

2020 David J. Slatkin *Symposium*

Honoring a Career that Bridged the Divide Between Practice & Research

COVID-19 HEALTH DISPARITIES AND CO-MORBIDITIES

**OCTOBER 21, 2020
Chicago State University
College of Pharmacy
Virtual Symposium**

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American Society
of Pharmacognosy

AGENDA

OPENING REMARKS

5:45 – 6:00 PM

Dr. Matthew Fete, PhD, Dean College of Pharmacy

Dr. Jeremy Hughes, PharmD, Associate Dean of Academic Affairs

TRIBUTE TO DEAN SLATKIN

6:00 – 6:15 PM

Dr. John Cardellina, II, President of the American Society of Pharmacognosy
Foundation

MODERATORS

Dr. John Cardellina, II, PhD, ASP

Dr. Melany P. Puglisi, PhD, Director of Learning Outcomes

PLENARY SPEAKERS

6:15 – 7:00 PM

*"COVID-19 among Underserved and Vulnerable populations: Evidence, Research
Needs and Next Steps"*

Monica Webb Hooper, PhD

7:00 – 7:30 PM

"Cues to Factors Linking Metabolic Comorbidities with Covid-19"

Mohd Shahid, PharmB, PharmM, PhD

7:30 – 8:00 PM

*"When Experts Become Learners: Experiences as an Infectious Disease Pharmacist
During a Novel Pandemic"*

Christy Varughese, PharmD, BCPS

POSTER SESSION

8:00 PM

"Delivery of Eupenifeldin via Polymer-Coated Surgical Buttresses to Prevent Local Lung Cancer Recurrence"

Zeinab Al Subeh

8:07 PM

"IEX-1 is Required for Vitamin D-induced Inhibition of Proinflammatory State of Macrophages"

Faaeiza Khan

8:14 PM

"LC-MSn Based Metabolic Profiling of Cyclopenta[b]benzofurans in Selected Aglaia species Collected from Laos"

Garima Agarwal

8:21 PM

"Endothelial IRF4 Instructs Cytoplasmic SPHK1 to Generate S1P and Resolves Sepsis Induced Inflammatory Injury"

Shamsideen Ali, Do Doan, Malek Hassan and Sandeep Arora

8:28 PM

"Bioassay-Guided Isolation of Cytotoxic Metabolites from Penicillium aurantiacobrunneum"

Charmaine Lindsay, PhD

8:35 PM

"Identification of Ligands that Target PBP3 by High Throughput Virtual Screening"

Clarreesa Hardin and Amarachukwu Akujieze

8:42 PM

"Chemical Signals from Caulerpa spp., A Model System for Understanding Quorum Sensing in Vibrio spp."

Marina Ghazar and Mary Kollo

8:49 PM

"Modulating Effects of Polyherbal Combination on Cyclophosphamide-induced Immunosuppressed Mice"

Abida Parveen, PhD

8:56 PM

"Using Practice Tests to Improve Student Learning Outcomes"

Seifu Teklemariam and Jamal Yusuf

AWARDS AND CLOSING REMARKS

9:00 – 9:15 PM





Dr. David J. Slatkin

Founding and Emeritus Dean
Chicago State University College of Pharmacy

Dr. David J. Slatkin was one of the country's most influential pharmacists and has made tremendous contributions to the field of pharmaceutical sciences, pharmacognosy and pharmaceutical education. His distinguished career as a teacher and administrator included service at Northeast Louisiana University School of Pharmacy, University of Pittsburgh School of Pharmacy, and the Midwestern University College of Pharmacy, Glendale.

He was the founding dean of three colleges of pharmacy, including the Chicago State University College of Pharmacy. For more information about David Slatkin. His distinguished career included founding three colleges of pharmacy, multiple faculty positions, and pharmacognosy research. He was awarded the Merck Award from Mercer University, the American Foundation for Pharmaceutical Education, Edwin Leigh Newcomb Memorial Fellow at the University of Mississippi, and was selected by *American Pharmacist* magazine in 1999 as one of the 50 Most Influential Pharmacists in the country. An author of more than 80 scientific publications, he served as reviewer for the *Journal of Natural Products* and the *Journal of Pharmaceutical Sciences*. He has served as treasurer of the American Society of Pharmacognosy for over 30 years and is a member of the Rho Chi Honorary Society and the Phi Delta Chi pharmacy fraternity.

Dr. Slatkin held bachelor's degrees from Wayne State University, Detroit, and Mercer University's Southern School of Pharmacy, Atlanta; a master's degree and Ph. D. from the University of Mississippi School Of Pharmacy.

In lieu of a registration fee for this year's symposium, the organizers request that participants consider making a donation that will help to change a student's life. A student scholarship fund for the Chicago State University College of Pharmacy has been created in the name of the Emeritus Founding Dean David J. Slatkin.



Slatkin Symposium Lecturers



Dr. Monica Webb Hooper

Deputy Director of the National Institute on Minority Health and Health Disparities (NIMHD)

National Institutes of Health

Dr. Monica Webb Hooper is Deputy Director of the National Institute on Minority Health and Health Disparities (NIMHD). She works closely with the Director, Dr. Pérez-Stable, and the leadership, to oversee all aspects of the institute and to support the implementation of the science visioning recommendations to improve minority health, reduce health disparities, and promote health equity.

Dr. Webb Hooper is an internationally recognized translational behavioral scientist and clinical health psychologist. She has dedicated her career to the scientific study of minority health and racial/ethnic disparities, focusing on chronic illness prevention and health behavior change. Her program of community engaged research focuses on understanding multilevel factors and biopsychosocial mechanisms underlying modifiable risk factors, such as tobacco use and stress processes, and the development of community responsive and culturally specific interventions. Her goal is to contribute to the body of scientific knowledge and disseminate findings into communities with high need.

Before joining NIMHD, Dr. Webb Hooper was a Professor of Oncology, Family Medicine & Community Health and Psychological Sciences at Case Western Reserve University. She was also Associate Director for Cancer Disparities Research and Director of the Office of Cancer Disparities Research in the Case Comprehensive Cancer Center. During her time as a professor, Dr. Webb Hooper was principal investigator of federal and foundation grants, totaling over \$15 million. To date, she has published over 90 peer-reviewed articles and book chapters.

Dr. Webb Hooper completed her doctorate in clinical psychology from the University of South Florida, internship in medical psychology from the University of Florida Health Sciences Center, and her Bachelor of Science from the University of Miami.



Dr. Mohd Shahid

Assistant Professor, Department of Pharmaceutical Sciences

Chicago State University College of Pharmacy

Dr. Mohd Shahid, PharmBS, PharmMS, PhD, FPGEC is a pharmacologist/cardiovascular physiologist and an Assistant Professor of Pharmacology at the Chicago State University College of Pharmacy (CSU-COP). He earned his Ph.D., in cardiovascular pharmacology from the Faculty of Medical Sciences at University of Delhi. Prior to coming to CSU, Dr. Shahid was an Instructor and Assistant in Pharmacology at the Massachusetts General Hospital, Harvard Medical School in Boston, where he completed a post-doctoral fellowship in

cardiovascular and metabolic disorders in 2012. In 2015 at Massachusetts General Previously, he completed a predoctoral fellowship in renal hypertension at Tulane University in New Orleans. Dr. Shahid's research interests consist of understanding the role of immune cells especially macrophages in the pathogenesis of cardiovascular and metabolic disorders and exploring the translational significance of his findings. The current research in his laboratory at the CSU is focused on investigating the role of macrophage in the development of atherosclerosis, osteoporosis, and obesity. He has published many research papers in the top peer-reviewed journals and received several awards for his scientific contribution from prestigious organizations such as the American Federation of Medical Research (AFMR), the American Heart Association, and the Harvard Medical School. Dr. Shahid's research activities have been supported by the funding from National Institute of Health (NIH), AHA, Harvard University, and Chicago State University. He is also a visiting faculty at the Massachusetts General Hospital in Boston. He has been invited as a guest speaker by many reputed institutes including MGH, Rush University, California Northstate University, and Hamdard University.

He was recently awarded the prestigious American Heart Association (AHA) AIREA grant and National Institute of Health (NIH) of the USA SC3 grant for a total amount of approximately half a million dollars. These awards were bestowed upon him to conduct research to investigate for novel drug targets for the treatment and diagnosis of atherosclerosis and coronary heart diseases-The major cause of heart attack and stroke in the world. Atherosclerosis is a disease of the blood vessels (arteries) characterized by the deposition of plaques of fatty material on their inner walls, blocking the blood supply to the heart and brain. In March 2020, he was invited by the American Association of Immunologist (AAI) to present his research work at their annual meeting in Hawaii, Honolulu, in the USA. He was also awarded AAI Early Career Faculty Travel Award to attend the conference. Considering his important scientific contributions, the Chicago State University awarded him with the Faculty Excellence Award in Research for two consecutive years in 2019 and 2020.



Dr. Christy Varughese

Clinical Pharmacist, Infectious Disease

Rush University Medical Center

Christy Varughese, PharmD is an infectious disease clinical pharmacy specialist at Rush University Medical Center in Chicago, IL. She and her ID pharmacist colleague Hayley Hodgson lead the antimicrobial stewardship program at RUMC, with the primary goal of improving patient safety, judicious use of antimicrobials, and slowing the spread of multidrug resistant organisms. She works closely with the infectious disease

service to manage difficult to treat infections and developing infectious disease guidelines for hospital wide use. She is also a preceptor and mentor to pharmacy residents and students.

Before joining RUMC, Dr. Varughese was the pharmacy clinical lead for Infectious Disease at Massachusetts General Hospital in Boston, MA. During her time in Boston, she developed an antimicrobial stewardship program and co-lead with medical director Alyssa Letourneau, MD.

Dr. Varughese completed her doctorate in pharmacy from Massachusetts College of Pharmacy in Boston; PGY1 residency at Rush University Medical Center; PGY2 in Infectious Disease at Yale-New Haven Hospital. She completed her Masters in Clinical Research at Rush University. To date, she has published over 20 peer-reviewed articles and book chapters. Her primary research interests are in antimicrobial stewardship, opportunistic infections, and multidrug resistant organisms.



John Cardellina, II, PhD

President of the American Society of Pharmacognosy Foundation

Dr. Cardellina received his PhD from the University of Hawaii under the direction of Dr. Richard E. Moore, a pioneer of cyanobacterial natural products. He has over 50 years of diverse experience providing effective program design, development, management and leadership in the US Navy, academia, government,

pharmaceutical and flavor/herb/spice industry R&D, and private sector trade association representing the dietary supplement industry. His research interests include natural products, organic, medicinal, and analytical chemistry. A thirty eight year member of this scientific society, have served on numerous committees, culminating in election to presidency (2000-2001); currently chair of ASP Foundation Board, and co-chaired two annual meeting organizing committees and an interim meeting on commercial botanicals. Selected as an Honorary Member and Fellow of the ASP.

POSTER SESSION ABSTRACTS

Spermidine Alkaloids and Phenolic Glycosides from *Homalium cochinchinensis*

Ermias Mekuria Addo,¹ Yulin Ren,¹ Gerardo D. Anaya-Eugenio,¹ Tran Ngoc Ninh,² Harinantenaina L. Rakotondraibe,¹ Esperanza J. Carcache de Blanco,¹ Djaja D. Soejarto,^{3,4} A. Douglas Kinghorn*,¹

¹Division of Medicinal Chemistry and Pharmacognosy, College of Pharmacy, The Ohio State University, Columbus, OH 43210. ²Vietnam Academy of Science and Technology, Hanoi, Vietnam. ³Department of Pharmaceutical Sciences, College of Pharmacy, University of Illinois at Chicago, Chicago, IL 60612. ⁴Science and Education, Field Museum of Natural History, Chicago, IL 60605.

As part of an anticancer drug discovery effort from higher topical plants, selected taxa were collected and tested for cytotoxicity against several human cancer lines. One of the species collected from Vietnam was *Homalium cochinchinensis* (Lour.) Druce (Salicaceae). This is a shrub that is distributed principally in mainland China and Vietnam and is used traditionally for treating gonorrhea and as an astringent. In the current study, the combined flowers, leaves, stems, and twigs were collected, extracted with methanol and the resulting crude extract was then tested for mitochondrial transmembrane potential (MTP) inhibition, showing an IC₅₀ value of 14.8 µg/mL. Subsequent purification work led to the isolation of eight unprecedented secondary metabolites, including two new spermidine alkaloids, and three known compounds. The absolute stereochemistry of the new compounds was determined by acid hydrolysis and comparison of the experimental optical rotation (OR) and circular dichroism (CD) data with the reported values. Currently, all of the isolated compounds are being tested for MTP inhibition.

LC-MSn Based Metabolic Profiling of Cyclopenta[*b*]benzofurans in Selected *Aglaia* species Collected from Laos

Garima Agarwal,¹ Kongmany Sydara,² Mouachanh Xayvue,² Djaja Doel Soejarto,^{3,4} Esperanza J. Carcache de Blanco,¹ Harinantenaina L. Rakotondraibe,¹ and A. Douglas Kinghorn*¹

¹Division of Medicinal Chemistry and Pharmacognosy, College of Pharmacy, The Ohio State University, Columbus, Ohio 43210. ²Institute of Traditional Medicine, Ministry of Health, Vientiane Capital, Lao People's Democratic Republic. ³College of Pharmacy, University of Illinois at Chicago, Chicago, IL 60612. ⁴Science and Technology, Field Museum, 1400 S. Lakeshore Dr., Chicago, IL 60605.

Cyclopenta[*b*]benzofurans, also known as rocaglates or flavaglines, are characteristic compounds of *Aglaia* species (Meliaceae) found predominantly in the tropical rainforests of South-East Asia. Since their first isolation in the 1980s, rocaglates, with a highly functionalized benzofuran core, have been of considerable interest to both medicinal chemists and biologists owing to their varied biological activities such as antibacterial, antifungal, antiproliferative, and antiviral effects. In a recent study, these molecules were shown to act as protein translation inhibitors by inducing dimerization and influencing the interaction between the eukaryotic initiation factor (eIF) 4A and mRNA, and have thus garnered much interest as potential anticancer and antiviral therapies. As part of our continued effort to discover novel flavaglines from *Aglaia* spp. extracts, an LC-MS/MS method was developed for the identification of selected known flavaglines previously isolated by our group. This method was then applied for rapid dereplication of these rocaglates from several *Aglaia* species extracts that were collected in Laos, for which the results will be presented.

Delivery of Eupenifeldin via Polymer-Coated Surgical Buttresses to Prevent Local Lung Cancer Recurrence

Zeinab Al Subeh,¹ Ngoc-Quynh Chu,² Jeremy W. Miller,³ Lillian Tsai,² Tyler Graf,¹ Yin Hung,² Cedric Pearce,⁴ Mark Grinstaff,³ Aaron Colby,^{3,*} Yolonda Colson,^{2,*} and Nicholas Oberlies^{1,*}

¹*Department of Chemistry and Biochemistry, University of North Carolina at Greensboro, Greensboro, North Carolina, United States.* ²*Division of Thoracic Surgery, Massachusetts General Hospital, Boston, Massachusetts, United States.* ³*Department of Biomedical Engineering, Boston University, Boston, Massachusetts, United States.* ⁴*Mycosynthetix, Inc., Hillsborough, North Carolina, United States.*

Lung cancer is the leading cause of cancer deaths worldwide. Unfortunately, high recurrence rates and poor survival remain despite surgical resection and chemotherapy. Local drug delivery systems are a promising tool for lung cancer treatment with the potential for improved efficacy with reduced toxicity. Here, we describe the development of a chemotherapy-loaded polymer buttress, to be implanted at the time of tumor resection, for achieving local and prolonged release of anticancer agent. We prepared five different formulations of buttresses with varying amounts of loaded eupenifeldin and/or external blank layers used to modulate drug release. The *in vitro* eupenifeldin release depends on the number of external coating layers with the formulation with the greatest number of polymer layers demonstrating a prolonged release approaching 90 days. Similarly, the long-term cytotoxicity of eupenifeldin-loaded buttress formulations against Lewis lung carcinoma (LLC) and human lung carcinoma (A549) cell lines showed a prolonged cytotoxic effect. *In vivo*, eupenifeldin-loaded buttresses significantly decreased local tumor recurrence and increase disease-free survival in a resection model.

Endothelial IRF4 Instructs Cytoplasmic SPHK1 to Generate S1P and Resolves Sepsis Induced Inflammatory Injury.

Shamsideen Ali, Do Doan, Malek Hassan, Sandeep Arora, Mohammad Tauseef

Department of Pharmaceutical Sciences, Chicago State University College of Pharmacy, Chicago IL, 60628.

Sepsis is a severe illness in which bacteria invade the normally sterile blood. Acute respiratory distress syndrome (ARDS), the most severe form of inflammatory lung injury, is a devastating clinical complication of bacterial sepsis, with a mortality rate of greater than 40%. Lung vascular endothelial barrier dysfunction via dismantling of vascular endothelial (VE)-cadherin protein is a primary pathogenic feature of ARDS. Yet the mechanisms of inflammatory lung injury remain largely unknown. Here, we show that systemic exposure to the bacterial endotoxin lipopolysaccharide (LPS) induces the destruction of the mouse pulmonary endothelial barrier, which results in protein-rich lung edema and decreased the expression of transcription factor, interferon regulatory factor 4 (IRF4) in lung endothelial cells. We demonstrated that endothelial IRF4 was crucial for VE-cadherin stability and the formation of the normal restrictive endothelial adherens junctions via sphingosine kinase 1 (SPHK1) dependent generation of sphingosine 1 phosphate (S1P). Furthermore, we found that endothelial cell knockdown of IRF4 caused disruption of barrier function and abrogated its recovery via preventing the reannealing of adherens junctions. Our findings demonstrate the fundamental role of the endothelial IRF4-SPHK1-S1P axis in promoting lung vascular integrity and suppressing inflammatory injury. Therefore, strategies aimed at enhancing endothelial IRF4-mediated VE-cadherin regulation potentially guide the design of novel therapeutic approaches.

Proposal for a Standard Protocol for Prescribing of Medicinal Marijuana in the State of Illinois

Heather Fields, Derek Kolaga, Danielle Lee, Folashade Ojero

Department of Pharmacy Practice, Chicago State University College of Pharmacy, Chicago IL, 60628.

To provide a framework for the development of a Best Practices guideline for prescribing medicinal marijuana. Currently, there are no clinical guidelines for healthcare practitioners. The lack of knowledge and standardization can result in concerns regarding safety and efficacy, inappropriate marijuana use, and suboptimal patient outcomes. Furthermore, the role of the pharmacist in this process remains undefined. To be approved into the Medical Cannabis Patient Program of Illinois (MCP), the patient must have a comprehensive examination by a mandatory trained prescriber. The prescriber will provide a prescription for the designated amount, composition, and day's supply of medicinal marijuana. The patient will follow-up with the prescriber every 90 days. Pharmacists can define their role through interprofessional collaboration with prescribers and pharmaceutical care with patients. Providing patient consultation on cannabis administration, potential interactions, adverse effects, and dosing recommendations are fundamental responsibilities of the pharmacist. Limitations to the development of a standardized protocol for medicinal marijuana are extensive due to lack of robust clinical trials on evidence-based medicine, safety and effectiveness, and addiction potential. Furthermore, the reclassification of marijuana as a Schedule I controlled substance should be evaluated. This information is needed to implement a complete Best Practice guideline. We are unable to evaluate the outcomes of our Best Practice proposal because it has not been implemented. However, there are several key stakeholders we want to engage to further our efforts.

Identification of Ligands that Target PBP3 by High Throughput Virtual Screening

Clarreesa Hardin, Amarachukwu Akujieze, Edward Ofori *

College of Pharmacy, Department of Pharmaceutical Sciences, Chicago State University, Chicago IL, 60628.

Pseudomonas aeruginosa is a gram-negative, aerobic, opportunistic pathogen that commonly causes infections in hospitalized patients. There is gathering evidence that suggest the emergence of antibiotic-resistant *P. aeruginosa* limiting the efficacy of treatment options. Thus, there is an urgent need for novel drugs that target *P. aeruginosa*. Computer-aided drug design approaches have played integral role in discovery of drugs for infectious diseases. Penicillin-Binding Protein 3 (PBP3), a key protein in the cell membrane of *P. aeruginosa*, presents as a viable target for drug design. In fact, *P. aeruginosa* lacking PBP3 fail to grow. In our current study, we embarked on virtual screening exploration to identify lead compounds with the potential to treat infections from *P. aeruginosa*. To this end, we utilized the virtual screening capabilities of the Meastro Glide platform from Schrodinger to perform docking studies. We prepared the protein (PDB code: 3PBO), generated grid box and validated the docking process with cognate ligand. Over 30,000 ligands obtained from the ZINC15 database were prepared and docked. Results were ranked and we identified ZINC000005568086, an epoxide diazo compound, as the ligand with the highest docking score. This ligand may serve as a lead for the development of a new class of drugs that have the potential to be effective at treatment of *Pseudomonas aeruginosa* infections and other infections.

IEX-1 is Required for Vitamin D-induced Inhibition of Proinflammatory State of Macrophages

Faaeiza Khan, Alex Ahern, Sandeep Singh, Elan Owens, Mohd Shahid

Department of Pharmaceutical Sciences, Chicago State University College of Pharmacy, Chicago, IL 60628.

Vitamin D (Vit-D) deficiency is a significant risk factor for poor outcomes for Covid-19 and many metabolic diseases. However, the underlying mechanism remains elusive. IEX-1—which is negatively regulated by Vit-D—plays a pathogenic role in infection, obesity, and cancers. It regulates the function of macrophages, the primary inflammatory cells. We hypothesize that Vit-D promotes anti-inflammatory state of macrophages via suppressing IEX-1. Bone marrow-derived macrophages were obtained from wild-type (WT) and IEX-1 knockout (KO) mice and differentiated into pro- or anti-inflammatory macrophages by treatment with LPS (10 ng/ml) or IL-4 (10 nM), in the absence/presence of Vit-D (10 nM). The inflammatory status of macrophages and mRNA levels of inflammatory genes were quantified by flow cytometry and qRT-PCR. The TNF- α protein level was measured in supernatant using ELISA. Vit-D inhibited LPS-induced increases in mRNA levels of TNF- α (42 ± 5 vs. 58 ± 5 -fold, $p < 0.05$) and iNOS (327 ± 29 vs. 523 ± 102 -fold, $p < 0.05$) and suppressed TNF- α production in WT cells (18 ± 1 vs. 27 ± 1 ng/ml, $p < 0.05$). Conversely, Vit-D potentiated IL-4-induced increases in expression of anti-inflammatory genes Arg-1 (15204 ± 2780 vs. 4362 ± 1624 -fold, $p < 0.01$), MRC-1 (13 ± 3 vs. 6 ± 1 -fold, $p < 0.05$), and Clec10a (8 ± 1 vs. 4 ± 1 -fold, $p < 0.05$). However, these effects of Vit-D were markedly attenuated in IEX-1 KO cells. Concomitantly, Vit-D dose-dependently decreased IEX-1 expression, showing negative regulation of IEX-1 by Vit-D. Further, IEX-1 deficiency alone was sufficient to inhibit LPS-induced pro-inflammatory macrophage formation (11 ± 1 vs. $26 \pm 3\%$, $p < 0.05$), due to increased apoptosis (10 ± 1 vs. 18 ± 2 -fold, $p < 0.05$). These results demonstrate that Vit-D favors the anti-inflammatory state of macrophages in part via repressing IEX-1 expression. The data suggest that Vit-D provides protection against inflammation produced by macrophages. Thus, Vit-D levels should be monitored regularly especially in at-risk populations.

Chemical Signals from *Caulerpa* spp., A Model System for Understanding Quorum Sensing in *Vibrio* spp.

Marina Ghazar, Mary Kollo, Elena Grigoriou, Mohammad Chammout, Melany P. Puglisi

Department of Pharmaceutical Sciences, Chicago State University College of Pharmacy, Chicago, IL 60628.

Vibrio bacteria are commonly found in seawater and known to cause seafood-associated gastroenteritis. Infections progress rapidly in immunocompromised patients. Recently, thirteen strains of *Vibrio* consistently were demonstrated to make up 65% of the microbiome associated with the invasive species *Caulerpa cylindracea* in the Mediterranean Sea. High densities of *Vibrio* on the surface suggest that the alga produces quorum sensing signals that trigger chemotactic behavior resulting in adhesion of the bacteria to the alga. The objective of this study was to explore the role of extracts from eight *Caulerpa* spp. collected in the Florida Keys in the formation of the algal microbiome. Solvent partitions and caulerpin were screened against a panel of 38 strains of surface-associated bacteria (SAB) for antibacterial activity in standard 96-well plate assays and biofilm formation in 24-well plate assays. While minimal growth inhibition (8.4%) and growth promotion (6.6 %) were observed for bacteria in the panel, 50% of the strains settled in the presence of four or more species. Subsequent bioassay-guided isolation of the active extract from *C. sertularioides* against *Vibrio* sp. yielded caulerpin which significantly promoted the growth of *Vibrio* sp. below natural concentration (1.8 μ g/mL) and induced settlement from seawater. *Caulerpa* spp. produce

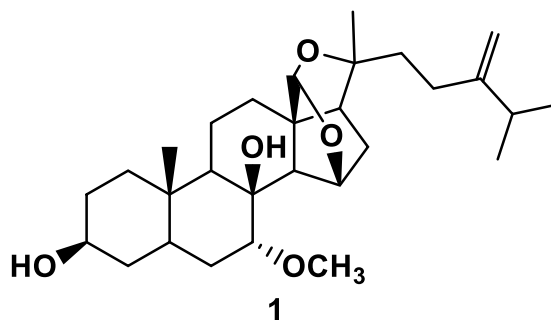
compounds that induce a chemotactic response in SAB, including several strains of *Vibrio*. Continued studies of this system will allow us to have a better understanding of the quorum sensing cues involved in the biofilm formation of *Vibrio* which can be used to develop treatments for patients with *Vibrio* infections.

Bioassay-Guided Isolation of Cytotoxic Metabolites from *Penicillium aurantiacobrunneum*

Charmaine Lindsay¹, Choon Yong Tan¹, Gerardo D. Anaya-Eugenio¹, Chad A. Rappleye², Richard J. Spjut³, A. Douglas Kinghorn¹, Esperanza Carcache de Blanco¹, Harinantenaina L. Rakotondraibe^{*1}.

¹*Division of Medicinal Chemistry and Pharmacognosy, College of Pharmacy,* ²*Department of Microbiology, The Ohio State University, Columbus, Ohio 43210, USA,* ³*World Botanical Associates, Bakersfield, California, CA 93380, USA.*

Cancer continues to be a disturbing disease, both because of its ubiquitous reach and negative impact. In 2020 alone, it is predicted that 1.8 million individuals will be diagnosed with cancer in the United States, and 600,000 will succumb to illness. Thus, it is imperative that new drugs are developed to address this rising global epidemic. In previous years, natural products have been a key source of anticancer compounds. However, due to dereplication, there is a decline in finding novel molecular scaffolds from whole tissue sources, calling for exploration of new sources. One source of novel compounds that can meet this demand are the mycobionts of U.S. endemic lichens. These fungi have already shown promise in their ability to produce unique and bioactive compounds with anti-cancer and antioxidant capabilities. Even more, they can provide a renewable and inexhaustible source of compounds. This has led us to investigate the strain RAK_A16 *Penicillium aurantiacobrunneum*, a mycobiont from the lichen *Niebla homalea*, for its ability to produce bioactive compounds. As a result, a new paxisterol derivative (**1**) and some known cytotoxic compounds have been isolated. Bioassay-guided isolation and the structural elucidation and identification of these compounds will be discussed.



Modulating Effects of Polyherbal Combination on Cyclophosphamide-induced Immunosuppressed Mice

Abida Parveen¹, Sultan Zahiruddin², Bushra Parveen², Muhammad Ibrahim², Nidhi Agarwal³, Muhammad Akhtar Siddiqui⁴, Sayeed Ahmad², Shahid Hussain Ansari^{2*}

¹Bioactive Natural Product Laboratory, Centre for Translational and Clinical Research, SIST, Jamia Hamdard, New Delhi-110062, India. ²Bioactive Natural Product Laboratory, Dept. of Pharmacognosy and Phytochemistry, SPER, Jamia Hamdard, New Delhi-110062, India, ³Centre for Translational and Clinical Research, SCLS, Jamia Hamdard, New Delhi-110062, India. ⁴Dept. of Moalijat, SUMER, Jamia Hamdard, New Delhi-110062, India. Corresponding Author*: Phone No.: +91-9810548460, E-mail ID: shansari@jamiahamdard.ac.in

Amla, giloy and black pepper have been traditionally used, individually for immunomodulation since decades though with limited validation and scientific data. Taking leads from the available research, we aimed to develop a polyherbal combination and to evaluate their effect on cyclophosphamide-induced immunosuppression in mice model and to explore the possible mechanisms involved in reversing the damage. The immunomodulatory activity of combination, of *Phyllanthus emblica* fruit, *Tinospora cordifolia* stem and *Piper nigrum* dried fruit, was determined by *in vitro* assays (pinocytic activity of peritoneal macrophages of mice and splenocyte proliferation) and *in vivo* study using cyclophosphamide-induced immunosuppression model in Swiss Albino mice. The ratio for combining three drugs was obtained by *in vitro* pinocytic and spleen proliferation assay. The combination was further evaluated for anti-oxidant activity by DPPH scavenging method and quantified for its bioactive metabolites by HPTLC. Serum collected on day 0, 4, 7 and 14 was employed for estimation of haematogram (haematocrit, differentiating leucocyte counts, total leucocyte counts, haemoglobin, etc) and immune parameters (IL-10, IL-6, TNF- α) by ELISA. The intermediate dose combination showed highest ($P \leq 0.0001$) *in vitro* pinocytic and splenocyte proliferation activity. The half-maximal inhibitory concentration (IC_{50}) of the best combination for DPPH scavenging was 113.5 μ g/ml. Treatment of cyclophosphamide-induced immunosuppressed mice with polyherbal combination significantly ($P \leq 0.0001$) improved the haematogram parameters, immune markers and histological parameters, with maximum protection offered by an intermediate dose (214 mg/kg p.o). The herbal combination possess promising immunomodulatory activity by boosting non-specific immunity, while suppressing pro-inflammatory cytokines.

Virtual Screening for CGRP Receptor Ligands with Potential Anti-Migraine Activity

Sana Siddiqui, Samawia Masood, and Edward Ofori

Department of Pharmaceutical Sciences, College of Pharmacy, Chicago State University 19501 S. King Dr, Chicago, IL 60628

Migraine headaches are a painful condition that affects 15% of the population. Current treatment options are expensive and are effective in only a fraction of patients. They are also inconvenient to store and administer. Thus, more effective and cheaper options are needed to treat migraines. Among the newly introduced classes of drugs for migraine are the calcitonin gene-related peptide (CGRP) inhibitors. CGRP plays a key role in the pathophysiology of migraines. CGRP is released via cortical spreading depression, and relays signals to the pain matrix in the thalamus. This project sought to identify novel CGRP inhibitors through a virtual screening method. We used the Maestro GLIDE screening tool in the Schrodinger basic drug discovery suite to dock over 10,000 molecules to the CGRP protein. We identified compound ZINC000004725139 with the best docking score.

Development and Evaluation of Paclitaxel Nanoemulsion for Cancer Therapy

Sara Shakhwar, Rana Darwish, Sami Malovski, Adnan Restum, Temitope Oni, Ahmed Abu Fayyad

Department of Pharmaceutical Sciences, College of Pharmacy, Chicago State University 19501 S. King Dr, Chicago, IL 60628

Tocosol™ is a tocopherol-based paclitaxel (PTX) nanoemulsion consisting of α -tocopherol (α -T) isomer of vitamin E as a solubilizer and vitamin E TPGS as the primary emulsifier. Despite its positive attributes in early clinical studies, it failed the pivotal phase III clinical trials. The longterm goal of this work was to reformulate Tocosol™. In this study, Tocosol™ formulation was optimized by replacing the α -T isomer with the more pharmacological active isomer γ -tocotrienol (γ -T3), and the surfactant vitamin E TPGS was replaced with in-house designed PEGylated γ -T3 surfactant. The reformulated paclitaxel γ -T3/PEGylated γ -T3 -based nanoemulsion was significantly more active against pancreatic tumor cell lines than α -T/Vitamin E TPGS based formulation ($IC_{50} = 0.5 \mu M$ and $1.1 \mu M$, respectively). Furthermore, the reformulated product showed an average size of 220 ± 6 nm with surface charge equal to -42 ± 2 mV. The optimized product was physically and chemically stable over 6 months per ICH storage condition guidelines.

Using Practice Tests to Improve Student Learning Outcomes

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Integration is seen as an important tool for making educational experiences coherent, relevant, and engaging; connecting diverse disciplines, and facilitating higher-order learning. This research hypothesizes that utilization of practice tests for first-year pharmacy microbiology and immunology course will enhance students learning, understanding and comprehension of complicated material, and could be encouraged to be integrated in more courses in the future. The pool of exam questions were collected over the last five years were accurately screened and 300 questions were selected based on the criteria of lectures topics, difficulty level and meeting the specific objectives for every lecture that was presented to students and covered in this exam. The survey was taken at the end of examination to assess the benefit of study guide to students. Likert-type Ordinary Scale data analysis was used to determine if hypothesis was supported. The analysis of primary endpoint indicated that majority of students 69.87% strongly agree or agree that it helped them to make their study more focused and improved their understanding of complicated material. The analysis of the secondary endpoints indicates that 63.85% of students worked in their usual study groups to find the answers and prepare for examination utilizing the practice test. The analysis of the tertiary endpoint indicates that 67.46% of students were overall satisfied with utilizing practice tests to prepare for examination.

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