "meats" at a 2.5 – 13.5% reduction in agricultural carbon footprint (drop of 2 to 12 million cows) with the potential for a 1.5 million job loss between the ranching and manufacturing workforces.

- From illustration and audio engineering to microbial mass spectrometry (and from *C&EN*):

Michael Mullowney

Moving from illustrating nature to a second career as a scientist seeking "to understand how the microbiome influences health and disease." With references to a person ASP members will likely recognize, see cen.acs.org/careers/Career-Ladder-Michael-Mullowney/100/i24

Jimmy Orjala, PhD, Treasurer
The American Society of Pharmacognosy
2720 Dundee Road, #260,
Northbrook, Illinois 60062

Full Membership

Full membership is open to any scientist interested in the study of natural products.
Current membership dues and *Journal of Natural Products* subscription rates can be found at **www.pharmacognosy.us**.

Associate Membership

Associate membership is open to students of pharmacognosy and allied fields only. These members are not accorded voting privileges.
Current membership dues and *Journal of Natural Products* subscription rates can be found at **www.pharmacognosy.us**.

Emeritus Membership

Emeritus membership is open to retired members of the Society who maintained membership in the Society for at least five years.
Current membership dues and *Journal of Natural Products* subscription rates can be found at **www.pharmacognosy.us**.

Honorary Membership

Honorary members are selected by the Executive Committee of the American Society of Pharmacognosy on the basis of meritorious service to pharmacognosy.

Present Honorary Members are:

Dr. John H. Cardellina · Dr. Alice M. Clark, University of Mississippi · Dr. Geoffrey A. Cordell, University of Illinois at Chicago
Dr. Gordon C. Cragg, National Institutes of Health · Dr. Harry H.S. Fong, University of Illinois at Chicago
Dr. Edward J. Kennelly, Lehman College, CUNY · Dr. Ikhlas Khan, University of Mississippi
Dr. A. Douglas Kinghorn, Ohio State University · Dr. Robert J. Krueger, Ferris State University
Dr. David J. Newman · Dr. Roy Okuda, San Jose State University · Dr. James E. Robbers, Purdue University
Dr. E. John Staba, University of Minnesota · Dr. Barbara Timmermann, University of Kansas

Additional information about membership may be obtained by writing to the Treasurer of the Society:
Jimmy Orjala, PhD, Treasurer, The American Society of Pharmacognosy,
2720 Dundee Road, #260, Northbrook, Illinois 60062. Email: asphcog@gmail.com