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American Council for Medicinally Active Plants (ACMAP)-11th ANNUAL HYBRID CONFERENCE

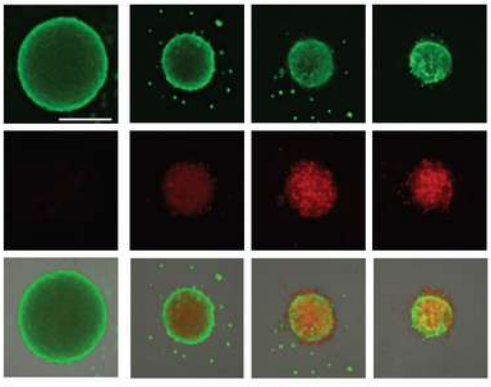
11th ANNUAL HYBRID CONFERENCE

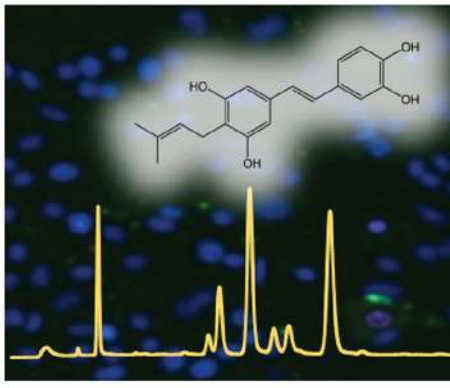
American Council for Medicinally Active Plants (ACMAP)

JUNE 28 - JULY 2, 2022

Inter American University of Puerto Rico, Barranquitas Campus
Puerto Rico, USA





ABSTRACTS

INTER BARRANQUITAS INTER BAYAMÓN ACMAP ISBiot Institute of Sustainable Biotechnology Inter American University of Puerto Rico Barranquitas Campus NSF USDA PRINBRE IDeA Network of Biomedical Research Excellence

11 th ANNUAL HYBRID CONFERENCE

American Council for Medicinally Active Plants (ACMAP)

EXPLORING THE UNEXPLORED: SCIENCE AND APPLICATIONS OF MEDICINAL PLANTS

JUNE 28 - JULY 2, 2022 | PUERTO RICO, USA

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JUNE 28 - JULY 2, 2022 | PUERTO RICO, USA

Inter American University of Puerto Rico and its campuses in Barranquitas and Bayamón welcome you to the Eleventh Annual Conference of the American Council of Medicinally Active Plants (ACMAP). Both campuses are the hosts for this event and our entire university system feels extremely honored to receive and assist you in these days of arduous work.

This great scientific gathering that takes place from June 28th to July 2nd, 2022, is an important international event, with more than 60 scientistsfrom the United States, Puerto Rico, Germany, India, Barbados, and Jamaica, including Dr. David Julius, Nobel Prize in Physiology in 2021, whom we salute and distinguish for joining us.

This Conference will allow for the discussion of various scientific topics, which will mostly revolve around the research, development, production, and conservation of plants with properties that help prevent and treat diseases.

This meeting facilitates direct contact and the exchange of ideas with professionals linked to the most recent discoveries in the realm of medicinally active plants. In addition, it represents an opportunity to promote faculty training and to stimulate an appreciation for research among our students.

We appreciate your participation and your commitment to science and research that benefits humanity. Welcome to the Inter American University of Puerto Rico.

Congratulations to the leadership of the Barranquitas and Bayamón Campuses

DR. RAFAEL RAMÍREZ RIVERA

INTERIM PRESIDENT OF THE
INTER AMERICAN UNIVERSITY OF PUERTO RICO

UNIVERSIDAD INTERAMERICANA DE PUERTO RICO

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EXPLORING THE UNEXPLORED: SCIENCE AND APPLICATIONS OF MEDICINAL PLANTS

JUNE 28 - JULY 2, 2022 | PUERTO RICO, USA

DR. JUAN A. NEGRÓN BERRÍOS
INTER AMERICAN UNIVERSITY OF PUERTO RICO
CHANCELLOR OF BARRANQUITAS CAMPUS

Inter American University of Puerto Rico at Barranquitas and Bayamón Campuses are pleased and honored toparticipate as the host institution for the 11th Annual hybrid conference of the American Council for Medically Active Plants (ACMAP). Traditional as well as modern medicine, have used plants products to preserve health and treat many diseases for humans and livestock. Plantsoffer an enormous amount of different chemicals compounds, with a wide range of applications, including medicinal properties. Plant biodiversity accounts for approximately 400,000 plant species, however, only a small number have been screened for medicinal properties. This implies a great opportunity for research and development, focusing in areas such as bioprospecting, clinical effects, mechanisms of action, structure-activity relationships, pharmacokinetic properties and many others. The celebration of Puerto Rico of the ACMAP 2022, offers the opportunity to examine the richness of medicinal plants locally, as well in the Caribbean. Medicinal plants in the Caribbean has along cultural tradition, as well as scientifically. We see an opportunity for collaboration, in which bioprospecting of local flora for bioactive molecules for the identification of new leads and eventually into drugs.

I hope that all participants enjoy the conference and have a memorable experience. For those visiting, I wish a pleasant stay and the opportunity to appreciate rich cultural and social activities available in Puerto Rico.

HOSTS 2022

JUAN NEGRON-BERRIOS, PH.D.
HOST UNIVERSITY CHANCELLOR

CARLOS OLIVARES, PH.D
HOST UNIVERSITY CHANCELLOR

ALOK ARUN, PH.D.
CHAIR

NIRMAL JOSHEE, PH.D.
CO-CHAIR

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DR. CARLOS OLIVARES
INTER AMERICAN UNIVERSITY OF PUERTO RICO
CHANCELLOR OF BAYAMON CAMPUS

Welcome everyone to the Interamerican University of Puerto Rico, particularly to the Barranquitas and Bayamón campuses.

Medicinal plants have been used in healthcare since time immemorial. Studies have been carried out globally to verify their efficacy and some of the findings have led to the production of plant-based medicines.

Medicinal plants play vital roles in disease prevention and their promotion and use fit into all existing prevention strategies. However, conscious efforts need to be made to properly identify, recognize, and position medicinal plants in the design and implementation of these strategies. These approaches present interesting and emerging perspectives in the field of medicinal plants. Recommendations are proposed for strategizing the future role and place for medicinal plants in disease prevention.

This year's congress will focus on scientific advances in various areas of health and nutrition. We hope that this meeting will be a forum to reflect on research and development activities, both basic and applied, that demonstrate how the application of science can and does make a difference to communities and society.

I hope that this event is to the liking of all of you and that it serves to learn more about such an important topic asscience and applications of medicinal plants.

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Saludos:

Human, animal and plant health, climate change, andfood security remain among the greatest challenges for societies around the globe. Natural products and medicinally active plants can contribute significantly to the improvement of health. The 11th annual conference of the American Council for Medicinally Active Plants (ACMAP) invites you to join us to share scientific studies and lessons from lab and field to illustrate the latest advances in knowledge that can be used to impact and transform the lives of fellow human beings all over the world.

This year's meeting will focus on the scientific advances in several health and nutritional areas including the emerging research field of hemp and medicinal cannabis. Let this meeting be a forum where we come together to reflect on both basic and applied research and development activities that demonstrate how the application of science can and does make a difference to communities and society. It is a great pleasure in invitingyou to present your research in Puerto Rico.

We look forward to a robust scientific discussion in Puerto Rico.

Alok Arun (Chair, ACMAP 2022)

Nirmal Joshee (Co-Chair, ACMAP 2022)

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¡Buenos días!

Dear Colleagues,

On behalf of the American Council for Medicinally Active Plants (ACMAP), I am honored and delighted to welcome you to the 11th Annual International Conference being held June 28 – July 2, 2022 at the Inter American University of Puerto Rico, Barranquitas, Puerto Rico. Last year's 10th Anniversary conference was held digitally due to the COVID-19 pandemic. Weare overjoyed to be hosting this year's conference both in person and virtually.

The beauty of Puerto Rico's biological and cultural diversity has attracted many scientistswho engage in multidisciplinary research, studying the botany and conservation of the unique species of Puerto Rico and the larger Caribbean, understanding their chemical structures and bioactivity, as well as the efficacy and safety of natural products for human health. The integrated efforts of researchers from diverse fields investigating the applicationof medicinally active plants will be required to translate basic science insights into public health benefit.

We are thrilled to officially open the conference with an outstanding Opening Plenary Lecture by Dr. David Julius, a 2021 Nobel Prize in Physiology and Medicine laureate. Dr. Julius's discoveries with capsaicin, the active component in red chili peppers, emphasize the tremendous potential of natural products research to develop breakthroughs that will prevent and treat many diseases. Dr. Julius's extraordinary work will inspire generations of students and young investigators involved in natural products research. This meeting has been made possible by the hard work of the organizing committee from the Inter American University of Puerto Rico and the ACMAP's Board of Directors. I am grateful for all the sponsors who provided support for the Conference.

Finally, I would like to thank all of you who are participating in the Conference for accepting our invitation and coming to Puerto Rico or joining us virtually to share our interest in medicinally active plants.

With best wishes for an outstanding meeting.

Anait S. Levenson, M.D., Ph.D.
President, ACMAP

ACMAP

ANAIT S. LEVENSON, M.D., PH.D.
LONG ISLAND UNIVERSITY, USA

11 th ANNUAL HYBRID CONFERENCE

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¡Bienvenidos!

On behalf of the American Council for Medicinally Active Plants (ACMAP), I am honored to welcome you to our 11th Annual Conference on the enchanting island of Puerto Rico. This year we are joined by presenters and attendees who are participating in-person and virtually from different parts of the world in Africa, Asia, Europe, North and South America,and the Caribbean.

ACMAP's goal is to discover new ways to link agriculture, biotechnology, ethnobotany, health, nutrition, and medicine and increase awareness of the need for plant-basedmedicinal research. To this end, this conference provides a forum to bring scientists, students, educators, and industry professionals to share their common interests. We hopeyou will exchange ideas and research findings that will stimulate the development of innovative means to produce medicinally active plants and identify new bioactive compounds with applications in human health.

I want to thank our Host and Chair, Dr. Alok Arun, and Co-Chair, Dr. Nirmal Joshee, and the local organization team at the Inter American University of Puerto Rico – Barranquitas for allowing us this opportunity to bring scientists together at this joint forum. Thank you for your attendance, and I invite you to enjoy a fruitful conference.

Sincerely,

Fabricio Medina-Bolivar, Ph.D.
ACMAP Executive Director

ACMAP

FABRICIO MEDINA-BOLIVAR, PH.D
ARKANSAS STATE UNIVERSITY, USA

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PLENARY SPEAKER

NOBEL LAUREATE

DAVID JULIUS, PH.D.

UNIVERSITY OF CALIFORNIA SAN FRANCISCO, USA

From Peppers to Peppermints: Natural Products as Probes of the Pain Pathway

Dr. David Julius used capsaicin, the active component inchili peppers, to identify the nerve sensors that allow theskin to respond to heat and pain.

Dr. David Julius was awarded the 2021 Nobel Prize in Physiology and Medicine jointly with Ardem Patapoutian for their discoveries of receptors for temperature andtouch. Dr. Julius discovered molecular mechanisms ofpain sensation and heat, including the characterization ofthe receptors that detect capsaicin, menthol, and temperature.

Dr. Julius earned his undergraduate degree from Massachusetts Institute of Technology and attained his doctorate from University of California, Berkeley. In 1997,his laboratory at the University of California, SanFrancisco cloned and characterized the transient receptor potential (TRPV1) channel, which is the receptor that detects capsaicin, the chemical in chili peppers that makes them “hot”. Subsequently, Dr. Julius’s laboratory contributed to the study of nociception by discovering other TRP channels that detect a range of temperatures and chemicals. These discoveries are vital to the development of therapeutics for chronic pain and other conditions.

https://www.ibiology.org/neuroscience/sensory-receptors/

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INVITED SPEAKERS

ANAIT S. LEVENSON, M.D., PH.D.
LONG ISLAND UNIVERSITY, USA

SUN-OK LEE, PH.D.
UNIVERSITY OF ARKANSAS, USA

FABRICIO MEDINA-BOLIVAR, PH.D
ARKANSAS STATE UNIVERSITY, USA

JEFFREY ADELBERG, PH.D.
CLEMSON UNIVERSITY, USA

JOSHUA KELLOGG, PH.D.
PENNSYLVANIA STATE UNIVERSITY, USA

SRINIVASA RAO MENTREDDY, PH.D.
ALABAMA A&M UNIVERSITY, USA

ANDREA I. DOSEFF, PH.D.
MICHIGAN STATE UNIVERSITY, USA

JEREMY JOHNSON, PH.D.
UNIVERSITY OF ILLINOIS AT CHICAGO, USA

YUANYUAN (ROSE) LI, PHD.
UNIVERSITY OF MISSOURI, USA

NIRMAL JOSHEE, PH.D..
FORT VALLEY STATE UNIVERSITY, USA

OLIVER KAYSER, PH.D.
TU DORTMUND UNIVERSITY, GERMANY

BAHAR ALIAKBARIAN, PH.D.
MICHIGAN STATE UNIVERSITY, USA

INVITED SPEAKERS

PRABODH SATYAL, PH.D.

AROMATIC PLANT RESEARCH CENTER, USA

NIHAL AHMAD, PH.D.

UNIVERSITY OF WISCONSIN, USA

SADANAND DHEKNEY, PH.D.

UNIVERSITY OF MARYLAND EASTERN SHORE, USA

NAMRITA LALL, PH.D.

UNIVERSITY OF PRETORIA, SOUTH AFRICA

MAHIPAL SHEKHAWAT, PH.D.

GOVERNMENT INSTITUTE OF POSTGRADUATE STUDIES AND RESEARCH, INDIA

SONIA PETER, PH.D.

BIOCULTURAL EDUCATION AND RESEARCH PROGRAM, BARBADOS

SYLVIA MITCHELL, PH.D.

UNIVERSITY OF WEST INDIES, JAMAICA

MARIA VILLARREAL ORTEGA, PH.D.

UNIVERSIDAD AUTONOMA DEL ESTADO DE MORELOS, MEXICO

DIANA ROOPCHAND, PH.D.

RUTGERS UNIVERSITY, USA

THOMAS TERRILL, PH.D.

FORT VALLEY STATE UNIVERSITY, USA

RODOLFO JULIANI, PH.D.

RUTGERS UNIVERSITY, USA

NIRANJAN ARYAL, PH.D.

VRX LABS, USA

ARUNA WEERASOORIYA, PH.D.

PRAIRIE VIEW A&M UNIVERSITY, USA

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TOPICS

- **Session I: Botanicals of Caribbean Diaspora**
- **Session II: Bioactive Compounds of Plants and Their Roles in Human Health I (Cancer)**
- **Session III: Chemistry of Medicinal Plants**
- **Session IV: Ethnobotany, Bioprospecting and Production**
- **Session V: In vitro Propagation and Conservation of Value-Added Plants**
- **Session VI: Bioactive Compounds of Plants and Their Roles in Human Health II (Inflammatory Diseases)**
- **Session VII: Hemp and Medical Cannabis**
- **Session VIII: Plant and Algae Derived Cosmeceuticals and Nutraceuticals**

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SCIENTIFIC PROGRAM

Times are in Atlantic Standard Time (AST)

11TH ANNUAL ACMAP CONFERENCE 2022

SCIENTIFIC PROGRAM (June 28 – July 2, 2022) *Times are in Atlantic Standard Time (AST)*

Day 1 **Inter American University of Puerto Rico (IAUPR) - Barranquitas Campus** VENUE: MULTIUSOS **Tuesday, June 28, 2022**		
2:00 PM – 8:00 PM		COVID-19 Vaccination check and Registration
2:00 PM		Shuttle pick-up from Hyatt Place Hotel – Bayamon (outside the entrance door)
4:30 PM – 5:30 PM	**Welcome**	**Master of Ceremony and Chair:** Dr. Alok Arun **Invocation:** Rev. Arnaldo Cintron Miranda **Co-Chair of ACMAP 2022**: Dr. Nirmal Joshee **Rector**, Inter American University of Puerto Rico, Barranquitas **Rector**, Inter American University of Puerto Rico, Bayamon **President**, Inter American University of Puerto Rico **Chairman**, Board of Trustees, Inter American University of Puerto Rico **Message of President** ACMAP: Dr. Anait S. Levenson **Message of Executive Director** ACMAP: Dr. Fabricio Medina-Bolivar
5:30 PM – 6:15 PM	**Plenary**	**Nobel Laureate Dr. David Julius (virtual)** Morris Herzstein Chair in Molecular Biology and Medicine University of California San Francisco, USA **From peppers to peppermints: natural products as probes of the pain pathway** Q&A (moderated by Alok Arun)
6:15 PM – 7:30 PM	**Opening ceremony**	Cultural event and dinner Vote of thanks: **Alok Arun (Chair)** Group Photo
8:00 PM		Shuttle leave for Hyatt Hotel Bayamon
Day 2		

11th ANNUAL HYBRID CONFERENCE

American Council for Medicinally Active Plants (ACMAP)

IAUPR – Bayamon Campus
Wednesday, June 29, 2022

Shuttle pick-up at 7:30 am (Hyatt Place Hotel – Bayamon)

8:00 AM – 8:30 AM	**BREAKFAST**		
		Session I: Botanicals of Caribbean diaspora ***(Venue: Salon Usos Multiples/SUM)***	**Session II: Bioactive compounds of plants and their roles in human health I (Cancer)** ***(Venue: Theatre)***
	Chair **Co-chair**	**S. Rao Mentreddy** Alabama A&M University, USA **James Ackerman** University of Puerto Rico, Puerto Rico	**Andrea Doseff** Michigan State University, USA **Claudia Ospina** Inter American University of Puerto Rico, Puerto Rico
8:30 AM – 9:10 AM	**Keynote**	**Sonia Peters** Bioscience Barbados Ltd., Barbados **Caribbean Plant Biodiversity – unlocking the potential of molecular diversity.**	**Nihal Ahmad** University of Wisconsin, USA **Grape antioxidants in skin cancer management**
9:10 AM – 9:40 AM	**Invited I**	**Sylvia Mitchell (virtual)** University of West Indies, Jamaica **Thirty-five years of tropical plant tissue culture R&D in Jamaica: the challenges and breakthroughs**	**Anait S. Levenson** Long Island University, USA **The role of dietary stilbenes in prostate cancer interception: evidence from preclinical studies.**
9:40 AM – 10:10 AM	**Invited II**	**Martha Giraldo** University of Puerto Rico, Puerto Rico **Role of roots and tuber crops in global household food security**	**Yuanyuan (Rose) Li** University of Missouri, USA **Maternal epigenetic diets on transgenerational breast cancer prevention**
10:10 AM – 10:40 AM	**Invited III**	**Alok Arun** Inter American University of Puerto Rico, Puerto Rico **Biology of underutilized crops of the Caribbean**	**Virginie Aires (virtual)** University of Burgundy, France **Bioactive dietary compounds: promising therapeutic adjuvants through the targeting of tumor lipid metabolism**
10:40AM – 11:00 AM	**COFFEE BREAK**		

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11:00 AM – 11:15 AM		**Please move to Theatre**	**Gisella Campanelli (virtual)** Long Island University, USA **Chemopreventive activity of Gnetin C in murine tumor models of prostate cancer**
11:15 AM – 11:30 AM		**Please move to Theatre**	**Mirielle Nauman** University of Illinois at Chicago, USA **Garcinia mangostana (mangosteen) xanthones promote androgen receptor degradation**
11:30 AM -12:30 PM	**Workshop**	**Plant tissue culture of medicinally active plants** (Jeffrey Adelberg, Sadanand Dhekney, Nirmal Joshee) (Venue: Salon Usos Multiples/SUM)	
12:20 PM- 1:30 PM	**LUNCH**		
	Chair **Co-chair**	**Session III: Chemistry of medicinal Plants** ***(Venue: Salon Usos Multiples/SUM)*** **Sun-Ok Lee** University of Arkansas, USA **Bruyanelis Ramos Aponte** Universidad Ana G. Méndez, Puerto Rico	**Session IV: Ethnobotany, bioprospecting and production** ***(Venue: Theatre)*** **Jeffrey Adelberg** Clemson University, USA **Angel Nunez Marrero** Inter American University of Puerto, Puerto Rico
1:30 PM -2:10 PM	**Keynote**	**Jeremy Johnson** University of Illinois at Chicago, USA **Translational development of phytochemicals and highly characterized plant extracts**	**James E Simon (virtual)** Rutgers University, USA **Bioexploration of indigenous plants in sub-Sahara Africa**
2:10 PM – 2:40 PM	**Invited I**	**Fabricio Medina-Bolivar** Arkansas State University, USA **Combined elicitation and targeted metabolomics approach for the discovery of medicinally active prenylated stilbenoids in hairy root cultures of peanut and pigeon pea**	**S. Rao Mentreddy** Alabama A&M University, USA **Ethnobotany and production of three high-value medicinally active herbs, basil, turmeric, and mounta mint in North Alabama**
2:40 PM – 3:10 PM	**Invited II**	**Joshua J Kellogg** Pennsylvania State University, USA **Biochemometric molecular networking to discover new aryl hydrocarbon receptor ligands from the diet**	**Prabodh Satyal (Virtual)** Aromatic Plant Research Centre, USA **Instrumental challenges with essential oil adulteration.**

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3:10 PM – 3:40 PM	**Invited III**	**Rodolfo Juliani** Rutgers University, USA **Quality, chemistry, and biological activity of the West African spice, grains of paradise (Aframomum melegueta)**	**Nirmal Joshee** Fort Valley State University, USA **Ethnobotanical knowledge paving way for medicinal compounds and value- added products in Paulownia tree**
3:40 PM – 4:00 PM	**COFFEE BREAK**		
4:00 PM – 4:15 PM	**Oral talk**	**Joseph Horzempa** West Liberty University, USA **Dillapole, a compound extracted from fennel, exhibits potential as an antibacterial chemotherapy by dampening virulence factor expression**	**B.K. Biswas** Fort Valley State University, USA **Stevia and Turmeric, consumption can help for anti-cancer benefits, know how to grow and consume**
4:15 PM – 4:30 PM	**Oral talk**	**Marco Nuno De Canha** University of Pretoria, South Africa **Harnessing the potential of two southern African plants for the treatment of acne vulgaris**	**Please move to Salon Usos Multiples/SUM**
4:30 PM – 6:00 PM	**POSTER PRESENTATION**		
Day 3 IAUPR – Bayamon Campus Thursday, June 30, 2022			
Shuttle pick-up at 7:30 am (Hyatt Place Hotel – Bayamon)			
8:00 AM – 8:30 AM	**BREAKFAST**		
	Chair **Co-chair**	**Session V: In vitro propagation and conservation of value-added plants** ***(Venue: Salon Usos Multiples/SUM)*** **Nirmal Joshee** Fort Valley State University, USA **Dr. Elizabeth Padilla Crespo** Inter American University of Puerto Rico, Puerto Rico	**Session VI: Bioactive compounds of plants and their roles in human health II (Inflammatory diseases)** ***(Venue: Theatre)*** **Anait S. Levenson** Long Island University, USA **Dr. Lizbeth Romero Perez** Inter American University of Puerto Rico, Puerto Rico
8:30 AM – 9:10 AM	**Keynote**	**Sadanand Dhekney** University of Maryland, USA	**Andrea Doseff** Michigan State University, USA

		Optimizing in vitro culture techniques for precision breeding of perennial fruits: grapevine as a model	**Flavonoids regulate macrophage immune function controlling cancer and halting obesity**

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9:10 AM – 9:40 AM	**Invited I**	**Jeff Adelberg** Clemson University, USA **Nutrients and lighting factors in controlling medicinal plant culture**	**Susanne Mertens-Talcott (virtual)** Texas A&M University, USA **Interactions of tannins with the intestinal microbiome and anti-inflammatory activities**
9:40 AM – 10:10 AM	**Invited II**	**Mahipal Singh Shekhawat (virtual)** Puducherry, India **In vitro regeneration of medicinal plants and analysis of structural plasticity of cells and tissues towards changed environmental conditions: A way forward to develop climate-resilient plants**	**Diana Roopchand** Rutgers University, USA **Grape polyphenols and cannabidiol: mechanisms for promoting metabolic resilience**
10:10 AM – 10:40 AM	**Invited III**	**Maria Luisa Villarreal Ortega (virtual)** Universidad Autónoma del Estado de Morelos, Mexico **Conservation of Mexican medicinal species with sedative and anti-inflammatory properties**	**Kevin Tveter (10:10 AM–10:25 AM)** Rutgers University, USA **Metabolic benefits of grape polyphenol consumption on bile acid signaling in mice with intestine- and liver-specific deletion of Fxr** **Meenakshi Sudhakaran (10:25 AM–10:40 AM)** Michigan State University, USA **Flavone apigenin regulates innate immune response through RNA binding protein hnRNPA2**
10:40 AM-11:00 AM	**COFFEE BREAK**		
11:00 AM-11:15 AM	**Oral talk**	**Ramana Gosukonda** Fort Valley State University, USA **Machine learning models in plant tissue culture: a case study of Brahmi**	**Please move to Salon Usos Multiples/SUM**
11:15 AM – 11:30 AM	**Oral talk**	**Samantha Sherman (virtual)** Fort Valley State University, USA **Histological examination of in vitro hyperhydric cultures of Scutellaria lateriflora.**	**Please move to Salon Usos Multiples/SUM**
11:30 AM -12:30 PM	**Workshop**	**Writing and submitting scientific papers to JMAP (Adolfina Koroch) (Venue: Salon Usos Multiples/SUM)**	

12.30 PM – 1.30 PM	**LUNCH**	
1.30 PM – 6.30 PM	**TOUR**	Guided Old San Juan Tour (Contact registration desk for more information)

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JUNE 28 - JULY 2, 2022 | PUERTO RICO, USA

Day 4 IAUPR Bayamon Campus Friday, July 1, 2022			
Shuttle pick-up at 7:30 am (Hyatt Place Hotel – Bayamon)			
8:00 AM – 8:30 AM	**BREAKFAST**		
	Chair	**Session VII: Hemp and Medical Cannabis** ***(Venue: Salon Usos Multiples/SUM)*** **Joshua Kellogg** Fort Valley State University, USA	**Session VIII: Plant and algae derived cosmeceuticals and nutraceuticals** **Alok Arun** Inter American University of Puerto Rico, Puerto Rico
8:30 AM – 9:10 AM	**Keynote**	**Aruna Weerasooriya** Prairie View A & M University, USA **Genetic complexity in Industrial hemp germplasm**	**Namrita Lall (virtual)** University of Pretoria, South Africa **Reinforce urban skin by connecting with the origins**
9:10 AM – 9:40 AM	**Invited I**	**Oliver Kayser (virtual)** TU Dortmund University, Germany **Endocannabinoid receptor pharmacology of rare cannabinoids**	**Sun-Ok Lee** University of Arkansas, USA **Health-promoting effects of functional foods**
9:40 AM – 10:10 AM	**Invited II**	**Sadanand Dhekney** University of Maryland Eastern Shore, USA **Screening industrial hemp cultivars for cannabinoid production in the Mid-Atlantic region**	**Bahar Aliakbarian (virtual)** Michigan State University, USA **Upcycling food process byproducts for cosmeceutical applications: Case of cherry waste**
10:10 AM – 10:40 AM	**Invited III**	**Wesley Raup-Konsavage** Penn State University, USA **Chasing the entourage effect in Cannabis**	**Thomas H. Terrill** Fort Valley State University, USA **Nutraceutical and cosmeceutical properties of sericea lespedeza (Lespedeza cuneata)**
10:40AM – 11:00 AM	COFFEE BREAK		
11:00 AM – 11:15 AM	**Oral talk**	**Niranjan Aryal** VRX Labs, USA	**Ana-Marie Reid (virtual)** University of Pretoria, South Africa
		Cannabis testing labs; Quality control and standardization	**Euclea natalensis A. DC., as an adjuvant, immunomodulator and hepatoprotectant**

11th ANNUAL HYBRID CONFERENCE

American Council for Medicinally Active Plants (ACMAP)

EXPLORING THE UNEXPLORED: SCIENCE AND APPLICATIONS OF MEDICINAL PLANTS

JUNE 28 - JULY 2, 2022 | PUERTO RICO, USA

11:15 AM – 11:30 AM	**Oral talk**	**Ke Sui** Rutgers University, USA **Cannabidiol improves inflammation, glucose metabolism and bone loss in a murine model of female post-menopause in association with a bloom of Lactobacullus sp.**	**Sepideh Mohammadhosseinpour (virtual)** Arkansas State University, USA **Prenylated stilbenoids from peanut increase the anticancer efficacy of paclitaxel in triple-negative breast cancer cells**
11:30 AM – 12:10 PM	**Keynote**	**Please move to Theatre**	**A. Douglas Kinghorn (virtual)** The Ohio State University, USA **Discovery of anticancer agents of diverse natural origin**
12:10 PM – 12:15 PM	**Flash talk**	**Please move to Theatre**	**Esther Mezhibovsky** Rutgers University, USA **Grape polyphenols may protect from diet induced obesity by preventing high-fat diet dampening of the hypothalamic-pituitary axis**
12:15 PM – 12:30 PM	**Flash talk**	**Please move to Theatre**	**Claudia A. Ospina-Millán** Inter American University of Puerto Rico, Puerto Rico **Natural Products Research in Puerto Rico: Isolation of bioactive metabolites from tropical plants**
12:30 PM – 1:30 PM	**LUNCH**		
1:30 PM – 4:30 PM	**LEISURE**		
4:30PM	**Shuttle Pick for Restaurant from Hyatt Bayamon**		
5:00 PM – 8:00 PM	**CLOSING CEREMONY (GALA DINNER) AND AWARDS**		
	Day 5 **Saturday, July 2, 2022** **Field Excursions and Tours (Group basis)** Contact Registration/Information desk for details		

SESSION I:
BOTANICALS OF CARIBBEAN DIASPORA

KEYNOTE

O1. Caribbean Plant Biodiversity - unlocking the potential of molecular diversity

Sonia Peter [1], John Headley [2], Neelam Buxani [3]. [1]Biocultural Education and Research Programme, 59 Meadowvale, St. James, Barbados, BB23022;
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Plant biodiversity is significant in the Caribbean with the estimated 11,000 species having a high endemicity of 72%. Of the estimated 1520 genera, 192 are considered endemic (Critical Ecosystem Partnership Fund). Endemic plant genera are concentrated in the Greater Antilles with greatest diversity recorded for the larger and more heterogenous islands of Hispaniola and Cuba. The five plant families with the highest number of endemic genera are Asteraceae (39), Rubiaceae (27), Orchidaceae (12), Euphorbiaceae (11) and Fabaceae (10). Protection of this resource is vital as it has been a key source of survival for Caribbean populations providing food, shelter, textiles, and medicine. Unique genera possess phytochemical scaffolds that lead to the biosynthesis of novel bioactive agents in many natural product classes including the heterocyclic polyphenolics and flavonoids. Chemotaxonomic features of polyphenolic complexity will also be influenced by chemotypes and biogeographical features including soil composition, altitude, and weather variability. Two families of global significance for bioactivity are the Lamiaceae and Asteraceae. Though the Lamiaceae is not representative of diverse genera in the Caribbean, an examination of chemotaxonomic features in natural products from island Lamiaceae species reflects the molecular diversity that must be present within the Caribbean islands' endemic genera. An assessment of Lamiaceae species extracts via HPLC MS MS demonstrated the tendency for biosynthesis of flavonoids, and flavonoid glycosides, with methoxylation on rings A, B and C of the flavonoid skeleton. The application of computer modelling to further unlock the bioactivity potential of these natural agents demonstrated the potential for molecular intervention against the SARS COV 2 corona virus, as a biological target. Molecular modelling has become a fast-track tool to clinical trials of bioactive compounds. The molecular diversity within the Caribbean archipelago is deserving of concerted focus as we search for novel bioactive agents.

SESSION I:
BOTANICALS OF CARIBBEAN DIASPORA

INVITED TALK

O2. Thirty-five years of tropical plant tissue culture R&D in Jamaica: the challenges and breakthroughs

Sylvia Adjoa Mitchell. Medicinal Plant Research Group, The Biotechnology Centre, The University of the West Indies, Mona Campus, Jamaica.
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In 1985, the International Institute of Tropical Agriculture (IITA) initiated a joint GOJ/UWI/IITA Root Crop Project. This project introduced minisett yam technology to Jamaica, enabled tissue culture capabilities at Life Sciences, UWI and built a tissue culture facility at the Scientific Research Council. In 1989, another tissue culture facility was initiated at The Biotechnology Centre, UWI, courtesy of a grant from the EuropeanCommunities. The Centre has maintained training and research facilitating postgraduates pursuing their MPhil or PhD in Biotechnology. The Medicinal Plant Research Group (MPRG) was initiated at the Centre in 1999. A five-prong approach has been refined by the MPRG to include 1) bioactivity (antifungal, antibacterial) and biochemical (chlorophyll level, antioxidant activity) studies of various crops (bottlebrush, breadfruit, jackfruit) which has resulted in several refereed papers and commercial business development; 2) ethnobotany studies and monographs; 3) tissue culture studies adding: bamboo (Bambusa vulgaris), bottle brush (Callistemon viminalis), cassava (Manihot esculenta), chainy root (Smilax balbisiana), pepper elder (Piper almalgo), sweet potato (Ipomea batatas), and yams (Dioscorea spp); 4) business support including taxonomic review of Jamaican root tonic plants, TRAMIL Jamaican study, and data gathering support to several country-wide projects, 5) International links – Caribbean Access and Benefit Sharing for ratification of the Nagoya Protocol, IUCN report on Caribbean Bioprospecting, the SRAD research cluster; Edinburgh projects on reformative justice and SOAD with links to Africa. There has been a conscious effort to be involved in and to tailor research to serve rural and industrial needs. There has also been a conscious effort to mix short-term research that has immediate application (eg. development of low-cost tissue culture kits, clean planting material) with longer-term R&D that may take years to apply but for which the potential is much greater (e.g., biofarming, somatic embryogenesis of elite trees, product development, commercial tissue culture). The challenges and opportunities arising from these activities will be discussed.

SESSION I:
BOTANICALS OF CARIBBEAN DIASPORA

INVITED TALK

O3. Role of roots and tuber crops in global household food security

Martha. C. Giraldo. Agroenvironmental Sciences Department, University of Puerto Rico Mayagüez Campus.
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Root crops are part of the regular diets in Puerto Rico, the Caribbean, and the Southern US. The sweet potato, yam, and tanier occupy an essential place as a primary food source. As part of global climate change and hurricane seasons is imperative for the South US, Caribbean, and Puerto Rico to strengthen their food security sources, and one of our main assets relies on our root crops. These root crops have not only the resilience for production but the nutritional facts required. Even though these food crops are mostly seen as minor or specialty crops, they have the potential to feed and be part of the solution to reinforce food security for the Caribbean and worldwide. Concerning yam, tanier, and sweet potato crops, as of 2019, it was reported that their value at the farm level is close to $6 million, with yam being the most economically important, followed by tanier and sweet potato. The contribution of these to total consumption fluctuated from 3.6% in sweet potato, 7% in tanier, and 20% in yam. We have a significant margin for growth in these crops, which are so important for local nourishing. These crops can significantly improve nutrition and food security. As essential cash crops, they present several mutual challenges. They are propagated clonally by vegetative material, allowing yield-reducing pathogens and pests to disperse and build up over time. This talk aims to address important research projects that are currently being developed to achieve this goal. Achieving greater food security is important for Puerto Rico and the world.

SESSION I:
BOTANICALS OF CARIBBEAN DIASPORA

INVITED TALK

O4. Development of scientific tools for underutilized crops of Caribbean

Alok Arun 1*, Celine Noirot 2, Rosalinda Aybar Batista1, Jacobo Morales Mendez1, Juan Colon Morales 1 , Natalia Berríos Rivera 1 , & Juan Negrón Berríos1 . 1 Institute of Sustainable Biotechnology, Department of Science and Technology, Inter American University of Puerto Rico, Barranquitas, PO Box 517, Puerto Rico, USA . 224 Chemin de Borde Rouge - Auzeville CS 52 627 - 31326 Castanet Tolosan cedex, France. Email: alok_arun@br.inter.edu

The Peruvian carrot (Arracacia xanthorrhiza) commonly referred, as apio is a crop that is a secondary food item for over 100 million people, mainly in South America and Puerto Rico. While the storage roots are the main product, the rootstock and leaves are used as animal feed and the aerial stems are used as propagules. The crop has low input requirements and can be grown in a variety of frost-free tropical highland environments. However, in the absence of preventive management practices and proper handling, infections caused by pathogens severely damage the storage roots. The lack of certainty about the agents and the process of infection is a major gap to understanding how to prevent infection at its very onset. Despite the economical and agricultural importance of apio, any biotechnological strategy aimed at improving the yield or protecting the crop from pest damage is non-existent, partly due to lack of any genomic tools and techniques. For non-model plants like apio that has very limited genomic information available, developing genomic and transcriptome databases may help improve its cultivation and shelf life. In our study, we characterized the global gene expression profile of A. xanthorrhiza tissues (tuber, leaf, flower and cormel) using Illumina high-throughput RNA sequencing platform. The study generated 74,533 contigs corresponding to approximately 72 million paired-end reads. Functional annotation of the dataset identified 12 of the 15 homologous enzymes involved in flavonoid biosynthesis pathway in plants and six gene families involved in starch biosynthesis. Further, we sequenced the nuclear genome of Arracacia xanthorrhiza using PacBioscience platform, which generated 117,654, reads with mean length of 61,758 bps. Currently, we are assembling and annotating the genome. Finally, we studied the tissue structure of the tuber using Scanning Electron Microscope to understand the structure of starch molecules. The present study is the maiden report on transcriptome and genome datasets in Arracacia species and dataset will provide a resource for further research on improving the quality and storage life of the crop.

Acknowledgment: USDA HSI STEM grant no. 2021-77040-34872 and UIPR FondoSemilla grant awarded to Alok Arun supported this research.

SESSION II:
BIOACTIVE COMPOUNDS OF PLANTS AND THEIR ROLES IN HUMAN HEALTH I (CANCER)

KEYNOTE

O5. Grape antioxidants in skin cancer management

Chandra K. Singh[1] and Nihal Ahmad[2]. [1]Department of Dermatology, University of Wisconsin, and [2]William S. Middleton VA Hospital, Madison, WI.
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Non-melanoma skin cancers (NMSCs) are the most frequently diagnosed cancers in the USA, with an estimated 5.4 million cases diagnosed annually in 3.3 million people in the USA. Therefore novel approaches are needed for the management of NMSCs. Dietary agents have gained considerable attention for protection against skin cancer. Red grapes contain a natural amalgamation of agents with antioxidant and anti-inflammatory properties. We have found that GP has significant chemopreventive effects against ultraviolet B (UVB) radiation mediated cutaneous responses, including photocarcinogenesis in male and female SKH1 hairless mice. The observed effects of GP were associated with modulations in multiple cellular processes (DNA repair, oxidative stress, protein ubiquitination and acute phase response signaling), in female mice. Similarly, we found a marked reduction in malignant conversion of premalignant lesions in GP-treated male mice. Additionally, we observed significant decrease in mast cell infiltration and serum IgE and cytokine CCL1 levels. To further understand the mechanisms of the biological response of GP, we employed cancer-pathway PCR array to profile 84 key genes related to transformation and tumorigenesis, in tissues obtained from mice. GP feeding modulated several genes related to cellular senescence, DNA repair, hypoxia and telomere maintenance. We observed significant modulation in 6 genes involved in hypoxia signaling (Hmox1, and Ldha), DNA repair (Ercc3), and telomeres and telomerase (Terf2ip, Tinf and Tnks2). Ingenuity Pathway Analysis (IPA) suggested association with increased cellular homeostasis and apoptosis, as well as decreased cell migration, viability and proliferation in tumors, which all support the chemoprotective response of GP. Additionally, IPA suggested probable inhibition of H2O2, PI3K, STAT3, IGF1, IL1A, IL1B, RELA, and TP53 activation, as the upstream regulators of GP-altered genes. A network pathway of interacting genes further suggested links to key players in skin cancer (NF-κB, PI3K, P38 MAPK, ERK1/2, AMPK, CD3, and histones H3 and H4) supporting anti-tumor properties of dietary grape. Overall, our studies suggest that grape consumption has chemopreventive effects against skin cancer.

SESSION II: BIOACTIVE COMPOUNDS OF PLANTS AND THEIR ROLES IN HUMAN HEALTH I (CANCER)

INVITED TALK

O6. The role of dietary stilbenes in prostate cancer interception: evidence from preclinical studies

Anait S Levenson. Department of Biomedical Sciences, College of Veterinary Medicine, Long Island University, Brookville, NY 11548, USA.
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Developing novel interceptive strategies for prostate cancer management is a supreme goal in clinical oncology. Polyphenols found in food and plants, particularly stilbenes, have gained increased importance as potential preventive and therapeutic anticancer agents due to their potent biological properties including anti-inflammatory, anti-oxidative, anti-proliferative, and pro-apoptotic effects. Studies have shown that stilbenes can affect multiple signaling pathways involved in inflammation, cell proliferation and survival, EMT, invasion, angiogenesis, and metastasis. In fact, stilbenes are shown to modulate epigenetic andtranscription factors, growth factors, enzymes, and non-coding RNAs. In our studies, we demonstrate metastasis associated protein 1 (MTA1)-mediated anti-inflammatory and anticancer effects of resveratrol, pterostilbene and Gnetin C in prostate cancer in vitro and in vivo. Importantly, we conducted various prostate cancer pre-clinical studies with stilbenes using both transgenic mouse models and xenografts and demonstrated potent MTA1- targeted interceptive outcome. I will discuss the importance of mechanistic preclinical studies with natural products for future successful human clinical trials towards protecting select responsive group of patients.

SESSION II: BIOACTIVE COMPOUNDS OF PLANTS AND THEIR ROLES IN HUMAN HEALTH I (CANCER)

INVITED TALK

O7. Maternal epigenetic diets on transgenerational breast cancer prevention

Yuanyuan (Rose) Li*. Department of Obstetrics, Gynecology & Women's Heath, Department of Surgery, University of Missouri *Address correspondence to Yuanyuan (Rose) Li, One Hospital Drive, Medical Sciences Building, M659, Columbia, MO, 65212, Tel: +1-573-884- 8975, E-mail: ylgrk@missouri.edu.

Breast cancer is the most common type of cancer and the second leading cause of death among women in the United States. Studies have shown breast cancer has strong developmental origins. Maternal nutrition has a significant impact on epigenetic reprogramming processes during early development, which may alter the offspring's health outcome later in adult life. In the current studies, we seek direct evidence that development of breast cancer may originate from a fetal environment and maternal nutrition composition may influence the disease outcome through epigenetic mechanisms. Our results showed that the prevention outcome for maternal soybean genistein (GE) was explicitly dependent on exposure timing, and temporal epigenetic changes controlled important gene expression that are central to the efficacy of maternal GE on breast cancer prevention in later life. This study provides important insights into an appropriate maternal administration of soybean-based botanical diets or bioactive compounds that can maximize their beneficial effects leading to improved health outcome such as breast cancer prevention later in offspring life.

SESSION II: BIOACTIVE COMPOUNDS OF PLANTS AND THEIR ROLES IN HUMAN HEALTH I (CANCER)

CONTRIBUTED ORAL TALK

O9. Chemopreventive activity of Gnetin C in murine tumor models of prostate cancer

Gisella Campanelli [1], Prashanth Parupathi [1] , Qing Cai [1] , Avinash Kumar [1], Anait S Levenson [2]. [1]Arnold & Marie Schwartz College of Pharmacy and Health Sciences, Long Island University, Brooklyn, NY 11201, USA; [2] School of Veterinary Medicine, Long Island University, Brookville, NY 11548, USA. E-mail: gisella.campanelli@my.liu.edu; anait.levenson@liu.edu

Prostate cancer (PCa) is the most common of all cancers in men. Epidemiological data suggest that diet has substantial impact on the development and progression of PCa. Among dietary polyphenols, stilbenes have been studied for their potential as chemopreventive and therapeutic agents in PCa. Gnetin C, a resveratrol-dimer found abundantly in melinjo plant (Gnetum gnemon), possesses more potent biological properties compared to resveratrol and pterostilbene (Pter) due, in part, to its improved pharmacokinetics. In our previous studies, we have extensively reported on the metastasis-associated protein 1 (MTA1)- and androgen receptor (AR) -targetedanti-inflammatory and anticancer properties of stilbenes. Here, for the first time, we examine the efficacy of Gnetin C in clinically adequate transgenic mouse models representing early and advanced stages of PCa progression. For this study, we generated prostate-specific MTA1-knocked in transgenes on the background of Pten heterozygosity (R26MTA1; Pten+/f;Pb-Cre+) and Pten knockout (R26MTA1; Ptenf/f; Pb-Cre+). R26MTA1; Pten+/f; Pb-Cre+ mice were used for chemopreventive strategy (diet supplementation with Gnetin C) while R26MTA1; Ptenf/f; Pb-Cre+ mice with more aggressive PCa were injected with Gnetin C as therapeutic strategy. Our results show that mice treated with Gnetin C (7 mg/kg bw, daily i.p.) exhibited more favorable histopathology with decreased severity and number of PIN foci (41.23 % reduction) accompanied by reduced proliferation (Ki67, 57.43% reduction), angiogenesis (CD31, 86.91% reduction), AR (31.57 % reduction), and MTA1 (27.94 % reduction). Ongoing chemopreventive studies with four different diets (Control-vehicle group; Pter (70 mg/kg diet); Gnetin C high dose (70 mg/kg diet); and Gnetin C low dose (35 mg/kg diet)) and are in progress. Taken together, these data provide an evidence for efficacy of Gnetin C in blocking PCa progression and implicate the potential of Gnetin C in PCa chemoprevention and therapy.

SESSION II: BIOACTIVE COMPOUNDS OF PLANTS AND THEIR ROLES IN HUMAN HEALTH I (CANCER)

CONTRIBUTED ORAL TALK

O10. Garcinia mangostana (mangosteen) xanthones promote androgen receptor degradation

Mirielle Nauman [1,2], Jonghoon Won [2], and Jeremy Johnson [1,2]. [1]Department of Pharmaceutical Sciences, University of Illinois at Chicago College of Pharmacy, Chicago, IL 60612, [2]Department of Pharmacy Practice, University of Illinois at Chicago College of Pharmacy, Chicago, IL 60612. E-mail addresses: mnauma6@uic.edu, jjjohn@uic.edu

The purple mangosteen fruit (Garcinia mangostana) contains a unique class of chemical compounds called the xanthones. Our lab has evaluated these xanthones for their potential activity in breast, colon, and prostate cancer cells. Preliminary data has shown that isoprenylated xanthones exhibit cytotoxic activity in multiple cell lines, specifically α-mangostin and gartanin, two of the most abundant mangosteen xanthones. In prostate cancer cells, both compounds induce apoptosis and induce androgen receptor (AR) degradation. Mechanistic data reveals that there is a simultaneous decrease in AR protein expression and an increase in BiP, a cell stress chaperone, protein expression in prostate cancer cells treated with α-mangostin. Ubiquitination of the androgen receptor via the proteasome has also been observed through western blots and immunoprecipitation experiments. Interestingly, α-mangostin also promotes degradation of mutated AR, containing either point mutations or splice variants, both of which are mechanisms of drug resistance for prostate cancer cells and present significant clinical problems. In vivo data has confirmed that α-mangostinis effective at reducing tumor size in mice xenografted with prostate cancer cells, even more effective than Bicalutamide, and that there may be in vivo modulation of the androgen receptor. We hypothesize that α-mangostin promotes degradation of both wild type and mutated AR by promoting an interaction between AR and BiP proteins. This data highlights a class of compounds that targets AR in drug resistant prostate cancer cases through a novel and unique strategy.

SESSION III:
CHEMISTRY OF MEDICINAL PLANTS

O11. Translational development of phytochemicals and highly characterized plant extracts

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Dose selection and the pharmacokinetic properties of phytochemicals is critical in the successful translation of promising study agents. The traditional approach with plant based medicine has been to isolate the “active ingredient” from a plant and utilize a high dose to achieve the greatest activity. For certain situations this may be appropriate, however, in other circumstances this could actually hinder the development of a study agent. More recently, it is becoming increasingly clear that the whole plant matrix likely contributes to biological activity. In addition, evidence is suggesting that higher doses may not be optimal for improving the pharmacokinetic and pharmacodynamic endpoints ofphytochemicals. Herein we will describe important considerations when deciding if a pure phytochemical or a complex plant matrix is the ideal choice as studyagents as they progress to early phase clinical trials. From our own research aswell others we will describe pharmacokinetic examples of several phytochemicals from different plants including rosemary (Salvia rosmarinus), green tea (Camellia sinensis), and mangosteen (Garcinia mangostana). Discussion will focus on dose selection and how raw material may impact the pharmacokinetic and pharmacodynamic endpoints in a pre-clinical and clinical research.

SESSION III:
CHEMISTRY OF MEDICINAL PLANTS

INVITED TALK

O12. Combined elicitation and targeted metabolomics approach for the discovery of medicinally active prenylated stilbenoids in hairy root cultures of peanut and pigeon pea

Fabricio Medina-Bolivar. Department of Biological Sciences and Arkansas Biosciences Institute, Arkansas State University, Jonesboro, AR 72401, USA.
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Prenylated stilbenoids are a class of phytoalexins produced in certain plants such as peanut and pigeon pea. Studies to elucidate the biological activities ofthese compounds have been limited because they are not commercially available and are produced at very low levels in plants making their isolation challenging. To address these issues, we established hairy root cultures of peanut and pigeon pea and co-elicited them with methyl jasmonate, cyclodextrin, hydrogen peroxide and magnesium chloride to induce the biosynthesis of prenylated stilbenoids. In peanut, several prenylated stilbenoids accumulated in the culture medium. These included arachidin-1, arachidin-2, arachidin-3, arachidin-5, and arachidin-6. In pigeon pea, the main prenylated stilbenoid was cajaninstilbene acid. Interestingly, the stilbenoids identified in peanut represent analogs of resveratrol. Whereas the stilbenoids in pigeon pearepresent analogs of pinosylvin. In both species, more than 95% of the total stilbenoids identified were found in the culture medium. Targeted tandem mass spectrometry analyses revealed that several other stilbenoids were also induced and secreted into the culture medium. To evaluate their biological activities, the prenylated stilbenoids from peanut were purified using column chromatography and semi-preparative high-performance liquid chromatography. The purified prenylated stilbenoids showed antioxidant, anti-inflammatory and anticancer activities in vitro. The hairy root cultures of peanut and pigeon pea demonstratedto be a reliable and sustainable platform for producing different types ofprenylated stilbenoids with potential applications in human health.

SESSION III:
CHEMISTRY OF MEDICINAL PLANTS

INVITED TALK

O13. Biochemometric Molecular Networking to Discover New Aryl Hydrocarbon Receptor Ligands from the Diet

Joshua J. Kellogg [1, 2]. [1]Department of Veterinary and Biomedical Sciences and [2]Huck Institute of the Life Sciences, Pennsylvania State University, University Park, PA. E-mail: jjk6146@psu.edu

The aryl hydrocarbon receptor (AHR) has emerged as a critical ligand-activated transcription factor that promotes barrier tissue integrity, cellular differentiation programing, and immune system homeostasis, especially in the gastrointestinal tract, where the presence of AHR ligands enhances resistance to toxic insults. While botanical foods are known to exert AHR effects, the understanding of which specific bioactive molecules responsible for AHR activity is generally wanting. We developed a library of known AHR ligands to use as a reference database to screen for potential ligands from common foods (mushrooms, peppers, carrots). Using a molecular networking approach, combined with biochemometric modeling, we uncovered several compounds that possessedAHR-activity in an in vitro model. The network allowed for preliminary structural information about the dietary ligands, and demonstrated enhanced detection capabilities compared to previous studies that utilized conventional bioassay guided fractionation discovery. These results suggest that there are a variety ofphytochemicals present in the diet that are capable of modulating AHR activity and potentially affecting downstream immune function in the gut.

SESSION III:
CHEMISTRY OF MEDICINAL PLANTS

INVITED TALK

O14. Quality, chemistry, and biological activity of the West African spice, grains of paradise (Aframomum melegueta)

H. Rodolfo Juliani. Department of Plant Biology. School of Environmental and Biological Sciences. Rutgers University. 59 Dudley Rd. New Brunswick, 08901, New Jersey.

Herbs and spices have seen a significant increase in their use during the 21stcentury. Consumers have been searching for new ways to spice up their lives, looking for new experiences, products, flavors, and spices. This trend hasincreased during the COVID19 pandemic, as people needed to hunker down athome and then cook food and introduce variety, color, and new flavors to foods through spicing. Grains of paradise (Aframomum melegueta), a member of the ginger family (Zingiberaceae), originated from West Africa, specifically, the countries of the Guinea forest, Ghana, and Liberia. Grains of paradise is a seedspice, like cardamom. Grains of paradise contains essential oils and non-volatile components, both responsible for the aroma and flavor. This presentation aims to hightlight the recent advances in the quality, chemistry, and biological activities of the West African spice. In terms of quality, developing standards can increaseits commercial interest. As part of my research at Rutgers University, I contributed in collaboration with the US and African colleagues to define those standards of quality. The presentation will highlight recent activities on standard developments, including macroscopic, microscopic characterizations, chemical and proximate analysis. The presentation will focus on our recent work on the chemical diversity of non-volatile polyphenols of grains of paradise and new biological activities.

SESSION III:
CHEMISTRY OF MEDICINAL PLANTS

CONTRIBUTED ORAL TALK

O15. Dillapole, a compound extracted from fennel, exhibits potential as an antibacterial chemotherapy by dampening virulence factor expression

Elliot Collins [1], Deanna M. Schmitt [1], Francisco Leon[2], Kristen Sikorsky[1], Anthony Sako[1], James Denvir [3], Donald A. Primerano [3], and Joseph Horzempa[1].
[1] Department of Biomedical Sciences, West Liberty University, West Liberty, WV. [2] Drug Discovery & Biomedical Sciences, College of Pharmacy, University of South Carolina, Columbia, SC. [3] Department of Biomedical Sciences, Marshall University, Huntington, WV E-mail: joseph.horzempa@westliberty.edu

Francisella tularensis has been classified as a Category A Bioterror Agent by the CDC. The intentional release of an antibiotic-resistant strain of F. tularensis could be devastating. Consequently, there is a need for novel treatments for F.tularensis infections. We previously tested a library of natural extracts to identify compounds that inhibit replication of a fluorescent F. tularensis strain during infection of THP-1 monocytes, but not outside the context of infection. One of themost promising extracts identified here was from Fennel (Foeniculum vulgare). Using bioassay guided fractionation, the Fennel extract was separated until a pure compound (dillapiole) was isolated and identified (via NMR and MS). Bonafide dillapiole (Sigma Aldrich) exhibited a similar effect to the purified compound, validating our findings. We first hypothesized that dillapiole may be augmenting host immunity.However, a multiplex analysis of RAW 264.7 macrophages suggested that only TNF-a was modulated by dillapiole. This finding was confirmed by ELISA. Moreover, RNA-seq data generated from THP-1 cells treated with dillapiole vs. vehicle were analyzed by Ingenuity Pathway Analysis. This analysis did not reveal an obvious host response that would explain the reduction in F. tularensis CFU upon treatment with dillapiole.Therefore, wehypothesized that dillapiole may be dampening virulence gene expression of F. tularensis. RNA-seq revealed that bacteria treated with dillapiole exhibited a reduction in expression of genes encoded in the Francisella Pathogenicity Island(FPI). Western blotting confirmed that dillapiole led to reduced production of IglAand IglC (two FPI proteins), but not LpnA (encoded elsewhere). This study shows that dillapiole is a promising novel type of antimicrobial that dampens virulence factor expression. Therefore, this compound does not exert the degree ofselective pressure compared to traditional antibiotics which will likely minimize the development of resistance to dillapiole.

SESSION III:
CHEMISTRY OF MEDICINAL PLANTS

CONTRIBUTED ORAL TALK

O16. Harnessing the potential of two southern African plants for the treatment of acne vulgaris

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Acne vulgaris is a chronic inflammatory skin disorder affecting the pilosebaceous unit. Moderate forms (comedonal) are characterised by non-inflammatory lesions including blackheads and whiteheads, whereas more severe forms present as inflammatorypapules, pustules, nodules and cysts. The Gram-positive microorganism, Cutibacterium acnes, is the major causative pathogen in acne progression characterised by a cascade of events initiated by abnormal skin keratinisation, increased sebum production, proliferation of C. acnes and the release of inflammatory factors. This study aimed to investigate the potential of two southern African medicinalplants, belonging to the Asteraceae and the Rosaceae family, for the treatment of acne vulgaris. In addition, the extracts were used to synthesise gold nanoparticles to determine whether their activity could be enhanced through nanoencapsulation. The antimicrobial activity was determined using the microdilution broth assay, the synthesised nanoparticles were characterised using standard techniques (High Resolution Transmission Electron Microscopy, Fourier Transform Infrared spectroscopy, Zeta-potential and Dynamic Light Scattering), quantification of phenolic content was performed using the Folin-Cioalteau reagent and the anti-biofilm activity was performed using the crystal violet staining technique. The Asteraceae species exhibited a minimum inhibitory concentration (MIC) of 7.81 µg/mL and the Rosaceae species had an MIC of 15.625 µg/mL. The Asteraceae species nanoparticles exhibitedno antimicrobial activity against C. acnes, showed inhibition of bacterial attachment at
20.42 µg/mL (determined using phenolic content). The Rosaceae species gold nanoparticles exhibited an MIC of 10.78 µg/mL (determined using phenolic content) which was below the extract MIC. The potent antimicrobial activity of these two southern African plant extracts against the biofilm forming C. acnes strain (ATCC 6919) warrants further development of these extracts as commercial active ingredients or formulations to combat acne.

SESSION IV: ETHNOBOTANY, BIOPROSPECTING AND PRODUCTION

O17. Bioexploration of indigenous plants in sub-Sahara Africa

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Sub-Sahara Africa is rich in biodiversity and a paradise to explore ethnobotanically. This presentation will present three case studies on bioexploration of selected indigenous plants. From West Africa we will focus on Griffonia, Voacanga, Shea Butter and Kinkeliba using a more traditional ethnobotanical approach. In East Africa, we employed a different model and focused on those indigenous or naturalized plants that are nutrient dense. Here, our research evaluated African Indigenous Vegetables (AIVs) andidentified those that are rich sources of pro-vitamin A, iron, zinc, and other health- promoting phytochemicals. We hypothesized that by improving access, availability, affordability, the consumption of AVIs would increase as would dietary diversity, food security and health and nutrition. In addition, we quantified the nutritional and anti- nutritional aspects of major AIVs. The third case focused on identifying the useful plants of Namibia, plant collection, screening using chemical and biological assays and then chemical profiling of promising species. All work was done in concert with local partnersand researchers.

SESSION IV: ETHNOBOTANY, BIOPROSPECTING AND PRODUCTION

INVITED TALK

O18. Ethnobotany and Production of Three High-value Medicinally Active Herbs, Basil, Turmeric, and Mountain mint in North Alabama

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Herbal products are gaining popularity as health supplements in the USA. About 80% of the world's population relies on herbal remedies in one form or the other, while 25% of the pharmaceutical drugs are plant-based. Among a wide range of medicinally active plants, basil (Ocimumspp), turmeric (Curcuma spp.), and mountain mint (Pycnanthemum virginianum) have wide applications ranging from culinary and aromatic to medicinal and confectionery purposes. Basil, particularly holy basil (O. tenuiflorum), has been shown to have a myriad of medicinal properties and is known as a panacea for many ailments ranging from commoncolds to chronic diseases such as cancers and diabetes. Turmeric, used in Indian medicine for over 4000 years, is now gaining popularity in the US as a miraclehealth supplement to combat inflammatory diseases and memory loss, immune deficiency, and common colds. Mountain mint is used in the medicinal and confectionery industries. Our research using basil accessions belonging to sevenspecies has shown their anticancer and antihyperglycaemic activity. The major components in the essential oils of five selected turmeric varieties were α- phellandrene (3.7–11.8%), 1,8-cineole (2.6–11.7%), α-zingiberene (0.8–12.5%),
β-sesquiphellandrene (0.7–8.0%), ar-turmerone (6.8–32.5%), α-turmerone (13.6– 31.5%), and β-turmerone (4.8–18.4%). Several of the varieties' essential oil yields and chemical profiles are comparable with those of tropical regions. Two of the four mountain mint varieties grown in North Alabama showed consistently high yield potential. They were rich in isomenthone concentrations, which increased dramatically from 20% to 69% as the season advanced, whereas pulegone and thymol tended to decrease. The essential oil components variedwith varieties and with time. One of the basil accessions studied showed antidiabetic activity comparable to commonly used medicine Acarbose. The three species with desirable essential oil composition offer potential for production as high-value medicinal crops in North Alabama.

SESSION IV: ETHNOBOTANY, BIOPROSPECTING AND PRODUCTION

INVITED TALK

O19. Instrumental Challenges with Essential Oil Adulteration

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About 80% of commercially available, so-called “pure and natural” essential oils are adulterated for economic profit. Not only does this create concerns for the end user, this also negatively impacts hardworking farmers and their ability to make a reliable income.Typically, adulteration of essential oils occurs through the addition of synthetic and natural compounds, those related and unrelated to the oil’s composition, in order to increase profits or meet some established requirements such as ISO. There are commonly used analytical instruments like Gas Chromatography Isotope-Ratio Mass Spectrometry (GC-IRMS), Site-Specific Natural Isotope Fractionation NMR (SNIF-NMR), EntGC-MS, and components ratio quantitation to analyze essential oil samples. GC-IR-MS is often used to detect the authenticity of the EO’s origin via the isotopic ratio measurement. However, this technique has several limitations. EntGC-MS also has specific limitations, as it is only applicable to chiral molecules and the enantiomeric ratio of chiral compounds varies from origin to origin. SNIF-NMR is only useful for small molecules (such as monoterpenes) to authenticate their origin via the Deuterium ratio, but essential oils are also composed of sesquiterpenes and diterpenes. Likewise, this method requires pure isolated compounds.Every adulterant has some kind of marker or impurity. Identifying this marker is a more effective way of detecting EO adulteration. The identification of those markers in the essential oil can provide the best solution for detecting adulteration through ordinary GC-MS. Therefore, my presentation will focus on sophisticated adulteration (undetected by ordinary lab and chemists).

SESSION V:
IN VITRO PROPAGATION AND CONSERVATION OF VALUE-ADDED PLANTS

INVITED TALK

O20. Ethnobotanical knowledge paving way for medicinal compounds and value- added products in Paulownia tree

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Bioprospectingis a systematic and organized search for useful products derived from bioresources that can be developed for overall benefits of the society and commercialization. Paulownia is a deciduous tree which is well known for its wood quality, while its medicinal properties are just gaining attention. The genus Paulownia, belonging to monogeneric Paulowniaceae family, comprises of nine species: P. albiphloea, P. australis, P. catalpifolia, P. elongata, P. fargesii, P. fortunei, P. kawakamii, P. taiwaniana, and P. tomentosa. Apart from its extensive use as a high-quality wood in the industrial and agricultural areas, Paulownia has also been used as an herbal medicine in traditional Chinese medicine (TCM). The "Compendium of Materia Medica" (a Chinese Materia Medica written by Li Shizhen in 1578) mentions Paulownia bark for the treatmentof hemorrhoids and worms; and the flowers for reducing swelling as well as promoting hair growth. Medical research has identified several potential applications for the genus Paulownia as an antibacterial, anti-inflammatory,thirst-quenching, diuretic, antihypertensive, hemostatic and insecticidal agent. Insecticidal properties have been linked to chemicals synthesized in glandular trichomes predominantly dispersed on the surface of leaf, flower bud, and flowers and are rich in bioactive compounds. In the last few years, various Paulownia tissues and fruits have been analyzed for phytochemical screening and bioactivity of potential compounds clinically and valuable leads have been obtained. More scientific studies using in vivo disease models are warranted to elucidate the medicinal properties and underlying mechanisms of Paulownia.

SESSION IV: ETHNOBOTANY, BIOPROSPECTING AND PRODUCTION

CONTRIBUTED ORAL TALK

O21. Stevia & Turmeric, consumption can help for anti-cancer benefits, know how to grow and consume

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Two very important plants-Stevia and Turmeric can be grown in our backyards for everyday consumption used for anti-cancer benefits. Stevia (Stevia rebaudiana Bertoni),is a plant native to Paraguay, and its leaves produce the best natural sugar substitutes. The steviol glycoside produced in stevia leaf is anti-cariogenic, anti-diabetic, antioxidant, hypotensive, anti-hypertensive, anti-microbial, anti-inflammatory, and has anti-tumor actions. On the other hand, Turmeric, (Curcuma longa), is also a perennial, herbaceous plant native to the Indian subcontinent and Southeast Asia. Turmeric rhizomes are used for consumption and the active ingredient in turmeric is curcumin. Some studies suggest that curcumin in turmeric has a variety of health benefits, including fighting cancer cells. Some lab studies have found it might work against lung, breast, prostate, and colon cancers. The global number of cancer patients is predicted to increase to 47% in the next 20 years. Therefore, it is better toknow how to grow and consume Steviaand Turmeric as a means of cancer prevention and therapy within the context of a healthy diet. The USA imports all stevia and turmeric from outside and mainly from China, Japan. Products grown here in the USA could help. This research study to grow and consu

SESSION V:
IN VITRO PROPAGATION AND CONSERVATION OF VALUE-ADDED PLANTS

O22. Development of efficient plant regeneration systems for grapevine precision breeding and genome editing

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Grape is among the most ancient crops cultivated worldwide and is highly valued for its ability to be converted into value-added products such as wine, juice, jelly, and jam. Several pathogens affecting grapevine can result in a significant decrease in productivity of vineyards worldwide. Genetic improvement of elite table and wine grape cultivars for disease resistance and quality traits is difficult using conventional breeding techniques. Precision breeding is defined as an approach to plant genetic improvement that transfers only specific traits among sexually compatible relatives via the relatively stable mitotic cell division pathway in order to avoid the significant genetic disruption imposed upon conventional breeding by meiosis. Recent advances in Vitis genome sequencing combined with optimization of grapevine regeneration protocols and gene insertion techniques have enabled the successful implementation of precision breeding technology. Grapevine somatic embryos are ideal target tissues for inserting and/or editing desired traits of interest and recovery of modified grapevines. Grape species and cultivars widely vary in their embryogenic response, which necessitates the optimization of protocols for individual cultivars. Factors influencing the production of embryogenic cultures including explant type, development stage, growth media, and culture conditions have been optimized for a large number of grape species and cultivars. The development of efficient grapevine embryogenic culture systems can enable their use in precision breeding and genome editing for rapid trait improvement.

SESSION V: IN VITRO PROPAGATION AND CONSERVATION OF VALUE-ADDED PLANTS

INVITED TALK

O23. Nutrients and lighting factors in controlling medicinal plant culture

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Plant nutrients and light spectra are both factors that profoundly influence plantgrowth and development. The in vitro environment offers a highly controlled platform to explore the effects of environmental on developmental growth and phytochemistry in clonal germplasm free from confounding micro-organisms, weather, and soil conditions. In clones of turmeric, Curcurma longa L., high nitrate, low ammonium, medium rich in phosphate was most useful to grow rhizomes and more water was needed allow maximal use of nitrate, and more sucrose was necessary for maximal use of phosphate. The elevated phosphateallowed rhizome dry mass and vegetative propagules to develop but interfered with the formation of cucurminoids and terpenes. Bioreactors and advanced DOE experimental models allowed a small experiment to reduce many of these termsto practice. Cannabis sativa L., is sensitive to plant growth regulators in vitro. Propagation without PGR's is approached with monochromatic LED's providing both energy and regulatory signals to the plant. Light effects are based both on intensity and the ratios of the varied monochromatic sources. Both nutrient andlight experiments are inherently multifactor, since ratios of factors are at least as important as absolute amounts. The experimental designs, in vitro methods, and special facilities needed to conduct this type of work will be shown.

SESSION V:
IN VITRO PROPAGATION AND CONSERVATION OF VALUE-ADDED PLANTS

INVITED TALK

O24. In vitro regeneration of medicinal plants and analysis of structural plasticity of cells and tissues towards changed environmental conditions: A way forward to develop climate-resilient plants

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The impact of climate change is evident on various ecosystems on the earth. The response of plant communities toward changed environmental conditions starts at the molecular level and is visible at cell and tissue levels (via microscopy). In vitro regeneration systems are highly useful in the mass production of genetically uniform plantlets. This technique provides controlled (simulated) environments to check how plants respond toward changed environments. The blending of microscopy with in vitro plant regeneration technology may shed light on the microstructural and histochemical developments taking place in plants under in vitro (fully heterotrophic), ex vitro(mixotrophic), and in vivo (fully autotrophic) environments. Plants that are growing under fully controlled conditions display underdeveloped foliar anatomical traits such as thin cuticle, unorganized epidermal cells, and fewer mesophyll tissue density and vascular elements with reduced deposition of lignins, cutin, pectin, tannins, and polyphenolic compounds. The mixotrophic environment impacts the improvements in the cuticle, development of uniform epidermal layer, increased mesophyll and vascular elements, and histochemicaltraits. The field-grown plants show well-developed dermal, ground, and vascular tissue systems along with increased deposition of primary and secondarymetabolites. These gradual changes positively affect the microstructural and physiological status of plantlets to withstand abiotic stresses in the field conditions which could assist the plantlets in the tolerance to elevated temperature and light. Thus, the microscopic evaluation of plantlets could help to better understand the anatomical and histochemical process of adaptation of plants and enhanced survival of plantlets under changed environmental conditions.

SESSION V: IN VITRO PROPAGATION AND CONSERVATION OF VALUE-ADDED PLANTS

INVITED TALK

O25. Conservation of Mexican medicinal species with sedative and anti-inflammatory properties

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Galphimia species of the Malpighiaceae family, are used as a popular sedative and anti-inflammatory medications in Mexico. The active sedative compounds are nor-secofriedelane triterpenes known as galphimines. Using metabolic profiling and, molecular DNA barcodes, we previously demonstrated that nine populations botanically classified as Galphimia glauca belong to four different species of the genus Galphimia, and that only one species exhibited the sedative properties; however, all the collected species showed anti- inflammatory activity. In a different study, we tested the hypothesis that this accumulation responds to genetic control of d Galphimia species. Individuals were collected from six previously studied populations, located in five Mexican states (Doctor Mora in Guanajuato, Jalpan in Querétaro, Cuernavaca andTepoztlán in Morelos, Guadalajara in Jalisco, and Tuxtla Gutiérrez in Chiapas),and transplanted to grow under uniform greenhouse conditions, for a period of
11 months. A phytochemical analysis using chromatographic procedures was performed for all individuals upon arrival and after 11 months of controlled growth. Results indicated that only two populations (Doctor Mora, Guanajuato, and Jalpan, Querétaro), out of the six that were collected, produced galphimines before and after controlled growth, exhibiting the same chemotypepattern in the greenhouse, as in the wild. Evident changes in foliar morphology, probably due to phenotypic plasticity, were observed in all the acclimatized plants.

SESSION V:
IN VITRO PROPAGATION AND CONSERVATION OF VALUE-ADDED PLANTS

CONTRIBUTED ORAL TALK

O26. Machine learning models in plant tissue culture: a case study of Brahmi

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The objective this study is to describe applications of machine learning models in plant tissue culture using Bacopa monnieri (L.) as a case study. Bacopa is a medicinal Ayurvedic herb that has been used centuries for improving memory and cognitive skills, insomnia, anxiety, depression and seizures. These therapeutic benefits of B. monnieri caused an increased demand for its use in commercial preparations. Tissue culture propagation offers clean, identical, and compatible Brahmi biomass in a large scale for downstream processing. On the other hand,in vitro growth kinetics can be viewed as a multi-variable procedure impacted bythe physical conditions (such as types, age, size, density, position, and source ofthe explants, light intensity, and temperature), the composition of culture media (macro and micronutrients, amino acids, vitamins and other nitrogen elements, organic supplements, carbon sources, agar), multiple endogenous and exogenous phytohormones, and their interactions. The combination of thesefactors often causes plant in vitro processes to be non-linear and non- deterministic developmental progressions. Because machine learning models such as Artificial neural networks (ANN), Random Forests (RF), Self-organizing maps (SOM) have inherent ability to handle high biological variability and the uncertainty associated with the tissue culture methods, they have proven to be appropriate approaches for modeling the non-linear and ill-defined in vitro biological processes. Lately, the use of machine learning approaches to accurately predict in vitro growth kinetics have gained importance in validating plant tissue culture processes and helping the industry to scale up productions by fine-tuning the automation process.

SESSION V:
IN VITRO PROPAGATION AND CONSERVATION OF VALUE-ADDED PLANTS

CONTRIBUTED ORAL TALK

O27. Histological examination of in vitro hyperhydric cultures of Scutellaria lateriflora

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Scutellaria lateriflora (American skullcap) belongs to the mint family, Lamiaceae. It is a facultative wetland plant distributed across most of North America. Traditionally, American skullcap has been used for anxiolytic properties,treatment of insomnia, and inflammation and is also available in the herbal health products market as tea, capsules, extracts, and tinctures. Our previous studies on
S. lateriflora to assess the effects of three culture systems (semi-solid agar, liquid stationary, and liquid agitated) on biomass accumulation revealed poor biomass yield coupled with high hyperhydricity in liquid stationary culture system. Two node explants were inoculated on the basal Murashige and skoog media supplemented with sucrose (non-reducing) or maltose (reducing) at 0 %, 3 %, 5
%, 7 %, and 10 % (w/v). With increase in the carbon source concentration, plant quality decreased producing hyperhydric shoots which exhibited dark green to purple, brittle, swollen stems, and small succulent leaves. There was a relationship observed with the increase in carbon source concentration and a decrease in the production of aerial parts. On the contrary, with the increase insugar concentration, more number of thickened roots with purple pigmentation were produced. The liquid stationary system was selected to further study morphology and anatomy of hyperhydric plants by inoculating two node explantsfor six weeks on basal MS medium. Leaves, stems, and roots were collected fromnine treatments of carbon source for histological examination using paraffin wax sections stained with safranin and fast green. Hyperhydric tissues differed in cuticle deposition, organization of different sell layers, and presence of large intercellular spaces in comparison to control plants. To the best of our knowledge,this is the first report on the hyperhydricity in S. lateriflora in relation to type ofculture, carbon source and concentration in an in vitro system.

SESSION VI:
BIOACTIVE COMPOUNDS OF PLANTS AND THEIR ROLES IN HUMAN HEALTH II (INFLAMMATORY DISEASES)

O28. Flavonoids regulate macrophage immune function controlling cancer and halting obesity

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Chronic inflammatory disease, including cancer and obesity, are reaching epidemic levels worldwide, inflicting life-threatening conditions and great socioeconomic burden. Thus, there is a great need to identify new therapeutic approaches to control inflammation. Flavonoids, including the flavones, are the largest class of bioactive dietary phytochemicals attracting great interest for their beneficial effects in the treatment and prevention of chronic inflammatory diseases. We showed that the dietary flavone apigenin and a celery-based foodrich in apigenin (CEBAR) reduces inflammation by modulating macrophage immune function. Using preclinical models of breast cancer and obesity, we foundthat apigenin decreases the number of aberrant macrophages at inflammatory sites. We found that apigenin targeting NFkB, a key transcription factor in inflammation, reduces tumor growth and metastasis. Our studies using RNAseq analyses revealed the gene regulatory networks modulated by apigenin. Extending our studies to models of obesity-induced inflammation, we showed that apigenin reducing macrophage infiltration rewires adipocytes and the microbiomeresulting in weight reduction. I will discuss our results and provide a new framework to understand how medicinally active phytochemicals result in their recognized health benefits in chronic inflammatory diseases. These findings mayimpact the clinical use of flavones in the prevention and treatment of chronic inflammatory diseases.

SESSION VI:
BIOACTIVE COMPOUNDS OF PLANTS AND THEIR ROLES IN HUMAN HEALTH II (INFLAMMATORY DISEASES)

INVITED TALK

O29. Anti-inflammatory Interactions of Tannins with the Intestinal Microbiome

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The global botanical market is projected to reach USD 49.36 billion by 2027, many based on a polyphenolic bioactive in the prevention of a wide array of ailments, including intestinal inflammation. Emerging evidence suggests that inter-individual variability of polyphenol metabolism has contributed significantly to inconclusive clinical trials with polyphenolics, and this is likely to be significantly mediated by differences in the intestinal microbiota. Gallotannins (GT) are gallic acid polymers that represent a significant portion of polyphenolintake from many fruits, green tea, spices, nuts, and botanical supplements and possess anti-inflammatory activities via IFG1R/AMPK signaling. Metabolism of GT generates the bioavailable anti-inflammatory metabolites gallic acid (GA) and pyrogallol (PG) but pharmacokinetics of these metabolites show largevariation between individuals. Prevalent dysbiosis with chronic intestinalinflammatory conditions is expected to limit polyphenol metabolism, and might be ameliorated via supplementation with targeted probiotics. Two well-defined intestinal microbial enzymatic steps yield the major metabolites of GTs: a) tannase (tannin acyl hydrolase, EC 3.1.1.20) hydrolyzes galloyl-ester bonds of GT to produce GA, and b) GA-decarboxylase (EC 4.1.1.59) produces PG andboth enzymes are active in probiotic strains. This presentation will present dataon the anti-inflammatory interactions of probiotics and large molecular tannins relevant to intestinal inflammation.

SESSION VI:
BIOACTIVE COMPOUNDS OF PLANTS AND THEIR ROLES IN HUMAN HEALTH II (INFLAMMATORY DISEASES)

INVITED TALK

O30. Multi-omics approach reveals biomarkers of metabolic resilience in healthy participants supplemented with grape polyphenols.

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Grape polyphenols extracted from grape pomace are rich in proanthocyanidins (PACs) compounds which are not bioavailable; however, evidence suggeststheir health benefits are likely mediated via the gut microbiota and/or bacterial metabolites. Using mice fed high-fat diet (HFD) or having leptin receptor mutation (db/db), we previously showed that GP supplementation can improve symptoms of metabolic syndrome and type-2 diabetes. In particular, GP supplemented mice showed improved oral glucose tolerance in association withmarked changes in gut microbial community structure, alterations in bile acid profiles, decreased intestinal FXR signaling, and reduced intestinal and hepatic markers of inflammation. To investigate the effects of GPs on the human gut microbiome and metabolome, twenty-nine healthy participants completed a single-arm longitudinal study. Serum, fecal, and/or urine samples were collected before and after 2, 4, and 10 days of GP supplementation followed by shotgun metagenomic sequencing, mass spectrometry-based metaproteomics, and/or targeted metabolomics (i.e., bile acids and polyphenols metabolites). Notable GP-induced bile acid changes appeared to be gender-specific and correlational analyses uncovered novel associations between gut microbes and metabolites associated with metabolic resilience.

SESSION VI:
BIOACTIVE COMPOUNDS OF PLANTS AND THEIR ROLES IN HUMAN HEALTH II (INFLAMMATORY DISEASES)

INVITED TALK

O31. Metabolic benefits of grape polyphenol consumption on bile acid signaling in mice with intestine- and liver-specific deletion of Fxr

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Bile acids (BA) are a unique class of lipids pivotal for digestion, metabolism, and absorption of other lipid species. Primary BAs (PBA) are produced using cholesterolin the liver and released into the gastrointestinal tract where they are modified by gut microbes into secondary BAs (SBA). Evidence suggests the gut microbiome may regulate energy metabolism by altering BA which, in-turn, may modulate energy and lipid metabolism via their differential affinity for BA receptors like nuclear transcription factor, Farnesoid X receptor (Fxr). Proanthocyanidins (PACs) are a class of polyphenols found in fruits that epidemiological and clinical evidence suggests may be beneficial, when consumed, for the prevention and management of cardiometabolic diseases. We have previously seen that consumption of a PAC- rich, grape polyphenols (GP) extract dramatically remodeled the gut microbial communities and BA profile of diabetic (db/db) mice to inhibit intestinal Fxr signaling and improve glucose metabolism. To investigate the tissue-specific requirement of Fxr in mediating the glycemic benefits of GP, we bred mice using Cre-Lox recombinase technology to breed mice with intestine and liver specific deletion of Fxr. Mice with liver- (AKO) and intestine (VKO)-specific deletion of Fxr and wild-type (WT) floxed littermates were fed high-fat diet (HFD) or HFD supplemented with 0.5% GP (HFD-GP) for 12 weeks. Metabolic phenotyping, BA profiles and gene expression of metabolic tissues, and cecal gut microbial composition were analyzed. Consumption of GPs did not have a impact on the metabolic phenotype of VKO mice as these mice are resilient to HFD-induced obesity. Interestingly, WT and AKO mice fed HFD-GP had decreased body weight and improved glucose metabolism compared to HFD-fed counterpart; however, BA profiles of liver and serum were markedly different. In all three strains, GPs significantly decreased expression of inflammatory markers (Tnfα, IFNγ, Nos2) in one or more metabolic tissues

SESSION VI:
BIOACTIVE COMPOUNDS OF PLANTS AND THEIR ROLES IN HUMAN HEALTH II (INFLAMMATORY DISEASES)

INVITED TALK

O32. Flavone apigenin regulates innate immune response through RNA binding protein hnRNPA2

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Inflammatory diseases such as cancer are characterized by an abnormal expansion of specific myeloid cells, including monocyte and macrophages that fuel tumor growth and dysregulated immune response. Thus, there is a need toidentify new approaches to restore immune homeostasis. Apigenin, a naturally abundant flavone, is emerging as a potential immuno-regulatory compound. Apigenin inhibited pro-inflammatory cytokine production in LPS-stimulated monocytes and in vivo transgenic mice. To investigate the mechanisms responsible for its function, we identified direct targets of apigenin using a phage- display library coupled with next-generation sequencing (PD-Seq). Among them, the RNA binding protein hnRNPA2 was found as a high affinity target. While therole of hnRNPA2 in cancer growth is well recognized, its function in inflammationhas not been investigated. In this study we reveal that apigenin through hnRNPA2 modulates inflammation. We found that apigenin diminishes LPS- andTNFα-stimulated inflammation through hnRNPA2. Lack of hnRNPA2 inhibits NF-kB, a transcription factor crucial in inflammation, as shown by reporter assays in stimulated macrophages. Deletion of hnRNPA2 using siRNA, similar to apigenin,inhibits the phosphorylation of NF-kB subunit p65 required for its transcriptional activity. Inhibition of NF-kB by apigenin or lack of hnRNPA2 resulted in suppression of pro-inflammatory cytokine expression in stimulated macrophages. Immunoprecipitation assays showed that hnRNPA2 associates with NF-kB. Genome-wide expression of stimulated macrophages suggests an hnRNPA2- dependent regulatory network contributing to NF-kB regulation. Together, our study identified a new role of how apigenin through binding with hnRNPA2 modulates NF-kB-dependent inflammation, thereby highlighting the relevance of apigenin as a potential immune-modulatory agent to prevent and treat inflammatory diseases.

SESSION VII:
HEMP AND MEDICAL CANNABIS

O33. Genetic complexity in Industrial hemp germplasm

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Industrial hemp (Cannabis sativa L.) is a multifaceted yet controversial crop that is long associated with humans. It contains genotypes of both non-narcotic hemp that has numerous industrial uses and intoxicating marijuana where their identities are mainly based on a threshold of THC (delta-9-tetrahydrocannabinol) concentration. Industrial hemp exhibits a worldwide distribution and is considered a lucrative industrial crop. The recent legalization of hemp provided a major economic impact on US agriculture. Therefore, elite hemp strains for different agroecological conditions and end-usages (e.g., fiber, seed grain, phytochemical, and other value-added products) should be identified and introduced to hemp breeding programs. We have acquired hemp genetic resources through exchange and exploration programs and cultivated them in controlled environmental conditions to obtain the best quality research samples to identify molecular signatures of industrial hemp using phenomic, metabolomic, and genomic approaches and test their agronomic performance in field cultivations. A collection of well-curated herbarium specimens of all cultivated strains was established and a digital repository was created. The superior strains resulting from this intensive filtering criteria will be identified for inclusion in the USDA Hemp Germplasm Repository at Cornell AgriTech in Geneva, New York, and also to use in field cultivations, breeding, and bioengineering experiments.

SESSION VII:
HEMP AND MEDICAL CANNABIS

INVITED TALK

O34. Endocannabinoid receptor pharmacology of rare cannabinoids

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Cannabinoids are important terpenophenolics in Cannabis sativa L. and are found at high concentrations in trichomes. Today, most cannabinoids tested have been isolated from the cannabis plant for their activity on endocannabinoid receptors CB1 and CB2. Unfortunately, most of the rare cannabinoids are not easy accessible why a limited number has been tested so far. In our continuedwork we have synthetied a series of cannabinoids with varying aliphatic chain lengths (C5, C3, C1, C0). Efficient syntheses of eight key cannabinoids were established and optimized. Predominant cannabinoids like cannabigerol (CBG-C) and cannabidiol (CBD-C) were prepared from olivetol via regioselective condensation. Further treatments of CBD led to -tetrahydrocannabinol (TH C ( ), -iso-tetrahydrocannabinol (so-THC-C) and cannabinol (CBN-C). Alternatively, a [3+3] annulation between olivetol and citral yielded the minor cannabinoid cannabichromene (CBC-C), which was converted into two very rare polycycles cannabicyclol (CBL-C) and cannabicitran (CBT-C) in an one-pot reaction (Fig.1). Finally, all eight syntheses were extended by utilizing resorcinol and two phenolic analogs, achieving a cannabinoid group with morethan 30 compounds through a facile synthesis strategy. All cannabinoids weretested for recombinant CB1, CB2, FAAS and MAGL activity or inhibition. Basedon the different analogs of tested cannabinoids surprising direct and indirect effects were observed for cannabinoids with varying chain lengths. In this talk,we provide a structure-activity-relationship (SAR) and explain the potential interactions of cannabinoids with protein domains of endocannabinoid receptors.

SESSION VII:
HEMP AND MEDICAL CANNABIS

INVITED TALK

O35. Optimizing propagation techniques and management practices for Cannabis sativa L. production in the U.S. Mid-Atlantic region

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The legalization of industrial hemp under the 2014 and 2018 US farm bills has led to a rapid increase in hemp production in the United States. Legally, hemp is classified as any cultivar of Cannabis sativa that has a delta 9 THC (tetrahydrocannabinol) level of 0.3% and such cultivars have been federallymandated for seed (oil, food and feed), fiber and cannabinoid production. Hemphas diverse applications including its use in food, fiber, and medicinal products.
Hemp propagation for cannabinoid production is achieved using feminized seed or softwood cuttings. Feminized seed production involves treating female hemp plants with plant growth regulators to induce sex reversal, leading to the development of male flowers and self-fertilization. Seed and seedlings produced from treated plants are predominantly female thereby eliminating the need for clonal propagation. The quality of hemp planting material obtained through asexual propagation and feminized seed is often compromised due to thetransmission of pathogens. Large-scale propagation of uniform, disease-free female plants can be achieved through in vitro culture techniques such as micropropagation. Hemp growth and cannabinoid levels is significantly influencedby genotype, soil and environmental conditions, which necessitates identification of suitable cultivars for specific macroclimates. We have optimized protocols for feminized seed production and micropropagation, for large-scale propagation of elite hemp clonal material. We are also evaluating several hemp cultivars for their suitability in cannabinoid production under indoor and field conditions. The optimization of propagation techniques and cultivar screening trials will enable growers select the appropriate legal cultivars for maximum biomass yield and cannabinoid levels and boost expansion of the hemp industry in the United States.

SESSION VII:
HEMP AND MEDICAL CANNABIS

INVITED TALK

O36. Chasing the entourage effect in Cannabis

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Cannabis produces a large number of compounds with potential medical uses,these compounds include cannabinoids, terpenes, and flavonoids. It is speculated that synergism between these three groups of molecules, known asthe “entourage” effect, substantiates the use of the whole plant for medicinal purposes. However, pure compounds are typically the standard for treatments in the medical and pharmaceutical fields. To examine the effectiveness of the “entourage effect”, we compared low-THC containing cannabis (hemp) extracts with pure cannabinoids in several disease models. We found that pure cannabidiol (CBD) has a modest but significant impact on colorectal cancer, glioblastoma, and melanoma cell viability. A comparison of three commercial CBD oils demonstrated markedly different effects on cell viability, however, no oil was superior to pure CBD, the IC_{50} values for pure CBD were lower than those for the most potent oil.This argues against the existence of an “entourage” effect in potential cancer treatments. In a murine model of chemotherapy-induced peripheral neuropathy(CIPN), we found that cannabigerol (CBG) significantly reduced hyperalgesia, measured using the vonFrey test. Additionally, we found that CBG/CBD oil (at a comparable CBG concentration) was significantly more effective at reducing hyperalgesia than pure CBG in mice expressing CIPN. Furthermore, in a murine model ofosteoarthritis, we found that CBG/CBD oil and pure CBG were both similarly able to reduce pain and disease progression; however, unlike CBG/CBD oil, pure CBG did not produce anti-inflammatory activity.These data suggest that there is something in the oil that contributes to the antinociceptive properties of these cannabinoids, additional studies are currently underway. In conclusion, if an “entourage” effect exists it appears to be dependent upon the condition being treated and not a more universal property of cannabis compounds.

SESSION VII:
HEMP AND MEDICAL CANNABIS

CONTRIBUTED ORAL TALK

O37. Cannabis testing labs; Quality control and standardization

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Cannabis testing laboratories play a pivotal role in the multidimensional cannabis industry. Production companies to the consumers, whole cannabis community rely on the analytical results produced by the laboratories. Given the immense importance, it is the responsibility of testing laboratories to produce precise, accurate, and consistent results for every sample they analyze. Several uncertainty factors including the Quality control (QC) checks, that a laboratory runs in every batch, are determining factors for the certainty of the results. Quality control checks are not only to satisfy the regulatory boards but to have confidencein the results produced. From calibration to the sample runs, every batch shouldconsist of quality control checks. It should be ensured that QC checks such as method blank, technical blank, laboratory control sample, and continuingcalibration verifications are passed before analyzing the data for the rest of the samples. Blind testing such as timely proficiency testing helps in maintaining theaccuracy of the instruments and the analysis. When the whole cannabis industryis proceeding towards the standardization, testing laboratories as well are workingon it. As of now, a clearer picture for the ultimate standardization of Cannabis testing laboratories is not visible, however, the debate has been started on how the standardization should look like, a plateau, or a peak? When several countriesare preparing to legalize cannabis and be part of the international market, a worldwide accepted standardization on testing is much awaited. I will be presenting on how the quality control in testing laboratories impacts the whole cannabis industry and how a testing laboratory can maintain a good quality control system. I will also be discussing how the future looks like for testing laboratories.

SESSION VII:
HEMP AND MEDICAL CANNABIS

CONTRIBUTED ORAL TALK

O38. Cannabidiol improves inflammation, glucose metabolism and bone loss in a murine model of female post-menopause in association with a bloom of *Lactobacillus sp.*

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The predominant form of estrogen, 17β-estradiol, declines during menopause resulting in increased risk of gastrointestinal disorders, cardiometabolic disease, and osteoporosis. Hormone replacement therapy can alleviate menopausal symptoms but also increases the risk of cancer and heart disease. Cannabidiol (CBD) has been reported to have anti-inflammatory effects therefore we investigated whether it could improve the consequences of estrogen deficiency in ovariectomized (OVX) C57BL6/J female mice. At 12 weeks of age mice underwent ovariectomy (OVX, n= 24) or sham surgery (SS, n= 24) followed by peroral administration of CBD (25 mg/kg) or vehicle (VEH, sesame oil) for 18 weeks. CBD treatment increased oxygen consumption and energy expenditure inOVX mice. In OVX mice, CBD treatment improved oral glucose tolerance compared to VEH-treated mice. CBD-treated OVX group had lower colonic gene expression of IL-6 and TNFα and increased gene expression level of tight junction protein ZO-1 compared to VEH-treated mice. Dual-energy X-ray absorptiometry showed that compared to VEH-treated OVX mice, CBD-treated OVX mice had increased whole body and femur bone mineral density. High resolution micro-computed tomography showed that CBD treatment improved trabecular thickness and bone volume/trabecular volume. Compared to the VEH-treated OVX group, changes of femoral mRNA expression of IL-6, RANKL and CB2 of CBD-treated OVX group indicated reduced inflammation and bone loss. 16S rRNA amplicon sequencing analysis revealed the fecal microbiota of CBD- treated OVX mice had increased relative abundance of Lactobacillus, which is associated with reduced bone loss and inflammation. In CBD-treated OVX mice,bile acid membrane receptor (Tgr5) in femur was activated and increased serum level of tauroursodeoxycholic acid (TUDCA) was observed. Overall, these data suggest that CBD may be useful in post-menopause for alleviating intestinal inflammation and bone loss as well as improving glucose metabolism via alteration of gut microbiome like increased relative abundance of Lactobacillus species.

SESSION VIII: PLANT AND ALGAE DERIVED COSMECEUTICALS AND NUTRACEUTICALS

O39. Reinforce urban skin by connecting with the origins

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Cosmeceuticals are hybrids between drugs and cosmetic products and are able to enhance both health and beauty by external application which is veryimportant for women specially. With about 25 000 known species, South Africa,is third only to Brazil and Indonesia as far as biodiversity is concerned. This constitutes about one tenth of all plant species in the world. Whether searchingfor ways to treat serious diseases like cancer and tuberculosis (TB), or formulating new acne creams and toothpastes that fight gum disease, one canbe convinced that solutions can be found in South Africa's indigenous plants. The vast traditional knowledge about SA's plants is still untapped, and there is ahuge amount of work needed to verify if and how traditional remedies and localplants actually work.

The synergy of usage of plants traditionally coupled with all the rare plants found in this country prompted us to evaluate the potential of unexplored plants and develop products which can be applied topically. A number of plants have been proven to have effect for skin- problems for example melasma, spots, pigmentation, acne etc. and effective cosmeceutical-prototypes products have been prepared from those. Not all work; what are bring to the lab, on averageonly 2% reach a stage which are subjected to clinical studies. Due to the already existing products in the cosmetic market, one needs to check carefully how wellthe efficacy of newly invented SA indigenous plants; compares with the available ones.

The purpose of this talk is to provide a holistic overview on the application of medicinal plants for the disorders of the skin including pigmentary disorders, wrinkle problems and melanoma. Once the medicinal products are developed, the dynamics of various ways for benefitting the people who have been using plants for centuries, will be discussed in the talk.

SESSION VIII:
PLANT AND ALGAE DERIVED COSMECEUTICALS AND NUTRACEUTICALS

INVITED TALK

O40. Health-promoting effects of functional foods

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Phytochemicals are not essential compounds that are usually present in small quantities as natural constituents in food. However, they have received scientific attention due to their protective effect against a number of chronic diseases including heart disease, diabetes, various type of cancer, stroke, and metabolicsyndrome. Public interest in foods that provide health benefits beyond basic nutrition has increased dramatically due to several factors, including an increasein healthcare costs and the desire to improve personal health. Current research efforts are focused not only on the development of health-promoting foods for health maintenance throughout the life cycle, but also on researching phytochemicals to evaluate the necessary dosage for optimum health. The ability of a compound to exert its biological effects depends on its bioavailabilitydose, rather than the administrated dose. Our recent data have shown the health benefits or bioavailability of phytochemicals in berries (blackberry, red raspberry, and blueberry), watermelon (flesh, rind, and skin), sweet potatoleaves, and onion peels (byproducts of onion).

SESSION VIII: PLANT AND ALGAE DERIVED COSMECEUTICALS AND NUTRACEUTICALS

INVITED TALK

O41. Upcycling food process byproducts for cosmeceutical applications: Case of cherry waste

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The use of plant-derived natural antioxidants in cosmetics is preferred over synthetic antioxidants. Extracts of plant-derived antioxidants generally contain a mixture of natural compounds, which could have synergetic effects; therefore, they can have better effects and less toxicity. The tart cherry process results in the generation of byproducts such as cherry pomace (15-28% of the initial fruit) and the cherry pit (7-15% of the whole fruit), depending on the process. Currently, byproducts from cherry industries are being used as animal feed, fuel, or preparation of activated carbons, despite their nutritional potential. This project aimed to define the target components and evaluate the antioxidant activity of natural extracts from the cherry pit for cosmetic applications using cellular models. Bioactive compounds from cherry pits were extracted using a high-pressure and temperature reactor and water: ethanol (50:50 v/v). Chemical characterization of the extracts demonstrated high amounts of total polyphenols (17 mgGAE/gDry Pit), flavonoids (12 mgQUE/gDry Pit), and antiradical power (7 gDPPH/Lextract). Extracts were stable for up to 40 days when stored at 4°C. This is the first time that a food byproduct (e.g., cherry pit) has been used for cosmetic applications. Cosmeceuticals with the potential to protect the skin from inflammation injury triggered by environmental stress offer an untapped market of exponentially growing interest. The dual purpose of this project makes it different from the current natural antioxidant available in the market.

SESSION VIII:
PLANT AND ALGAE DERIVED COSMECEUTICALS AND NUTRACEUTICALS

INVITED TALK

O42. Nutraceutical and cosmeceutical properties of sericea lespedeza (Lespedeza cuneata)

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Sericea lespedeza (SL; Lespedeza cuneata), a warm-season perennial legume native to Asia and Eastern Australia, has been used in the United States for over 100 years for soil conservation and as an inexpensive hay and grazing crop. Interest in the plant as a nutraceutical forage has surged over the past 20 yearsdue to its excellent bioactivity against gastrointestinal nematodes and coccidia inlivestock and its ability to reduce methane emissions from ruminant animals. While much of this bioactivity has been attributed to the high concentration andunique structure of the condensed tannins in SL, which consist of up to 98% prodelphinidin subunits, recent research has revealed the presence of a numberof additional bioactive secondary compounds in the plant, including β-sitosterol, quercetin, kaempferol, pinitol, avicularin, juglanin, trifolin, and flavone glycosides. Due to the presence of these and other bioactive compounds, SL has been reported to possess anti-inflammatory, anti-oxidant, and anti-cancer properties, including against breast and colon cancer cells, in humans. Additional studies have demonstrated the medicinal properties of SL in treating kidney and lung disorders, as well as its anti-diabetic and hepatoprotective properties. In addition, documented anti-wrinkle, anti-melanogenic, and anti-aging properties have shownthe potential value of SL for development of cosmeceutical ingredients. In additional to SL, there are several other Lespedeza species native to North America that may have even greater bioactivity potential than SL, but have not been adequately evaluated. Additional research is needed to unlock the nutraceutical and cosmeceutical potential of these Lespedeza species.

SESSION VIII: PLANT AND ALGAE DERIVED COSMECEUTICALS AND NUTRACEUTICALS

CONTRIBUTED ORAL TALK

O43. Euclea natalensis A. DC., as an adjuvant, immunomodulator and hepatoprotectant

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Currently, conventional therapy is not effective against cases of infection with drug-resistant tuberculosis and severe non-compliance is hampering total eradication. Adjuvants that can be taken in conjunction with conventional treatment are of crucial importance. Euclea natalensis A. DC. (EN), has traditionally been used for the treatment of associated symptoms of tuberculosis, coughs and chest complaints amongst others. The root extracts of EN were shown to be very active against Mycobacterium tuberculosis, in-vitro, with a minimum inhibitory concentration (MIC) of 0.8 µg/ml. Due to sustainability concerns, ethanolic shoot extracts (MIC- 125 µg/ml) have been used for further development by evaluation of the immunomodulatory and hepatoprotective properties. Several further investigations into the myriad of properties of EN have been investigated such as cytotoxicity, pharmacokinetics (inhibition/stimulation of major CYP P450 enzymes), nutritional content, heavy metal analysis, microbial content, antimutagenicity and antifibrotic activity. Future projects include the PLGA nanoparticle formulation of the main active ingredient, a polyherbal formulation with several other indigenous plants and propagation trials. Development of EN has included community development, capacity building, the issuing of a bioprospecting permit and a PCT patent. Various in-vitro and preclinical in-vivo investigations have since concluded that EN is an effective adjuvant that can be used in conjunction with conventional treatment. A current licensee and proudly South African company is in the process of launching a liver protectant product with EN as the main ingredient. This product will potentially be distributed and sold at local pharmacies nationwide.

SESSION VIII:
PLANT AND ALGAE DERIVED COSMECEUTICALS AND NUTRACEUTICALS

CONTRIBUTED ORAL TALK

O44. Prenylated stilbenoids from peanut increase the anticancer efficacy of paclitaxel in triple-negative breast cancer cells

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Triple-negative breast cancer (TNBC) is one of the deadliest forms of breast cancer. Investigating alternative therapies to increase survival rates for this disease is essential. One approach to address this issue is adjuvant therapy, where are drug is combined with a chemotherapy drug to increase its efficacy. This study aimed to examine if prenylated stilbenoids from peanut can act as adjuvants for paclitaxel, a chemotherapeutic drug with severe side effects. The prenylated stilbenoids arachidin-1 (A-1) and arachidin-3 (A-3) were produced in hairy root cultures of peanut. The cytotoxicity activity of A-1, A-3, and resveratrol (RES) alone or combined with paclitaxel was studied by checkerboard assays in TNBC cell lines MDA-MB-231 and MDA-MB-436. The apoptotic effects of this combination treatment were studied by western blotting targeting protein expression levels of PARP, caspase-8, caspase-9, and surviving and by the Apo-ONE Homogeneous Caspase-3/7 assay. To further investigate the apoptosis and cell cycle stages, cells treated with prenylated stilbenoids or RES were studied using flow cytometry. After 24 hours of treatment, A-1 exhibited higher cytotoxicity than A-3 and RES with approximately 11-fold and 6-fold lower IC50, respectively, in MDA-MB-231 cells, and 9-fold and 8-fold lower IC50, respectively, in MDA-MB-436 cells. Importantly, A-1 did not show significant cytotoxicity in the non-cancerous cell line MCF-10A. The results showed an increase in the apoptotic efficacy of paclitaxel when combined with prenylated stilbenoids. This suggests that the prenylated stilbenoid A-1 should be further explored as a potential adjuvant for chemotherapy drugs such as paclitaxel in TNBC treatment.

SESSION VIII: PLANT AND ALGAE DERIVED COSMECEUTICALS AND NUTRACEUTICALS

FLASH TALK

O45. Grape polyphenols may protect from diet induced obesity by preventing high-fat diet dampening of the hypothalamic-pituitary-adrenal axis

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Chronic intake of a high-fat diet (HFD) induces weight gain due to impaired circadian hypothalamic-pituitary-adrenal (HPA) axis activity. Diet-induced HPA impairments are related to decreased levels of circulating corticosterone and altered glucocorticoid metabolism. Cholestasis has been shown to suppress HPA axis activity. HFD-fed mice supplemented with proanthocyanidin-rich grape polyphenols (GPs) have reduced body weight gain and hepatic steatosis, increased energy expenditure (EE), and altered bile acid (BA) gene regulation and profile. Here we investigate the potential of GPs to prevent HFD-induced disruptions to the HPA axis in association with BA changes. C57BL/6J male mice were fed HFD or HFD supplemented with 0.5% w/w GPs (HFD- GP) for 17 weeks. As previously seen, GP-supplemented mice had reduced weight gain,attenuated hepatic steatosis, and elevated EE. LC-MS analysis revealed a GP-inducedreduction to circulating primary and secondary BAs, while qPCR showed increased hepatic expression of BA synthesizing enzymes, Cyp7a1 and Cyp27a1, and reduced ileal expression of BA transporter, Slc10a2, suggesting a mechanism for reduced cholestasis and BA leakage into circulation. Hormones involved in HPA axis activity, leptin and corticosterone, were increased in circulation of HFD-GP-fed mice while hepatic expression of 11βhsd1, an enzyme which converts inactive 11- dehydrocorticosterone to active corticosterone, was increased and corticosterone metabolizing enzymes, Srd5a1, and Akr1d1, were reduced. Expression of inflammatorymarkers Tnfα, Il6, and Il1b were reduced in both intestinal and hepatic tissue. We hypothesize that GPs improve metabolic health by protecting the liver from HFD-induced BA accumulation and the subsequent inflammation and disruptions to corticosterone and leptin regulation of EE. GP-supplementation may preserve diurnal regulation of the HPA axis and thus improve adaptations to excess dietary fat.

SESSION VIII:
PLANT AND ALGAE DERIVED COSMECEUTICALS AND NUTRACEUTICALS

FLASH TALK

O46. Natural Products Research in Puerto Rico: Isolation of Bioactive Metabolites from Tropical Plants

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According to the World Health Organization (WHO), ~80% of people in developing countries depend on traditional medicine for primary health care. Traditional herbal treatments have also yielded drug discovery efforts of purification and characterization of the active compound, as well as evaluation of safety, pharmacokinetics and efficacy of the drug candidate. In fact, 52% of the total molecules approved by FDA from 1981 to 2014, are natural products or their derivatives possessing structurally distinct families of chemical compounds. These data indicate that research in natural products continues to be a field of interest for the discovery of new drugs. However, less than 15% of plants have been assessed for bioactive potential, emphasizing a critical need for the discovery of novel bioactive compounds from unexplored plant species. Cancer is one of the major causes of death and research is focused on the discovery of novel drugs that are specific for tumor cells. It is expected that such drugs increase the effectiveness of treatment while reducing their side effects. Moreover, current therapeutic treatments of infectious diseases have limitations such as toxicity and low effectiveness. In addition, the emergence of strains resistance to current antifungal agents had led to the search for new drugs from natural sources. The overall goal of the proposed project is to discover and characterize novel compounds from higher plants with potential therapeutic application for cancer and anti-infective treatments. Our published and preliminary data showed that Caribbean plants of Croton, Guaiacum, Piper, Schinus and Simarouba genus provide an important source of new leads for in depth investigation as new anticancer and anti-infective therapeutics.

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POSTER ABSTRACTS

P1. Isolation and characterization of novel plant-derived antimicrobial compounds from plantains.

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Musa spp. genus, specifically bananas and plantains have had a variety of applications throughout the history of mankind. This crop has been key to feeding population besides its variety of additional applications including medicinal properties. Currently, there is an emerging problem of bacterial resistant to commercially available antibiotics. Phytomedicine presents a sustainable solution to develop new compounds that can control bacterial growth. Pseudostem in banana reportedly contains an increased concentration of organic compounds, some of which have been partially characterized. This study aimed to study the antibacterial characteristics of extracts obtained from plantain pseudostem tissues. Organic extraction technique using the Soxhlet system was applied to produce organic and aqueous extracts. Further, these extracts were applied to Pseudomonas aeruginosa and Escherichia coli to analyze the bacteriostatic and bactericidal effect using Minimum Inhibitory Concentration (MIC) and Minimum Bactericidal Concentration (MBC) assays. Preliminary results indicate potential antimicrobial activity of plantain pseudostem extracts at 25.6 mg/ml on both tested bacteria. We are currently carrying out an in-depth validation of the antibacterial activity using a combination of microbial and biochemical assays. This study might help to identify and characterize novel sources of plant-derived antimicrobial compounds for a wider application in areas of human health.

POSTER ABSTRACTS

P3. Bioprospecting of early-evolving land plants from Puerto Rico for pharmacological activities

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Plants are known for their unique biochemical properties. Recently, early evolving land plants are emerging model systems to extract metabolites. Bryophytes and pteridophytes are early evolving land plants that have been utilized in primitive eras for folklore medicines due to their medicinal properties. Research suggests that bryophytes and pteridophytes have been able to lower proliferation of cancer cells in addition to their antibiotic properties. Early evolving land plants from Puerto Rico remains to be explored. Our research aims to evaluate the medicinal properties of three bryophyte species and two pteridophyte species, by estimating the number of flavonoids, totalpolyphenol, and antioxidant capacity. Our preliminary results show that the tissues from pteridophytes have more amount of total flavonoids and total polyphenol content. Samples from pteridophytes showed 214.44µg/mL of total flavonoid content as compared to 71.09µg/mL in bryophytes. Similarly, pteridophytes show an average of 171.25µg/mL of total polyphenol content in comparison with Bryophytes that showed an average of 62.23µg/mL. Furthermore, we determined the antimicrobial effect of these plants on four different gram-positive and gram-negative bacterial strains, using the methanolic extracts of each plant obtained by Soxhlet extraction method. This assay demonstrated once again that pteridophytes have effect inhibiting the growth of some of these bacteria compared to the bryophytes in study. Our study provides a preliminary data to carryout an in-depth bioprospecting of early evolving land plants from Puerto Rico.

POSTER ABSTRACTS

P4. Cytotoxicity effect of medicinal plants used by the Moroccan population against Covid-19

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The present study was conducted to test the cytotoxicity effect of essential oils from three different medicinal plants used by the Moroccan population against Covid-19; Melissa officinalis, Zingiber officinalis and Eucalypthus globulus. Plant essenital oils were obtained from plant leaves by hydrodistillation and their cytotoxicity was determined using VERO-E6 cells (ECACC-code 84121903) in a standard red dye test. These plants were selected on the basis of an online ethnobotanical survey on medicinal plants used by people in Morocco againt Covid-19. The results of the neutral red assay on VERO-E6 cells showed that essential oil from M. officinalis, Z. officinalis and E. globulus exhibit moderate cytotoxic activities with a cell viability of 50%. The extracts from these plants are currently being tested against Covid-19.Cytotoxicity studies of medicinal plants used against Covid-19 is The results provide an attractive perspective for further exploration of their antiviral and anti-inflammatory potential to combat viral respiratory infect

POSTER ABSTRACTS

P5. Study of the chemical composition of the hexane extract from Simarouba

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The Simaroubaceae family comprise around 32 genera and more than 170 species of trees and brushes distributed throughout the tropical regions of America, Asia, Africa, and Australia. This family is characterized by the presence of quassinoids that are responsible for antimalarial, antiviral, insecticide, and antitumor activities. In our ongoing efforts to discover new compounds with anticancer activity, we tested the hypothesis that leaf extracts from Simarouba showed the highest antiproliferative effects against breast cancer cell lines (Claudio et al., 2015). From the chloroform extract, we reported the isolation and cytotoxic activities of the quassinoid Simalikalactone D (SKD) which showed potent in vitro cytotoxicity with an IC50s of 58 to 65 nM on ovarian and breast cancer cell lines (Mendez et al., 2020).The hexane extract showed an inhibitionpotential at a concentration of 24 ng/mL against breast cancer cells. However, the chemical composition is unknown. The goal of our work is to isolate the secondary metabolites with less polarity and evaluate their anticancer activity. The 1H-NMR spectrum of the extract showed the presence of aliphatic, vinylic, α-heteroatoms and vinylic protons. This crude extract was chromatographed on Silica gel with a mixture of 10% of ethyl acetate in hexane to obtain 20 fractions. The fractions are being analyzed by TLC and NMR to identify the chemical components.

POSTER ABSTRACTS

P6. Volatile extracts from blackberries, black raspberries, and blueberries inhibits proliferation of human lung cancer A549 cells through apoptosis

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Berries are one of the most common fruits in our diet and are rich in vitamins, minerals, dietary fibers, and especially polyphenols and volatiles. Berry volatiles are low molecular weight compounds that are in charge of the berry aroma and flavor. There have been many studies conducted to identify the chemical composition of berry volatiles for developing consumer acceptability. However, there are lack of information available on the health-promoting properties of berry volatiles. In this study, we investigated the apoptotic effect of blackberry, black raspberry, and blueberry volatile extracts on human lung adenocarcinoma A549 cells. Cells were treated with three dilutions (2-, 4-, and 8-fold diluted) of three berry volatile extracts (BVEs) for 12, 24, and 48
h. The proliferation of A549 was measured by the MTS assay. Changes in the cell cycle and apoptosis were examined by using cell sorting analysis, flow cytometry, and cell death detection ELISA kit. The apoptotic mechanism was further investigated by western blot analysis. Statistical analysis was performed by using one-way ANOVA, followed by Tukey's multiple comparisons to determine significant differences at $p<0.05$. All two-fold diluted BVEs significantly inhibited the proliferation of A549 after 48 h by inducing apoptosis after 24 h ($p<0.05$). Two-fold diluted BVEs treatment for 48 h also increased the cell population in G0/G1 phase (64.9-73.1%) compared to control (60.3%). Flow cytometric quantification of apoptosis identified the most early apoptotic cells in blackberry volatile extracts. Similarly, blackberry volatile extracts significantly inhibited the level of poly ADP-ribose polymerase (PARP), procaspase-9, and procaspase-3 compared to control ($p<0.05$). These results showed that berry volatile extracts from three berries have the anti- proliferative effect on human lung adenocarcinoma cells via apoptosis, suggesting that berry volatiles from blackberry, black raspberry, and blueberry may have potential anticancer activity through the apoptosis in lung cancer.

POSTER ABSTRACTS

P8. Arachidin-1 induces apoptosis and growth inhibition in triple-negative breast cancer cells

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Triple-negative breast cancer (TNBC) is an aggressive, fast-spreading, and hormonal treatment-resistant form of breast cancer. These factors lead to worse prognoses for TNBC patients, stressingthe need for investigating alternative treatment options for this type of cancer. Plant natural products, such as the prenylated stilbenoid arachidin-1 (A-1) from peanut, have shown cytotoxicity to certaincancer cells while showing no significant cytotoxicity to non-cancerous cell lines. The goal of this study was to examine the apoptotic effects of A-1 alone and in combination with paclitaxel, achemotherapeutic drug that causes adverse side effects. The apoptotic effects of these treatmentswere studied in MDA-MB-436 and MDA-MB-231 via western blotting through protein expressionlevels of PARP, caspase-8, caspase-9, and survivin. Vinculin and GAPDH were protein-loadingcontrols. Flow cytometry was used to detect apoptosis and cell cycle arrest in the treated cells.Results showed that A-1 decreased the IC50 of paclitaxel in TNBC cells, and consequently increased the expression of cleaved PARP and cleaved caspase-9. The amount of survivin, anapoptosis inhibitor protein, decreased at increased A-1 concentrations. In addition, flow cytometry analysis showed that A-1 in combination with paclitaxel led to cell cycle arrest in G2-M stage and induction of apoptosis in the treated cells. These results support an increase of apoptotic effects of paclitaxel when combined with A-1. This accentuates the importance of expanding our understanding of the connection between stilbenoids and triple-negative breast cancer cells. In future research, we will study the effects of A-1 on signaling pathways in TNBC cell lines.

POSTER ABSTRACTS

P9. Antimalarial activity of Puerto Rican tropical plants

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Malaria, as a major global health problem, continues to affect many people in developing countriesworldwide. There is a critical need to discover compounds from new sources to overcome the problem of drug-resistant Plasmodium strains. Plants continue to be one of the most important sources in the search of new antimalarials. This study aimed to investigate the antimalarial activity of the crude extract, solvent fractions, pure compounds, and tea preparations from Puerto Rican tropical plants. In a preliminary study, one of the plants specie tested positive to antiplasmodial activity against P. berghei. The crude extract of this plant was chromatographed in silica gel with a mixture of 2% of methanol in chloroform to obtain 8 fractions. Fractions 4 and 6 were purified by reversed phase chromatography with a mixture of 45% of water in methanol to obtain compounds A and B. Compounds A and B showed a potent antiplasmodial activity at EC50 of 15 and 18 nM against P. berghei, respectively. This study suggests that tropical plants from Puerto Rico are promising sources of compounds that might be further investigated as novel drugs against malaria.

POSTER ABSTRACTS

P11. Study of the chemical composition and biological activities of Piper sp.

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Piper genus are aromatic plants belonging to Piperaceae family. These plants are native of Puerto Rico and the Virgin Islands. It has been found that compounds isolated from different Piper speciehave anticancer and antifungal activities. The objective of this work is to evaluate the anticancer and antifungal properties of Piper genus and isolate the chemical compounds responsible for biological activity. The plants were collected, dried, and extracted with a mixture of CH2Cl2-MeOH (1:1). The resulting crude extract was suspended in water and extracted with solvents of different polarities. The crude extract was analyzed by nuclear magnetic resonance (NMR) and tested for the anticancer and antifungal activities. Our preliminary results showed that this extract has anticancer antiproliferative activity against the A2780CP20 ovarian and MCF-7 breast cancer cell line cancer cell lines at a concentration of 0.18 and 0.14 mg/mL, respectively. In addition, the extracts were active against Saccharomyces cerevisiae at a concentration of 500 µg/mL. The hexane extract was chromatographed over silica gel with a mixture of 15% of ethyl acetate in hexane to obtain 16 fractions. The NMR analysis of fractions 11 to 13 showed the presence of signals corresponding to aromatic compounds. We are working with the characterization of the chemical compounds.

POSTER ABSTRACTS

P12. Chemical Analysis and Biological Properties of the Native Plant Schinus terebinthifolius

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Fungal diseases represent a substantial cause of infections in plant and animal species as well as a public health problem. In addition, the emergence of strains resistant to current antifungal agents has led to search for new drugs from natural sources. Schinus terebinthifolius is a plant belonging to the Anacardiaceae family native to South America, which is also found in tropical regions of the United States and the Caribbean. In traditional medicine, it has been used as an antimicrobial and anti-inflammatory agent. It is known that the chemical composition of a plant varies according to where it is collected. To our knowledge, the Schinus sp. that grow in Puerto Rico have not been studied. The crude extract from the leaves was tested for determination of antifungal activity on wild- type Saccharomyces cerevisiae yeast strains using a viability assay on yeast agar plate cultures. Preliminary results showed that this extract presented 100% antifungal activity at a concentration of 500 µg/mL in the first 72 hours. Based on this observation, our objective is to assess the antifungal potential of Schinus extracts and the purified compounds. For this purpose, the plant was collected, dried, and extracted with a mixture of CH2Cl2-MeOH (1:1). The resulting crude extract was suspended in water and extracted with solvents of different polarities. Fraction 15 of the hexane extract was chromatographed on silica gel with a mixture of 10% of ethyl acetate in hexane to obtain 17 fractions. The NMR analysis of fractions E and F revealed the presence of aliphatic, allylic, α- heteroatoms and vinylic protons. We are working with the characterization of the chemical compounds.

POSTER ABSTRACTS

P13. Production of cajaninstilbene acid in hairy root cultures of pigeon pea (Cajanus cajan) using an optimized elicitation procedure

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Cajaninstilbene acid (CSA) is a prenylated stilbenoid derivative that exhibits anti-inflammatory, anti-bacterial, and neuroprotective properties. Hairy root cultures of pigeon pea (Cajanus cajan) were developed via Agrobacterium rhizogenes-mediated transformation to establish a production platform for this bioactive compound. The cultures were co-treated with methyl jasmonate, cyclodextrin, hydrogen peroxide, and magnesium chloride to enhance the production of CSA. The majority of CSA accumulated in the culture medium. CSA was purified from extracts of the culture medium by semi-preparative HPLC, and its identity was confirmed by tandem mass spectrometry. After 144 h of elicitation in 12-day old hairy root cultures, the total yield of CSA was 8058.61 ±
445.78 µg/g DW. The yield of CSA in the elicited hairy root culture was approximately 277-fold higher than in the non-elicited hairy root culture. The difference in phenotype of elicited versus non-elicited pigeon pea hairy roots was studied using scanning electron microscopy. The non- elicited hairy roots had uniform surfaces whereas the elicited hairy roots had non-uniform shapes. Pigeon pea hairy roots provide a sustainable platform for producing CSA.

POSTER ABSTRACTS

P18. Turmeric (Curcuma longa L.): An Important Medicinally Active Plant Investigated for Ease of Germination Using a Laboratory Method

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Turmeric (Curcuma spp.), native to southeast Asia, has been used in Indian culture for more than 4,000 years for multiple uses, like medicinal, culinary, cosmetics, and as a dye. Research worldwidehas shown that curcumin, an active ingredient of turmeric, has potential to cure cancer, arthritis, inflammation, Alzheimer and so on. Therefore, to enable turmeric production in the USA and to benefit US consumers and growers, this experiment was carried out to examine the germination potential of turmeric in the laboratory. In this study, two different methods were used: i) in Ziplock bags and ii) in a rocker shaker box. Turmeric rhizomes were collected from various sources: 1. hydroponics grown germplasm, 2. raised beds, and 3. field plots. The rhizomes were placed in the rocker shaker box and in the Ziplock bags filled with 50-100 mL of distilled water, so that rhizomeswere soaked well, but not completely submerged in water. In both experiments, rhizomes sprouted within 2-3 days and grew to 2.5 cm within 7-9 days. The rhizomes in the rocker shaker boxes sprouted within 2 days and grew faster than the rhizomes in the plastic bags. The Ziplock bag turmeric sprouted a day later- on day 3and grew slower than those in the rocker shaker box. The experiment will be repeated and the data will be present at the ACMAP conference.

POSTER ABSTRACTS

P21. Using Gold Nanoparticles for the Sensitive Detection of Aflatoxin B1 in Peanuts

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It is estimated that more than 25% of the world's food supply is contaminated by mycotoxins and up to 4.5 billion people are exposed annually. Mycotoxins, or toxins produced by fungi, are naturally occurring contaminants produced by the Aspergillus, Penicillium and Fusarium fungi and are known to contaminatefood supplies and animal feeds throughout the world. Aflatoxins are highly toxic mycotoxins ans are found on agricultural crops such as maize (corn), peanuts, cottonseed, and tree nuts and depending on the levelof exposure, it can result in growth retardation, immune-suppression, liver damage or at worst, death. Peanuts are a major source of food throughout the world, consumed either as peanut butter, crushed andused for oil, or simply consumed as a snack. The total U.S. peanut production in 2021 measured morethan 6.3 billion pounds of peanuts and more than half of them were grown in Georgia. In terms of income, aflatoxins are a major limitation to accessing lucrative export markets leading to loss of income for farmers. There are at least 20 known aflatoxin and of the aflatoxins, aflatoxin B1 (AFB1) is the most toxicand the most potent naturally occurring chemical liver carcinogen. Most human exposure comes from contaminated nuts, grains, and their derived products. The toxins can be present even if there is no visible mold on the food, which is why early detection is key. There have been methods used to detect mycotoxins, in the past, but they require the use of expensive, large machines or have a low sensitivity.The aim of this research is to develop a nanobiosensor for the rapid, sensitive, and selective detection of aflatoxin B1 (AFB1) in peanuts using magnetic beads, carbon probes, and gold nanoparticles.

POSTER ABSTRACTS

P22. Use of Aspergillus oryzae for the enrichment of zinc and selenium by using solid-state fermentation

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Zinc and selenium are essential minerals for human health. Studies suggest that they enhance immunity, antioxidant effect, growth, reproductive performance, and the ability to resist disease. They are naturally found in many food sources such as dairy, poultry, cereals, and other grain products. However, the risk of zinc and selenium deficiency has been recognized in a few countries. This could be due to the lack of zinc and selenium content in the crops' soil. Meanwhile, antinutrients in the foodsource also inhibit from proper absorption of minerals into the human body. But these antinutrients can be reduced by the fermentation process. The fermentation is carried out by yeast, bacteria, fungi, or a combination of these. In this study, solid-state fermentation (SSF) was applied to determine the amountof zinc and selenium uptake by A. oryzae. The sorghum grain (substrate) was treated with A. oryzae and supplemented with the different concentrations of zinc or selenium. After 7 days of fermentation, the samples were analyzed with Inductively Coupled Plasma Mass Spectrometry (ICP-MS). The results showed an exponential improvement in zinc content in the fermented samples, from the initial value of
4.5 mg/g to 158 mg/g, and selenium content increased from 0.19 mg/g to 0.8 mg/g. Data indicate that zinc and selenium uptake by A. oryzae from substrate significantly ($P<0.05$) varied by added concentration. Overall, this research shows that A. oryzae can uptake and increase the amount of zinc and selenium through SSF and the resulting product may use as zinc or selenium-rich ingredient for functional food products.

POSTER ABSTRACTS

P23. Artificial neural network models for the prediction of thermal properties of stevia powder

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Stevia leaves have been used as a natural sweetener for centuries by indigenous peoples of South America. Various research studies have shown that stevia contains ingredients that possess anti-diabetic, anti-hypertensive, anti-inflammatory, anti-cancer, and anti-diarrheal therapeutic effects. Commercially, stevia is available as an extract and in powdered form and its consumption in food and medicinal industries is increasing globally. Most of the studies on stevia are focused on the plant growing parameters, medicinal, and functional properties, whereas a very few studies have been reported on the processing and storage of stevia. Since many unit operations in the processing and storage of stevia powder involve heat transfer, it is important to understand its thermal properties. Stevia powder thermal properties data are required in the design of storage and drying equipment as well as in the estimation of process times for refrigerating, heating, or drying. An energy balance for heating or cooling of stevia powder cannot be made and the temperature profile within the powder cannot be determined without knowing the thermal properties of stevia powder. In recent years, Artificial Neural Networks (ANNs) have been used for modeling of complex and nonlinear processes. The advantages of ANNs over conventional mathematical methods in modeling performance have been recognized by many researchers. This study focused on the development of ANN models using Backpropagation and Kalman Filter learning algorithms for predicting thermal properties (thermal conductivity, volumetric specific heat, and thermal diffusivity) of stevia powder as a function of moisture content.

POSTER ABSTRACTS

P24. Effect of medicinal plant extracts against Fusariumoxysporum f. sp. albedinis: the causal agent of Bayoud diseaseon date palm

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Fusarium oxysporum f. sp. albedinis (Foa) is the causal agent of the vascular wilt of date palm, also known as Bayoud disease.It is the most serious soil borne disease of date palm causing the disappearance of millions of palm trees in Moroccan's oasis. Attempts to control the disease have focused on the selection of genetically resistant cultivars. However, some of the elite-but-sensitive industrial cultivars, notably "Medjool", are highly sensitive to Foa andtheir cultivation requiresan integrated management. The objective of this study was to examine the effect of ethanolic and aqueous leaf extracts, as well as essential oils from two medical plants; Artemisia absinthium and Mentha pulegium, onFoa in-vitro. Four concentrations of plant extracts (0.625 mg/ml to 5 mg/ml) and essential oils (1 ul/ml to 7 ul/ml) were tested for their ability to inhibit spore germination, sporulation, and mycelial growth of Foa.Themost significant results were obtainedusing the ethanolicextract of A. absinthium and the essential oil of
M. pulegium. When applied at 5 mg/ml, the ethanolic extract of A. absinthium inhibited 100% Foa spore germination as well as sporulation, and 35% of the pathogen's mycelial growth. All other extracts showedweaker effects on Foa. Inaddition, the essential oil of M. pulegiumwas more effective against Foacompared the essential oil of A. absinthium. The former completely inhibited Foa mycelial growth and sporulation even at a low concentration of 4 ul/ml. These results provide significant insight into the potential of using bioactive compounds from A. absinthium and M. pulegium in future managementstrategies of date palm Bayoud disease in Morocco.

POSTER ABSTRACTS

P25. Antimicrobial and Antioxidant Properties of Central American Traditional Medicinal Plants

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The search for alternative naturally occurring antimicrobial agents never ends, especially when emerging diseases like COVID-19 urge to find safe and effective ways to prevent or treat these infections. We studied the antioxidant properties and potential antiviral activity of three medicinal plants used in Central America: Theobroma cacao, Bourreria huanita, and Elettaria cardamomum. Ethanolic plant extracts were prepared from commercial products derived from the seeds or flowers of these plants. The cytotoxicity and antiviral activity against severe acute respiratory syndrome coronavirus type 2 (SARS-CoV-2) were evaluated using the XTT colorimetric assay and a SARS-CoV-2 delta pseudoviral model, respectively. The half-maximal cytotoxic concentration (CC50) and half- maximal effective concentration (EC50) were used to calculate the therapeutic index (TI). We estimated total phenolics and antioxidant activity using Sigma Aldrich's phenolic compounds and total antioxidant assay kits. The extracts showed total phenolics in the range of 0.23 to 1.36 mM catechin equivalents, with T. cacao beans extract showing the highest content. The antioxidant activity showed values between 0.05 to 0.34 mM Trolox equivalents, and once again, T. cacao beans extract showedthe highest antioxidant activity. Most plant extracts showed none to moderate selective antiviralactivity with TI values between 1 and 5.5. However, T. cacao beans extract had excellent antiviral activity against SARS-CoV-2 with a CC50 and EC50 of 425.1 and 19.7 µg/mL, respectively, resulting in a TI value of 22. Future studies will look at the phytochemical composition of this extract to identify potential active pharmaceutical ingredients.

POSTER ABSTRACTS

P27. In vitro antiviral activity of essential oils against SARS-CoV-2 Delta variant

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Essential oils (EOs) are widely studied due to their broad bioactive spectrum, including antimicrobial, antifungal, antioxidant, and antiviral properties. These properties are attributed to terpenes present in their composition. Recent studies have suggested the antiviral potential of EOsagainst SARS-CoV-2 due to their proven activity against several other viruses (e.g., herpes simplex, influenza, human immunodeficiency virus, among others) and for managing symptoms in patients with COVID-19. This study aimed to evaluate the in vitro antiviral action of 12 EOs against the SARS-CoV-2 Delta variant using a pseudoviral (PsV) model, which is rare in the literature. The twelve EOs assessed in this study were selected based on our preliminary systematic and meta- analytic study to identify the most promising EOs against SARS-CoV-2 considering their affinity by target proteins from in silico studies. Furthermore, EOs with antiviral potential against other viruses identified from the literature were also selected. Antiviral activity and cytotoxicity were tested using the XTT and cell-based PsV assays, and the half-maximal effective concentration (EC50) and half- maximal cytotoxic concentration (CC50) was determined (GraphPad Prism software version 9.0.2). The therapeutic index (TI) was calculated for each EO (TI = CC50/EC50). The EC50 values ranged from 0.09 to 57 µg/mL, wherein the EOs from Syzygium aromaticum (0.09 µg/mL), Cymbopogon citratus (0.1 µg/mL), Citrus limon (0.15 µg/mL), Pelargonium graveolens (0.2 µg/mL), Origanum vulgare (0.4 µg/mL) and Illicium verum (0.5 µg/mL) were more effective against the virus. The CC50 values ranged from 0.2 to 81 µg/mL, resulting in the highest TI values for Illicium verum (TI = 60), Citrus limon (TI = 8.67), Pelargonium graveolens (TI = 8.50), and Syzygium aromaticum (TI =4.44). These four EOs proved to be a promising EO for SARS-CoV-2 inhibition, mainly Illicium verum.

POSTER ABSTRACTS

P29. Discovery and development of anxiolytic agents from tropical marine macroalgae

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Surveys show that one-third of the population is affected by an anxiety disorder. These are mostlytreated with benzodiazepines (BZD's) which can induce dependence disorders through tolerance and resistance mechanisms. This highlights the need for safer and more effective anxiolytic drugs. Recently, marine natural products have proven to be a rich chemical space for drug discovery anddevelopment. Specifically, tropical marine algae produce a wide range of metabolites with diverse biological activity, including neuroprotection. We propose to study the anxiolytic effects of natural products derived from marine tropical brown algae using an invertebrate fly model (drosophila). Our research aims to chemically characterize brown algae extracts, use these extracts for anxiety- related behavioral tests using Drosophila and identify the chemical components responsible for the anxiolytic activity. We have recently published results reporting that a crude extract of Stypopodiumzonale decreases fear-related behavior in Drosophila melanogaster using an Open Field Test(OFT). This study will further develop and validate Drosophila as a versatile and useful alternative for drug discovery efforts geared towards the treatment of anxiety disorders. Our research represents an unprecedented approach to anxiolytic drug discovery. It will also contribute to our understanding of Puerto Rico's marine algae and their natural product's chemo-diversity. Our marine brown algae chemical library will also serve as a unique resource that harnesses Puerto Rico's marine biodiversity and platform for other biotechnological discoveries.

POSTER ABSTRACTS

P30. Fermentation of Vaccinium floribundum Berries Reduces Oxidative Stress in Endothelial Cells

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Evidence suggests that high consumption of food containing antioxidants reduces the risk ofcardiovascular diseases. Additionally, fruits fermentation with lactic acid bacteria (LAB) enhances their beneficial properties as regulators of the immune, digestive, and cardiovascular system. In this context, we investigated the effects of fermentation with Lactiplantibacillus plantarum of Pushgay berries (Vaccinium floribundum, Ericaceae family) in human umbilical vein endothelialcells (HUVECs). The effects of berries solutions on cell viability and proliferation were assessed byLactate dehydrogenase (LDH) release and Trypan blue exclusion test. Antioxidant activity was evaluated by a cell-based chemiluminescent probe for the detection of intracellular H2O2 production. Heme oxygenase-1 (HO-1) expression levels were investigated by RT-qPCR. Glutathione reductase (GR), glutathione peroxidase (Gpx), superoxide dismutase (SOD), and catalase (CAT) activities, as markers of intracellular antioxidant defense, were evaluated by spectrophotometric analysis. Data showed that fermentation of Pushgay berries increases their intracellular antioxidant activity, as indicated by the reduction in H2O2-induced cell death and the decrease in H2O2-induced HO-1 gene expression in HUVECs treated for 24 h with fermented berries solution (10 µg/mL). Taken together, our results show that LAB fermentation of Pushgay berries enhances their antioxidant properties.

POSTER ABSTRACTS

P31. The potential application of essential oil of Thymus broussonetii Boiss., as a preservative ingredient in cosmetic products

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The aim of this study was to evaluate the antioxidant, and preservative efficacy of Thymus broussonetii Boiss. essential oil (EO) in topically applied formulation using a challenge test.The EO was extracted from the aerial part of T. broussonetii using hydrodistillation and the obtained EO was further analysed by GC/MS (Gas Chromatography/Mass Spectrometry). The antioxidant effect of the EO was evaluated using two methods, the inhibition of free radical 2,2-DiPhenyl-1- PicrylHydrazyl (DPPH) and Reducing Power Ferric Antioxidnat Power (FRAP) methods. Furthermore, the preservative efficacy of T. broussonetii EO was assayed at 2% (v/w) in topical cream formulation, using a challenge test against standard specific microorganisms'recommended by the European Pharmacopoeia. Chemical composition of the EO revealed the presence of thymol (63.09%), p-cymene (11%) and γ-terpinene (8.99%) as the major components. The antioxidant assays revealed that the essential oil exhibited strong antioxidant activity as indicated by the minimum inhibitory concentration IC50 (IC50 = 210±0.3 µg/mL for DPPH assay and IC50 = 84±0.21 µg/mL for FRAP assay) when compared to Quercetin and Butylatedhydroxytoluene (BHT) as controls. Moreover, the EO of T. broussonetii evaluated at 2% (v/w) in cream formulation succeeded in satisfying the A criteria for preservation efficacy against Staphylococcus aureus, Escherichia coli and Aspergillus brasiliensis but exhibited less efficacy against Pseudomonas aeruginosa (1.78 log reduction in the number of CFU/g after the 7 day of evaluation) and Candidaalbicans (1.09 log reduction in the number of CFU/g after the 14 days of evaluation) when compared to the synthetic preservative Phenoxyethanol 1% (v/w).These results indicate that the EO of T.broussonetii possess an important antimicrobial and antioxidant activities and can therefore be used as a natural preservative ingredient in cosmetic industry.

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