6th annual CNPD Conference 2025

In association with

The Society for Natural Products Discovery (SNPD)

Liverpool, 23-26 June 2025

BOOK OF ABSTRACTS

Edited by:

Dr Touraj Ehtezazi

Executive Editor-in-Chief, *Journal of Natural Products Discovery*

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School of Pharmacy and Biomolecular Sciences

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Message from the President of the Conference Organizing Committee

On behalf of the Conference Organising Committee, I am delighted to welcome you to the 6th Annual CNPD Conference 2025, which is organised in association with the Society for Natural Products Discovery (SNPD) in Liverpool on 23-26 June 2025.

The Centre for Natural Products Discovery (CNPD) series of annual conferences started in 2020 to mark the first anniversary of CNPD, and has been held successfully every year after that, either using an online platform or in person in Liverpool. The CNPD conducts externally funded and impactful natural products research to discover new high-value natural products that will contribute to tackling current and future societal and global challenges in health and well-being, socio-economic growth, natural conservation, and environmental sustainability. The CNPD is based in the School of Pharmacy and Biomolecular Sciences at LJMU, which is the second oldest Pharmacy education provider in the UK and has a rich history of world-leading natural products research.

These CNPD conferences always provide a unique platform for highlighting the advances in natural products research covering cosmetics, food, medicine, and agricultural products. The 6th Annual CNPD Conference 2025 comprises plenary talks, invited talks, short talks, and poster presentations focusing on what matters most, to be delivered by global leaders in natural products research as well as by young scientists (PhD students and postdocs). This conference offers individual sessions dedicated to open, interactive, and participatory discussions with selected panel members and the audience on various challenges associated with natural products research.

This year, CNPD has teamed up with the newly formed society SNPD, a UK-registered charity dedicated to enhancing global collaboration, participation, and cooperation in high-value natural products research and public understanding of natural products and their applications. At the 6th Annual CNPD Conference 2025, we will honour four world-renowned natural products scientists with the SNPD International Fellowship for the first time, and there will be three prizes for presentations from young scientists.

I hope you enjoy the conference, and most importantly, the city of Liverpool, which is a city of imagination, dreams and hope.

Prof Satya D Sarker
President of the Conference Organizing Committee

Message from the Chief Coordinator of the Conference

Once again, it is my pleasure to welcome you to the 6th annual Centre for Natural Products Discovery conference taking place here in the magnificent city of Liverpool. As the *Chief Coordinator* of the conference, it has been my pleasure to work with other members of the organising committee towards providing you with the best possible conference experience. We would very much like to thank Liverpool John Moores University for the kind donation of the excellent facilities that we will use this week for the conference.

In common with our previous conferences, we are very much looking forward to an exciting four days where the very best of natural products research will be discussed in the warm and friendly atmosphere for which the CNPD conferences are famous. This year is doubly exciting due to the conference being held for the first time in conjunction with our new society, the Society for Natural Products Discovery (SNPD). The SNPD is a UK-registered charity with the intention of continuing to educate both scientists and the public about natural products. Please ask one of the volunteers at the reception desk about joining the society today and becoming a proud contributor to this noble cause!

Over the next four days, we hope that you will get fully involved with the conference and take advantage of rubbing shoulders with some of the very best scientists in natural products discovery research, but also enjoy the city of Liverpool with its vibrant atmosphere. We will, of course, be sampling some of this atmosphere as we take to the waters of the Mersey on Tuesday afternoon when we board the famous 'Ferry Cross the Mersey' for a river tour, before we head to the grandeur of the newly refurbished Radisson Red Hotel to enjoy our conference dinner. Finally, we very much hope that you will be inspired by the high-quality science that will be on show and that you will return in two years to be part of this exciting conference series. However, you will also be able to meet us online at the online CNPD conference next year. On behalf of the conference organising committee, I wish you a successful conference.

Dr Kenneth J Ritchie
Chief Coordinator of the Conference

Message from the Editor: 6th Annual CNPD Conference 2025

It is with great pleasure that I welcome you to the 6th Centre for Natural Products Discovery Conference, a gathering that continues to showcase the remarkable potential of nature's molecular diversity in addressing contemporary scientific and medical challenges. Natural products have served as humanity's original pharmacy for millennia, yet their scientific exploration remains as relevant and exciting as ever. From the discovery of penicillin to the development of modern cancer therapeutics like paclitaxel, nature continues to provide innovative solutions to complex problems. This conference celebrates both our rich heritage in natural product research and the cutting-edge technologies that are revolutionizing how we discover, characterise, and develop these precious compounds.

This year's program brings together leading researchers, emerging scientists, and industry professionals from across the globe to share breakthrough discoveries in biosynthesis, synthetic biology, computational approaches, and therapeutic applications. The diverse range of presentations—from marine metabolites to microbial drug discovery—reflects the extraordinary breadth of natural product science. We are particularly excited to highlight advances in the use of natural products in the treatment of neuroinflammation, the vascular endothelium as a therapeutic target, immunosugars, potential artificial intelligence-driven discovery platforms, cyclin-dependent kinase inhibitors, sustainable bioproduction methods, and targeting antimicrobial resistance, just to provide a few examples. These innovations are opening new frontiers in our quest to unlock nature's chemical treasures.

The challenges facing our world—from antimicrobial resistance to climate change—demand innovative solutions. Natural products, with their evolutionarily refined structures and diverse biological activities, offer unique opportunities to address these pressing issues.

I extend my sincere gratitude to our distinguished speakers, dedicated reviewers, poster presenters, and enthusiastic participants who make this conference possible. Your collaborative spirit and scientific rigor continue to drive the field forward.

Together, we are writing the next chapter in natural product discovery, bridging traditional knowledge with modern innovation to benefit humanity and our planet.

Dr Touraj Ehtezazi
Editor of the 6th Centre for Natural Products Discovery Conference

Biography of Plenary Speakers

Prof Ming-Quan (Mark) Guo

Head of Natural/Marine Biomedical Materials Group, Ningbo Cixi Institute of Biomedical Engineering, Ningbo Institute of Materials Technology and Engineering, Chinese Academy of Sciences, Ningbo 315201, China; University of Chinese Academy of Sciences

Professor Guo is currently a Professor at the University of Chinese Academy of Sciences, and the head of the Natural/Marine Biomedical Materials Group at Ningbo Cixi Institute of Biomedical Engineering. His current research interests include, but are not limited to medicinal biological chemistry and food chemistry, and especially involve the development of a variety of chemical-biology and bio-affinity ultrafiltration-based strategies for the quick screening of bioactive small molecules against various drug targets from natural products in the context of targeted new drug discovery and development. To date, he has published over 130 SCI articles, including some highly cited ones, and is ranked among the Top 2% of Scientists in the world. He has been acting as a principal investigator (PI) for over 30 national or provincial scientific projects since 2012. He has also been invited to serve as Guest Editor or Editorial Board Member for at least seven international renowned journals, such as *Journal of Pharmaceutical Analysis (SCI), Chinese Medicines (SCI), Journal of Analysis and Testing (EI, ESCI); Phytochemical Analysis (SCI), Current Analytical Chemistry (SCI), Phytochemical Analysis (SCI), Frontiers in Nutrition (SCI), etc*. In addition, he has delivered over 50 keynote or invited talks at various international/national conferences in the past decade.

Prof Dr Anca Miron

Prof Dr Anca Miron got her PhD degree in Pharmaceutical Sciences from *Grigore T. Popa* University of Medicine and Pharmacy Iasi, Romania in 1998. In 2008, she became a professor in the Department of Pharmacognosy-Phytotherapy, Faculty of Pharmacy, the same university. Prof dr Anca Miron's main areas of interest are plant polyphenols and volatiles. Her major research activities include isolation, chemical characterization, and biological evaluation of plant extractives/constituents with antioxidant, antigenotoxic, antibacterial, and antitumor effects. She has published over 80 peer-reviewed articles in international journals and has co-authored seven books and eight book chapters. She was the principal investigator in several national and international research grants and a co-author of four national patents. Prof Miron received several national awards, such as the Servier Young Investigator Award (1998), Award for Pharmaceutical Research Activity (2002), and Award for Excellence in Pharmaceutical Research (2014). Currently, she heads the Department of Pharmacognosy-Phytotherapy, Faculty of Pharmacy, *Grigore T. Popa* University of Medicine and Pharmacy Iasi, Romania, and serves as the regional representative for Romania, Bulgaria, and Moldova in the *Phytochemical Society of Europe*.

Professor Robert J Nash

Prof Nash started his research career working for the UK Medical Research Council on anti-HIV molecules from plants at the Royal Botanic Gardens, Kew. His PhD was awarded by King's College London on the identification and biological activities of new iminosugars. He was Head of the Chemistry Group at the BBSRC institute IGER from 1993-2002, and then founded four pharmaceutical discovery companies in the UK from 1999 to the present. Currently, Prof Nash is the director and researcher of PhytoQuest Limited and Sugars for Health Limited in the UK. The companies have several granted patent families around iminosugars and their potential drug uses. He has many collaborations with leading biologists and chemists in both universities and companies around the World, and this is shown in the patents and publication record with over 250 refereed papers. He has a consistent track record within the pharma/biotech sector of building and leading successful R&D teams and has worked on many grant applications and project management teams. The R&D applications worked on have been broad across agri-food, pharmaceuticals, and cosmetics. The purpose of his research is to find better health solutions involving better medicines or preventing disorders based mainly on manipulating carbohydrate biology. He is an Honorary Professor at the Swansea Department of Science and Technology.

Prof Satyajit D Sarker

Prof Satyajit D Sarker, *Professor of Pharmacy* and an extensively cited *phytochemist* with over 800 publications (*h*-index 75 and *i*10 index 403)**,** is the Director of the School of Pharmacy and Biomolecular Sciences at Liverpool John Moores University. He is the recipient of the prestigious ISE-SFE Outstanding International Ethnopharmacologist 2023 Award and an Expatriate Fellowship of the Bangladesh Academy of Sciences in 2024. He is the Founding Head of the Centre for Natural Products Discovery (CNPD) at LJMU and the Founding Chairperson of the Society for Natural Products Discovery (SNPD), which is a UK-registered charity. He is a *Visiting Professor* at Qilu University of Technology, China, and an *Adjunct Faculty* at Khulna University, Bangladesh. He served as a *Guest Professor* at the Chinese Academy of Sciences, a *Visiting Professor* at the School of Medicine, Taylor's University, Malaysia, and Mae Fah Luang University, and an *Honorary Professor* at the University of East Anglia. He was the *President* of the Phytochemical Society of Europe (2018-2020). Prof Sarker obtained his PhD in Phytochemistry from Strathclyde University, Glasgow, UK, and conducted a BBSRC post-doctoral fellowship at the University of Exeter. Previously, he held various posts at the University of Wolverhampton, the University of Ulster, the Robert Gordon University, the University of Bourgogne, and the University of Dhaka. He is a reviewer of over 80 international journals, a member of the editorial board of 42 reputed journals like *Biochemical Systematics and Ecology*, *Current Medicinal Chemistry*, *Journal of Pharmacy and Pharmacology, Molecules*, *Pharmaceutical Sciences, Phytochemistry Letters* and *DARU*, and the founding Editor-in-Chief of *Natural Products Analysis*, and *Journal of Natural Products Discovery*. He served as the Editor-in-Chief of *Phytochemical Analysis* (2010-2024) and raised the profile and built a high reputation for that journal to the current level.

Professor Miroslav Strnad

Miroslav Strnad is a professor at the Laboratory of Growth Regulators, Institute of Experimental Botany ASCR & Palacký University in Olomouc, Czech Republic. His current focus is on the research and development of a new generation of compounds with antiviral, antiproliferative, anti-angiogenic, and antisenescence properties, new phytohormone-derived cosmetics, and plant growth regulators for biotechnology and agriculture. He graduated in Phytotechnologies from the Faculty of Agronomy, Mendel University, Brno, in 1982. In 2001 was promoted to Professor of the Palacký University in Olomouc. In 1998, he was awarded the Rhone-Poulenc Rorer Award by the Phytochemical Society of Europe (PSE). In 1999, he received the award of the City of Olomouc; in 2004 the prize of the Learned Society of the Czech Republic, in 2024 Silver Medal of PSE for significant progress in the research of natural substances and in May 2025 Silver Medal of the Leibnitz Society (Germany) for research on bioactive compounds. Prof. Strnad has been widely publishing (21 chapters in books; more than 510 papers in recognized journals; 3 books; 36 Czech and 277 international patents: 313 records on Espacenet. Total number of citations: > 22300; *h*-index: 76. In the published analysis of research.com databases, he was evaluated as the best Czech scientist in the field of biology and biochemistry for the last few years: https://research.com/scientists-rankings/biology-and-biochemistry/cz). He has many years of experience in protecting know-how worldwide. He is responsible for 3 of the 4 most cited patents in the Czech Republic. He was the initiator and organizer of a number of commercialization and licensing agreements, for example with Cyclacel Pharmaceuticals, Merck, Syngenta, Intracrop and Pyratine.

Professor Alvaro Viljoen

Prof Viljoen completed a BSc, BSc Hons. (*cum laude*) and MSc (*cum laude*) in Botany at Stellenbosch University (SA). In 1994, he commenced with a PhD at the University of Johannesburg on the chemotaxonomy of the genus *Aloe*. In 1999, he was appointed as a Lecturer in the School of Pharmacy at WITS Medical School, where he was promoted to Associate Professor in 2004. In July 2005, he was offered a research fellow position in the Department of Pharmaceutical Sciences, Tshwane University of Technology (Pretoria). More than 100 post-graduate students have graduated under his supervision. He has authored/co-authored >320 peer-reviewed papers (Scopus *h*-index 56), 2 books, and several book chapters, mostly on the phytochemical exploration and pharmacological activity of indigenous medicinal and aromatic plants. He has been elected to the editorial board of *Phytochemistry* (Elsevier), Journal of Applied Research on Medicinal and Aromatic Plants (Elsevier), and he has been the Editor-in-Chief of the *Journal of Ethnopharmacology* (Elsevier, IF 4.8) since 2017. In October 2013, he was awarded the National Research Chair in Phytomedicine, a position which he holds concurrently as Director of the SAMRC Herbal Drugs Research Unit in South Africa.

Plenary Talks

Bioactive compounds from medicinal plants and their anti-obesity and antidiabetic potential explored by ultrafiltration LC-MS

Mingquan Guo [1,2*], Mengjia Xu[1] and Xiaowen Hua[1]

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Chinese tea plants, including lotus leaves and *Moringa oleifera* leaves, are well-known for their traditional applications in managing obesity and diabetes. These plants have been historically utilized in preventing and treating metabolic disorders; however, the bioactive components responsible for their therapeutic effects remain largely unidentified. Recently, the pursuit of safer and more efficacious natural therapies for metabolic diseases has garnered significant attention. In this study, we employed a combination of multi-target affinity ultrafiltration LC-MS analysis and *in vitro/in vivo* experiments to investigate bioactive compounds within these tea plants and elucidate their mechanisms of action. To evaluate the anti-obesity and antidiabetic potential *in vitro*, inhibition assays targeting α-glucosidase and pancreatic lipase were conducted. The IC_{50} values of the plant extracts on both enzymes were higher than those of the corresponding positive controls. Subsequently, multi-target affinity ultrafiltration strategies, utilizing these enzymes as potential targets and coupled with LC-MS, were developed for rapid screening of bioactive compounds that interact with these enzymes. *In vivo* studies were performed using Type 2 Diabetes Mellitus (T2DM) mouse model, and demonstrated a dose-dependent effect across high, medium, and low dosage groups. These treatments significantly reduced body weight and fasting blood glucose levels in T2DM mice while markedly improving glucose tolerance. Further analyses revealed a significant decrease in serum levels of total cholesterol (TC), triglycerides (TG), and low-density lipoprotein cholesterol (LDL-C), alongside a notable increase in high-density lipoprotein cholesterol (HDL-C). Additionally, potent bioactive components identified via ultrafiltration/LC-MS significantly altered the composition and abundance of gut microbiota and enhanced short-chain fatty acid (SCFA) levels in T2DM mice. Our findings suggest that the bioactive components of these tea plants represent key compounds for lowering blood sugar and lipids, and thus, hold promise for further development as functional foods or natural health products for metabolic disorders.

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The vascular endothelium as a therapeutic target: Advances in plant-based ınterventions

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Endothelial dysfunction, marked by impaired vasodilation, prothrombotic, proinflammatory, and prooxidant conditions, plays a key role in the development of various vascular diseases (peripheral arterial disease, stroke, hypertension, venous thrombosis), as well as diabetes, chronic kidney failure, cancer, and severe infectious diseases. Prevention and early treatment of endothelial abnormalities are critical strategies for reducing the risk and progression of the aforementioned diseases. Plant-derived agents (extracts, phytochemicals) have been reported to prevent and/or reverse endothelial dysfunction in various experimental models. Many of them exhibit multitarget activity, which represents a significant advantage in tackling such a complex and multifactorial condition as endothelial dysfunction. Consequently, they may serve as valuable candidates for the development of novel therapeutic agents. Highlighting both literature data and own research findings, this presentation explores the potential of plant-derived agents in modulating endothelial function. The focus is on agents that mitigate endothelial dysfunction through various mechanisms (↑eNOS, ↑Nrf2, ↑GSH, ↑SOD, ↑CAT, ↓iNOS, ↓VCAM-1, ↓ICAM-1, ↓NF-kB, ↓E-selectin, ↓XO-1, ↓ACE, ↓COX-2, ↓VEGF, ↓TGF-beta, ↓TIMP-1, ↓vWF), thereby alleviating key hallmarks of endothelial dysfunction such as vasoconstriction, thrombosis, oxidative stress, and inflammation. For several of these plant-derived agents, the ability to improve endothelial function is supported by animal studies. However, clinical investigations are essential to confirm their efficacy and safety. Despite promising experimental results, the therapeutic application of plant-derived agents is significantly constrained by their low bioavailability. In this regard, novel formulation strategies that enhance stability, absorption, and targeted delivery offer a promising approach for the prevention and treatment of various diseases associated with endothelial dysfunction.

Iminosugars and iminosugar acids in the diet and their potential health benefits

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Iminosugars are common in plants and microbial cultures. In their simplest form they are analogues of sugars where the ring oxygen is replaced by a nitrogen, but they can also be bicyclic analogues of disaccharides. Iminosugar acids are also often found and have a carboxyl group replacing the sugar hydroxymethyl-group or have an acid attached to the ring nitrogen. The iminosugars can be highly active against glycosidases such as α-glucosidases, e.g. 1-deoxynojirimycin from Mulberry and Bacillus/Streptomyces, and can be highly selective. The iminosugar acids tend to show selectivity against enzymes such as sialidases and glucuronidases and this can give them anti-microbial activity. There are a range of potential health benefits from inhibiting glycosidases but some of these compounds can also increase the activity of glycosidases that may be deficient in illnesses. An important characteristic of these compounds as modulators of health is that they are very stable in extraction and processing and also very stable in the body once consumed; only a small number have been studied to date, but all these shows good bioavailability and are excreted in urine unaltered from hours to days. It appears that some of these compounds can also interact with receptors and induce immune responses to tumours *in vivo* and others have potent anti-inflammatory activities. This talk will present an overview of the current knowledge on iminosugars and related compounds and their potential contribution to health.

A dream shared, a dream realized

Satyajit D Sarker* and Lutfun Nahar

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Sometimes, a dream may come true. When one shares one's dream with someone else, it increases the likelihood of achieving it. A shared vision provides support, motivation, and accountability, making the dream tangible and achievable. Liverpool John Moores University (LJMU) has a long history of pharmacy education since 1849; LJMU is the second oldest pharmacy education provider in the UK. Like all pharmacy programmes, at the beginning and several years after that, pharmacognosy played a significant role in pharmacy education at LJMU and formed the foundation of medicinal plant research. As pharmacy education in the UK has evolved over the years, the presence of pharmacognosy in modern pharmacy curricula is almost invisible. While the word 'pharmacognosy' has disappeared from the UK pharmacy curricula, research involving medicinal plants has continued in some universities, including LJMU, but regrettably, not as mainstream research. In 2013, the Natural Products and Medicinal Chemistry Research Group, led by the author, was formed within the School of Pharmacy and Biomolecular Sciences (PBS) to intensify research on medicinal plants with a dream to establish a unique centre for excellence in natural products research in the UK, which would have a global outlook and tangible impact. This dream was shared with several other like-minded PBS researchers, who put their efforts together to establish the Centre for Natural Products Discovery (CNPD), which was officially launched in March 2019. Subsequently, the *Journal of Natural Products Discovery* (JNPD), an MSc Programme in Natural Products Discovery (MNPD), and most recently, a charity organization, the Society for Natural Products Discovery (SNPD), have been launched. This talk will present an overview of the achievements, success stories, and activities of the CNPD that exemplify 'a dream shared, a dream realized' and the opportunities that SNPD offers to facilitate and enhance global collaborations in natural products research.

New natural anticancer drug candidates for cell cycle regulations

Miroslav Strnad[1,2]*, Vladimír Kryštof[1], Radek Jorda[1], Eva Řezníčková[1], Tomáš Gucký[1], Marek Zatloukal[1], Pavel Klener[1] and Libor Havlíček[1]

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Throughout history, natural products have afforded a rich source of compounds that have found many applications in the fields of medicine, pharmacy and biology. Within the sphere of cancer, a number of important new commercialized drugs have been obtained from natural sources, by structural modification of natural compounds, or by the synthesis of new compounds, designed following a natural compound as model. Deregulation of the cell cycle is a common hallmark of cancers and is tightly linked to cyclin-dependent kinases (CDKs). Deregulation of CDKs is often caused by amplification or overexpression of cyclins, or by mutation or silencing of the genes encoding natural protein inhibitors of CDKs. As a consequence, hyperactivate CDKs inappropriately promote proliferation of cancer cells despite the lack of mitogens. Due to their frequent deregulation in cancer cells, CDKs have been viewed as valid drug targets and to this date, more than 20 inhibitors have entered clinical trials in cancer patients. Originally, we focused on the primary action mechanisms of the plant hormones cytokinins (N^6-substituted adenine derivatives) in mammalian cell division cycles, and showed that natural cytokinins are rather non-specific inhibitors of various protein kinases. Surprisingly, at that time, among aromatic cytokinin derivatives we discovered a compound, 2-(2-hydroxyethylamino)-6-benzylamino-9-methylpurine, named "olomoucine", which inhibits several cyclin-dependent kinases (CDKs) at micromolar concentrations. In subsequent studies the purine heterocycle was one of the first systematically investigated scaffolds of kinase inhibitors (partly due to its amenability to various substitutions), leading to discovery of roscovitine. Roscovitine is a pan-selective CDK inhibitor with multiple effects on cell proliferation, p53 expression and p53-dependent transcription and/or induction of apoptosis in cancer cells. Consequently, roscovitine was among the first CDK inhibitors to enter clinical trials. It is currently being evaluated in phase phase 2 multicenter, open-label clinical trial which will evaluate safety and efficacy of 4 weeks of oral seliciclib in patients with newly diagnosed, persistent, or recurrent Cushing disease. During the last decade we have continued to develop increasingly effective kinase inhibitors, leading to the discovery of several other potent compounds with various structural motifs. New drugs scaffolds usable for kinase inhibition, their molecular and cellular mechanisms of action as well as in vivo effects will be discussed in this presentation.

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Modernizing African herbal medicine: The role of analytical pharmacognosy and evidence-based ethnopharmacology

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Southern Africa is home to an extraordinary diversity of plant life, boasting more than 24,000 species of flowering plants. Embedded within this botanical wealth is a deep-rooted tradition of using indigenous flora for medicinal purposes. To support the research and commercialization of African herbal medicines, it is crucial to establish validated analytical methodologies, develop official monographs, and provide scientific evidence for the traditional use of ethnomedicinal plants. However, the limited representation of pharmacognosy in pharmacy education has led to a shortage of expertise, posing a significant barrier to achieving these goals. Another major challenge lies in the intrinsic complexity of medicinal plants, particularly due to their extensive chemotypic variability. Reliable chemical fingerprinting techniques are essential for accurately characterizing plant materials, necessitating the development of sophisticated analytical approaches for profiling complex herbal extracts. This presentation will showcase selected examples to demonstrate the rigorous workflow involved, encompassing extensive plant sampling, analytical profiling of volatile and non-volatile compounds using GC-MS and LC-MS, HPTLC, vibrational spectroscopy, and the application of preparative chromatography for biomarker isolation. Additionally, the integration of analytical chemistry with chemometric modelling (including pharmacological data using a biochemometric approach) will be highlighted as a powerful tool for medicinal plant research.

Invited Talks

Food Supplements with beta-glucans on the market in Czech Republic

Lucie Cahlíková*

Secondary Metabolites of Plants as Potential Drugs Research Group, Department of Pharmacognosy and Pharmaceutical Botany, Faculty of Pharmacy, Charles University, Heyrovského 1203, 500 05 Hradec Králové, Czech Republic

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Beta-glucans derived from yeast and medicinal mushrooms are potent immunomodulators of both innate and adaptive immunity. Beta-glucans are heterogeneous polysaccharides composed of glucose polymers that exhibit variable activities due to different molecular weights, structures, frequencies of branching and solubility. The basic unit in β-glucans, β-(1→6)-branched β-(1→3) glucohexaose, is reported to play a key role in anti-tumor activity. Yeast (1→3)-β-glucan activates various immune cells, including macrophages and neutrophils, leading to increased production of interleukin (IL), cytokinin and special antibodies. This comprehensive stimulation of the immune system prepares the body to better fight against diseases. In addition, yeast (1→3)-β-glucan restores the ability of lymphocytes to produce cytokines such as IL-1 and effectively regulates immune function. Many experiments have indicated that yeast (1→3)-β-glucan promotes the production of IgM antibodies, improving humoral immunity. Furthermore, beta-glucan not only affects the immune system but may also reduce cholesterol levels. In fact, major physicochemical properties of beta-glucan include their antioxidant effects, which are involved in the scavenging of reactive oxygen species and their role as dietary fibre, subsequently preventing the absorption of cholesterol. Due to the above facts, beta-glucans are becoming extremely popular as dietary supplements. There are a number of these products on the Czech market, but their quality varies greatly. The lecture will summarize information that is important for choosing a quality dietary supplement containing beta-glucans.

Natural products in 3D printing of medicines

Touraj Ehtezazi* and Satyajit D. Sarker

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Three-dimensional printing (3DP) is an additive manufacturing method that provides the opportunity to create and produce pharmaceutical dosage forms with outstanding properties that cannot be achieved by conventional techniques. The fast disintegration time of Spritam tablet (within 5 seconds) is an excellent example. 3DP has also been employed for the formulation of fast-dissolving oral films (FDFs) and medicated gummies to improve medication adherence in children. We have employed fused deposition modelling (FDM) for the formulation of FDFs containing linalool. As conventional FDM degrades/evaporates approximately 50%-60% of linalool content when printing at 150°C, we evaluated direct printing by FDM, eliminating the need to produce filaments. This method allowed us to print films at 95°C, resulting in only 30% evaporation of linalool during printing. We also found that the incorporation of effervescent compounds in the formulation of linalool FDFs reduced the film disintegration time from approximately 80 seconds to 50 seconds. In other experiments, we examined the use of natural products in the formulation of medicated gummies, such as basil seed filaments. These filaments modified the viscoelastic properties of the formulations; however, this method was hampered due to the requirement of freeze-drying to obtain the basil-seed filaments, which prevented investigation of higher basil-seed filament concentrations. The addition of corn starch made the formulations more resistant to mechanical stresses, allowing for better handling. We identified an inconsistency in printed medicated gummies due to the significant temperature gradient within the printhead. In conclusion, direct printing by FDM allowed the production of FDFs with higher linalool content. Additionally, improvements in the design of gel 3D printers are required to reduce the formation of significant temperature gradients in the printer head to enable the use of this manufacturing method in clinical settings.

Natural and unnatural products targeting antimicrobial resistance

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Antimicrobial resistance (AMR) is among the most pressing global health threats in the 21st century. It is estimated to be directly responsible for the annual loss of more than one million deaths by the WHO and a GDP loss of $1 trillion by 2030 by the World Bank. Historically, natural products were the most important source of leads for antimicrobial drug discovery, although the clinically approved agents were often optimised semisynthetic or fully synthetic analogues. I will discuss recent efforts within my group to discover novel antimicrobial agents through the isolation and total synthesis of natural products of plant and marine origin.

Combating cancer: Natural products and pseudo-natural products-based strategies underpinned by medicinal chemistry

Hidayat Hussain*

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It has been reported that natural products (NPs) have an excellent track record in the discovery of lead compounds to treat various human diseases. A characteristic feature of natural products is their chemical diversity, which is created by a sequence of enzymatic reactions in the producing organisms. The phytochemical investigations of *plants* and *fungi provided* a continuous supply of the natural products of interest, but with a limited number of their derivatives. Moreover, synthetic chemists are applying rational approaches to the generation of lead-like libraries to achieve increased potency, broader biological activity, and fewer side effects and thus, several clinically important NP-derived derivatives have reached the market. We have isolated several natural products (*viz.*, triterpenes, polyketides, and phenazines) from fungi and plants, which have interesting chemical diversity. Following the natural product-inspired diversity-oriented synthesis strategy, various derivatives of these bioactive natural products have been prepared with the objective of obtaining compounds with greater anticancer effects. A detailed discussion about natural and synthetic chemical diversity and their role in anticancer drug discovery will be presented.

Acute/sub-chronic toxicity evaluation and insecticidal activity of marigold essential oil

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The persistent drive among farmers to prevent or reduce crop losses from insect infestations often leads to the widespread use of insecticides on their farms. While this approach has historically been effective, research has revealed that residues of synthetic insecticides can remain in harvested produce long after these chemicals are applied. Some of the compounds found in these synthetic insecticides have been linked to negative health impacts in humans, prompting increased caution regarding their use. In response to these growing concerns, there has been a marked increase in research focused on organic and plant-derived alternatives for effective pest management, particularly solutions that can simultaneously mitigate health risks, preserve ecological balance, and enhance the international marketability and exportability of agricultural products. Among the promising botanical candidates, *Tagetes erecta* (marigold) and its essential oil have recently gained significant attention in agricultural and pharmacological communities for their diverse bioactive properties and potential medicinal applications. This presentation will provide a comprehensive analysis of the phytochemical profile of marigold essential oil, detailing its primary constituents, including monoterpenes and sesquiterpenes through GC-MS characterization. It will present original research findings from our laboratory on both the safety profile and efficacy aspects of this essential oil. The safety evaluation encompasses acute toxicity assessment using established protocols and sub-chronic toxicity monitoring with emphasis on haematological, biochemical, and histopathological parameters in model organisms following extended exposure periods. Additionally, it will demonstrate the insecticidal and repellent properties of the essential oil against key agricultural pests, including detailed mortality rates, repellence indices, and comparative efficacy metrics against conventional synthetic alternatives. Through this examination, we aim to illuminate the efficacy and safety of marigold essential oil as a sustainable alternative for pest control in agriculture.

A phytochemical beauty hidden in the carnation family – a case study of corncockle and relatives

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Plants from the *Caryophyllaceae* family are widely known for their saponin content. Many of them are also abundant in type 1 ribosome-inactivating proteins (RIP) that are postulated to act in concert with certain saponins in boosting the RIPs toxicity by facilitating cell entry. In addition to the well-known triterpenoid saponins and RIP, there is a high content of flavonoid *C*-glycosides, such as orientin, that may render interesting pharmacological properties beyond the saponin/RIP-related toxicity. Despite this richness, plants of this large family have not found a broader use in phytomedicine, with only a few examples of popular herbs such as soapwort, rupturewort or chickweeds. For example, an ancient and almost forgotten annual weed - *Agrostemma githago* L., once notorious for contaminating cereal grains, stands out for its notable combination of RIP and triterpenoid glycosides. Nowadays, modern weeding practices have nearly eradicated this plant, to the point where it is now considered endangered. In history, some records were known of using *A. githago* in both official and folk medicine, but all are scarce and lack coherent information. Currently, the seeds are being marketed for use in blooming meadows in urban environments. In this paper, the state-of-the-art in phytochemistry of corncockle and selected other representatives from Caryophyllaceae will be presented, as well as some outlooks into using the biotechnological approach to understand the mechanisms of production and regulation of the major classes of phytochemicals and bioactive proteins.

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Natural products as anti-inflammatory interventions in pharyngitis (sore throat)

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Bacterial and viral pathogens are the major causes of infections and complications in the respiratory system. Viral causes of pharyngitis (sore throat) are usually rhinovirus and influenza, while *Streptococcus pyogenes* is the most common cause of bacterial pharyngitis in children and adults. Although antibiotics offer some benefits for sore throats, the rate of antibiotic prescribing for this condition remains high, with the resultant antibiotic resistance. It has been established that the discomfort experienced with a sore throat is due to inflammation and pain in the oropharyngeal mucosa. To address this, the use of oral non-steroidal anti-inflammatory drugs (NSAIDs) and corticosteroid sprays has been recommended. However, these are associated with significant side effects. Consequently, natural products with anti-inflammatory effects provide a safer and sustainable strategy to relieve the inflammation in sore throats. Investigations to identify plant extracts with potential anti-inflammatory activity for sore throat employed an *in vitro* model involving human tonsil epithelial (HTEpiC) cells challenged with a combination of lipoteichoic acid (LTA) from *Streptococcus pyogenes* and peptidoglycan (PGN) from *Staphylococcus aureus*. Release of pro-inflammatory mediators and proteins (PGE_2, COX-2, LTB_4, TNFα, IL-6, IL-1β and IL-8) was measured in HTEpiC cells treated with extracts from *Garcinia kola, Andrographis paniculata*, *Picralima nitida,* and *Zanthoxylum zanthoxyloides*. The presentation will discuss the results from these investigations and their implications for the use of plant extracts in the symptomatic treatment of sore throat. Results of experiments to identify the potential molecular targets of the anti-inflammatory effects of these extracts will also be presented.

Unlocking cellular secrets: The role of natural products in modern science

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Natural products are privileged skeletal scaffolds that have been "optimized" over hundreds of thousands of years for their biological activity. Unsurprisingly, these compounds are once again becoming the focus of the scientific community in the search for new biologically active species. Over the past decade, various natural products and their derivatives have become a source of new drugs. The identification of such drug candidates has propelled advancements not only in the domain of organic synthesis, through the determination of structures via total synthesis and the development of new synthetic methods, but also in the field of non-destructive analytical methods, pushing the limits of detection and the ability for advanced 3D structural determination. Furthermore, these developments have enabled the creation of new molecular probes that have been successfully used to reveal the mechanisms of action of various molecules and plant hormones. In this presentation, I will showcase several recent examples from our research group, illustrating how projects oriented towards natural product synthesis have led to the development of new synthetic methods. These methods have enabled the synthesis of previously inaccessible synthetic scaffolds, which in turn have allowed us to design new biological probes. These probes have been instrumental in elucidating, or at least shedding light on, the mechanisms of action of various biological processes. The talk will primarily focus on two key areas: the development of gibberellin late-stage biosynthesis antagonists and the role of elusive nitro-fatty acids as NRF2 activators. Achieving these goals required the development of several novel synthetic methods that control stereochemical outcomes in both 2D and 3D space.

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New chemopreventive phytochemicals: The search continues...

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Phytochemicals represent the largest class of chemicals that are currently being investigated for the ability to treat cancer (chemotherapy) and prevent cancer (chemoprevention). This intense interest is justified by the continued extensive use of vinca alkaloids, taxol, etoposide, and camptothecin for cancer treatment. Cancer chemoprevention describes the process of using a chemical to prevent cancer; however, many chemopreventive phytochemicals, which can activate important cellular defence pathways, can also activate pathways that lead to the development of cancer drug resistance. At the cellular level, this seemingly divergent consequence of phytochemical stimulation can be distilled down to the effects of one transcription factor, NF-E2 p45-related factor-2 (Nrf2), which induces the expression of over 200 genes involved in both cellular protection and cancer drug resistance. To discover new phytochemicals with cancer chemopreventive capability, we have utilised a cell-based assay to identify phytochemicals with the ability to activate Nrf2. In this presentation, our recent efforts to investigate the delicate balance that phytochemicals play in cancer will be considered.

Using assembly-line strategies for the synthesis of natural products: Enantioselective total synthesis of tatanan A

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Iterative strategies are highly attractive for the synthesis of complex molecules and natural products. In particular, the iterative homologation of boronic esters is a valuable method, as it avoids the need for functional-group manipulations between chain-extension steps. This process involves the repeated addition of chiral building blocks, resulting in carbon chains bearing multiple contiguous stereogenic centres. This assembly-line approach enables the construction of extended chains of vicinal stereocentres with complete control over both relative and absolute stereochemistry. An iterative lithiation–borylation approach was employed in the stereoselective total synthesis of the sesquilignan natural product tatanan A, which was isolated from the rhizomes of *Acorus tatarinowii* Schott. This compound has been reported to exhibit potent glucokinase-activating properties, making it a promising lead for the development of antihyperglycaemic drugs. Three contiguous stereocentres were installed with high enantio- and diastereoselectivity. Stereospecific alkynylation of a hindered secondary benzylic boronic ester enabled completion of the synthesis in just eight steps.

Exploring the antidiabetic potential of lemon balm using network pharmacology and molecular docking

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Diabetes mellitus (DM) is a chronic metabolic disorder primarily characterised by hyperglycaemia. Type-2 diabetes mellitus (T2DM), usually associated with obesity, is the most prevalent type of DM worldwide. If left untreated or poorly controlled, DM increases the risk of severe vascular complications. DM is a global public health crisis for which lifelong conventional treatments present adverse side effects and, for some, limited effectiveness. Around 75% of all DM cases occur in middle- and low-income countries, where medicinal plants, easily accessible and more affordable than conventional treatments, are used as the primary treatment option. These plants are also gaining popularity in scientific research as an attractive source for the discovery of new antidiabetic drug templates. *Melissa officinalis* L. (Lamiaceae), also known as lemon balm, is a medicinal and culinary plant growing in many parts of Europe, Western Asia, and North Africa. This species is used traditionally for various diseases, including DM. Several *in vitro*, *in vivo,* and randomised clinical studies have demonstrated its antidiabetic activity. Few, however, have explored its antidiabetic targets and mechanisms of action at the molecular level. Previous studies have highlighted the successful application of network pharmacology/molecular docking in elucidating the multimodal activities of phytochemicals in complex diseases, including DM and its complications. To the best of our knowledge, no work on the antidiabetic potential of *M. officinalis* using network pharmacology/molecular docking has ever been undertaken. This talk will present an overview of the antidiabetic effects of medicinal plants/phytochemicals and the author's findings on the molecular targets and mechanisms of antidiabetic action of *M. officinalis* aerial parts in T2DM using network pharmacology and molecular docking. These findings enhance our understanding of the antidiabetic potential of *M. officinalis* and underscore the need for further studies on this medicinal plant in search for future antidiabetic agents.

Established antibacterial drugs from plants

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Plants hold great promise as a source of novel antimicrobial agents due to a wide variety of chemically and structurally diverse secondary metabolites generally grouped into terpenoids, phenolics and polyphenols, and alkaloids. Historical records and modern investigations highlight the importance of plant products in treating bacterial diseases. Though there are a plethora of antibacterial compounds originating from plants, only a small number of them have already been examined under clinical trials. Plants make up only a tiny percentage of the current repertoire of FDA-approved antibacterial drugs (contributing just 3%). Therefore, the current percentage of approved antibacterial drugs from plants does not accurately reflect the potential of plant natural products for future applications as antibacterial therapies. In part, there are some inherent difficulties in the development of plant natural products as antimicrobial pharmaceuticals, including, among others, their incredibly chemically complex and the rediscovery of the same compounds from various sources. This talk will offer a compelling overview of prominent plant-based antibacterial drugs and compounds, highlighting their significance in modern medicine. It advocates for the integration of ethnobotanical and experimental approaches in the quest for innovative antibacterial drug discovery, exploring diverse mechanisms of action and identifying innovative targets for future research. Furthermore, the discussion addresses the critical implications of toxicity and safety associated with herbal medicines while showcasing notable patents related to phytochemicals and plant-derived treatments for bacterial infections. This comprehensive examination aims to inspire further exploration and investment in the potential of natural compounds in combating resistant bacterial strains.

Prenylated substances with therapeutic potential

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The phenolics are a group of plant secondary metabolites biosynthetically derived from shikimic acid and/or polyketide pathways. The hydroxyls of phenolics are commonly substituted with one or more sugar units. The sugar unit can also be connected via a C-C bond. The aglycones can be lipophilic; their lipophilicity can be further enhanced by methylating the hydroxyl groups or by prenylation or geranylation at various positions on the skeleton. The prenyl or geranyl moiety may also be modified in diverse ways. Experimental in vitro and in vivo studies have revealed many biological and pharmacological activities of prenylated. The process of identifying a particular structure-activity relationship is complicated, especially in vivo, because prenylated phenolics can have pleiotropic effects that target many cellular proteins or mechanisms. Prenylated phenolics show pleiotropic effects and can modulate a broad spectrum of inflammatory regulatory nodes. Their antiphlogistic action combines many effects. The antiphlogistic action of prenylated phenolics can be mediated by several pathways: via antioxidant and pro-oxidant effects, by interacting directly with pro-inflammatory proteins, and by interacting with signal pathways and inhibiting the expression of inflammation-related genes. The lecture will introduce some prenylated phenols with potential to be used as drugs for inflammation-related diseases and will show some perspectives in their research.

Acknowledgement: The work was supported by the Czech Science Foundation project GA23-04655S, Role of prenylation and glycosylation patterns in anti-inflammatory activity and metabolism of natural phenolic compounds.

Novel cryptolepine analogues active against gametocyte and asexual stages of *Plasmodium falciparum*

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New antimalarial drugs are urgently required due to the increasing resistance of *Plasmodium falciparum* to currently used antimalarial agents, including artemisinin derivatives. In addition, the eradication of malaria will require drugs that are able to block malaria transmission between the human host and the mosquito vector. The roots of the West African climbing shrub, *Cryptolepis sanguinolenta* (Lindl.) Schltr. (Apocynaceae) are used traditionally in West Africa for the treatment of malaria and other infectious diseases. The roots contain the indoloquinoline alkaloid cryptolepine (**1**), which has been shown to have moderate oral antimalarial activity in mice but is also potentially toxic due to its DNA-intercalating property; in addition, **1** has been reported to have modest activity against stage 3-4 malaria parasite gametocytes. The synthetic cryptolepine analogue, 2,7-dibromocryptolepine (**2**), is 10-fold more active than **1** *in vitro* against *P. falciparum* (drug-resistant strain K1), does not intercalate into DNA, and is superior to **1** in other respects. However, **2** has been found to inhibit the HERG ion channel, indicating that it may be cardiotoxic and therefore not suitable for clinical use. In this presentation, recent progress towards cryptolepine analogues that are active against gametocytes as well as asexual stages of *P. falciparum*, but less likely than **2** to be HERG inhibitors, will be discussed.

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Short Talks

From ancient seeds to modern approaches: Phytochemical profiling of chia seeds and beyond for functional food valorisation

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Salvia hispanica L., commonly known as chia, has emerged as a valuable crop in the food industry, recognized for its rich dietary fibre content, functional properties, and nutraceutical potential. Traditionally cultivated by ancient civilizations such as the Mayans and Aztecs, chia is gaining global recognition for its health-promoting properties, such as antihypertensive and antioxidant activities. Our research aims to investigate the metabolic profiling of natural and mutant genotypes of chia, assess the adaptability of mutant varieties to high latitudes, and explore the potential of its by-products under different agronomic management. Using advanced spectroscopic techniques (NMR, GC-MS, and LC-MS), chemometric analyses, and molecular networking, we profiled the metabolome of natural genotypes of chia and its early flowering mutants (G3, G8, G17, W13.1) in different parts of the plant, including seeds, leaves, stems, and flowers. Significant genotypic differences were observed between seeds in omega-3 fatty acids, polyphenols, flavonoids, and amino acids, highlighting opportunities for varietal selection to enhance nutraceutical properties. Early-flowering genotypes, particularly G8 and G17, stood out for their high omega-3 and polyphenol content, positioning them as promising resources for food and feed applications. Beyond seeds, our investigation of chia leaves using molecular networking of LC-HRMS data revealed distinct flavonoid profiles, including vitexin and orientin derivatives. Additionally, flowers and stems showed potential as sources of antioxidants, omega-3 fatty acids, and flavonoids. Notably, chia flowers exhibited strong antioxidant activity, suggesting novel uses for these plant parts. This research highlights how the genetic selection coupled with a comprehensive metabolic profiling can drive varietal innovation in *Salvia hispanica* L., while supporting both local biodiversity preservation and global nutraceutical markets.

Anticancer potential of *Juniperus phoenicea* L. and *Ruta chalepensis* L. against lung cancer cells (A549)

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Lung cancer is a leading cause of cancer-related deaths worldwide. To explore potential therapeutic options, the cytotoxic effects of two Libyan medicinal plants, *Juniperus phoenicea* L. (Fam: Cupressaceae), and *Ruta chalepensis L.* (Fam: Rutaceae), were investigated against lung cancer cells using the MTT assay. The dichloromethane (DCM) and the *n*-hexane extracts from *J. phoenicea* leaves exhibited significant cytotoxicity against the lung adenocarcinoma cell line (A549) with IC_{50} values of 16 and 13 µg/mL, respectively. Three biflavonoids (cupressuflavone, amentoflavone, and sumaflavone) and four diterpenoids (13-*epi*-cupressic acid, imbricatholic acid, 3-hydroxy-sandaracopimaric acid, and dehydroabietic acid) were isolated from the different fractions of *J. phoenicea*. Cupressuflavone and sumaflavone displayed the highest cytotoxicity against lung cancer cells with IC_{50} values of 65 and 77 µM, respectively. On the other hand, the extracts of *R. chalepensis* aerial parts were also investigated, and the DCM extract showed the most potent cytotoxicity against A549 cancer cells, with an IC_{50} value of 55 µg/mL. Eleven known compounds were isolated from the different fractions of *R. chalepensis,* including three alkaloids (graveoline, 4-hydroxy-2-nonyl-quinoline, and kokusaginine), three coumarins (bergapten, chalepin, and chalepensin), two flavonoid glycosides (rutin and methoxy rutin), one sinapoyl glycoside, one alkane (tetradecane), and a dehydromoskachan derivative. All the isolated compounds were assessed for cytotoxicity against the lung cancer cell line A549. Chalepin and 4-hydroxy-2-nonyl-quinoline showed good cytotoxicity against the lung cancer cells with IC_{50} values of 92 and 97.6 µM. The cytotoxicity of each compound was compared with the anticancer drug, etoposide (IC_{50} = 61 µM). These findings highlight the potential of *J. phoenicea* and *R. chalepensis* as sources of cytotoxic compounds against lung cancer cells. Chalepin, 4-hydroxy-2-nonyl-quinoline, cupressuflavone, and sumaflavone hold promise for future lung cancer research and drug development efforts.

Evaluation of cancer chemopreventive activity of *Claoxylon longifolium* via activation of the Nrf2 in AREc32 cells

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Nrf2 is a cytoprotective transcription factor that regulates the expression of many antioxidant and detoxifying enzymes. Undoubtedly, activation of Nrf2 is beneficial in cancer prevention. To date, many natural compounds have been identified as Nrf2 activators. *Claoxylon longifolium* (Euphorbiaceae) has been used in southern Thai traditional medicine and cuisine. A bioassay-guided approach was adopted to investigate the phytochemicals and chemopreventive potential of this species. Dried leaves and stems were ground separately and sequentially Soxhlet-extracted with *n*-hexane, dichloromethane, and methanol (MeOH) followed by fractionation using solid-phase extraction and compound isolation and purification using analytical, semi-preparative, and preparative reversed-phase HPLC. The structural elucidation of isolated compounds was achieved by NMR spectroscopy and mass spectrometry. The chemopreventive effects of crude extracts, fractions, and isolated compounds at non-cytotoxic concentrations were evaluated for Nrf2 induction potential using a luciferase assay in AREc32 cells. The MeOH extracts of stems and leaves were the most active with 38.9 and 24.9-fold induction of luciferase activity (relative to control), respectively. GC-MS analysis revealed that the major constituents present in the active stem fractions were fatty acid methyl esters. Bioassay-guided isolation led to the identification of six known compounds from active MeOH fractions, including caffeic acid, hexadecanoic acid methyl ester, isovitexin and vicenins 1-3. All identified and isolated compounds were reported for the first time from this species. Vicenin 1 was considered a potent chemopreventive compound as it increased luciferase activity by 2.3-fold. *In silico* studies on the *C*-glycosyl flavones revealed the potential of these compounds as cancer chemopreventive and chemotherapeutic agents. This study generated the first report on the chemopreventive properties of *C. longifolium*. The findings of a recent study indicate that *C. longifolium* contains promising chemopreventive agents, supporting the utilisation of this local plant in cancer prevention and consumption for health benefits in the southern Thai community.

The flavonoid chrysosplenol D inhibits the proliferation and invasiveness of triple-negative breast cancer and castration-resistant prostate cancer cells

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Breast cancer and prostate cancer rank among the leading causes of cancer death in females and males, respectively. Triple-negative breast cancer (TNBC) and castration-resistant prostate cancer (CRPC) are subsets of breast cancer and prostate cancer, respectively, which are regarded as difficult-to-treat cancers, due to their associated chemoresistance. Finding an effective treatment for them is, therefore, an unmet clinical need. Chrysosplenol D (CSD), a flavonoid isolated from *Artemisia annua*, has shown anticancer potential in different forms of cancer. Therefore, in this study, we evaluated the cytotoxic and anti-invasiveness effects of CSD in TNBC and CRPC. A TNBC cell line (MDA-MB-231) and a CRPC cell line (PC3) were treated with CSD up to 100 µM, after which viability was estimated using the 3-(4,5-Dimethylthiazol-2-yl)-2,5-Diphenyltetrazolium Bromide (MTT) assay. The results were validated using the Alamar blue and the CellTiter-Glo assays. CSD's potential to inhibit invasiveness in the cell lines was investigated using the scratch assay. Based on the MTT assay, CSD's cytotoxic IC_{50} in MDA-MB-231 was 15.99±1.27 µM and 3.96 µM for 48 h and 72 h, respectively, and 2.11±1.02 µM and 0.71 µM in PC3 for 48 h and 72 h, respectively, while based on Alamar blue and CellTiter-Glo the values were 37.84 µM and 14.43 µM, respectively, following 72 h exposure. CSD's cytotoxic IC_{50} values for PC3 were 1.45 µM and 1.33 µM, based on Alamar blue and CellTiter-Glo, respectively, following 72 h exposure. CSD also inhibited the migration of MDA-MB-231 and PC3 cells when assessed up to 48 h. The results indicate that CSD is potently cytotoxic against both TNBC and CRPC model cell lines, although more potent against the CRPC model. It also exhibits anti-metastatic potential. We are now gaining further insights into the potential anticancer efficacy and mechanisms of CSD in both TNBC and CRPC.

Traditional plant fabricated biogenic metal-oxide nanoparticles: Unveiling a new avenue for green sustainable nano-biomedicine development

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The emergence of nanotechnology has reshaped the field of biomedicine, contributing revolutionary therapeutic strategies and diagnostic tools. However, the wild methods of nanoparticle synthesis involve hazardous chemicals and energy-intensive processes, posing health hazards and environmental concerns. Wild approaches suffer from the challenging concern of stability, sustainability, and biocompatibility. Designing eco-friendly nanoparticles has become a persistent necessity. Synthesis of inorganic metal oxide nanoparticles offers a better alternative for handling different health complications in nano-biomedicine. But environmental biodegradation hinders its long-term stability. Ethnic botanicals, rich in potential phytochemicals, render a favourable solution for fabricating biogenic metal-oxide nanoparticles (BMNPs). This technique influences the reducing and capping properties of plant extracts to synthesize stable BMNPs, showcasing unique physicochemical properties. This nanocomposite makes them suitable for various biomedical applications, including targeted drug delivery, imaging, and pharmacological therapy. The present study aims to provide a comprehensive overview of the ethnic plant-mediated synthesis of BMNPs, highlighting their potential for green sustainable nano-biomedicine, emphasizing Indian traditional-plant extract plugged metal-oxide nano-phytopharmaceutical formulation, including their probable challenges and future scopes in this emerging field for industrial scale-up. The current investigation framed a model of zinc-oxide nanoparticles (ZnO-NPs) fabricated by *Acmella paniculata* flower extract. UV-VIS spectroscopy (λ_{max} at 251 nm), DLS assessed particle-size (630nm), FT-IR spectroscopy showing a sharp peak at 1076 cm^{-1} due to the reference compound, spilanthol, and zeta potential value (-5.8 mV) unravel its sustainable standardisation. Morphological characterisation of the AP-ZnONPs analysed by XRD, FESEM-EDAX, TEM, and DSC techniques was found to be inspiring for standardisation. AP-ZnONPs displayed remarkable IC_{50} of 28.57, 34.58, 41.01, 71.45 µg/ml for *in vitro* DPPH antioxidant, H_2O_2 radical scavenging, anti-protein denaturation, and α-amylase inhibition activity, respectively. It showcased efficient photocatalytic degradation of Rhodamine B by 45.84% within 60 minutes. The study suggests that AP-ZnONPs could be used as a potential bio-remedial agent and nano-biomedicine for treating inflammation, diabetes, compared to empty ZnONPs.

Nature's toolkit reloaded: Microbial genes engineered into plants for next-gen natural products

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Natural products have long served as vital sources of bioactive compounds, yet their sustainable production remains a global challenge. This talk will present my contributions to natural product discovery and biosynthesis through innovative plant metabolic engineering, with a focus on omega-3 long-chain polyunsaturated fatty acids (LC-PUFAs), the active ingredients of fish oil. I will first describe the discovery and functional characterisation of the first elongase gene identified in marine microalgae, an enzyme essential for LC-PUFA biosynthesis. By elucidating its specific role in elongating fatty acid precursors, this work unlocked a key bottleneck in the pathway. Using synthetic biology, I integrated these microalgal elongase and two desaturase genes derived from microalgae and fungi to engineer the model plant *Arabidopsis thaliana* as the first plant capable of synthesising fish oil. This breakthrough not only demonstrated the feasibility of reconstituting complex metabolic pathways in plants but also established a versatile platform for natural product discovery. The subsequent translation of this system into the oilseed crop *Camelina sativa* enabled scalable, land-based production of omega-3 oils, now commercially deployed in America for sustainable salmon feed. This modular approach, combining gene discovery, functional validation, and pathway engineering, provides a blueprint for harnessing plant systems to produce diverse high-value natural products. By mining microbial genes and deploying them in engineered crops, we can produce novel compounds, from fish oils to vaccines, while reducing reliance on environmentally destructive and costly platforms. This work underscores the power of interdisciplinary strategies to bridge natural product discovery with sustainable biomanufacturing, offering solutions to pressing challenges in food security, aquaculture, and green technology.

Anticancer properties of a bergamot derivative in malignant blood cells

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Acute myeloid leukaemia (AML) is a haematological malignancy characterized by the accumulation of undifferentiated myeloid cells ("blasts") in the bone marrow with consequent impairment of the hematopoiesis process. Thereby, the blockage of cell differentiation has been considered a critical hallmark of AML. In this regard, the use of pro-differentiating agents revolutionized the AML therapy, yet is associated with severe side effects. This prompted a search for new and safer candidates within the plant kingdom, such as flavonoids, thus tracing the route towards the study of more complex flavonoid-rich sources, such as *Citrus bergamia* (bergamot) derivatives. Therefore, this study aimed to evaluate the capability of a flavonoid-rich extract of bergamot juice (BJe) to exert antileukaemic effects in THP-1 monocytes, by acting as a potential inducer of cell differentiation. The cell treatment with BJe exerted anti-proliferative effects, by significantly reducing the growth and viability of THP-1 cells with a concentration- and time-dependent trend. These effects were ascribed to differentiation processes within the cell. Indeed, the cell exposure to BJe induced the differentiation of THP-1 cells, as witnessed by changes in cell adhesion and morphology, as well as after treatment with phorbol 12-myristate 13-acetate (PMA), which is a known pro-differentiating agent used as a positive control. In turn, the BJe-treated cells displayed an increased expression of differentiation-associated surface antigens, such as CD11b, CD14, and CD68. Interestingly, the cell differentiation induced by BJe in leukaemia THP-1 cells promoted their autophagic cell death. Indeed, BJe treatment significantly enhanced the protein levels of autophagy-related markers, such as Beclin-1 and LC3, as well as BJe induced the phosphorylation and the subsequent activation of autophagy regulators, such as JNK, ERK, and p38 kinases. Our study shows the antileukaemic effects of BJe by unveiling its pro-differentiating properties in the context of AML.

The discovery and characterisation of natural byproduct produced from blended plants mixtures

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Organosulfur compounds found in edible plants such as garlic (*Allium* spp.) and cruciferous vegetables (*Brassica* spp.) are widely recognized for their antimicrobial, antioxidant, and anticancer properties. Upon cellular disruption, *Allium* species produce allicin via alliinase-mediated conversion of alliin, while *Brassica* species hydrolyze glucosinolates into isothiocyanates through the enzyme myrosinase. These reactive thiol intermediates play vital roles in plant defence and human health. This project aimed to explore where these reactive intermediates could be used to generate novel antimicrobial natural products when both cruciferous and alliin plants are crushed and extracted as a mixture. Specifically, sinigrin and glucoraphanin were selected as model glucosinolates, and allicin was used as the reactive sulphur donor from garlic. The reactions were conducted under mild aqueous conditions (phosphate buffer, pH 6) and monitored by ^{1}H-NMR and HSQC NMR spectroscopy. Distinct new signals were observed, indicating the formation of previously unreported compounds. Following isolation by preparative HPLC, two novel compounds were structurally characterized using 1D and 2D NMR techniques, high-resolution mass spectrometry, and single-crystal X-ray diffraction. The compounds, named alligrin (from sinigrin and allicin) and alliphanin (from glucoraphanin and allicin), represent a new class of organosulfur natural products. Preliminary antimicrobial assays demonstrated that both alligrin and desulfo-alligrin exhibit significant inhibitory activity against selected bacterial strains. This work highlights a novel strategy for discovering bioactive compounds through plant metabolites interactions, offering a new dimension to natural product research. The findings provide a strong rationale for further biological evaluation and open new avenues for the development of plant-based antimicrobial agents.

Posters

Evaluation of Egyptian Figs for Cancer Chemopreventive Potential

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Egypt has a rich flora of medicinal plants. Some of these plants offer both medicinal and nutritional benefits. Among them are various types of figs, such as *Ficus carica* (common fig), *Opuntia ficus-indica* L. (Barbary fig), and *Ficus sycomorus* (sycamore fig), all belonging to the family Moraceae. These figs are known to be rich in bioactive natural products, including antioxidant compounds. Based on their traditional uses and phytochemical diversity, as reported in the literature, it was hypothesised that these figs may support cancer chemoprevention. This approach is considered one of the most promising strategies in the fight against cancer. The selected figs were collected in Egypt, shed-dried, ground, and extracted using Soxhlet extraction. The process involved sequential use of n-hexane, dichloromethane (DCM), and methanol (MeOH). The resulting extracts are being tested for their ability to activate Nrf2, a key regulator of cellular defense, using MTT and luciferase assays. These tests aim to evaluate their potential in cancer chemoprevention. Currently, reversed-phase high-performance liquid chromatography (HPLC) is being used to chemically profile the extracts. This will be followed by preparative HPLC to isolate active compounds. Their structures will then be elucidated using one-dimensional (1D) and two-dimensional (2D) nuclear magnetic resonance (NMR) spectroscopy and mass spectrometry (MS). This poster presents an overview of the progress made in this ongoing research project.

Deciphering the anticancer and anti-inflammatory potential of steroidal saponins derived from *Avena sativa* L.

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Avena sativa L. (oats) is a cereal crop rich in bioactive phytochemicals, particularly steroidal saponins. This project explores the anticancer and anti-inflammatory properties of steroidal saponins isolated from the aerial parts of *Avena sativa* L. Avenacoside A and avenacoside B, major saponins from *Avena sativa*, possess amphiphilic structures enabling interactions with cellular membranes, disruption of tumor cell integrity, and modulation of key inflammatory and oncogenic pathways. Their influence on cytokine production and enzyme activity underpins their immunomodulatory potential. Advanced extraction, fractionation, and characterization methodologies were employed, including bioassay-guided isolation, flash chromatography, HPLC, NMR, and LC-HR-ESI-MS. Functional assays assessed cytotoxicity against selected cancer cell lines and anti-inflammatory effects using LPS-stimulated macrophages. Preliminary results highlight the promising therapeutic value of these saponins. This study contributes to the understanding of cereal-based bioactive ingredients, supporting their potential development as novel therapeutic agents.

Cytotoxic and protective activities of *A. atemoya* crude extracts

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Primary liver cancer ranks as the sixth most diagnosed cancer worldwide and is the third leading cause of cancer-related deaths. Hepatocellular carcinoma (HCC) is the most prevalent type, accounting for 75 to 85% of liver cancer cases, and is the second leading cause of cancer-related deaths. The primary risk factors for developing HCC include chronic hepatitis B or C infections, obesity, excessive alcohol consumption, smoking, exposure to aflatoxin-contaminated foods, and type 2 diabetes. Systemic therapies for advanced HCC are required, and natural products, such as herbal extracts or pure compounds, have garnered attention from scientists as potential alternative anti-cancer agents. In recent years, the *Annona* species have been the focus of much interest for their anticancer activities. *Annona atemoya,* also known as the custard apple, is a hybrid between two Annonaceae species: Cherimoya (*Annona cherimola*) and the sugar apple (*Annona squamosa*). It is widely cultivated in tropical and subtropical continents, including North and South America, Asia, Africa, and Australia. The biological activity of *A. atemoya* crude extracts was examined using Huh-7 cell line. Results from this study indicated that only two crude extracts, LH and SEY, displayed anti-cancer activity in Huh-7 cells, with IC_{50} values of 67.21 and 22.55, respectively. Both extracts exhibited a dose-dependent inhibition of cell viability within 24 hours, as assessed by the MTT assay. For the remaining crude extracts that did not demonstrate cytotoxic effects, their protective effects were studied against PA. Most of these extracts were found to block PA by increasing the levels of anti-apoptotic proteins like Bax and Bim, while reducing the levels of pro-apoptotic proteins such as Bcl-XL and Mcl-1.

Bioprospecting for drug discovery from the plant kingdom (*Garcinia caudiculata)*

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Natural products are important sources for drug discovery, offering a wide variety of compounds from animals, marine organisms, fungi, bacteria, and plants. Among them, plants are rich in bioactive metabolites and are a main source for developing new therapeutic agents. In the plant kingdom, the Clusiaceae family includes about 400 species of *Garcinia*. Many of these species are native to tropical regions and have received strong scientific interest due to their production of secondary metabolites such as xanthones, flavonoids, and terpenoids. This study focuses on *Garcinia caudiculata*, a species that has not been studied extensively. Previous research reported two meroterpenoids: a new compound called caudiquinol and a known benzofuranone derivative. Building on these findings, our research aims to further investigate the chemical profile of *G. caudiculata*, identify new bioactive compounds, and evaluate their potential pharmacological activities. Leaves of *G. caudiculata* (300 g) were extracted with ethanol and ethyl acetate to collect polar and semi-polar metabolites. The crude extracts were first separated using Vacuum Liquid Chromatography (VLC). Bioassay-guided fractionation was then used to select the bioactive fractions. These active fractions were further purified by preparative High-Performance Liquid Chromatography (HPLC). The structures of the isolated compounds were identified by Nuclear Magnetic Resonance (NMR) spectroscopy and Mass Spectrometry (MS). We identified three main compounds: a known benzofuranone, isovitexin, and chlorogenic acid. These compounds are recognized for their antioxidant, anti-inflammatory, and antimicrobial activities. These findings add new knowledge to the phytochemistry and pharmacology of *Garcinia* species and show that *G. caudiculata* is a promising source of novel natural therapeutic agents.

Natural product-producing microbes from the marine environment

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One of the world's most difficult challenges is antimicrobial resistance (AMR), which threatens a century of medical advancement. AMR has had an explosive rise on a worldwide scale, and a faster-than-expected transfer from one nation to the next. The number of fatalities from drug-resistant illnesses currently accounts for 700,000 annually worldwide, and if persistent efforts are not made to manage this, deaths from AMR may rise to 10 million by the year 2050. The discovery of penicillin in the 20th century marked the beginning of microbial drug discovery. Microorganisms became an important source of novel antibiotic secondary metabolites. These secondary metabolites are secreted into the surrounding environment depending on different environmental cues, which may change microbial metabolism, consequently affecting the types of extracellular metabolites. This study aims to discover novel metabolites to overcome the issue of AMR. Fourteen water and four sediment samples were collected from a lake at the University of East Anglia and the River Yare in Norfolk, UK—areas that remain unexplored for microbial diversity. From these samples, approximately 80 fungal colonies were isolated using potato dextrose agar with the antibiotic ampicillin at 28°C. Antimicrobial activity of secondary metabolites from these isolated colonies was assessed using agar diffusion assay against two test microorganisms (Gram-positive Staphylococcus aureus and Gram-negative Escherichia coli). Fungal isolates demonstrating zones of inhibition were selected for metabolite extraction. These crude extracts are being analysed to determine the bioactive compound. Additionally, five fungal colonies were inoculated in PDA and oatmeal media to investigate any differences in metabolites, using liquid chromatography-mass spectrometry. Next, work will optimize metabolite yield and diversity by: (1) cultivating isolates on different media to activate silent biosynthetic gene clusters, and (2) co-culturing microbial strains to stimulate production of novel natural products.

Development of nasal drop prototypes containing *Origanum vulgare* L. and *Eucalyptus globulus* L. / *Eucalyptus citriodora* L. essential oils against upper respiratory tract infection pathogens

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In this study, effective binary combinations of standardized *Origanum vulgare* L. and *Eucalyptus globulus* L. / *Eucalyptus citriodora* L. essential oils were prepared and incorporated into carrier systems. *In vitro* antimicrobial activities were evaluated against pathogens associated with upper respiratory tract infections (URTIs). While individual preparations of these plants have been used to treat sinusitis, this study marks the first development of phytotherapeutic formulations specifically effective against URTI pathogens. Essential oils were standardized using GC-FID and GC-MS. According to GC-MS results, *O. vulgare* oil contained carvacrol (61.8%) and *p*-cymene (11.5%); *E. globulus* oil was rich in 1,8-cineole (30.9%), *α*-pinene (11.4%), and *β*-pinene (11.4%); and *E. citriodora* oil was dominated by citronellal (79.9%). Antimicrobial activity was assessed with MIC determination (broth microdilution) against *Staphylococcus aureus* (ATCC 25923), *S. epidermidis* (ATCC 14990), *S. mutans* (ATCC 25175), *S. pneumoniae* (ATCC 10015), and *Moraxella catarrhalis* (ATCC 23245). Checkerboard assays and FICI values identified additive effects. Based on *in vitro* results, the most active combinations were incorporated into *in situ* gel formulations. Toxicity and irritation tests on cell cultures revealed no toxicity. Essential oils alone showed limited activity; however, some combinations produced additive effects, particularly *against S. mutans* and *S. aureus*. The triple combination (*O. vulgare* × *E. globulus* × *E. citriodora*) exhibited the highest and broadest antimicrobial activity. However, activity against *M. catarrhalis* and *S. pneumoniae* was weak or absent, indicating the need for further optimization. Compared to tetracycline, the triple blend showed comparable or superior inhibition against *S. mutans* and *S. aureus*, highlighting its potential as a natural antimicrobial alternative.

Bio-inspired synthesis of steroidal heterocyclic hybrids as neuroprotective agents

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Neurodegenerative diseases, especially Alzheimer's and Parkinson's, are on the rise, affecting millions of people worldwide. Despite the severity of these disorders, current drug therapies are rarely curative. These diseases are caused due to complex mechanisms such as protein misfolding, oxidative stress and chronic inflammation, which contribute to progressive cognitive and motor decline. Many naturally occurring compounds, including alkaloids, polyphenols, and terpenoids, have shown neuroprotective effects by reducing oxidative stress, preventing protein aggregation, and modulating inflammatory pathways. Among them, natural neurosteroids like dehydroepiandrosterone (DHEA) have attracted attention for their antioxidant, anti-inflammatory, and neuroregenerative properties. Moreover, various synthetic DHEA-like compounds featuring different heterocyclic groups have demonstrated strong neuroprotective activity. Their structural diversity offers promising candidates for the development of new therapeutic agents targeting neurodegenerative diseases. This research aims to design, synthesise, and evaluate novel DHEA-heterocyclic hybrids as potential neuroprotective agents. After synthesis, structural characterisation will be performed using NMR and LC-HRESI-MS techniques. The resulting analogues will be screened through bioassays on G418-selected HEK-293 cells expressing P2X receptors. The findings from this work are expected to support the development of novel neuroprotective compounds and contribute valuable insights towards new treatment strategies for neurodegenerative diseases.

Evaluation of the anti-inflammatory effect of three *Trigonella* species

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Trigonella foenum-graecum (TFG), known as fenugreek, a plant cultivated in Turkey is utilized for various purposes. It has been traditionally used for its galactagogue, and anti-inflammatory effects. While there are numerous studies in the literature on fenugreek, detailed investigations on some endemic species widely grown in Turkey are lacking. The subject of this article is to investigate the possible anti-inflammatory effects of the aerial parts of the aqueous extract of TFG and 2 endemic species (*T. macrorrhyncha*-TM and *T. kotschyi*-TK). The aerial parts of the plants were extracted with 80% methanol. The combined extracts were dissolved in water and partitioned with petroleum ether. Anti-inflammatory potential of the aqueous extract, and trigonelline, a major alkaloid of *Trigonella* species, and indomethacin were determined on LPS-induced RAW 264.7 macrophages via proinflammatory cytokines: nitric oxide (NO), interleukin-6 (IL-6), interleukin-1β (IL-1β). Cytotoxic activities of the tested samples on RAW 264.7 cells were also examined by the MTT method. The concentrations of the extracts (20-500 µg/mL), trigonelline (2-100 µM), and indomethacin (2-200 µM) were selected for the study. The samples, except TK, maintained over 70% cell viability at all tested concentrations. None of the extracts reduced IL-6 levels. However, TFG significantly reduced the production of NO and IL-1β levels at the concentrations of 50-100 µg/mL, whereas TM induced a marked reduction only in nitrite levels. Trigonelline at the concentrations of 50 and 100 µM, selectively reduced IL-1β levels. Indomethacin significantly reduced nitrate and IL-1β levels at concentrations of 100–200 µM. As a result of the experiments, it was concluded that the aqueous extract of the aerial parts of the traditionally used plant for its anti-inflammatory effect, and that the two Turkish endemic species, investigated for the first time, demonstrated mild anti-inflammatory effects.

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Glioblastoma-targeted peptide carriers derived from natural proteins for microRNA delivery

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Glioblastoma (GBM) is an aggressive and difficult-to-treat brain cancer. It is known for its resistance to standard therapies and the challenges in effectively delivering treatments across the blood-brain barrier (BBB). In this research, we are developing self-assembled peptide-based nanoparticles (NPs) designed to deliver miRNA directly to glioblastoma cells, and glioblastoma stem cells, targeting tumour growth and improving therapeutic outcomes. These NPs are specifically engineered to cross the BBB, allowing for precise delivery of the treatment while minimising potential side effects. We designed peptide-based nanocarriers by generating tandem fusions of naturally occurring peptide sequences that (a) can traverse the BBB and enter GBM cells (b) can bind to small RNAs and other oligonucleotides, which are designated as NBTPs. The gel-agarose retardation assay demonstrated encapsulation of miRNA by NBTPs with an N/P ratio of 7. The Ang-NPs successfully delivered TAMRA-miRNA into U251 glioblastoma cells, which was confirmed by a confocal microscopy analysis. NBTPs were loaded with several miRNAs, which demonstrated apoptosis of the glioblastoma cells by the MTT assay. Using certain miRNAs, the cell viability was significantly reduced to 50% of the untreated cells. Such significant reduction of cell viability was not observed in glioblastoma stem cells; however, NBTPs significantly reduced the cell viability by 75% compared to the untreated cells. NBTPs themselves also showed cell toxicity at concentrations above 100 µg/mL. In conclusion, NBTPs are promising for targeting glioblastoma cells and glioblastoma stem cells.

Electron paramagnetic resonance spectroscopy: A powerful tool in natural product research

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Electron paramagnetic resonance (EPR) spectroscopy is a powerful analytical technique increasingly applied in natural product research to probe the properties of plant extracts and their constituent compounds. Recent studies have used EPR to generate both qualitative and quantitative data on radical species, including the assessment of radical scavenging capacity, singlet oxygen detection, and direct observation of semiquinone radicals within complex mixtures. Additional applications involve investigating autooxidation processes and photochemical behaviours relevant to bioactivity. The current emphasis lies in evaluating antioxidant potential through radical scavenging assays, supported by a diverse range of experimental methods that can be adapted to specific biological contexts. While the use of EPR for detecting semiquinone radicals has diminished, the continued interest in quinone-containing plant metabolites and the growing accessibility of benchtop EPR instruments present renewed opportunities. Advances in EPR technology now allow for higher-resolution measurements, offering new possibilities for exploring the chemical and functional properties of natural products.

Nature-inspired materials for biomedical applications

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The interest in natural polymers as materials for biomedical applications has increased exponentially over the recent years. Polysaccharides and proteins from plant, microbial or animal sources have been widely used to obtain biocompatible materials for regenerative medicine, from wound healing to tissue engineering applications. Although natural polymers suffer from a higher degree of batch-to-batch variability compared with their synthetic analogues, they offer mechanical and chemical cues that promote cell migration, differentiation, and growth. In addition, post-isolation modifications by chemical or physical methods allow tuning the structural and mechanical properties of these species to render them suitable for a palette of applications. A further advantage of natural polymers arises from the fact that they are generated from renewable sources and often obtained through more environmentally friendly processes. Here we aim to showcase the potential of different naturally sourced materials, ranging from mucilage obtained from seeds (e.g., chia, basil, flax) to obtain self-standing hydrogels, to wool keratin and cortical cells to obtain rigid materials (bioplastic), to plant proteins (zein, soy hydrolysate) as components for scaffold for bone regeneration. We describe different chemical and fabrication approaches to tailor the properties of the resulting material.

Isolation and determination of alpha- and beta-bitter acids in hops and nutraceuticals

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Humulus lupulus has a long history of being used as a medicinal plant. Numerous phytochemical constituents and secondary metabolites of the hops extract have been studied for their potential therapeutic and cosmetic use. It is most importantly suggested to help alleviate anxiety and insomnia. In Chinese medicine, hops are used to treat insomnia, diarrhoea, and lack of appetite. In addition, alcoholic extracts of the plant have been used to treat tuberculosis, leprosy, and dysentery in the past. In the last decade, a wide range of pharmacological studies have been conducted on the use of individual hop components. These studies were aimed at producing scientific proof of its traditional use. The effects of the plant on the central nervous system have been studied repeatedly in laboratory animals. However, the results of the studies are sometimes contradictory. *In vivo* studies in rats have shown that the extract of hops containing alpha acids has mainly sedative effects, and the beta acids show antidepressant activity. A wide range of nutraceuticals contains hop extract in various amounts. It can also be found in different dosage forms. However, the quantities of bitter acids are not mentioned in many descriptions of the supplements. To obtain standards of bitter acids, hop pellets were extracted with the use of LLE, followed by flash chromatography, and preparative LC-MS. Fractions were monitored by HPTLC and GC-MS. To elucidate the concentration of bitter acids, a monitoring method was developed, optimised, and tested on commercially available nutritional supplements and beer samples.

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Anti-inflammatory effects of ethanolic extract from *Sansevieria cylindrica* Bojer ex Hook. on macrophages via inhibition of TNF-α, IL-1β, IL-6, iNOS, and COX-2 expression

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Inflammation is the immune system's response to infection and injury. The tissue inflammatory response releases several inflammatory mediators. Prostaglandins (PGs) play a key role in the generation of the inflammatory response. The inflammatory mediators include inflammatory PGs derived from cyclooxygenase-2 (COX-2), such as PGE_2, and nitric oxide (NO) derived from inducible nitric oxide synthase (iNOS)]; as well as pro-inflammatory cytokines produced by the host inflammatory cells [such as tumour necrosis factor-alpha (TNF- α), interleukin-1 beta (IL-1β), and IL-6]. The traditional uses of *Sansevieria cylindrica* Bojer ex Hook. across diverse cultures highlights its significant ethnomedicinal value. Phytochemical studies of *S. cylindrica* leaf extract revealed the presence of steroidal saponins, coumarins, and flavonoids. It has been traditionally applied for the treatment of inflammation, wounds, and systemic ailments. This research aimed to determine the anti-inflammatory effects of the ethanolic leaf extract from peeled *Sansevieria cylindrica* (PSC). The ethanolic extract of PSC was prepared using a microwave-assisted extraction (MAE) method in an *in vitro* model. In this study, we investigated the molecular mechanisms underlying the anti-inflammatory effect of PSC in lipopolysaccharide (LPS)-stimulated RAW 264.7 macrophage cells. The gene expression levels of pro-inflammatory cytokines (TNF-α, IL-1β, and IL-6) and inflammation-inducible enzymes (iNOS and COX-2) were significantly reduced after treatment with PSC (25-100 μg/ml) in LPS-induced RAW 264.7 macrophage cells. Moreover, PSC inhibited NO production as well as their responsible mRNAs in a dose-dependent manner. The findings of this study demonstrated that *S. cylindrica* possesses anti-inflammatory activities, suggesting that PSC may be a potential therapeutic agent for inflammation-related diseases.

Bioactive biopolymer production from Halotolerant yeast *Rhodotorula dairenensis*

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In this study, the exopolysaccharide (EPS) production of *Rhodotorula dairenensis*, isolated from hypersaline environments (Acıgöl, Turkey), was investigated. EPS production was optimized using the Box-Behnken experimental design. The EPS, partially purified via a dialysis membrane, was analyzed for total carbohydrate and protein content, as well as the presence of uronic acid. Structural and functional group analyses were conducted using NMR and FT-IR, while surface morphology and elemental composition were examined using SEM-EDS. The antioxidant activity was determined using the DPPH method, while the cytotoxic activity of the EPS was assessed using the MTT method in the HaCaT (keratinocyte) cell line. The viability of HaCaT cells was studied at concentrations ranging from 61.5 to 125 µg/mL. It was determined through the halotolerance test that *R. dairenensis* is a halotolerant fungus adapted to extreme environments with high salt concentrations. By optimizing the medium conditions for EPS production, yields were approximately six times higher than those obtained under non-optimized conditions (2.61 g/L). The obtained EPS were partially purified by dialysis and further analyzed, revealing that the EPS contained 51.1% carbohydrate, 0.047% protein, and 0.17% uronic acid, respectively. The polysaccharide structure, characterized by β-configuration linked via glycosidic bonds, was identified through FT-IR and NMR analyses. Surface morphology and elemental composition, including sulphur (indicative of sulphate groups), were detected through SEM-EDS analysis. The IC_{50} value for cytotoxic activity, reflecting 50% cell viability, was found to be 295 µg/mL. The antioxidant activity exhibited an IC_{50} value at an EPS concentration of 1 mg/mL. The structural properties of the obtained EPS, along with its demonstrated antioxidant and cytotoxic activities, suggest that this compound may be considered a potential biomaterial for industrial applications.

Reduction of inflammation in A549 lung epithelial cells by *Eucalyptus globulus* leaf extract

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Lower respiratory tract infections caused by bacteria and viruses, including the recent COVID-19, are associated with severe lung inflammation. The use anti-inflammatory drugs such as the NSAIDs and corticosteroids in treating conditions resulting from lung inflammation has been associated with significant side effects. However, the COVID-19 pandemic has resulted in renewed focus on the use of herbal remedies and natural products to treat inflammatory symptoms associated with lower respiratory tract infections. The oil from *Eucalyptus globulus* is widely reputed for its benefits for treating infections and inflammation of the upper and lower respiratory tract. Consequently, in this study, the effect of an extract of *Eucalyptus globulus* was investigated in interleukin-1β (IL-1β)-induced increase in inflammatory cytokine production in A549 lung epithelial cells. The cells were treated with dried leaves extract (6.25 µg/ml, 12.5 µg/ml, 25 µg/ml, 50 µg/ml, and 100 µg/ml). They were then stimulated with IL-1β for 24 hours. Thereafter, culture supernatants were obtained. Levels of tumour necrosis factor-alpha (TNFα) and interleukin-6 (IL-6) in the supernatants were determined using human ELISA kits. Further, an MTT assay was performed to assess the viability of the cells. Results of MTT assay showed that the extract did not reduce the viability of the cells at all the concentrations investigated, with or without IL-1b stimulation. Anti-inflammatory experiments revealed that the extract (6.25 µg/ml, 12.5 µg/ml, 25 µg/ml, 50 µg/ml, and 100 µg/ml) produced significant ($p<0.05$) reduction in IL-1β-induced elevated production of TNFα. Similar results were obtained in experiments to assess the effects of the extract on IL-1β-induced increased secretion of IL-6. These results suggest that *Eucalyptus globulus* leaf extract has an anti-inflammatory effect in the lung and could be employed as a natural treatment for lung inflammation in respiratory tract infections.

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