American Council for Medicinally Active Plants

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Abstract book

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PLENARY SPEAKER

Dr. Bhimanagouda (Bhimu) Patil, Texas A&M University

Dr. Bhimu Patil, a Regents Professor and Inaugural Leonard Pike University Professor at Texas A&M University, is renowned for his influential work as Director of the Vegetable and Fruit Improvement Center and USDA National Center of Excellence for Melons. Additionally, he holds the esteemed position of Love Tito's Endowed Professor at Texas A&M University. With over 250 peer-reviewed publications, Dr. Patil's research is at the forefront of understanding the comprehensive impacts of fruits and vegetables on human health. His pioneering work spans the integration of plant breeding, agronomic practices, and harvesting methods, emphasizing the crucial role of quality, food safety, and consumption in enhancing health benefits. Dr. Patil has significantly advanced the 'Foods for Health' concept, integrating diverse methodologies to improve the overall quality and health benefits of fruits and vegetables. Dr. Patil's leadership has been instrumental in securing substantial funding, including $34.8 million and $20.6 million grants for his program, with notable projects related to melons and tomatoes under USDASCRI-CAPS. He has delivered over 120 invited presentations globally, including 26 keynote addresses at prestigious conferences in countries such as Australia, Brazil, China, Canada, and many others. Throughout his distinguished career, Dr. Patil has received 19 prestigious awards, including six "Fellow" recognitions from professional societies such as the American Chemical Society and the American Society for Horticultural Sciences. He co-founded the International Symposium on Fruit and Vegetable Health in 2005 and has chaired or co-chaired 25 symposia, reflecting his leadership and commitment to advancing horticultural science. Dr. Patil's work has been extensively featured in 135 articles and news media outlets, including BBC, The New York Times, Wall Street Journal, and NPR, cementing his reputation as a leading authority in the field. His contributions continue to drive innovation and excellence in both the scientific community and the produce industry, promoting a healthier future through enhanced understanding and utilization of fruits and vegetables.

ABSTRACT

O1. Climate Resilience and Its Influence on Bioactive Compounds in Fruits and Vegetables: Implications for Health and Gut Microbiota

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Coping with climate change requires researchers and plant breeders to identify new climatic zones for our current crops and develop novel cultivars capable of withstanding the conditions encountered in these regions. The effects of these changes in food crops also have implications for human health because they affect health-promoting phytochemicals such as vitamins and antioxidants in the food we eat. In our studies, we are developing varieties of crops that can modify their growth to coincide with seasonal conditions and maintain yield under adverse conditions. For instance, our most recent success in this area has been the cultivation of melon breeding lines with deep root systems. Preliminary work on spinach and several other crops has identified that in addition to the nutritional benefits for human consumption, breeding for high Ascorbic Acid or Vitamin C, the most abundant soluble antioxidants in plants, increases biomass resulting in higher yields and enhanced tolerance to salinity, cold, and heat stress.

Because climate change alters the quantity and types of phytochemicals produced by plants, making sure that crop plants produce health-promoting compounds is another important aspect of our research. For example, stress can trigger the production of phenylpropanoid pathway–associated metabolites, resulting in a higher level of biologically active compounds. In a recent study, the major tri-terpenoids obacunone and limonin increased due to drought stress. Moreover, our cell culture studies demonstrated that obacunone may protect against human colon, prostate, breast and pancreatic cancer, and limonin suppresses $CD4^+$ T-cell proliferation, interleukin-2 production, and colon cancer proliferation. In tomato, lycopene can reduce inflammation and increase the relative abundance of beneficial gut bacteria including *Verrucomicrobia*, *Akkermansia*, and *Alloprevotella* and high temperature stress increased lycopene levels by 7.3% in some tomato varieties. In another set of studies, drought-induced gamma-aminobutyric acid (GABA) accumulation improves plant stress responses and helps in retaining water under drought conditions. Moreover GABA is a neurotransmitter that helps in controlling anxiety.

Therefore, our studies and other studies elsewhere demonstrated the interconnected effects of climate change on plant health and human health aim to make plant varieties that withstand the effects of weather conditions, thrive in new climate zones, and produce ample amounts of nutritious food.

Session I Ethnobotany and Bioprospecting

Chair: Nirmal Joshee, Fort Valley State University, USA

Co-chair: Surendra Surujdeo-Maharaj, Prairie View A&M University, USA

Keynote

O2. Ethnobotany of dioecious species and future perspectives in bioprospecting

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More than 15,000 angiosperm species are dioecious, i.e., having distinct male and female individual plants. These 15,600 dioecious angiosperms occur in 987 genera (6%) and 175 families (38%), with a number of families being entirely dioecious, e.g., Menispermaceae, Moraceae, Myristicaceae, and Putranjivaceae. The allocation of resources between male and female plants is different, and also variation in secondary metabolites and sex-biased herbivory is reported among dioecious plants. However, little is known about the ethnobotany of dioecious species and whether preferences exist for a specific gender, e.g., in food, medicine or timber. Ethnobotanical data was collected on perceptions and awareness of dioecious plants, and preferences of use for specific genders of dioecious species using semi-structured interviews with folk healers in India. The results revealed that Indian systems of medicine contain 5–7% dioecious species, and this estimate is congruent with the number of dioecious species in flowering plants in general. Informants recognized the phenomenon of dioecy in 31 out of 40 species, and reported gender preferences for 13 species with respect to uses as timber, food and medicine. Among informant's different plant traits such as plant size, fruit size, and visibility of fruits determines the perception of a plant being a male or female. A number of phytochemical studies have shown that there are significant variations in the concentration of phytochemicals present between male and female plants. Based on this, we propose that researchers conducting ethnobotanical studies should consider documenting traditional knowledge on sexual systems of plants, and test the existence of gender specific usages in their conceptual framework and hypothesis testing. Incorporating such concepts could provide new dimensions of scientific knowledge with potential implications to conservation biology, chemical ecology, ethnoecology and drug discovery.

Invited I

O3. Conserving the proposed federally threatened Ocmulgee skullcap (*Scutellaria ocmulgee*) on Robins Air Force Base, Georgia.

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The federal government owns 640 million acres of land in the United States with the Department of Defense (DoD) occupying approximately 17 million acres. Out of 5 federal agencies, DoD land holds the second highest number of species (23%) with Endangered Species Act (ESA) status and harbors the second highest number of imperiled species (15%). In 2023, it was reported that the Air Force properties alone contain over 500 federally listed species. Because the federal government owns the most land in the country with a substantial number of protected plants and animals, agencies must comply with the

ESA by conserving federally threatened and endangered species. Robins Air Force Base (AFB) is home to the proposed federally threatened Ocmulgee skullcap. The Ocmulgee skullcap is a perennial herb that is rare throughout its range as it only grows on hardwood bluffs with eastern or northern aspects. This species exists in two known populations, one in the Savannah River watershed in South Carolina, and one within the Ocmulgee River watershed in Georgia. The Ocmulgee skullcap has medicinal significance as studies found that leaf extracts have strong anticancer activity. The largest threats to the Ocmulgee skullcap include the encroachment of invasive plant species and non-insect herbivory. Robins AFB's Natural Resources department actively monitors its population and has historically treated population sites with herbicide to reduce competition from invasive plants. Robins AFB is currently working with the U.S. Fish and Wildlife Service and local universities to further advance management techniques to improve the resiliency of the Ocmulgee skullcap while maintaining its mission readiness.

Invited II

O4. A double-edged sword? Participatory research into traditional plant benefits and toxicity

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Plants represent a mainstay of health-promoting medicines for indigenous communities across the United States and form a powerful connection between traditional knowledge and personal and community health. However, as development (e.g., industrial agriculture, petroleum exploration) encroaches on native plant habitats, harvesting is relegated to marginalized and potentially polluted areas. Thus, there is community concern that the plants are also harboring toxins that could counteract their potential benefits. To investigate these potentially conflicting aspects of traditional plants in the upper Great Plains region, we examined plants used by indigenous communities in North Dakota (e.g., *Populus deltoides, Inonotus obliquus, Amelanchier alnifolia*) for their ability to promote gut health by reducing inflammation. Results show that extracts activated the aryl hydrocarbon receptor (AHR) and decreased expression of pro-apoptotic markers. However, plants collected from industry-adjacent areas also indicated high levels of nickel, lead, and molybdenum, suggesting possible chronic toxicity. This study highlights the potential traditional plants can have for improving health, but also the precarious position these plants reside with current trends of development, and how participatory models of inquiry are essential to answer research questions that are informed by, and in service to, the communities from which this knowledge and these plants are central.

Oral I

O5. Ethnobotany and DNA Barcoding of Medicinal and Cosmetic Plants in Kalu and Bati Districts of Amhara Region, Ethiopia

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DNA barcoding is a relatively new method which has been developed to provide rapid, accurate and automatable species identification using standardized DNA sequences as tags. It helps to identify distinct DNA regions that can differentiate most of the world's species, forming an extensive reference library. Currently, no standardized methods exist for identifying species in herbal products to detect contamination and substitution, making DNA barcoding is essential for mitigating health risks and verifying the authenticity of herbal medicines. Furthermore, barcode sequences for angiosperms in online databases are still incomplete, highlighting the need for further barcoding of Ethiopian traditional medicinal plants to expand the reference database. In this study, 145 medicinal plant species, including five species that were not morphologically identified, were collected from Kalu and Bati districts. Morphological identification was conducted at the National Herbarium of Ethiopia, Addis Ababa University. Genomic DNA was extracted using a modified CTAB method (Cota-Sánchez et al., 2006). The final PCR products were sequenced using the Sanger sequence, and sequence analysis from Macrogen produced new Fasta files for ITS, rbcL, and matK regions. The results were aligned using SeqTrace (0.9.0). PCR amplification and sequencing were entirely successful, and the amplified products were sequenced. The BLAST algorithm compared the medicinal plant sequences to the reference database, showing high sequencing success rates for rbcL (97.4%) and ITS (96.1%), but lower for matK (75.97%). BLAST queries revealed no sequence variation between barcoding identification and morphological identification for 67.5% of ITS samples, 73.4% of rbcL samples, and 71.4% of matK samples. However, powder form samples displayed discrepancies and revealed fungal contamination in market samples. Therefore, molecular authentication based on DNA barcoding sequences is crucial for the quality control of traditional medicinal plants, plus expand the reference database.

Oral II

O6. Heritage of healing, use of medicinal plants in treating envenoming- case of villages in the dry zone tank cascade systems in Sri Lanka with reference to “Bellankadawala” cascade.

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Sri Lanka is a tropical country with a rich heritage of healing and the indigenous medical systems are still being practiced. The country reports the highest annual mortality rate due to envenoming in the world where North Central Province (NCP) reports the highest incidents in the country as it is situated in the dry zone, providing habitat for highest medical importance and secondary medical importance snakes and venomous arthropods.“Bellankadawala” is an ancient cascade system in NCP consists of thirty-one man-made tanks across seven villages, covering 44 km2 with population of 2820. The cascade belongs to the “Malwathu” river basin, considered as the cradle of ancient Sri Lankan civilization, encompass a rich source of indegenous knowledge. The aim of the study was to study ethnobotany of medicinal plants in treating envenoming. In-depth interviews were conducted using a semi structured questionnaire with all four indigenous physicians and six medicinal plant collectors in the cascade. Monthly average of 13 treatments were done for the envenoming of Hump nose vipers (*Hypnale* sp), cat snakes (*Boiga* sp), hairy spiders (*Poecilotheria f*asciata), Black scorpion (*Androctonus crassicauda*) while post recovery treatments for toxin purgation (40%), remaining pain (32%), numbness (14%), blurred vision (10%), constipation (4%) were undertaken for Cobra (*Naja n*aja), Kraits (*Bangarus* sp.), vipers (*Daboia russelii*) bites. The study revealed that the indigenous physicians in the cascade use sixty-three medicinal plant species, belongs to 36 families to treat envenoming. The most used plant families were Fabaceae and Malvaceae, verified by herbarium sheets preparations. Roots of the plant species were mostly used (62%) while barks (19%), leaves (13%), pods and flowers (6%) were used respectively. Paste (40%), decoction (28%), oil extract (25%), inhaling were major preparation methods using plants while the major routes of administration were topical (45%) and oral (40%).

Oral III

O7. Neem and Turmeric, two incredible medicinally active plants, an overview of many known and rarely known information to help the community

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Neem (*Azadirachta indica*, *A. Juss*) and Turmeric (*Curcuma longa*)-two incredibly important medicinally active plants (MAP) known to the people of Indian subcontinent since time immemorial. These two plants parts and products have been in use for human health, animal health, and to control insect – pest attack on crops as well as for food storage. This paper will discuss about many known and rarely known uses of these two MAPs through pictorial presentations that we came across during COVID-19 pandemic in India. This presentation will increase our knowledge on these plants for future use and research. The ACMAP organization and this conference has been playing a significant role to share and enhance our knowledge on MAPs and its active ingredients and their uses. As we all agree that the main goals of our work are to benefit human society as well as the global community through research and knowledge sharing. Sometimes, we carry out valuable research on various MAPs but we do not get its fruit to the users. Or it might take too long to see the final outcomes of our research, which is also not the right thing. Thus, here our goal is to find out uses and share them for the community to sue them for health benefits or for using in research and education. This presentation can provide ground level uses of neem and turmeric plants and its products. It can open new avenue of future research to validate these uses through lab research. Beside showing various uses through pictorial evidence, we will be presenting product preparation, acknowledgements of health benefits and research data on antimicrobial effect, food safety, and insect, pest control potential.

Session II Chemistry of Medical Plants

Chair: Joshua Kellogg, Penn State University, USA

Keynote

O8. Investigation of the Secondary Metabolites of Cameroonian Plants Used as Antinociceptives

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There is a pressing need to identify and validate new targets for chronic pain and new sources for novel compounds. We have developed a long-standing collaboration between the Nguelefack, Kolber, and Tidgewell labs to investigate the effect and composition of Cameroonian plant extracts used in traditional medicine practice to relieve pain. Cameroon provides a mixture of diverse habitats for collection of plants as well as a strong history of traditional herbal medicine. We are investigating extracts and pure compounds from multiple Cameroonian plants namely *Paullinia pinnata*, *Petersianthus macrocarpus* and *Acacia sieberiana* to probe the biology and therapeutic potential of non-opioid targets for pain, focusing on calcium homeostasis especially through sigma 2 (σ-2) (aka transmembrane protein 97 (TMEM97)). Our primary research goal is to use a focused interdisciplinary approach to isolate bioactive compounds from traditional medicine and utilize these new tools in Cameroon to address research and education disparities that contribute to poor pain outcomes in Central Africa. Preliminarily, the Nguelefack lab has shown that crude extracts of *P. Pinnata, P. macrocarpus* and *A. sieberiana* significantly decrease inflammatory and neuropathic pain in rats. The Tidgewell/Kolber groups have shown that the methanol extracts of *P. pinnata* show in vitro binding affinity to σ-2/TMEM97 and modulate primary sensory neurons. This presentation will focus on our interdisciplinary approach to validate plant extracts function, investigate secondary metabolites present, and screen these compounds for affinity against non-opioid receptors involved in sensation. We will present on validation of σ-2/TMEM97 as a target, verification of efficacy of plant extract in lab based models of nociception, and our planned use of molecular networking and metabolomics to explore the chemistry within these active extracts.

Invited I

O9. Potent HIV-1 Latency Reversal by an African medicinal plant extract, Croton megalobotrys, in primary cells from People Living with HIV and Humanized Mice

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Latency reversing agents (LRAs) have had limited success in vivo, indicating a need for more potent agents. We previously reported that “Mukungulu,” an extract prepared from C.megalobotrys bark, traditionally used for HIV/AIDS management in Botswana, is an LRA in vitro, containing protein kinase C-activating phorbol esters (PMID: 28970153). However, its properties ex vivo and in vivo are not known.Peripheral blood mononuclear cells (PBMCs) and isolated CD4+ T cells of antiretroviral therapy (ART)-suppressed individuals, were treated with test agents Mukungulu and/or its isolated active ingredients (Namushen phorbol-esters) or anti-CD3/CD28 and/or phorbol 12-myristate 13-acetate (PMA) positive controls and assessed for viral p24 protein induction after 72 hours using Simoa (PMID: 33796087). Intact and defective proviral DNA were assessed by IPDA (PMID: 30700913). ART-suppressed BLT-Humanized mice, infected with HIVSUMA (PMID: 36460646), were intraperitoneally injected with 5 µg/mL Mukungulu (N=7) or PBS vehicle (N=5), and assessed for plasma viral load (pVL) and viral RNA (vRNA), after 24 hours. In PBMC from 12 ART suppressed donors, Mukungulu induced 0.30 and 0.46 pg/mL of p24 protein in pellets and supernatants, respectively, without cytotoxicity, compared to only 0.11 and 0.17 pg/mL of p24 induced by anti-CD3/CD28 ($p = 0.06$ and 0.07). This activity was ~2.5 higher than the positive control (anti-CD3/CD28) and correlated well with intact provirus reservoir size. Similar results of HIV Gag-p24 induction by Mukungulu and Namushens were obtained in CD4+ T cells, showing strong correlation with defective provirus ($r2 = 0.82$ and 0.72 for the cellular pellets). In humanized mice, Mukungulu induced 1336 vRNA copies/million human cells plus a pVL of 391copies/mL, compared to no change by PBS — indicating robust HIV-1 latency reversal activity in a

living biological system. Mukungulu and its active components (Namushens) are potent LRAs ex vivo and in vivo.

Invited II

O10. Steroid Based Synthesis of a Dual-PROTAC Targeting Oncogenic and Resistance Drivers in Metastatic Castration Resistant Prostate Cancer (mCRPC)

Melanie Rodriguez[1], Alexander Busse[1], Su Deng[2], Ping Mu[2], Uttam Tambar[1].[1]Biochemistry Department, University of Texas Southwestern Medical Center, Dallas TX, USA and [2]Department of Urology, Yale University, New Haven, CT, USA. E-mail: melanie.rodriguez@utsouthwestern.edu, alexander.busse@utsouthwestern.edu, Uttam.tambar@utsouthwestern.edu, ping.mu@yale.edu, su.deng@yale.edu

Prostate cancer (PCa) is the most prevalent cancer diagnosed in American men, and it's rapid progression eventually culminates in its deadliest form, metastatic Castration-Resistant Prostate Cancer (mCRPC). Current therapies for mCRPC involve Androgen Receptor (AR) targeted therapy such as Enzalutamide alone or in combination with other natural product derived compounds, however drug resistance develops in almost all patient cases. Proteolyzing Targeting Chimeras (PROTACs) are heterobifunctional molecules that simultaneously bind to a biological protein of interest (POI) and components of the ubiquitin-proteasome system to enable ubiquitination and inducing degradation of the biological target via the cell's proteasome. In recent years, discovered PROTACs have provided a powerful platform to target and degrade various oncogenic drivers, including AR, ER, BCL2, TGF-B, STAT3 and BRD4. Since the Glucocorticoid Receptor (GR) signaling has been identified as a crucial driver of AR-therapy resistance in mCRPC, various small molecule inhibitor-type GR antagonists have been developed to target the resistant mCRPC, such as mifepristone, Relacorilant and ORIC-101. So far, developed inhibitors have been unsuccessful because the sole inhibition of GR signaling reverses the dependency of mCRPC tumor cells back to AR signaling. These results suggest that the simultaneous inhibition of both GR and AR signaling is necessary to effectively overcome the AR therapy resistant mCRPC growth. Currently, our strategy focuses on the development of a novel dual-targeting PROTAC-based degrader platform and the effects of this GR/AR degrader in overcoming mCRPC therapy resistance. The dual-targeting degrader platform developed in this study will provide an innovative tool for simultaneously targeting a wide spectrum of oncogenic drivers in other cancers. Additionally, these results will also lay the foundation for a clinical trial designed to combat AR therapy resistance with novel dual-degraders in mCRPC.

Oral I

O11. Phyto-GCMS analysis on leaves and stems of *Triumfetta tomentosa* Boj and *Triumfetta rhomboidea* Jacq.

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Triumfetta tomentosa Boj. and *Triumfetta rhomboidea* Jacq are plant species in the family *Malvaceae,.* In Africa, the leaves, stems and roots of these species have been used to treat various ailments, including fever, rheumatism, skin conditions, cough, and respiratory conditions, etc. While these plants are so valuable, reports on their phytochemical constituents and bioassays are scanty. The objective of this

research is to analyze the phytochemical contents of the two commonly used species, *Triumfetta tomentosa* Boj. and *T. rhomboidea* Jacq using GC-MS procedures. Results obtained revealed the presence of tannins, flavonoids, saponins and other substances in leaves of both species. While alkaloid was absent in both stems of the two species, flavonoid was present in *T. Rhomboidea* stem but absent in *T. tomentosa*. The GC-MS quantitative analysis also showed significantly higher amounts of constituent in leaves and stems of *T. tomentosa* compared to those of *T. rhomboidea* . Further research is however, required to ascertain the bioactive status of these constituents.

Oral II

O12. Isolation and Purification of Antimicrobial activity Cola acuminata and RNASeq Exploration of induces Cola acuminata Gene Expression

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The emergence of resistant bacterial strains has led to the need for developing new antibiotics. Cola acuminata and Cola nitida are two eatable plant nuts showing both antimicrobial and antifungal activity in selective microorganisms. Recently, we reported that the acetone extract of Cola acuminate (Biz-3w) contains putative antimicrobial bioactivity in Staphylococcus aureus. In this study, we focused on isolating the active ingredients in Biz-3w, evaluating their sensitivity, and exploring their mechanism of action. An analytical reverse-phase HPLC chromatographic separation method was used to isolate Biz-3w_A1, an enriched antimicrobial fraction. This method resulted in an 80% purification of the antimicrobial activity in Biz-3w as determined by growth inhibitory turbidity assay and disc diffusion assay. A wavelength spectrum scan of purified peaks (Biz-3w-A1) detected the presence of at least five individual compounds having an observation max at 210-225 nm. Biz-3w_A1 had excellent bactericidal activity against S. aureus and was similar to vancomycin in killing organisms in the late exponential growth phase. Biz-3w_A1 treatment resulted in lysis of over 90% of the organism after three hours. RNASeq gene expression profiling of Staphylococcus aureus in response to two deferent concentrations (0.25XMIC and 2.5X MIC) of Biz-3w_A1 at 3hr induction resulted in a total of 102 genes that were deferentially expressed (2.0-fold log2 change in expression). In response to the Biz-3w_A1 challenge, 36 genes were upregulated, and 66 genes downregulated. KEGG pathway analysis reveals that over fifty percent of the regulated gene was associated with either the ABC Transporter (19 genes), the Quorum sensing (11 genes), the purine metabolism (10 genes), or the Staphylococcus aureus infection (11 genes) pathways. These results demonstrate that Cola acuminata is an excellent new antimicrobial agent source that affect multi biochemical pathways in gram-positive bacteria.

Session III Hemp and Medical Cannabis

Chair: Diana Roopchand Rutgers University, USA

Co-chair: Aruna Weerasooriya Prairie View A&M University, USA

Keynote

O13. Medicinal Cannabis Production in Controlled Environments

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Cannabis sativa (cannabis) has seen a significant rise in legal cultivation worldwide in recent years. Increasing number of scientific studies have demonstrated that cannabis plant and its extracts can be beneficial to many different human and animal diseases. Over the past decade, our lab has been dedicated to researching the cultivation of medicinal cannabis in controlled environments. This presentation will explore strategies to enhance the active phytochemical contents and yields of cannabis through horticultural management techniques, including the manipulation of lighting—such as spectrum and intensity—and root zone management.

Invited I

O14. Cannabinoids for the treatment of chronic pain and cancer: new insights and mechanisms of action

Robert Barnes[1], Satish Banjara[1], Ava Oliver[2], Amanda Garcia[2], Sharilyn Almodovar[2], and Josée Guindon[1]. [1]Department of Pharmacology and Neuroscience, [2]Department of Immunology and Molecular Microbiology, Texas Tech University Health Sciences Center, Lubbock, TX USA.

Cannabinoid-based therapies are increasingly being used by cancer patients to treat chemotherapy-induced nausea and vomiting. Our previous work demonstrated that JWH-133, a cannabinoid receptor type 2 (CB2R) selective agonist, stimulates ovarian cancer tumor growth (Blanton et al., 2022). However, preclinical studies have failed to evaluate the effects of cannabinoid compounds on alleviation of pain, antinociceptive tolerance, and tumor growth in mice with CINP and cancer. The objective of our current work is to identify role of cannabinoid (CB1 (ACEA), CB2 (JWH-133) and mixed (CP55,940) agonists) agonists on tumor growth in our newly developed breast (AT3 sygeneic breast cancer cells cells inoculated at $5x10^6$ cells in mammary fat pad) cancer CINP (cisplatin 5 mg/kg/week; Guindon et al., 2014) mouse model. This will be accomplished using an integrative and comprehensive mechanistic approach that involves behavioral pharmacology, biochemistry, molecular biology and CRISPR techniques. Our preliminary data demonstrate that injection of AT3 (breast cancer cells) into the mammary fat pads significantly decreased CINP in our breast cancer CINP mouse model. Furthermore, our results also showed a delay in antinociceptive tolerance to CP55,940 in our breast (AT3) cancer tumor CINP model in comparison to sham CINP mice lacking breast cancer tumors. Further studies will be investigating the role of cannabinoid (CB1, CB2 and mixed agonists) agonists in terms of alleviation of pain, their influence positive or negative on tumor growth, and their potential role in influencing sex hormones. Our study will improve cannabinoid drug development for treatment/prevention of CINP in cancer patients, identify the role of cannabinoids compounds in modulating tumor growth, and investigate cannabinoids role and effects on sex hormones in our breast cancer CINP model.

Invited II

O15. AI-assisted discovery of bioactive minor cannabinoids from hemp

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Industrial hemp (*Cannabis sativa*) contains more than 100 cannabinoids. Most of these cannabinoids occur in minor quantities and go to waste in the cannabidiol (CBD) industry. However, there has been growing interest in the therapeutic benefits of minor cannabinoids, such as their effects on low-grade inflammation and pain. Our study aims to identify bioactive minor cannabinoids from CBD-depleted hemp extract by investigating their effects on low-grade inflammation and integrating a machine learning approach. The hemp extract was fractionated into 47 fractions using a Sephadex LH-20 column. Fractions were analyzed by loop-injection combined with electrospray ionization and high-resolution accurate mass spectrometry (LI-ESI-TOF). RAW264.7 murine macrophage cells were treated with fractions (1 µg/ml) and lipopolysaccharide (LPS, 100 ng/ml) for 24 h to assess their effects on inducible nitric oxide synthase (iNOS)-mediated nitric oxide production. A random forest model was used to predict which minor cannabinoids contribute to the bioactivity using the mass peak intensities of fractions from LI-ESI-TOF and bioassay results. A total of 16 cannabinoids were identified by comparing them with our in-hand library of 35 standards. While LPS treatment significantly increased iNOS-mediated nitric oxide production compared to the vehicle control, LPS-stimulated nitric oxide levels were significantly inhibited by fractions #20-45 ($p<0.05$). Eight peaks showed importance by random forests analysis, of which cannabinoid acids were predicted to contribute most to the observed bioactivity. Their bioactivity was validated by testing the predictors individually in pure form. This study demonstrates the utility of machine learning to expedite the identification of bioactive cannabinoids. Identifying bioactive minor cannabinoids from waste products of CBD industry will benefit both the development of hemp-based phytochemical supplement and the promotion of a sustainable agro-industry. This project is funded by National Institutes of Health grant # R21AT012695 and by USDA-NACA-Project #2072-2100-054-00-D.

Oral I

O16. High cannabigerol hemp extract moderates colitis and modulates the microbiome in an inflammatory bowel disease model

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Ulcerative colitis (UC) is one of the two major forms of inflammatory bowel disease (IBD) in which inflammation and ulceration are restricted to the colon. Current therapies to treat UC (steroids, immunosuppressants, and 5-aminosalicylic acid) have limited effectiveness and frequently have undesirable side-effects. Recent surveys of patients with IBD suggest that between 10-12% use cannabis or cannabis products to treat the symptoms of their disease, despite the lack of evidence to support the use of cannabis for UC. To induce colitis, mice received 2% dextran sodium sulfate (DSS) in their drinking water for 5 days and then were returned to normal water. Animals were treated daily with either vehicle (coconut oil) or CBG/CBD hemp extract (20 mg/kg CBG; 20.7 mg/kg CBD) via intraperitoneal injection. Tissue and stool samples were collected at days 5 and 7 of the procedure and stool was collected also collected prior to the start of DSS. We found that treatment with high CBG hemp extract largely reduced disease symptoms, as measured by disease activity index. This effect was confirmed histologically through hematoxylin and eosin staining of colonic sections, that revealed normal colonic architecture was largely maintained in mice treated with hemp extract. In contrast, animals that received vehicle treatment showed large areas of ulceration. Additionally, our data show that high CBG oil changes the microbiota in a potentially protective manner. Finally, metabolome analysis performed on stool samples collected pre- and post-colitis indicate that high CBG oil treatment reduces changes in the metabolome associated with colitis. We show here, for the first time, that hemp extract (CBG/CBD oil) is effective at reducing the symptoms of colitis in a murine model. These data indicate that CBG/CBD oil may be a novel therapeutic for reducing disease flare-ups in patients with UC.

Oral II

O17. Evaluation the nutritional profile of different hemp plant biomass and spent hemp biomass (SHB) as a potential feed supplement for goats

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Hemp (*Cannabis sativa L)* is a multipurpose herbaceous crop used for food and medication for centuries. In recent years, industrial hemp has been extensively used for CBD and oils extraction. The hemp extraction process also produces a large volume of extraction residues known as Spent Hemp Biomass (SHB). Although hemp seeds and flowers are high in macro and micronutrients essential in human diets, little information is available in the literature regarding the value of SHB as a feed for animals. The objective of this research was to evaluate the nutritional profile of the hemp plant biomass of different strains of hemp and spent hemp biomass (SHB) as feed for goats. From November 2023 to April 2024, 12 hemp varieties were grown in a separate pot in a Greenhouse setting. In June 2024, samples of trimmed leaves and stems were handpicked and stored in a refrigerator for further analysis. Samples of spent hemp of different mixes were collected from a CBD processing company. Samples were oven-dried, ground to pass a 2-mm screen to determine DM contents and analyzed for crude protein and mineral contents. The results showed significant differences in crude protein contents among strains of hemp plants and SHB, while mineral contents show no detectable differences. While the CP content of plant biomass was low, ranging between 7.8% and 18.4%, spent hemp biomass had higher CP% ranging between 22.4 and 27.2%, the later comparable to the CP contents of high-quality feeds, such as alfalfa. Thus, with a comparable CP%, SHB has the potential for inclusion as supplementary ingredient in ruminant diets, however, further research is warranted to determine the nutritional attributes, such as energy, digestibility and intake of hemp biomasses.

Session IV Production, Strategies, and Challenges

Chair: Ram Ray, Prairie View A&M University, USA

Co-Chair: Sanjita Gurau, Prairie View A&M University, USA

Keynote

O18. Climate Change Impact on Medicinal Plant's Growth and Spatial Distribution

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Due to climate change, a steady increase in mean winter temperatures and extreme minimum temperatures were observed and projected. An increase in temperature triggers a change in optimal crop temperature thresholds, increasing heat stress on crops and eventually an increase in crop failures. Different plant species respond differently to climate change, and so do medicinal species. Some species can stay in place but adapt to new climatic conditions through selection. Other species move to higher latitudes or altitudes. Therefore, climate change is affecting the distribution of plants, including medicinal plants. To understand the impact of climate change on the spatial distribution of plants, we conducted a study in the south-central of the USA. This study developed climate change scenarios in the south-central states, indicating a minimum temperature change. These scenarios combined multiple emission scenarios, Global Climate Model Simulations, and statistical downscaling techniques. The scenarios were for the mid-century (2036-2065) and far future (2070-2099). Based on the USDA definitions, Plant Hardiness Zones (PHZs) were delineated under different climate change scenarios. These zones divide the geography into zones by 10°F (5.56 °C) increments from each zone. PHZ mapping under diverse climate change scenarios corroborates that the southern region of Texas may experience heat stress, while Colorado and Kansas may benefit from an expansion of thermally suitable areas for plant growth. Several plants, including medicinal plant species, might potentially be the most threatened by climate change in the future and are, therefore, the highest priority for conservation.

Invited I

O19. Frankincense biosynthesis pathway: a lead for new medicinal products development

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Historically, frankincense resin is one of the three gifts offered to Christ by the three Wise Men and is mentioned 22 times in the Bible. This iconic product, with a history dating back to the late 4th millennium B.C., was behind the flourishing trade between South Arabia and the rest of the world. Frankincense products have shown anti-inflammatory, anti-cancer, and anti-depression properties. This ability is due to the presence of boswellic acid in the resin. Despite the advances in its medicinal chemistry, its genomic and transcriptomic data remained unknown. How the trees produce key boswellic acid still needs to be better understood. We used RNA-sequencing analysis to profile the transcriptome of B. sacra after 30min, 3h, and 6h of post-tapping of tree tissues. Results showed 5,525 differentially expressed genes (DEGs) related to terpenoid biosynthesis, phytohormonal regulation, cellular transport, and cell wall synthesis. Plant-growth-regulators were applied exogenously which showed regulation of endogenous jasmonates and resulted in rapid recovery of cell-wall integrity by significantly up-regulated gene expression of terpenoid biosynthesis (germacrene-D synthase, B-amyrin synthase, and squalene

epioxidase-1) and cell-wall synthesis (xyloglucan endotransglucosylase, cellulose synthase-A, and cell-wall hydrolase) compared to control. We propose that boswellic acids are synthesized by amyrin and squalene. Improving the gene expression via plant cell culture can improve the commercial production of boswellic acid.

Invited II

O20. The Hemp Conversion Program: Developing a public hemp germplasm collection with maximized genetic diversity

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The Hemp Conversion Program was created by the Industrial Hemp Breeding Program to develop germplasm adapted to heat: drought prone ecoregions across the southern U.S. Field cultivated hemp crops—cannabinoid and fiber types—failed near universally across Texas following legalization in 2020. Replicated evaluation trials of twenty diverse cannabinoid types at six locations across the state over multiple years failed to identify high-yielding and superior adapted cultivars. Heat stress caused precocious flowering, inferior plants, significant mortality, and dramatically reduced cannabinoid production compared to yields previously reported for the same cultivars in more temperate U.S. locations. In order to address this issue and expand hemp genetic diversity to plant breeders, development of an open-source, publicly available germplasm collection was initiated in 2022. A total of 110 diverse pollen donations across thirteen countries globally have been utilized to generate more than sixty compliant hemp F2 populations to date. Following seed increase, the first submissions to the USDA-NPGS were made in September, 2024. The project will greatly benefit plant breeders, seed industries, producers, government agencies, private individuals, and other stakeholders.

Oral I

O21. Multifunctional Health Food & Supplement properties of Ceylon Cinnamon *Cinnamomum zeylanicum*

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Cinnamomum zeylanicum, also known as Ceylon cinnamon or 'True Cinnamon' is one of the most popular and useful spices in the world. This spice is reputed for its medicinal properties in Sri Lankan traditional medicine. Many of the medicinal properties have been scientifically validated including clinically proven anti-diabetic and anti-lipidemic properties. In our studies on authenticated Ceylon cinnamon, *Cinnamomum zeylanicum* grown in Sri Lankan cinnamon plantations, we have demonstrated in vivo antidiabetic effect in streptozotocin-induced rat model, In vitro Antioxidant, Anti-amylase, Anti-cholinesterase, Anti-glycation, Glycation Reversing, Anti-inflammatory, and cytotoxicity from both Bark and Leaf extracts. Further, we demonstrated In vitro Antilipidemic and Bile Acids binding properties from the bark, pharmacodynamic properties and safety of Ceylon cinnamon in healthy adults as phase I clinical trial and anti-diabetic and anti-lipidemic properties in a double-blind placebo-controlled randomized Clinical Trial with 260 patients.

The effect on peripheral glucose uptake is important in the clinical and dietary management of diabetes. Therefore, we conducted the yeast cell glucose uptake bioassay to understand the effect of Ceylon cinnamon on the facilitation of cellular glucose uptake. Results showed that ethanolic bark extract of Ceylon cinnamon significantly increases the % glucose uptake by yeast cells in a dose-dependent manner. Further, the glucose uptake negatively correlated to the glucose concentration in the yeast suspension. The results of this in vitro assay further strengthen the anti-diabetic properties reported from Ceylon cinnamon.

Oral II

O22. Supplemental lighting influences the antioxidant content and associated kinetic attributes in greenhouse-grown tomatoes

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Controlled environment agriculture (CEA) is emerging as a crucial solution to address nutrition security issues amid shifting climatic conditions and changing demographics. Environmental factors, especially light, influence tomato fruit quality by altering their physio-biochemical properties, and often, the variability in such responses is genotype-specific. Although previous studies have highlighted the importance of light for agricultural production, research on the effects of supplementing narrow-spectrum blue and UV-B on antioxidant compounds in tomatoes under CEA is limited. This study subjected tomato plants to supplemental blue, UV-B, a combination of both, or no additional lighting (control) in a greenhouse to study the effects on antioxidants such as ascorbic acid and the antioxidant activities in harvested fruits. Our results demonstrated that the ascorbic acid content in plants exposed to UV-B light and the combination of blue and UV-B were significantly ($p<0.05$) higher than that of control. Likewise, antioxidant activities were also higher than control under all the supplemental lighting conditions. The antioxidant kinetics over an hour showed an exponential rise to the maximum pattern with varying kinetic slopes for different supplemental light exposures. Moreover, different slope values were observed upon linearization, with UV-B (0.246) and blue light (0.258) treatments displaying higher slopes than the control, indicating the accumulation of fast-acting antioxidant compounds. These antioxidant compounds offer substantial health benefits and have the potential to reduce various degenerative diseases. This study underscores the importance of optimizing the growth environment to enhance the quality of tomatoes and potentially other crops and further ensure the delivery of high-quality produce to consumers. This work was supported partially by the USDA-NIFA- SCRI- 2017-51181-26834 through the National Center of Excellence for Melon, USDA-NIFA 2024-51181-43464 at the Vegetable and Fruit Improvement Center of Texas A&M University and partially supported by the funding from Texas A&M Institute for Advancing Health Though Agriculture.

Session V Bioactive Compounds of Plants and Their Roles in Human Health I–Cancer

Chair: Jeremy Johnson University of Illinois Chicago, USA

Keynote

O23. A modified natural small molecule for triple-negative Breast cancer

Chendil Damodaran, Texas A&M University

Invited I

O24. Screening of Xanthones from *Garcinia mangostana* to target the Allosteric site in BiP to overcome Drug Resistant Prostate Cancer

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Prostate cancer (PCa) is the second most diagnosed malignancy among men. Although FDA-approved antiandrogens, including enzalutamide and abiraterone acetate, are initially effective, most patients eventually develop drug resistance. Androgen receptor splice variant 7 (AR-V7) is a leading cause of drug-resistant prostate cancer (DRPC). Our previous studies have shown that α-mangostin, a xanthone from *Garcinia mangostana*, promotes AR-V7 protein degradation via the activation of molecular chaperone-binding immunoglobulin protein (BiP, also known as GRP78). Importantly, this effect relies on α-mangostin-induced formation of the BiP-AR-V7 complex, which directly promotes proteasomal degradation of AR-V7. This study revealed a novel mechanism for AR-V7 degradation, and the BiP-AR-V7 complex may be a unique druggable target for overcoming DRPC. Our preliminary results using Surface Plasmon Resonance (SPR) showed that α-mangostin directly binds to BiP. In this study, we investigated whether other xanthones from mangosteen fruit could bind to BiP. To isolate the allosteric BiP binder from mangosteen extract, four distinct mangosteen fractions were separated by high-performance liquid chromatography (HPLC). In addition, r-BiP was expressed in E. coli BL21 cells and purified using a Ni-NTA column. SPR experiments revealed that the four fractions exhibited varying binding affinities for r-BiP, with fractions I, II, and III binding with high affinity. We intended to further purify the fractions to individual peaks and identify them using Nuclear magnetic resonance (NMR) spectroscopy. Our long-term goal is to use SPR for the high-throughput screening of allosteric BiP binders, including 200, 000 natural products.

Oral I

O25. Immunostimulatory and Anti-cancer effects of Calocybe Indica Mushroom

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Calocybe Indica (CI) is a nutritionally rich and one of the most commercially grown mushroom in the world. Yet, the therapeutic properties of CI are not fully understood. Here, we aim to explore the immunomodulatory and anti-cancer properties of CI. First, we show that treatment of *Calocybe Indica* Crude Polysaccharides (CIP) on C57BL/J6 mouse spleen cells increases total T cells, activated T cells and Double Negative T cells within 24 hours of treatment. Furthermore, B cell activation markers were exceptionally high in B-cell exposed to CIP and short-live plasma cells (B220+CD138+) were detected. Similar B cell phenotypes appeared when CI was added to isolated C57BL/J6 B-cells. Antibodies produced by B cells play a critical role in providing protection against diseases. Thus, we analyzed IgM and IgG antibody levels in the supernatants of CIP treated and untreated splenocytes. ELISA results show elevated IgM in CIP treated controls. IgM concentration was five times greater in CIP treated whole splenocytes when compared to CIP treated isolated B splenocytes. No significant difference in IgG was observed. This implies the interplay of immune cells to boost B cell activity upon treatment. On the other hand, MTT assay, apoptosis assay, and fluorescent images show that *Calocybe Indica* ethanol extract

(CIEE) directly inhibits Human Breast Cancer cells in vitro. The dual nature of CI to directly reduce Breast cancer cell viability and indirectly to modulate the immune system makes this mushroom a potential non-toxic anti-cancer agent as well as an adjuvant for vaccines. CI's molecular mechanism of action in both mouse immune cells and human breast cancer cells were identified using Reverse Phase Protein Array. The ongoing studies include chemical characterization of CI extracts to determine major constituents affecting immune and cancer cells, and in vivo studies to test CI's capabilities as an adjuvant.

Oral II

O26. Bioactive Metabolites, and Cytotoxicity for Eight Blueberry Cultivars

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Eight blueberry cultivars at three developmental stages were evaluated for metabolite profiling, antioxidant, and anticancer activities. Cultivars- and developmental stages-variations were determined in total phenolic, flavonoid, DPPH, and FRAP antioxidant assays. The anticancer capacity was equal against A549, HepG2, and Caco-2 cancer cells, whereas the inhibition rate was dose-, incubation period-, cultivar-, and developmental stages-dependent. Throughout the developmental stages, the untargeted metabolite profiling by UPLC-TOF-MS analysis of two contrast cultivars, 'Vernon' and 'Star,' revealed 328 metabolites; the majority of them were amino acids, organic acids, and flavonoids. The multivariate statistical analysis identified five metabolites, including quinic acid, methyl succinic acid, chlorogenic acid, oxoadipic acid, and malic acid, with positively higher correlations with all anticancer activities. This comprehensive database of blueberry metabolites, along with anticancer activities, could be targeted as natural anticancer potentials. This study would be of great value for food, nutraceutical, pharmaceutical industries, and plant biotechnologists.

Session VI Bioactive Compounds of Plants and Their Roles in Human Health II – Inflammatory Diseases and Beyond

Chair: Andrea Doseff, Michigan State University, USA

Co-chair: Sepideh Mohammadhosseinpour, MD Anderson Cancer Center, USA

Keynote

O27. Microbiome-Polyphenol-Host Interactions in Obesity – The Gut-Brain Axis

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Recent studies indicate that intestinal microbial polyphenol metabolites play a crucial role in the health benefits derived from plant-based foods. However, individuals with intestinal microbial dysbiosis, commonly seen in obesity, may struggle to effectively metabolize polyphenols, specifically complex tannins. This impaired metabolism limits the absorption of bioactive metabolites, leading to reduced health benefits. Consequently, intestinal microbial dysbiosis poses a significant disadvantage to those who are in critical need of the anti-inflammatory benefits provided by microbial polyphenol metabolites. Microbial tannin-metabolites have been shown to exert anti-inflammatory effects and beneficially impact

the gut-brain axis, while human intervention studies show great inter-individual variability and molecular mechanisms are not fully elucidated.

Invited I

O28. Zeaxanthin Metabolism in Type 2 Diabetes: A Microbiome Perspective

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Population-based clinical and animal studies reveal that zeaxanthin carotenoid has the potential to mitigate multiple chronic and acute disease processes, including type 2 diabetes. Dietary zeaxanthin is a potent antioxidant yet is poorly absorbed in the human GI tract. β-carotene oxygenase 2 (BCO2) is the primary enzyme in cleaving zeaxanthin at 9,10 and 9',10' positions. Prior publications and preliminary data from my lab indicated that zeaxanthin and BCO2 deficiency are associated with inflammation in mice and humans with type 2 diabetes. Feeding of zeaxanthin promoted cecal microbiome beta-diversity and richness in some beneficial microbes, such as Akkermensia, in mice. These effects were sex dependent. Ongoing work is focused on the mechanism of action of zeaxanthin on immune cell gene expression through a transcriptomics approach.

Invited II

O29. Flavonoids as Biomedicines: Regulation of Microbiome-Immune Cell Function in Obesity-induced Fatty Liver Disease

Andrea I. Doseff. Department of Physiology, Department of Pharmacology and Toxicology, Michigan State University, East Lansing, MI, 48824, USA. E-mail: doseffan@msu.edu

Obesity-induced non-alcoholic fatty liver disease (NAFLD) is a metabolic inflammatory condition characterized by lipid accumulation and microbiome dysbiosis. Due to the obesity pandemic, NAFLD has become the most common cause of liver disease worldwide. Despite its prevalence, there are no FDA-approved therapies for NAFLD. Consequently, reducing inflammation has emerged as a key strategy for managing the disease.

Flavonoids, particularly flavones, are the largest class of bioactive dietary phytochemicals and are gaining attention for their potential to modulate chronic inflammatory diseases. Investigating the mechanisms by which flavones in whole foods interact with the gut microbiota-liver immune system axis offers novel insights into their anti-inflammatory effects. Our research aims to elucidate how medicinally active phytochemicals like flavones can mitigate obesity-associated NAFLD, providing a new avenue for controlling its development and progression.

Oral I

O30. Potential impact of *Anchomanes difformis* aqueous extract on testes and epididymis of diabetic animal model.

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Anchomanes difformis is a medicinal plant well-reported for its phytochemical composition, and its beneficial effect in the treatment of oxidative stress-related diseases. Diabetes mellitus (DM) is one of the diseases accompanied by hyperglycaemia-induced oxidative stress and consequent male infertility. This study investigates the antioxidant activity of the aqueous leaf extract of A. difformis in the testes of diabetic rats. Male Wistar rats (n=64) were randomly divided into 7 groups. Diabetes induction was through streptozotocin (STZ) (40 mg/ kg body weight) and a 10% fructose injection intraperitoneally. A significant ($p < 0.05$) increase in malondialdehyde (MDA) was observed in the testes of diabetic rats, which was significantly reduced after the treatment with the leaf extract of A. difformis. Activities of catalase and superoxide dismutase and the concentration of glutathione (GSH) significantly ($p < 0.05$) reduced in testes of untreated diabetic rats. Both ferric reducing antioxidant power (FRAP) and 2,2-diphenyl-1-pycrylhydrazyl (DPPH) values in the testes were reduced ($p < 0.05$) in untreated groups. The administration of the extract increased both the antioxidant activities and antioxidant capacity values significantly ($p < 0.05$). The findings of the present study revealed that the aqueous leaf extract could possibly ameliorate oxidative stress in DM-related male infertility.

Oral II

O31. Dietary phytochemicals modulate inflammatory responses in ulcerative colitis patient-derived colonoids

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Inflammatory Bowel Diseases (IBD) are multifaceted chronic conditions affecting about 5 million people worldwide. There are two main diseases categorized as IBD, Crohn's disease (CD) and ulcerative colitis (UC). They are primarily characterized by continuous inflammation of the large intestine (UC) or discontinuous inflammation throughout the digestive system (CD). Rising global urbanization has increased IBD incidence worldwide, especially in previously less urbanized countries. Available IBD treatments help about 50% of patients, leaving the rest with few options. Hence there is a need for drugs that can effectively treat a higher percentage of IBD patients with minimal adverse effects. Plants have long been used as medicinal treatment and drug sources for a variety of inflammatory conditions. Among these, dietary plants are a promising source of medicinal compounds because of their known traditional and ethnobotanical uses. Thus, in the work presented, we explored the anti-inflammatory effects of dietary phytochemicals -sulforaphane and carnosic acid- in ulcerative colitis patient-derived colonoids. Both phytochemicals are nuclear factor erythroid 2-related factor 2 (Nrf2) modulators. Nrf2 is a transcription factor that promotes transcription of antioxidant and anti-inflammatory proteins. In addition, Nrf2 inhibits activation of nuclear factor kappa-light-chain-enhancer of activated B cells (NF-ƙB), a known pro-inflammatory transcription factor. Through qPCR, ELISA, and Western Blot techniques we found that

sulforaphane and carnosic acid decreased inflammatory cytokines and modulated Nrf2 target proteins in TNF-α stimulated colonoids. Hence, these phytochemicals are an encouraging lead for anti-inflammatory treatments in ulcerative colitis.

Session VII Medicinal / Functional Foods

Chair: Rao Mentreddy, Alabama A&M University, USA

Co-chair: Sun-Ok Lee, University of Arkansas, USA

Keynote

O32. Capsiate Enriched Extracts from *Capsicum* sp. Fruit and its Associated Pharmacological Activities

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Capsinoids, the nonpungent analogs of capsaicinoids, are present in the fruit of many *Capsicum* species and genotypes - typically at low concentrations. Recently, a method to efficiently extract and purify capsinoids from *Capsicum annuum* fruit has been published and patented. A critical step in this process is the unique liquid/liquid extraction procedure that utilizes a pentane crude extract, and acetonitrile as the extraction solvent, to provide capsinoids of 45.7 % (wt/wt) purity. A >90 % capsinoids-enriched product can also be accomplished in bulk using an hp20ss resin system. A series of pharmacological studies utilizing these enriched capsinoid extracts and pure capsiate have been completed and used to investigate the effects of capsinoids on nuclear factor erythroid 2–related factor 2 (NRF2), peroxisome proliferator-activated receptors alpha and gamma (PPARα and PPARγ), liver X receptor (LXR), glucose uptake, and lipid accumulation in relevant cellular models. This study revealed the multiple nuclear receptors agonistic action and glucose uptake-enhancing properties of capsiate, and also its antiadipogenic effect, indicating its potential in preventing the undesired adipogenic effects of full PPARγ agonists such as the glitazone class of antidiabetic drugs. These and other pharmacological studies utilizing enriched capsinoid extracts will be discussed. Possibilities for the utilization of capsinoids and/or capsiate enriched preparations as functional food target ingredients, dietary supplements, topical and oral pharmaceutical active ingredients, etc. will be discussed.

Invited I

O33. *Urtica dioica*: A Functional food for protection against dysbiosis, Inflammation, insulin resistance and obesity

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Urtica dioica is widely used as a food in several cultures and its extract has been widely studied as intervention against several diseases, but the molecular mechanisms involved are unclear. Most studies have focused on the extract not the plant as a whole food. Because U. dioica exerts effects in several tissues, we hypothesized that its phytochemicals get into circulation to reach target tissues, but also impact obesity and insulin resistance through pathways involving the gut microbiota and ultimately the gut immune system.The data presented herein was acquired in 3 different studies in C57BL6/J mice and in vitro models. Supplementing diet with whole U. dioica vegetable, attenuated high fat (HF) diet-induced weight gain, fat accumulation, insulin resistance and changed the gut microbiota composition, by increasing diversity and promoting the proliferation of species from *Clostridium sensu stricto*. This genus has been associated with activation of regulatory T cells (Tregs; CD4+ FoxP3+ T) in the intestine. We confirmed that *U. dioica* induced T cells' antigenic stimulation, promoted the activation of Tregs and protected against inflammation. Furthermore, *U. dioica* promoted the browning or beiging of adipose tissue as evidenced by enhanced gene expression of key markers of this process and associated enhanced fat oxidation. Using enteroids derived from small intestinal tissue, we showed that in presence of excess nutrients, supplementation with *U. dioica* reduced the amount fatty acids and glucose absorbed. In absence of a gut microbiota (germ free mice) *U. dioica* decreased the expression of markers of lipogenesis and thus contributed to a lower body weight. In conclusion, supplementing a HF diet with *U. dioica* attenuates fat accumulation and insulin resistance via mechanisms involving the gut microbiota and also independent of the gut microbiota. Pathways targeted include promotion of immune homeostasis, reduced inflammation and moderation of amounts of macronutrients absorbed in the intestine. In adipose tissue metabolites of *U. dioica* target fatty acid oxidation and lipogenesis.

Invited II

O34. Synergistic Effects of Citrus Terpenoid and Dietary Fibers on *Lactobacillus* Growth and Metabolite Production

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Dietary fiber is an excellent food source for gut microbes, promoting growth and the production of bacterial metabolites that benefit gut health. However, the specific role of phytochemicals, notably terpenoids, in influencing gut microbiota has not been fully explored. In the present study, we investigated the ability of the citrus-derived terpenoid limonin glucoside and two types of dietary fiber, inulin and citrus pectin, to influence the growth of five gut-associated *Lactobacillus* strains: *Lactobacillus plantarum* (LP), *Lactobacillus acidophilus* (LA), *Lactobacillus casei* (LC), *Lactobacillus rhamnosus* (LR), and *Lactobacillus delbrueckii* (LD). Experiments were also conducted in combination (1:1) to determine the combined prebiotic potential of limonin glucoside, inulin, and pectin. The growth rates varied across all Lactobacillus strains. Compared to untreated controls, LD, LR, and LA exhibited significantly increased growth. However, no growth differences were observed with inulin, limonin glucoside:inulin, or limonin glucoside:pectin treatments. These results suggest that lower dietary fiber levels in combination with LG

synergistically enhance growth for these Lactobacillus strains. While LC growth was improved with limonin glucoside:inulin compared to inulin alone, the effect of limonin glucoside: pectin on LC growth was not statistically significant.

Typically, high salt concentrations hinder the growth of bacteria. However, our findings showed that limonin glucoside supplementation reduced the negative effects of salt stress on Lactobacillus strains. Increasing acidity throughout growth indicated the formation of short-chain fatty acids (SCFAs). GC-MS analysis indicated higher amounts of acetate, butyrate, and propionate in limonin glucoside–supplemented cultures compared to controls. These SCFAs are known for their intestinal health benefits, which include strengthening the gut barrier, improving cell communication, supplying energy, and preventing foodborne bacteria. Our findings suggest that limonin glucoside promotes the proliferation of probiotic Lactobacillus bacteria, resulting in enhanced SCFA synthesis and possible advantages to gut health.

Oral I

O35. Hypoglycaemic effect of *Coccinia grandis* leaves extract encapsulated herbal porridge

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Diabetes mellitus is a cluster of metabolic diseases characterized by hyperglycemia. Since this epidemic is growing rapidly in Sri Lanka, the usage of phototherapeutics to manage diabetes is becoming a trend. Porridge prepared incorporating fresh plant leaf extract is a traditional breakfast in Sri Lankan cuisine. *Coccinia grandis* leaves are considered effective medicinal plants for reducing blood sugar levels. Hence, this study investigates the hypoglycaemic effect of an instant herbal porridge cube incorporating traditional rice, soybean flour, coconut milk, and *Coccinia grandis* leaves powder. The developed porridge cube showed high bioactivity with a 66.77±0.74 mg/gGAE total phenolic content, 27.65±6.79% of DPPH radical scavenging activity, 5.72% of alpha-amylase inhibition activity, and 59.64% of alpha-glucosidase inhibition activity. The effect on postprandial blood sugar levels after consuming the developed porridge was measured using healthy adults, and noticed suppression in blood glucose levels, compared with fasting blood glucose levels after 30 minutes of ingestion. Further, *Coccinia grandis* leaf extract was encapsulated with food-grade sodium alginate and incorporated into the same porridge ingredients as a safe delivery method. An Invitro digestion assay was conducted, and the results showed that alpha-amylase inhibition activity for the gastric phase and alpha-glucosidase inhibition activity for the intestinal phase was higher in encapsulated porridge. Results conclude that consuming *Coccinia grandis* leaf extract encapsulated porridge plays a role as a functional food that may have a hypoglycaemic effect. The study is warranted to execute a Randomised Clinical Trial to confirm the results further.

Oral II

O36. Brassicas: What makes them functional foods

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The term "functional food" was first coined in Japan in 1984 and is defined as "*Foods and food components that provide a health benefit beyond basic nutrition. These substances provide essential nutrients often in quantities necessary for normal maintenance, growth, and development, and/or other biologically active components that impact health benefits."* The market value of these foods was estimated at USD 198.8 billion in 2023 and is projected to increase to USD 216.09 billion in 2024 and USD 387.48 billion by 2032. Increasing customer preference for healthy food items is the key market driver enhancing functional foods' growth worldwide. A class of functional foods is a wide range of vegetable crop species (kale, broccoli, cauliflower, cabbages, brussels sprouts, mustard greens, to name a few) belonging to the Brassicaceae family. Brassicas are the top functional foods because they contain high levels of dietary fiber, vitamins C, A, E, and K, folate, calcium, iron, potassium, and phosphorus. They are considered unique because they are the sole source of glucosinolates, naturally occurring bioactive sulfur-rich compounds responsible for Brassicas' health benefits. A significant health benefit to humans from eating brassicas is the protection against common cancers and cardiovascular disease. Additionally, brassica vegetables contain carotenoids and selenium that may protect against cancers. Germinated broccoli seeds and radishes are sources of lipids, proteins, minerals, dietary fibers, and vitamins B1, B2, B3, B6, B9, C, and E produced during the germination stage of seeds. The broccoli seed sprouts are also sources of bioactive compounds such as polyphenols, -aminobutyric acid, and isothiocyanates and are considered antihyperlipidemic and antihypertensive. Besides the phenolic compounds, the brassica microgreens contain sinigrin, allyl isothiocyanate, and other phytochemicals conferring high antioxidant capacity. Thus, a rich nutritional profile and a unique presence of sulfur-rich compounds make brassicas highly potent functional foods.

Session VIII Emerging technologies in medicinal plant research

Chair: Alok Arun, California State University Stanislaus, USA

Co-Chair: Fabricio Medina-Bolivar, Arkansas State University, USA

Invited I

O37. Tea Phenols and Citizen Science for Health

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Tea is a vehicle for the extraction of plant principles, many of which carry important bioactivities for homeostasis. Throughout our existence, the act of preparing tea became an important lifestyle component with underlying health benefits. Medicinal and Aromatic Plants (MAPs) have been proven to have efficacy due to their unique biosynthetic pathways that generate a multiplicity of molecular characteristics lending to varied bioactivity. Phenolic compounds are antioxidants implicated in mitigating age related onset diseases including Type 2 diabetes, cancer and also infectious diseases. Casual tea

drinkers are increasingly seeking more information as modern consumers have greater interest in regulating their health status. This can be considered as a positive outfall of the COVID 19 pandemic. Biocultural education workshops for MAPs are important strategies for building public awareness of plant values. Citizen science models offer opportunities for gathering unique data sets that can inform health initiatives. An ethnobotany workshop for tea evaluation applied a citizen science platform utilizing both sensory perception and molecular targeting via a simple chemical coupling reaction. This qualitative assessment demonstrated that citizens can be engaged in science platforms and can provide accurate data sets once guided in accordance with the scientific method.

Invited II

O38. Exploring Puerto Rican biodiversity through mass spectrometry based metabolomics: initial studies in natural products discovery

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Puerto Rico is recognized as an important region for biodiversity, housing numerous natural products derived from medicinal plants, amphibians, reptiles as well as microorganisms. The Puerto Rico Science, Technology and Research Trust is actively involved in conservation and bioprospecting initiatives on the island. One such effort is the Center for Tropical Biodiversity (CTB), which focuses on protecting the biodiversity resources of Puerto Rico and promoting the sharing of benefits that arise from their commercial development. In collaboration with local universities, we have undertaken a research projects that uses advanced metabolomics techniques to investigate secondary metabolites in Puerto Rican organisms. Specifically, we employ mass-spectrometry-based untargeted metabolomics to explore metabolites of the island flora and fauna. Our approach includes a workflow for identifying both known and novel metabolites using high-resolution mass spectrometry, the mass spectral deconvolution software MS-DIAL, and molecular networking through Global Natural Products Social Networking (GNPS). We will present ongoing projects that utilize this untargeted metabolomics workflow to study amphibians, understudied plants, fungi, and bacteria. Our goal is to discover and characterize new natural products with potential medicinal applications. These efforts not only advance natural products research on the island but also open avenues for developing novel bioprospecting opportunities.

Oral I

O39. Production of bioactive isoflavones in elicited hairy root cultures of pigeon pea

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Isoflavones, a class of flavonoids, have anticancer, antioxidant, anti-inflammatory, antibacterial, and pro-apoptotic properties. Extracting and purifying these bioactive phenolics from natural sources is

challenging and time-consuming. This project aimed to develop a hairy root culture system for pigeon pea using *Agrobacterium rhizogenes*-mediated transformation as a sustainable production platform for isoflavones. Twelve-day-old hairy root cultures were co-treated with methyl jasmonate, methyl-β-cyclodextrin, hydrogen peroxide, and magnesium chloride for 192 hours to examine their effects on isoflavone accumulation in the culture medium and root tissues. Two isoflavones, genistein and its prenylated analog isowighteone, were identified and purified from the elicited culture medium extract using column chromatography, semi-preparative high-performance liquid chromatography, tandem mass spectrometry, and 1D & 2D nuclear magnetic resonance spectroscopy. Morphological differences between normal and elicited hairy roots were studied using scanning electron microscopy. Elicited hairy root tips showed non-uniform cell shapes and surface ruptures. The antioxidant activity of these isoflavones and isoflavone-rich extracts was measured using the DPPH assay, with the extract showing higher antioxidant activity than individual compounds at equimolar concentrations. The anticancer activities of genistein and isowighteone at 25 □M were tested in MDA-MB-231 triple-negative and MCF-7 estrogen receptor-positive breast cancer cells, whereas the anti-inflammatory activity was assessed in RAW 264.7 macrophages. Isowighteone demonstrated higher cytotoxicity against MDA-MB-231 and MCF-7 cells up to 72 hours and greater anti-inflammatory activity at 24 hours compared to genistein. The antibacterial activity of genistein and isowighteone was tested against various gram-positive and gram-negative bacteria, with isowighteone showing higher activity against gram-positive bacteria. In summary, pigeon pea hairy roots provide a sustainable platform for producing bioactive isoflavones, and the prenylated isoflavone isowighteone showed higher biological activities than its non-prenylated analog genistein.

Oral II

O40. Seed nanopriming with nitrogen-doped carbon dots enhances yield, quality, and potential health-promoting attributes in tomato fruit

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Seed nanopriming is an emerging agricultural technology that uses nanoscale (25–100 nm) particles of diverse composition, including metals and carbon dots. Nanopriming can enhance seed germination, growth, yield, and resistance to biotic and abiotic stresses by inducing secondary metabolite biosynthesis, which aids in plant protection and health promotion. Despite its benefits, concerns about the potential toxicity of metal nanoparticles persist. Carbon dots, as a green priming agent, can potentially eliminate these concerns, but their efficacy on crop production and postharvest quality attributes remains largely unexplored. This study investigates the effects of nitrogen-doped carbon dots (N-CDs) on the production of tomatoes, an economically vital crop worldwide. N-CDs were synthesized using phenylalanine and citric acid and used to prime seeds of two Texas A&M-developed tomato varieties, TAM-C3 and TAM-C11. The analysis included germination percentage, seedling growth, yield, and bioactive profiling of health-promoting compounds, including vitamin C, β-carotene, lycopene, and amino acids. Early effects on seed germination, shoot, and root lengths were observed, and the fruit were harvested for qualitative and detailed bioactive analysis. Seed nanopriming significantly enhanced yield in both cultivars, with N-CDs giving a 30% higher yield than the control. Ascorbic acid levels were 1.6 times higher in N-CD seed-primed fruits, indicating a strengthened antioxidant pool and improved nutritional attributes. N-CD priming also significantly affected amino acid levels, enhancing glutamic acid, aspartic acid, and branched-chain amino acids, which play key roles in volatile biosynthesis and flavor development. Higher levels of proline, histidine, serine, glycine, and threonine were observed, indicating delayed senescence and prolonged shelf-life. These amino acids contribute to stress tolerance and carotenoid biosynthesis, suggesting reduced ripening-related modifications. N-CD treatment significantly enhanced the levels of β-carotene

and lycopene in both tested cultivars. Lycopene levels were 2.2-fold higher in nanoprimed TAM-C3 compared with control, and 1.3-fold higher in TAM-C11. β-Carotene levels were 1.4-fold higher in TAM-C11 but remained unchanged in TAM-C3, potentially due to reduced conversion of lycopene to β-carotene, as lycopene serves as a substrate for β-carotene biosynthesis. N-CD seed priming–induced accumulation of ascorbic acid and the carotenoids lycopene and β-carotene could potentially ensure the delivery of high-quality tomato fruit with substantial health benefits, particularly due to their antioxidant properties and roles in supporting cardiovascular health, vision, immune function, and skin health.

Poster Presentations

P1 - Glucosyloxybenzyl 2R-benzylmalate and glucosyloxybenzyl 2R-isobutylmalate derivatives from *Arundina graminifolia*

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Orchids are flowering plants that have been reported has prolific producers of glycodises as secondary metabolites. Glucosyloxybenzyl 2R-benzylmalate and glucosyloxybenzyl 2R-isobutylmalate derivatives are rare secondary metabolites that are almost exclusive to the family Orchidaceae. *Arundina graminifolia* (a.k.a bamboo orchid) is native to South East Asian countries and it is traditionally, the plant is used for treating food poisoning, blood stasis, bacterial infections and rheumatism. *A. graminifolia* is a rich source of bibenzyls phenanthrenes, phenolics and glucosyloxybenzyl 2R-benzylmalate derivatives. In continuation of our interest in metabolites present in *A. graminifolia*, further investigation was conducted resulting in the isolation and structural elucidation of eleven previously undescribed compounds; nine glucosyloxybenzyl 2R-benzylmalate derivatives named arundinosides I-IX and two glucosyloxybenzyl 2R-isobutylmalates named graminifolosides A-B. The structures of the eleven undescribed compounds were determined by HRESIMS and NMR spectroscopic analyses.

P3 - Impact of soil quality on cannabinoid and terpene content of hemp

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Several studies have found that regenerative farming practices improve the nutritional profile of crops and livestock compared to conventional farming practices. This is particularly true for micronutrients, minerals, and phytochemicals. To date, however, no study has examined the impact of regenerative farming on crops grown for non-food uses, such as hemp. In this study, *Cannabis sativa* L. (hemp cultivars 'Tangerine' and 'CBG Stem Cell') was grown under tow conditions in neighboring fields. The first field was a long-term no-till field with cover crops (high soil quality), and the other was a conventional tilled field (low soil quality). Soil analysis confirmed improved soil health in the long-term no till field, while the conventional field had an overall lower soil health score. Dried biomass from each field was extracted via supercritical CO_2 extraction, winterized, and decarboxylated. Extracts were all reconstituted in fractionated coconut oil at 300 mg/ml. No differences were observed for total cannabinoid or total terpene levels between growing conditions. Interestingly, for one cultivar terpene levels were higher in the no-till samples but this was reversed for the other cultivar. Terpene levels were similar for both cultivars in the

no-till field; however, these levels varied greatly between the two cultivars grown in conventional fields. CBG levels are highest from those plants grown in the highest quality soil; however, no other trends were consistently observed between cultivars and conditions with regards to terpene or cannabinoid content. While no differences in cannabinoid or terpene content were observed between the conditions, there was significantly more variability in the conventional field with regards to levels of both cannabinoid and terpenes, suggesting that no till conditions produce more consistent growth compared to conventional farming of hemp.

P4 - Assessing the antiproliferative effects of *Thalassia* sp. extracts on metastatic colorectal cancer cell line

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Marine autotrophic organisms, particularly species within the genus *Thalassia*, hold promise as reservoirs of bioactive compounds with potential antitumoral properties. However, a comprehensive understanding of the cytotoxic impact of *Thalassia*-derived extracts on aggressive cancers, such as colorectal carcinoma, remains limited. This study systematically investigated the cytotoxic potential of solvent-based and aqueous extracts derived from *Thalassia*, sourced from the southwestern region of Puerto Rico, against HCT-116 colorectal cancer cells. Our findings revealed a significant reduction in HCT-116 cell viability upon exposure to *Thalassia* extracts, suggesting its antiproliferative capacity against metastatic colorectal cancer cells. Further elucidation of the underlying mechanisms by which this occurs is essential to unravel the related pathways and to better understand the processes involved. The growing recognition of *Thalassia*-derived bioactive compounds highlights their candidacy for the development of novel therapeutic modalities targeting aggressive malignancies such as the alarmingly increasing colorectal cancer.

P6 - High throughput screening of NCI-Natural Product Repository extracts that inhibit androgen receptor-variants in castration resistant prostate cancer

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Prostate cancer is the most common cancer among men, with ~1.4 million new cases and ~375,000 deaths annually. Uncontrolled androgen receptor (AR) activation drives the development and progression of prostate cancer, so the primary treatment strategy is to inhibit AR signaling with surgery and drugs. Most existing drugs and natural products act indirectly to inhibit AR "activation." Unfortunately, ~20-30% of castration-resistant prostate cancer patients rapidly develop resistance to FDA-approved drugs (enzalutamide and abiraterone) by generating AR-splice variants that lack the ligand-binding domain. As part of our ongoing high-throughput screening efforts, we collaborated with NCI Natural Product Repository (NPR) to identify novel AR and AR-V7 degraders. We identified five NCI-NPR primary extracts and 13 sub-fractions that inhibited advanced prostate cancer cell growth and confirmed AR and AR-V7 degradation by Western blots. These data demonstrates that the NCI-NPR library contains novel AR and AR-V7 degraders. Based on these preliminary data, NCI-NPR purified two active compounds (staurosporine derivative and butenolides) we are now testing in our cell-based phenotypic screens. We have also tested 7000 marine extracts from NCI-NPR for anticancer activity using our standardized AR-V7 and CRPC growth protocol. Seven extracts were identified that inhibited both cell lines (0.1% hit rate). By targeting the AR N-terminal domain, activating the cell-intrinsic ubiquitin/protein-degradation

apparatus, and screening prostate cancer cell lines that harbor AR splice variants, we will identify a new class of potent AR degraders with the potential to prevent prostate cancer from developing into an advanced stage or becoming castration-resistant prostate cancer.

P7 - Evaluating the antiproliferative capacity of extracts from *Syringodium filiforme* in colorectal cancer cell line

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Colorectal cancer is one of the most frequent cancers affecting males and females. Although several treatment options are available, not all are effective. There is need to find novel sources of treatment against aggressive cancers, including those from the colon. Algae-derived products are a promising alternative found to be effective against several cancers. *Syringodium filiforme* is a type of seagrass commonly found in tropical areas that contain active metabolites typically described as having antiproliferative capabilities. However, there are not many studies directly focused on evaluating the potential of this alga against colorectal cancer. The aim of this study was to evaluate the antiproliferative capacity of extracts obtained from *Syringodium filiforme* and to verify possible routes by which this activity might be promoted. Water-based and polar-based extracts from the alga were obtained and their antiproliferative potential was evaluated by cytotoxic assay. Preliminary, a reduction in cancer cell viability was observed. More studies will be required to better understand the mechanisms involved. There is a potential to use compounds obtained from *Syringodium filiforme* to reduce the proliferative capacity of colorectal cancer and other similar aggressive cancers.

P8 - A natural plant derived small molecule for treatment of chemoresistant colorectal cancer

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Colorectal cancer (CRC) is the third leading cause of cancer-related deaths in the United States. Despite effective strategies for treating CRC, chemoresistance to 5-fluorouracil (5FU), a first-line agent for CRC treatment, leads to metastasis. We found that a transcription factor, Forkhead box M1 (FOXM1), involved in resistance to cisplatin, paclitaxel, docetaxel and epirubicin, was significantly high in metastatic CRC (mCRC) patient and this was associated with decreased overall survival in CRC patient cohort treated with 5FU. Most FOXM1 inhibitors, failed due to high toxicity, while others have yet to establish their chemotherapeutic effects on 5FU resistant-CRC (5FUR-CRC).We performed OncoDB analysis to ascertain FOXM1 expression in CRC patients and Combined aanalysis of the Cancer Cell Line Encyclopedia (CCLE) and Genomics of Drug Sensitivity in Cancer (GDSC) databases was performed to choose CRC cell line that is less sensitive to 5FU with increased FOXM1 expression (HCT116 cells). To investigate the effect of ASR-458, a drug like molecule, on 5FU resistant HCT116 (HCT5FUR) cells, we performed molecular docking, MTT assays, siRNA knockdown, western blotting, Calnexin staining, immunofluorescence, and Xenograft studies.High FOXM1 expression was observed in mCRC patients. Similarly, 5FU treatment induced the expression of FOXM1 in two mCRC cell lines (HCT116 and SW480). Silencing FOXM1 sensitizes 5FUR-CRC to 5FU treatment, whereas its induction causes resistance to 5FU in mCRC cells. We established 5FU resistant HCT116 cells (HCT-5FUR) that showed high resistance to 5FU (IC_{50}>100μM) compared to the parental HCT-116 cells (IC_{50}: 32.5μM) and displayed higher FOXM1 expression. Our high throughput screening efforts led to discovery of a naturally derived small molecule, ASR458, that inhibits FOXM1 expression and inhibits the growth of HCT-5FUR cells in nanomolar concentrations (24h_IC50: 780nM, 48h_IC50: 410nM, 72h_IC50: 392nM). More importantly, no significant toxicity was observed in normal colon epithelial cells. CETSA analysis indicated a direct

binding of ASR458 with FOXM1. Subsequently, our Insilco analysis revealed possible binding site within the DNA binding domain of FOXM1. Interestingly, we found that ASR458 induces autophagic cell death indicated by high levels of autophagosomes and expression of markers of active autophagy such as LC3B. CRC xenotransplant studies suggest that ASR458 effectively inhibits the growth of mCRC tumors and is not toxic at 20mg/kg. In our preliminary screening, 31.5% of ASR458 was remaining in human liver microsomes (HLM) with T1/2 being 41.25 as compared to 6.73 min for the control (Midazolam). It was also highly stable in human plasma in vitro, with 22.2% remaining after a two-hour incubation. The high stability of ASR458 in the human plasma suggests that ASR458 is not subject to cleavage of any significant levels.

P9 - Biochemical profiling of *Garcinia livingstonei* aqueous leaf extract: A preliminary study

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The use of medicinal plants continues to increase in developing countries due to affordability, effectiveness, and belief. Naturally occurring phytochemical compounds in medicinal plants are associated with the amelioration of oxidative stress and inflammation in the treatment of diabetes mellitus. The present study evaluated the phenolic profile, anti-inflammatory, antioxidant, and hypoglycaemic effects of aqueous leaf extract of *Garcinia livingstonei*. The antioxidant capacity evaluation of the extract showed values of 253.4268 mg AAE/g for ferric reducing antioxidant power (FRAP), 192.232 mg TE/g for trolox equivalent antioxidant capacity (TEAC), and 167.8724 mg TE/g for 2,2-diphenyl-1-pycrylhydrazyl (DPPH).The total polyphenol was 100.9741 mg GAE/g with the presence of 2.3548 mg QE/g flavonols and 16.7712 mg CE/g flavanols. Ultra-High Performance Liquid Chromatography Mass Spectrometry (UHPLC-MS) revealed the presence of other several phenolic compounds. Results also showed a significantly ($P<0.05$) higher α-glucosidase inhibitory activity compared to acarbose. The significant ($P<0.05$) reduction of nitric oxide in a dose-dependent manner revealed the anti-inflammatory effect of the extract. The findings of this study suggest the possible antidiabetic effect of G. *livingstonei* in the treatment of diabetic-related complications. Further in vitro and in vivo studies are recommended.

P11 - Peanut shell extract and luteolin improve glucose homeostasis and modify gut microbiome composition in type 2 diabetes-prone mice

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Gut dysbiosis has been linked to the development of type 2 diabetes mellitus (T2DM). Dietary bioactive compounds with anti-inflammatory and antioxidant properties have great potential to improve T2DM-associated parameters, such as hyperglycemia, insulin resistance, and gut dysbiosis. Among different dietary bioactive compounds, we previously reported peanut shell extract (PSE) improved mitochondrial function of liver, brain, and white adipose tissue in db/db diabetic mice due to PSE's anti-oxidative stress and anti-inflammatory properties. This study further examined the effects of PSE and its bioactive compound (luteolin) on glucose homeostasis and gut microbiota composition in T2DM-prone mice. Thirty-six male SLC6A14-/- mice modeling T2DM were divided into low-fat diet (LFD), high-fat diet (HFD), HFD+200 mg/kg BW PSE (HFD+PSE), and HFD+100 mg/kg BW luteolin (HFD+LUT) for four months. Parameters of glucose homeostasis included serum insulin, HOMA-IR, HOMA-B and pancreatic islet analysis. Gut microbiome composition of cecal feces was analyzed by 16s RNA sequencing. Data were analyzed statistically. Relative to LFD group, the HFD group exhibited increased levels of serum insulin, HOMA-IR, and HOMA-B in SLC6A14-/- mice. Both PSE and LUT supplementation reverted HFD-induced levels in serum insulin, HOMA-IR and HOMA-B in SLC6A14-/- mice. Pancreatic islets were normal in all groups. At species level analysis, we observed changes in the relative abundance of species in most phyla between HFD and LFD, including > 50 species that either increased or decreased in HFD. The supplementation of PSE or LUT reversed a few of the changes altered by HFD. For example, *Phocaeicola vulgatus* (Previously known as *Bacteroides vulgatus*) was completely depleted by HFD ($P_{adj} \leq 0.01$), yet after PSE or LUT supplementation this species was recovered and increased in abundance ($P_{adj} \leq 0.05$). The study concludes that dietary PSE and LUT supplementation has a beneficial impact in mitigating T2DM-associated glucose homeostasis and gut dysbiosis on T2DM-prone mice.

P13 - Unveiling the medicinal potential of the underutilized crop *Arracacia xanthorrhiza*

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Arracacia xanthorrhiza, commonly known as "arracacha" or "apio," belongs to the plant family *Apiaceae.* This root vegetable has gained attention due to its high nutritional value and folklore-associated medicinal properties. Previous studies have indicated that various varieties of apio possess significant antioxidant capacities. Despite the established antioxidant properties, there is a lack of comprehensive studies investigating the full spectrum of bioactive compounds in apio, particularly its flavonoid content and overall phenolic profile. Additionally, the specific health-promoting effects of these compounds remain largely unexplored. This study aims to verify the flavonoid content of *Arracacia xanthorrhiza* and explore its potential medicinal benefits through a detailed metabolomic analysis. By doing so, we intend to provide a deeper understanding of the bioactive components present in apio and their possible health implications. Extraction and rotovaporation, antioxidant capacity analysis, mass spectrometry, total phenolics, metabolomics. Preliminary studies confirmed the high antioxidant capacity of various apio varieties. The ongoing research will further elucidate the flavonoid content, total phenolic content, and detailed metabolomic profile through mass spectrometry. These results are expected to substantiate the medicinal potential of *Arracacia xanthorrhiza.* The findings of this study could highlight *Arracacia xanthorrhiza* as a valuable functional food with significant health benefits. Further research is warranted to fully understand the specific health-promoting effects of these flavonoids and other bioactive compounds, potentially leading to new applications in the health and wellness industry.

P14 - Antimicrobial effects of extracts from *Liriodendron tulipifera* on AMR *Staphylococcus aureus*

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The increase in the spread of antimicrobial resistant bacteria has become a public health threat. The goal of our study is to examine the antibacterial effects of extract from *Liriodendron tulipifera* against an antimicrobial resistant bacterium, *Staphylococcus aureus,* and explore the underlying mechanisms. In this study, methanolic extracts of leaves of *Liriodendron tulipifera* were partitioned successively through hexane, chloroform, ethyl acetate, and the antibacterial activity of chloroform fraction from *Liriodendron tulipifera* was tested against *Staphylococcus aureus*. Our preliminary data demonstrated that the chloroform fraction of *Liriodendron tulipifera* exhibited about a 10^5 times inhibition on the growth of an antibiotic resistant bacterium, *Staphylococcus aureus*. We further investigated its possible antibacterial mechanisms. Our results indicated that the treatment of the chloroform fraction of *Liriodendron tulipifera* significantly increased the leakage of DNA from bacterial cells. SEM examination of the bacteria after treatment of chloroform fraction of methanolic extract from *Liriodendron tulipifera* identified cell membrane damages, implying that the plant extract may damage bacterial cell membrane and result in increased membrane permeability. We will continue to explore other possible mechanisms, such as inhibition on biofilm formation, efflux pump activity, that the chloroform fraction of *Liriodendron tulipifera* uses to kill bacteria. Our results suggested that extracts from *Liriodendron tulipifera* may be utilized to develop effective treatments tackling antimicrobial resistant bacteria.

P15 - Inhibition of angiotensin-converting enzyme (ACE) activity by cannabinoids from *Cannabis sativa L.*

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Though the cannabinoids of *cannabis sativa* L.(hemp) are reported to affect blood pressure, the mechanistic effects/interactions of these cannabinoids on blood pressure regulation have yet to be described. In this study, we have investigated the inhibitory activity of hemp extracts on the essential enzyme, angiotensin-converting enzyme-I (ACE), of the blood regulating system renin-angiotensin system (RAS). Three cultivars of locally grown hemp were evaluated for their inhibitory activity using a colorimetric enzymatic reaction assay. Hemp inflorescences were extracted utilizing 96% ethanol. Crude hemp extracts were then reconstituted to a fixed concentration of 2.5 mg/mL before being evaluated for their ACE inhibitory. Hemp crude extracts lowered ACE activity by 50%. The most crude extract was separated via a flash chromatography system producing chemically diverse fractions which were then evaluated for their effectiveness against ACE activity at a concentration of 4 mg/mL. Targeted mass spectrometry revealed that the high-performing fractions contained varying amounts of cannabinoids and terpenes. ACE inhibitory activity of the fractions was paired with mass spectrometry data to identify the potential bioactive chemical constituents. The identified cannabinoids were evaluated for their ACE inhibitory potential by determining the half-maximal inhibitory concentration (IC_{50}). When testing cannabinoids at 10 µM, CBC and CBN lowered ACE activity by >80% while terpenes displayed no ACE inhibitory activity. CBC generated an IC_{50} of 2.361 µM compared to lisinopril with an IC_{50} of 0.058 µM. Within this *in vitro* system*,* neutral cannabinoids CBN and CBC can significantly impact ACE activity*;* suggesting that ACE could be a potential pharmaceutical target of cannabis cannabinoids.

P16 - Determination of ingredient ratios in a dye used to protect American Ginseng (*Panax quinquefolius*) from poaching in the Shenandoah National Park

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American ginseng (*Panax quinquefolius*) is a native plant to Virginia that is primarily harvested for medicinal purposes. This plant was discovered in the New World by Canadian explorers, who were searching for a plant like Asian ginseng (*Panax ginseng*). To supplement a rising demand for Asian ginseng, American ginseng was exported to Asia. Like Asian ginseng, American ginseng exhibits numerous medicinal benefits, including antioxidant, anticancer, and anticardiovascular disease properties which are attributed to bioactive ginseng saponins, commonly referred to as ginsenosides. Hundreds of ginsenosides have been discovered in American ginseng, most of which are found in the roots. The medicinal properties and profitable trade market of American ginseng led to the overharvest of this plant. Due to the long maturity time and lack of regeneration without sustainable harvesting practices, American ginseng became scarce in North America, and in 1979, Virginia classified American ginseng as a threatened species. Laws prohibit the harvest of American ginseng in National Parks, yet people still poach this plant. The Shenandoah National Park, among other National Parks in the eastern U.S., deployed a locally formulated dye on American ginseng to protect this plant from poaching. Unfortunately, the person who formulated the dye did not record the ratios of the formulation ingredients before he passed away. Now, the Shenandoah National Park is running low on the dye without a formulation to make more of it, so they reached out to the Chemistry department at James Madison University (JMU) for help. Three samples of the dye from 2017, 2018, and 2019 and the ingredients of the dye were analyzed by Powder X-ray Diffraction. Of five additional samples formulated from the ingredients at JMU, one formulation was determined to be the closest match to the original formulation and will be tested in field trials over the next year.

P17 - Identification of terpenes in Industrial Hemp (*Cannabis sativa* L.)

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Industrial hemp (*Cannabis sativa* L.) is a genotype of the genus *Cannabis.* In the United States many states have established hemp programs. All plants contain secondary metabolites and these compound classes include phenolics, flavonoids, alkaloids and terpenoids. Among the many secondary metabolites present in plants, terpenoids are the most diverse with significant properties. Terpenes are responsible for the environmental adaptation and stress tolerance and give plants and flowers their fragrance. These compounds have shown positive results in indoor toxicity assays and insecticidal activity. Terpenes are incredibly abundant in cannabis plants and play an important role in the aroma and flavor of a cannabis cultivar. Terpenes in cannabis are thought to protect plants from biotic and abiotic stresses. Each cannabis cultivar has a unique terpene profile and identification of these are very important in genotype characterization. Unfortunately, there are relatively few published data that provide meaningful indications of the pesticidal potential of terpenoids specially as herbicides. Limitations exist in the difficulties of isolation, structural identification and the amount of yield. However, the availability of modern instruments and improved methods are reducing the difficulty, cost and time involved in the steps in this process. In this work, Industrial hemp terpenes were extracted and identified using liquid-chromatography-mass spectrometry using a C-18 column, with solvents A: water/ammonium acetate/formic acid and B: acetonitrile/formic acid. Preliminary results show the existence of fifteen distinct peaks with clear

separations and with m/z range of 500-1000. Future studies will lead to the identification of the individual terpenes that can be used in many applications.

P18 - Evaluating the role of LED grow lights in enhancing hemp biomass

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Hemp (*Cannabis sativa* L.) has recently gained significant attention due to its diverse applications in medicine, textiles, and industrial materials. Optimizing hemp cultivation has led to the adoption of advanced technologies, with LED (Light Emitting Diode) grow lights standing out as a key innovation. This study explores the effects of LED grow lights on biomass accumulation in hemp plants, evaluating their potential as a sustainable cultivation method. Through controlled indoor experiments, we compared the growth of hemp plants exposed to LED grow lights with those under traditional lighting conditions, monitoring growth parameters such as plant height, leaf area, chlorophyll content, and biomass accumulation throughout the plant's life cycle. We also assessed the energy efficiency and cost-effectiveness of LED grow lights relative to conventional systems. Our results indicate that LED grow lights significantly enhance biomass accumulation in hemp, with optimized LED light spectra promoting increased photosynthetic activity, resulting in improved growth rates and larger biomass yields. Additionally, LED grow lights were found to be more energy-efficient and cost-effective, presenting a sustainable alternative to traditional lighting methods. In conclusion, this study underscores the positive impact of LED grow lights on hemp biomass accumulation, suggesting that LED technology can revolutionize hemp cultivation by boosting productivity while reducing resource consumption and environmental impact. These findings support ongoing efforts to promote sustainable hemp production, enabling its varied applications across multiple industries.

P19 - Exploring the anticancer properties of *Asparagopsis taxiformis* algae; as a potential therapeutic agent against cancer and its application in modern medicine

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The red seaweed *Asparagopsis taxiformis* has attracted significant interest due to its bioactive compounds with potential anticancer properties. This study investigates the effects of bioactive components containing *Asparagopsis taxiformis* extract on HT-29 colon cancer cells, focusing on their impact on inhibiting cell growth over a period of 24 to 48 hours. HT-29 cells were treated with different concentrations of the extract and cell viability was assessed using MTT assays. The results indicated a dose-dependent inhibition in cell proliferation, with significant reductions in cell growth observed at different dilutions of the extract. Morphological evaluations through microscopy revealed an increase in cell apoptosis and necrosis in treated cells compared to controls. These findings underline the potential of *Asparagopsis taxiformis* extract as a natural therapeutic agent against colon cancer, warranting further investigation into its molecular mechanisms and in vivo efficacy. Finally, the bioactive components present in the extract could innovate phytomedicine for future colon cancer treatments in the world.

P20 - Production of genistein and its prenylated analog isowighteone in pigeon pea hairy roots and their cytotoxic effect on breast cancer cells

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Triple-negative breast cancer (TNBC) is a highly aggressive form of breast cancer that lacks the three traditional receptors targeted by most current treatments, which significantly restricts available therapeutic options. Therefore, it is crucial to investigate alternative treatments, such as using naturally occurring plant compounds. Genistein and its prenylated analog isowighteone are isoflavones, a class of flavonoids with antioxidant, anti-inflammatory, and anticancer properties. Obtaining significant amounts of these compounds for testing is challenging; therefore, an inducible hairy root culture production platform was developed using *Agrobacterium rhizogenes*-mediated transformation of pigeon pea. This system produced different isoflavones, including genistein and isowighteone, by co-elicitation with methyl jasmonate, methyl-β-cyclodextrin, hydrogen peroxide, and magnesium chloride. This study aimed to optimize the pigeon pea hairy root production system for genistein and isowighteone and assess their cytotoxic effects on the MDA-MB-231 TNBC cell line and the MCF-7 estrogen receptor-positive breast cancer cell line. A 192-h time course elicitation experiment was performed to assess for isoflavone production in the hairy root cultures. Genistein and isowighteone were mainly recovered from the elicitation media at 192 h (over 90 %). The highest production of genistein (137.37 ± 7.51 mg/L) and isowighteone (157.70 ± 16.35 mg/L) was achieved after 120 h of elicitation. Anticancer activity was tested at 10 µM and 25 µM in MDA-MB-231 and MCF-7 cancer cells for up to 72 h. Isowighteone showed higher cytotoxicity than the non-prenylated analog genistein at 25 µM after 48 h in MDA-MB-231 cells and 72 h in MCF-7 cells, with cell viabilities of 68.68 ± 2.7 % and 68.01 ± 6.27 %, respectively. In summary, the inducible pigeon pea hairy root system is a reliable source to produce genistein and isowighteone with anticancer properties.

P21 - Dietary phytochemicals modulate inflammatory responses in ulcerative colitis patient-derived colonoids

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Inflammatory Bowel Diseases (IBD) are multifaceted chronic conditions affecting about 5 million people worldwide. There are two main diseases categorized as IBD, Crohn's disease (CD) and ulcerative colitis (UC). They are primarily characterized by continuous inflammation of the large intestine (UC) or discontinuous inflammation throughout the digestive system (CD). Rising global urbanization has increased IBD incidence worldwide, especially in previously less urbanized countries. Available IBD treatments help about 50% of patients, leaving the rest with few options. Hence there is a need for drugs that can effectively treat a higher percentage of IBD patients with minimal adverse effects. Plants have long been used as medicinal treatment and drug sources for a variety of inflammatory conditions. Among these, dietary plants are a promising source of medicinal compounds because of their known traditional and ethnobotanical uses. Thus, in the work presented, we explored the anti-inflammatory effects of dietary phytochemicals -sulforaphane and carnosic acid- in ulcerative colitis patient-derived colonoids. Both phytochemicals are nuclear factor erythroid 2-related factor 2 (Nrf2) modulators. Nrf2 is a transcription factor that promotes transcription of antioxidant and anti-inflammatory proteins. In addition, Nrf2 inhibits activation of nuclear factor kappa-light-chain-enhancer of activated B cells (NF-ƙB), a known pro-inflammatory transcription factor. Through qPCR, ELISA, and Western Blot techniques we found that sulforaphane and carnosic acid decreased inflammatory cytokines and modulated Nrf2 target proteins in

TNF-α stimulated colonoids. Hence, these phytochemicals are an encouraging lead for anti-inflammatory treatments in ulcerative colitis.-

P23 - Ecologically inspired co-cultures of anti-fungal bacteria to combat white-nose syndrome

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Bats play a crucial role in global biodiversity and support diverse ecosystems. Unfortunately, the fungal pathogen *Pseudogymnoascus destructans,* the causative agent of White-Nose Syndrome (WNS), is sweeping across the US, killing over 7 million bats in the last decade. Already two of the 47 North American bat species are endangered (4%), and another ten (21%) are affected by WNS with varying severity. Previous efforts surveyed >1000 bacterial isolates from bats captured in and around WNS-free caves in New Mexico and Arizona and found ~100 strains with anti-*P. destructans* activity, suggesting that bats' natural microbiome may provide some protection from infection. Preliminary studies on 18 strains that exhibit antifungal behavior against *P. destructans* were performed and a suite of putative antifungal molecules were identified for purification efforts. Unfortunately, upon arrival at James Madison University, the strains of interest no longer produced the target antifungal metabolites under standard culture conditions. To more accurately mimic the ecological niche in which these bacteria originate, we are now working to produce ecologically-inspired co-cultures with bacteria isolated from the same bat species to induce expression of biosynthetic pathways that may produce these target metabolites. Following growth of co-cultures, untargeted mass spectrometry-based metabolomics will be used to evaluate expression of the target antifungals and identify additional up-regulated metabolites induced by co-culture experiments.

P24 - Comparison of health-beneficial compounds: Lycopene and citrulline retention in watermelon juice using hgh-pressure homogenization vs. heat processing

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Watermelon (*Citrullus lanatus*) is known for its high content of bioactive compounds such as citrulline and lycopene. Lycopene reduces cancer risk and supports heart health, while citrulline boosts cardiovascular function and exercise performance. This study compared continuous flow high-pressure homogenization (CFHPH) and high-temperature short-time (HTST) processing in preserving the nutritional quality and stability of watermelon juice during cold storage at 4 °C. The study evaluated the impact of CFHPH and HTST treatments on the retention of key nutrients, including carotenoids, and amino acids. The findings showed CFHPH exhibited better retention of carotenoids, particularly lycopene, compared to HTST. Furthermore, both methods resulted in a notable increase in free amino acid content, with a significant enhancement in citrulline levels. Overall, the study suggests that CFHPH holds promise as a method for maintaining the nutritional stability of watermelon juice during cold storage. This could potentially extend the shelf life of the juice while preserving its health benefits, thereby offering consumers a healthier and longer-lasting product.

P25 - Utilizing biopolymers from lactic acid bacteria to enhance the stability, bioactivity, and antimicrobial efficacy of eugenol

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Essential oils such as eugenol (from clove oil) are naturally derived and have strong medicinal properties, but their low stability limits their uses in diverse applications. This research investigated the possibility of using biopolymers, specifically exopolysaccharide (EPS) from lactic acid bacteria to enhance eugenol's stability, bioactivity, and antimicrobial efficacy. Using a novel encapsulation technique, we developed a stable eugenol oil-in-water emulsion with EPS as a natural emulsifier. The optimized emulsion, featuring a 40:60 oil: water ratio and 3% EPS (w/v), exhibited a droplet size of 192 ± 1.89 nm, a polydispersity index of 0.362 ± 0.01, and a zeta potential of −32 ± 1.90 mV. Remarkably, the EPS maintained its emulsifying properties under varied conditions (−20 to 70 °C, pH 3–9, salinity 1%–30%), ensuring emulsion stability for over 90 days. The emulsion demonstrated strong bactericidal properties, eradicating 95%–99.9% of biofilms on plastic and stainless-steel surfaces. It achieved a 99.99% reduction in *Listeria monocytogenes* on queso fresco and effectively removed *Salmonella* biofilms from tomato and blueberry surfaces, reducing bacterial titers by up to 3.17 log CFU/cm². Additionally, the emulsion displayed notable antioxidant activity at low concentrations, with bioaccessibility reaching nearly 85% following in vitro digestion. Moreover, cytotoxicity and prebiotic activity assessments indicated potential health benefits, supporting the use of these emulsions as functional food ingredients. Our findings underscore the potential of *Lactobacillus*-derived EPS as a natural emulsifier to improve essential oil emulsions' stability, bioactivity, and antimicrobial properties, with promising applications in food safety, functional foods, and pharmaceuticals. This work was supported partially by the USDA-NIFA- SCRI- 2017-51181-26834 through the National Center of Excellence for Melon, USDA-NIFA 2024-51181-43464 at the Vegetable and Fruit Improvement Center of Texas A&M University and partially supported in part by funding from the Texas A&M Institute for Advancing Health Though Agriculture.

P27 - Protection of gut-liver axis by gut recycled herbal components during chemotherapy

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Irinotecan (IR) is topoisomerase I inhibitor used as anticancer drug for treating solid tumors. One of the mechanisms of IR cytotoxicity includes ROS generation, causing oxidative stress (OS). Like other chemotherapeutics, toxicity of IR affects normal cells too, causing serious side effects, especially impacting gastrointestinal (GI) tract. Prevention of drug-induced toxicity with herbals has been proposed as an alternative to standard care or early withdrawal and postponing the chemotherapy treatment leading to therapy failure.We hypothesize that a simplified well-characterized herbal formula Prowoz™, derived from traditional Chinese medicine Xiao-Chai-Hu Tang (XCHT) can ameliorate liver and GI toxicity of IR by maintaining OS and inflammation homeostasis. High and low concentrations (1000 and 500 mg/kg/day) of Prowoz™ (provided by Sanarentero) and Honso XCHT (1000 mg/kg/day) as positive control, were administered to F344 rat model of IR-induced delayed onset severe diarrhea (n=6 rats/group). Herbal treatment started 3 days before IR IV treatment (1150 mg/m^2 on day 4 and 5). Animals were euthanized on day 6 and liver and ileum tissues were collected to measure total antioxidant capacity (TAC) and malondialdehyde (MDA) levels as OS biomarkers. Antioxidant and human recombinant COX-2 enzyme inhibition activities of XCHT and Prowoz™ were also measured. Lower concentration of Prowoz™ has shown similar effects as XCHT on liver and ileum TAC and MDA, preventing harmful effects of IR on gut-liver axis by reducing OS and tissue inflammation. Prowoz™ contains highly potent

polyphenolic antioxidants, as shown by its high antioxidant capacity (2208.38 mg ascorbic acid equivalents/g extract), as compared to XCHT (273.90 mg ascorbic acid equivalents/g extract). Similarly, Prowoz™ showed superior COX-2 inhibition capability (IC_{50} = 26.2 µg/ml) as compared to XCHT (IC_{50} = 2.38 mg/ml). In conclusion, Prowoz™, a proprietary herbal formula, is a safe and effective strategy to protect against GI side effects of chemotherapy in cancer patients.

P30 - Discovery and development of anxiolytic agents from tropical marine macroalgae

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Anxiety disorders are commonly treated with benzodiazepines, which can lead to dependence due to tolerance and resistance mechanisms. This underscores the need for safer and more effective anxiolytic drugs. Marine natural products have emerged as a promising source for drug discovery and development, producing a wide range of metabolites with diverse biological activities, including neuroprotective properties. In this study, we explore the anxiolytic effects of natural products derived from tropical marine brown macroalgae found along the coasts of Puerto Rico, using an invertebrate fly model (*Drosophila melanogaster*). The methodology involves conducting Open Field Tests (OFT), an anxiety-related behavioral test, with young adult flies to compare the behavior of control and experimental groups after both acute (6 hours) and chronic exposures (from oviposition to adulthood) to algae extracts. The behavioral test is based on centrophobia, the innate tendency of *Drosophila* to avoid the center of open spaces. We measure the reduction of centrophobia by recording the distance each fly travels from the center of the Open Field Arena to the walls. Ring assays are also conducted as a counter-assay to ensure the extracts do not affect the flies' locomotor activity. We have previously reported anxiolytic effects in *Drosophila* after chronic exposure to the crude organic extract of *Stypopodium zonale*. Recent data also demonstrate anxiolytic effects from acute exposures to this alga. Statistically significant anxiolytic results were obtained for *Dictyota cervicornis* and *Padina boergesenii* after chronic exposures, while no anxiolytic effects were observed for *Ulva*, *Symploca*, and *Sargassum* species. Ring assays confirmed that exposure to the extracts did not impair *Drosophila's* locomotor activity. In conclusion, our research offers a novel approach to anxiolytic drug discovery, enhancing our understanding of Puerto Rico's marine algae and the chemo-diversity of their natural products.

P32 - Tannin concentration and bioactivity of field grown *Lespedeza* species

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Sericea lespedeza (*Lespedeza cuneata*), a low-input, tannin-rich perennial legume, has been adapted for use in erosion control and use as an anti-parasitic bioactive forage in the United States (U.S.). Bioactivity of other lespedeza species, both native and introduced to the U.S., has not been evaluated. In this study, condensed tannin (CT) concentrations and bioactivity of 32 accessions of *L. cuneata* and 15 other *Lespedeza* species, three of which are native to the U.S., were evaluated. Seeds were obtained from a USDA germplasm collection, established in the greenhouse, then transferred to three replicates of field plots (6.1 x 1.5 m) at the Fort Valley State University Research Station in Fort Valley, GA. After one year, forage samples were collected, freeze-dried and ground, and concentration of extractable CT (ECT), total CT (TCT), total phenolics (TP), and protein-precipitable phenolics (PPP) were determined. The ECT and

TCT for *L. cuneata* accessions averaged 6.6 ± 1.4% and 9.1 ± 1.8%, respectively, while TP were 114.8 ± 33.2 mg/g plant material and PPP averaged 81.5 ± 25.3 mg binding CT/g plant material. For other *Lespedeza* species, ECT ranged from 3.7 ± 1.3 (*L. striate*) to 8.8 ± 1.3 *(L. frutescens*) and TCT from 6.0 ± 0.5 (*L. japonica*) to 10.8 ± 1.3 (*L. frutescens*). Total phenolics ranged from 45.3 ± 24.0 (*L. striate*) to 185.8 ± 43.9 (*L. virgata*), and PPP from 22.1 ± 71 (*L. tomentosa*) to 89.0 ± 23.6 (*L. virginica*). All three of the U.S. native *Lespedeza* species were higher in bioactive compounds than *L. cuneata*, suggesting their potential use as nutraceutical forages.

P33 - Isolation and chemical modification of cembrane diterpenes from *Nicotiana tabacum*

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Cembranes form part of a series of natural diterpenes that can be found in terrestrial plants, like tobacco, and marine organisms like corals. These compounds are comprised of a fourteen-membered carbocyclic ring skeleton substituted by three methyl and one isopropyl group. Tobacco plants contain the highest content of cembrane diterpenes, specifically 4S-cembratrienediol (4S) and 4R-cembratrienediol (4R). Conversely, the interest in the synthesis of organoselenium compounds has risen in recent years due to their potential as novel cancer treatments. In our ongoing efforts to discover novel compounds from tropical medicinal plants with anticancer activity, our goal is to synthesize a series of novel selenocembrane compounds in order to evaluate their possible anticancer properties. From the flower extract, we isolated the 4R and 4S utilizing the technique of normal-phase silica gel chromatography. We carried out a reaction to obtain a mixture of selenocembranes. This mixture then went through the first stage of purification by using column chromatography over Si gel. Currently, we are working with the purification of these novel selenocembrane compounds and the evaluation of their anticancer properties. Therefore, this is the first time that organoselenium compounds have been synthesized from cembrane diterpenes.

P34 - Isolation, preparation, and evaluation of quassinoids as STAT3 inhibitors in breast cancer

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Quassinoids are derivatives degraded from triterpenoids that are widely distributed in the Simaroubaceae family. These metabolites exhibit different bioactivities such as anti-inflammation, antiparasitic and antimalarial. Several quassinoids isolated from Simaroubacea family have been demonstrated to possess anticancer activities in the last years. Simalikalactone D (SKD), a quassinoid, was isolated by our research group and showed potent in *vitro* cytotoxicity with IC_{50}s of 58 to 65 nM in on MDA-MB-435 and MDA-MB-231 breast cancer cell lines. Recent studies on natural products affecting the STAT3 signaling pathway have shown that quassinoids such as bruceantinol, ailanthone, and brusatol are STAT3 inhibitors for the treatment of colorectal cancer and head and neck squamous cell carcinoma. STAT3 is a transcriptional activator in breast cancer that affects breast cancer progression, proliferation, apoptosis, metastasis, and chemoresistance. SKD was isolated from the chloroform extract and purified on Silica gel with mixtures of chloroform/methanol and water/methanol. Docking analysis was performed to examine the binding modes of SKD in the DNA-binding domain of STAT3. Our docking models of SKD into STAT3 propose that the compound interacts with a binding pocket near the DNA-binding domain of STAT3. On the other hand, we prepared synthetic derivatives of SKD by carrying out reduction reactions.

The derivatives were purified by column chromatography and analyzed by spectroscopic methods. SKD and the new synthetic analogs will be analyzed for their cytotoxic effect on cancer cells as well as on the STAT3 signaling pathway.

P35 - Maternal broccoli sprout consumption: A novel strategy to reprogram offspring gut microbiome and prevent early-life obesity

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Obesity is a global health concern, increasing disease risks like diabetes, heart disease, and cancer. It can begin before birth, especially if the mother is obese, leading to complications in pregnancy and future health problems for the child. Dietary changes, including consuming certain vegetables like broccoli, cabbage, and kale, known for their rich sulforaphane and glucosinolates, can help prevent obesity and related health issues. A wealth of evidence from epidemiological and animal studies indicates the important roles of maternal beneficial nutrients and dietary factors in reversing early-life obesity programming in the offspring. Intriguingly, our pilot studies found that maternal broccoli sprouts (BSp) diet significantly reduced the risk of high-fat diet (HFD)-induced body fat accumulation and glucose intolerance in offspring mice. Numerous studies have shown that obesity is associated with dysbiosis in the gut microbiome. Importantly, our preliminary studies revealed that maternal BSp consumption may reshape the early-life gut microbiome and the signature of bacterial metabolite profiles in the offspring. This may alter host metabolism, leading to a reduced risk of obesity and metabolic disorders later in life. Our overall hypothesis is that maternal BSp consumption reprograms the early-life gut microbiome leading to altered metabolites and subsequent key regulatory gene expression changes in the offspring, which may contribute to its effects on prevention of offspring obesity and metabolic disorders from early life. This research harbors the potential to redefine pregnancy nutrition guidelines by introducing an innovative in-utero BSp intervention strategy, offering a pathway to augmenting metabolic well-being in offspring from infancy onward.

P36 - Evaluating the anti-cancer potential of *Padina* Extracts in colorectal cancer cell lines

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Colorectal cancer (CRC) is a significant health burden worldwide, with substantial morbidity and mortality rates. Conventional treatments often come with severe side effects, prompting the need for more natural and less toxic therapeutic options. *Padina* is known for its rich bioactive compounds, including terpenes, which have been shown to possess various biological activities. This study explores the potential anticancer properties of the brown algae *Padina*, focusing on its effects aggressive colorectal cancer cell lines. (HCT116 and HT29). To obtain the different compounds of *Padina* two types of extracts were prepared, methanolic and aqueous. These extracts were analyzed in the different cell lines to evaluate potential anticancer effects. A whole genome search was conducted to identify metabolic genes associated with biosynthesis of terpenes. The extracts showed a reduction in cell viability in both cell lines. Several genes were identified to be potentially associated with the biosynthesis of terpenes. This result showed that *Padina* extracts have a positive effect in reduction of cell viability and identified potential genes that could be related to this effect.

P37 - Determining the anti-proliferative capacity of colorectal cancer cell line treated with extracts derived from *Sargassum*

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Colorectal cancer (CRC) is one of the most common cancers in the United States with an increase of 153,020 new cases in 2023. Currently, CRC treatments include chemotherapy, radiotherapy, and surgery, among others. Secondary metabolites obtained from algae have been used as an alternative route to conventional therapy due to possible alternative mechanisms. Due to the great environmental abundance of *Sargassum,* anticancer effects may have been studied, but few studies have been reported against CRC. Using in-silico studies, it is possible to determine the presence of genes that control the production of secondary metabolites. The objectives of this study were to evaluate by cytotoxic assay Sargassum extracts found in Puerto Rico against CRC and to determine by in-silico assay genes associated with flavonoid production. A cytotoxic assay was performed with MTT implementation, using different extracts against cell lines HT 29 and HCT 116 during 24, 48, and 72 hours. In addition, a western blot was performed to determine specific markers of metabolic pathways of apoptosis. On the other hand, a combination of BLASTp and InterProscan was used to determine the presence of flavonoid metabolic genes. Preliminary results showed that both extracts reduced viability in HT-29 and HCT 116 cell lines and apoptosis-related metabolic pathway activation. Several flavonoid-producing metabolic genes were determined. Further studies are needed to determine which compound from the extract had the anti-cancer effect. These results demonstrate that *Sargassum* extracts have anti-cancer ability against CRC that are worth of assessing in more depth.

P38 - Effects of low-temperature plasma on germination, seedling growth and nutrient profile of microgreens

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Microgreens are nutrient-dense, antioxidant, and phytochemical-rich seedlings, offering significant antiproliferative and antidiabetic benefits. However, their production is challenged by poor seed germination, seed-borne diseases, high water consumption, and susceptibility to humidity-related diseases. While chemical treatments are viable, they pose environmental risks. Low-temperature plasma (LTP), a partially ionized gas containing reactive species, is emerging as a viable non-chemical tool for seed priming to enhance germination, break dormancy, and disinfect seeds. This study evaluated the efficacy of Argon (Ar) and Helium (He) gas LTP by exposing the seeds of fifteen microgreen species for 0 s (Control), 30 s, 60 s, and 90 s. After appropriate treatment, the seeds were placed in Petri dishes with germination paper at 25 seeds per dish. The imbibition and germination rates were assessed under controlled laboratory conditions. In an additional greenhouse experiment, mustard greens exposed to He and Ar LTP for 0 s (Control), 30 s, 60 s, and 90 s were assessed for seedling growth (shoot length, root length, biomass) and nutrient profiles. Results showed that Radish, buckwheat, and scallion exhibited significantly improved imbibition with He 90 s treatment, while spinach and Pac Choi responded positively to Ar 30 s. Cilantro, scallion, and mustard showed positive responses for both Ar and He treatments, whereas broccoli, cabbage, and fenugreek showed no response to LTP. In the greenhouse, Ar 30 s treatment increased plant height by 98% compared to Control, whereas He 60 s increased growth rate by 94.29% compared to Control. Biomass production increased by 78.2%, 63.2%, and 51.6% in the Ar 60 s, He 60 s, and Ar 30 s treatments. Nutrient analysis revealed that He 90 s, AR 60 s, and He 60 s enhanced total phenolic content by 32.6%, 27.6%, and 24.8% compared to the control. Antioxidant power increased 24.3% with Ar 90 s, 23.6% with Ar 30 s, and 23.2% with He 90 s compared to the control. Thus, this study demonstrated that seed treatment using LTP improved plant stand, biomass, and nutrient profile of microgreens.

P39 - Use of emerging technologies in advancing medicinal plant research: a Prospective

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Medicinal plants, considered essential to traditional medicine, provide a vast source of bioactive molecules. Nevertheless, these compounds' intricate chemical compositions and diverse biological impacts have traditionally posed challenges regarding their recognition, description, and utilization. The emergence of ingredient informatics, in conjunction with artificial intelligence (AI) and machine learning (ML), can transform the investigation and application of medicinal plants. The present research explores the ways in which these technologies can be integrated to improve the process of discovering, analyzing, and applying therapeutic plant components. *Ingredient informatics*, a systematic process that collects and analyzes chemical data, can play a crucial role in enhancing the safety and effectiveness of medicinal plant research. By enabling researchers to compare the chemical profiles of plants, identify the molecules with an effect, and make predictions about their biological activities, this approach can significantly enhance the evaluation of safety and effectiveness. AI-based Natural language processing models have emerged as a valuable tool in medicinal plant research. They can find therapeutic substances by examining ethnobotanical records and scientific literature and can reveal plants that possess untapped medicinal qualities. Additionally, this can improve the process of analyzing phytochemicals, resulting in more precise identification and expedited drug development. Machine learning can be used to forecast the bioactivity of plant chemicals, which can help to simplify the process of discovering new drugs. This application of ML not only accelerates drug discovery but also facilitates comprehension of the environmental variables that impact both the growth and efficacy of plants, thus enhancing the efficiency of sustainable growing techniques. This convergence of technologies can significantly enhance the effectiveness and safety of both traditional and modern medicines, ushering in an era of exciting possibilities in medicinal plant research.

P40 - Health benefits of peanuts: A deep dive into medicinal properties

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Peanuts (*Arachis hypogaea* L.) are highly valued for their rich nutritional profile but also for their significant medicinal properties. Rich in vitamins, proteins, healthy fats and minerals, peanuts also contain high content of monosaturated fats and bioactive compounds such as flavonoids, polyphenols and resveratrol. While peanut has low saturated fatty acids, it consists of high oleic acid, antioxidant capacity, and a good source of vegetable protein. At the same time, it has a high content of magnesium, potassium, and many bioactive components (such as phytosterols and polyphenols), which is associated with decreased risk of various diseases. Evidence suggests that regular consumption of peanuts may reduce the risk of chronic diseases such as diabetes, cardiovascular diseases and certain cancers. Due to the nutritional properties, peanuts have been used to combat malnutrition in most developing countries. It has also been reported that processing methods like boiling and roasting have shown increase in the concentration of bioactive compounds. Moreover, Hairy root cultures of peanut induced by the bacterium *Agrobacterium rhizogenes,* offer a valuable platform to produce nutraceuticals like resveratrol and resveratrol derivatives. Despite their nutritional advantages, peanuts are also a leading cause of food allergies, particularly in children. Peanut allergies can aggravate severe immune response, leading to symptoms like mild irritation to life threating condition. The current review highlights the various health benefits related to peanut consumption, emphasizing their role in promoting overall health, preventing chronic diseases alongside the implications of peanut allergies. Ongoing research is directed at peanut-*Aspergillus* biology such as micromorphological diversity in the vegetative and reproductive parts of peanut cultivars and to study the mode of *Aspergillus* invasion.

P43 - Utilizing biopolymers from lactic acid bacteria to enhance the stability, bioactivity, and antimicrobial efficacy of eugenol

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Essential oils such as eugenol (from clove oil) are naturally derived and have strong medicinal properties, but their low stability limits their uses in diverse applications. This research investigated the possibility of using biopolymers, specifically exopolysaccharide (EPS) from lactic acid bacteria to enhance eugenol's stability, bioactivity, and antimicrobial efficacy. Using a novel encapsulation technique, we developed a stable eugenol oil-in-water emulsion with EPS as a natural emulsifier. The optimized emulsion, featuring a 40:60 oil: water ratio and 3% EPS (w/v), exhibited a droplet size of 192 ± 1.89 nm, a polydispersity index of 0.362 ± 0.01, and a zeta potential of −32 ± 1.90 mV. Remarkably, the EPS maintained its emulsifying properties under varied conditions (−20 to 70 °C, pH 3–9, salinity 1%–30%), ensuring emulsion stability for over 90 days. The emulsion demonstrated strong bactericidal properties, eradicating 95%–99.9% of biofilms on plastic and stainless-steel surfaces. It achieved a 99.99% reduction in *Listeria monocytogenes* on queso fresco and effectively removed *Salmonella* biofilms from tomato and blueberry surfaces, reducing bacterial titers by up to 3.17 log CFU/cm². Additionally, the emulsion displayed notable antioxidant activity at low concentrations, with bioaccessibility reaching nearly 85% following in vitro digestion. Moreover, cytotoxicity and prebiotic activity assessments indicated potential health benefits, supporting the use of these emulsions as functional food ingredients. Our findings underscore the potential of *Lactobacillus*-derived EPS as a natural emulsifier to improve essential oil emulsions' stability, bioactivity, and antimicrobial properties, with promising applications in food safety, functional foods, and pharmaceuticals.

P44 - Characterization of elemental contents and volatile compounds in *Moringa oleifera* leaves grown in Southern Texas

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Moringa oleifera (*Fam. - Moringaceae*), commonly known as the "Drumstick tree" due to the shape of its pods, is a plant native to the tropics and subtropics of Asia and Africa. This plant is renowned for its health benefits and potential in treating and preventing various diseases, including diabetes, heart disease, arthritis, liver disease, and digestive disorders. The objective of this study was to determine the concentration of Carbon (C), Hydrogen (H), Nitrogen (N), and Sulfur (S) contents and other micronutrients, as well as the volatile components of Moringa Oleifera leaves grown in Texas. In the first experiment, approximately 125 mg of plant samples were analyzed for CHNS concentration using a vario MACRO cube. The second experiment extracted 2.0 grams of *Moringa Oleifera* leaves using an Accelerated Liquid Extractor (ASE 350) with hexane and methanol as solvents. The extracted samples were then analyzed for volatile components using GC-MS. The *Moringa Oleifera* leaves contain various phytochemicals, including Heptacosane, Nonacosane, Tetracosane, and others. These phytochemicals, identified through GC-MS analysis, suggest that *Moringa oleifera* leaves have a complex chemical profile that may contribute to their medicinal properties. The study's findings underscore the significance of Moringa Oleifera as a nutritionally and medicinally valuable plant, particularly in regions like the Southern USA, including Texas, where it has the potential to cultivate. Further research could explore the bioavailability of these compounds and their specific roles in human health, as well as the impact of growing conditions on the phytochemical composition of Moringa oleifera leaves.

P45 - Phytochemistry of milk thistle (*Silybum marianum)* and its therapeutic potential

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Silybum marianum (SM), commonly known as milk thistle, is a well-known medicinal plant widely used to treat various diseases, particularly hepatic diseases. The fruits and seeds of SM contain a flavonolignan complex known as silymarin. The active compounds of silymarin include silybin, isosilybin, silychristin, silydianin, dihydrosilybin, and so on. Most of the documented research on *Silybum marianum* pertains to its effects on liver disorders. However, recent studies have highlighted its potential beneficial properties in the treatment of a wide variety of other disorders, including anti-atherosclerosis activities, cardiovascular protection, hypolipidemic, renal protection, and prevention of insulin resistance, especially in cirrhotic patients. Furthermore, it shows promise in the prevention of Alzheimer's disease and cancer. Aim: This current research aims to provide the latest information on different aspects of *Silybum marianum*, including pharmacological activities, adverse effects, phytochemistry, and therapeutic implications. Materials and methods: An extensive review of the literature was conducted using pertinent keywords and publications with rational methodology and robust data were selected and discussed. Studies pertaining to *Silybum marianum* or its main active ingredients with regards to antidiabetic, cardiovascular protection, hepatoprotective, anticancer, and antimicrobial activities as well as the clinical trials performed on the plant, were discussed here.

P46 - Mechanistic interplay in broccoli glucoraphanin-induced beneficial effects on obesity prevention

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Obesity and its associated metabolic comorbidities pose a major global challenge for public health. Studies have shown that glucoraphanin (GRN), a natural bioactive compound enriched in broccoli, exhibits various health benefits in reversing adverse metabolic parameters. However, the precise mechanism by which broccoli exacts its beneficial effects through the interaction between gut microbiota, metabolites and host health outcome is still not fully understood. Therefore, we interrogated the impacts of broccoli GRN supplementation on hepatocyte morphology and gut microbiome-metabolomics profiling, and how their interplay influences obesity development process, which is of importance for the field of obesity intervention. The study was conducted in an obese-related C57BL/6J mouse model through the treatment of normal control diet, high-fat diet (HFD), and HFD-GRN diet (GRN supplemented in HFD) to determine the metabolic protection of GRN in vivo. Fecal bacterial composition and serum metabolomic profiles were performed by 16S rRNA sequencing and liquid chromatography with tandem mass spectrometry (LC MS/MS), respectively. Our study showed that HFD-GRN significantly reduced body weight and body fat accumulation leading to improved glucose metabolism in HFD-fed animals. GRN significantly reduced lipid infiltration in the liver. Mechanically, GRN treatment significantly altered microbial beta-diversity and composition. For example, GRN significantly increased abundance of beneficial genera such as *Mucispirillum*, *Enterorhabdus*, and *Lachnoclostridium*. Furthermore, higher blood levels of L-alanine, L-proline and Levetiracetam, but lower levels of alpha-glycerophosphate, N-acylornithine and ceramide compounds were observed in GRN supplemented group compared to HFD group. These results indicate that GRN has a positive impact on reversing adverse metabolic parameters and reducing risk of non-alcoholic fatty liver disease under HFD stimuli. GRN-induced microbial and metabolomic reprogramming provide mechanistic insights for the beneficial potential of GRN that further warrants GRN as a dietary intervention candidate for obesity and obesity-related abnormalities.

P47 - Plant-based functional foods of the Sultanate of Oman: Innovation and future perspectives

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Oman has a wide range of plant species diversity, containing more than 1400 angiosperm species. Among these species, approximately 1000 have socioeconomic importance. Approximately 100 species are cultivated in Oman as food sources. However, there are several plant species globally classified as functional foods that are cultivated or exist in the wild. However, there are other groups within the plant diversity of the sultanate that were consumed by the local people as food, but they are not classified as functional foods. These potential functional foods and plant species have been documented in several studies. However, there is no compiled information on functional foods indigenous to Oman. This study identified these species from national literature, monographs, and research publications that focus on their traditional uses as food. This study will elaborate on procedures and technologies that may upgrade these potential functional foods of Oman origin to innovative forms of food or nutraceuticals.