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Editorial

RESEARCH ACTIVITIES IN THE CENTRE FOR NATURAL PRODUCTS DISCOVERY IN 2023

Jose M. Prieto[1], Alistair J. Fielding[1], Fyaz M. D. Ismail[1], Ismini Nakouti[1], Touraj Ehtezazi [1], Pattanathu K.S.M. Rahman [1], Amos A. Fatokun[1], Kenneth J. Ritchie[1] and Satyajit D. Sarker[1]

1. Centre for Natural Products Discovery (CNPD), School of Pharmacy and Biomolecular Sciences, Liverpool John Moores University, James Parsons Building, Byrom Street, Liverpool L3 3AF, United Kingdom.

In 2023, the Centre for Natural Products Discovery (CNPD) made significant strides in the scientific community through a series of impactful research initiatives. These efforts underscore our commitment to harnessing the world's natural resources to advance health. The fertile research environment at the CNPD has given rise to various sections, each contributing innovative and practical applications. Our goal here is to provide a concise overview of our research activities for the year. While this summary is not exhaustive, it focuses on the work of our section leaders, which in turn encompasses the contributions of numerous other researchers both within and outside the CNPD.

Natural Products Analysis

The leader for this section is Dr A. J. Fielding. His expertise in advanced techniques like electron paramagnetic resonance (EPR) spectroscopy sheds light on complex molecular structures and interactions. His recent work with colleagues explored the mechanisms of inverse vulcanization using EPR, offering valuable insights into this emerging field (Dale et al., 2023). He has also applied this expertise to develop electrochemical sensors for environmental pollutants like bisphenol E (Miller et al., 2023), showcasing the versatility of EPR for tackling real-world problems. Dr. Fielding's dedication to exploring the potential of natural products through cutting-edge analytical methods positions him as a leading figure in the field, and his contributions to publications like the inaugural issue of the Journal of Natural Products Discovery (Fielding, 2022) further solidify his expertise.

Natural Products Synthesis

The leader for this section is Dr F.M.D. Ismail. His work in Medicinal Chemistry tackles the age-old scourge of malaria, utilizing AI tools and advanced spectroscopic techniques like INADEQUATE to design superior antimalarials as well as offering new pathways for crafting nature-inspired molecules (Ismail, Nahar and Sarker, 2021).

Phytochemistry and Phytotherapy

Dr J.M. Prieto-Garcia, the leader of this section at the Centre for Natural Products Discovery (CNPD), has made significant advances in the fields of phytochemistry and phytotherapy in 2023.

In the realm of phytotherapy, Dr Prieto-Garcia has been mapping potential herb-drug interactions and translating the "language of plants" into treatments for various ailments. This work was highlighted in a scoping review published in Plants (Prieto-Garcia et al., 2023). He also collaborated on a study on how frankincense induces an oxidative burst in leukocytes (Dade et al., 2023). Furthermore, Dr Prieto-Garcia has been part of a team that explored the effects of dietary supplementation with yerba mate infusion on insulin sensitivity and secretion in rat pancreatic islets (Maiztegui et al., 2023).

Dr Prieto-Garcia has also been focusing on the cytotoxic effects of natural products on melanoma and prostate cancer cells, covering the cytotoxic effects of ferruginol analogues on human melanoma cells (Shao et al., 2023a), co-authoring a comprehensive review on the advances in molecular regulation of prostate cancer cells by top natural products of Malaysia (Hanafi and Prieto, 2023), studying the pro-apoptotic and anti-migratory effects of *Marantodes pumilum* extracts on human prostate cancer cell lines (Hanafi et al., 2023) and participating in the first attempt to model how natural compounds perturb the melanoma risk-gene network (Shao et al., 2023b).

Natural Products Pharmacology

The leader for this section is Prof. Amos Fatokun. His team unlocks the therapeutic potential of nature's pharmacy. His work also extends beyond national borders, as evidenced by his collaborative project to embed innovation and entrepreneurship into medical curricula abroad (funded by the British Council, £150,000). His collaborative work with some international partners has deployed a plant source to develop a novel lipophilicity assay, which has now been submitted by LJMU (on behalf of all collaborative partners) to the UK Patent Office (UKPO) for UK-wide and international intellectual property (IP) protection. This focus on knowledge sharing and capacity building paves the way for a future where the benefits of natural products reach every corner of the globe. Professor Amos Fatokun's work in 2023 spanned a wide range of topics at the chemistry-biology interface and involved collaboration with colleagues within the CNPD and internationally. The work includes the study of the toxicity of the methanol root extract of *Olax subscorpioidea* Oliv. in mice and rats (Adekunle et al., 2023a), the identification of cytotoxic triterpenoid saponins from the root of this plant (Adekunle et al., 2023b), as well as the discovery of ceibinin, a new positional isomer of mangiferin from the inflorescence of *Ceiba pentandra*, which has similar antioxidant effects, but no anti-inflammatory potential compared to mangiferin (Taiwo et al., 2023). In addition, Prof. Fatokun has been involved in the study of shikonin and juglone's inhibitory effects on *Mycobacterium tuberculosis* Mt-PTPa (Sulyman et al., 2023). Furthermore, he has contributed to the synthesis, spectroscopic characterization, and anticancer potential studies of organoruthenium (II) arene dithiocarbamate complexes (Paca et al., 2023). He also worked on the synthesis, crystal structure, and anticancer studies of organoruthenium (II) p-cymene N-phenyldithiocarbamate complex (Ajibade et al., 2023). Prof. Fatokun was also part of a team that formulated resveratrol into PGA-co-PDL nanoparticles to increase its cytotoxic potency against lung cancer cells (Muller et al., 2023). Lastly, he led the investigation that confirmed that *Cola rostrata* K. Schum. constituents induced cytotoxicity through reactive oxygen species generation and mitochondrial membrane depolarisation (Ajayi et al., 2023). This diverse range of research highlights Prof. Fatokun's extensive contributions to the field.

Natural Products Formulation and Delivery

Under the leadership of Dr. T. Ehtezazi, the team, including Dr. Alice P. McCloskey, is pushing the boundaries of natural product delivery by exploring cutting-edge techniques like 3D printing. Their collaboration with Alder Hey Children's Hospital is particularly noteworthy, as they investigate the use of 3D-printed teddy bears for medication delivery, a strategy that considers both practicality and the emotional well-being of young patients. This work exemplifies the CNPD's dedication to finding patient-centric solutions and improving healthcare experiences. Their expertise in pharmaceutical formulation is evident in their publications this year. They have published a study in this journal demonstrating the precision and accuracy of their analytical methods for optimizing 3D-printed fast-dissolving oral films (Ehtezazi et al., 2023a). In Pharmaceuticals (MDPI, Basel), they published research exploring innovative bioprinting techniques for creating more effective and patient-friendly drug delivery systems using Micro-Ribbons and Micro-Fibres in the Formulation of 3D Printed Fast Dissolving Oral Films (Algellay et al., 2023). They also published a review in Expert Review of Clinical Pharmacology on how 3D printing provides an alternative strategy for paediatric medicines, which highlights the potential of 3D printing to address the challenges of administering medication to children and proposes a compelling future for personalized medicine (McCloskey et al., 2023). They have also contributed to the understanding of the pathological effects of circulating hydrophobic bile acids in Alzheimer's disease in a comprehensive review published in Journal of Alzheimer's Disease Reports (Ehtezazi et al., 2023b).

Natural Products Toxicology

The leader for this section is Dr K. Ritchie. He is pioneering the use of modified breast cancer cells in Natural Products Toxicology to shed light on the cancer-preventative potential of phytochemicals, revealing promising candidates for future therapies (Radapong et al., 2021).

Microbial Natural Products

At the Centre for Natural Products Discovery (CNPD), the exploration of microbial natural products is a key area of focus. Dr. I. Nakouti leads this section, delving into the fascinating world of microscopic allies. Her research is centred on developing innovative antimicrobial nanoparticles, specifically those composed of hyaluronate and copper oxide. She also explores the intricate dialogue between microbes, offering the potential to prevent and cure infectious diseases by studying and modulating the mechanism of microbial communications.

Dr. Nakouti's significant contributions to the field are reflected in her publications this year. In the Journal of Environmental Chemical Engineering, she co-authored a paper on the bio-functionalization, stabilization, and potential functionalities of hyaluronate macromolecules capped copper oxide nanoparticles (Cherian et al., 2023). In Scientific Reports, she contributed to a study on the eco-friendly remediation of tetracycline antibiotic from polluted water using waste-derived surface re-engineered silica sand (Al-Hashimi et al., 2023).

Further, in Inorganic Chemistry Communications, she was part of a team that reported on the green synthesis of silver nanoparticles using *Andrographis macrobotrys* Nees leaf extract and its potential antibacterial, antioxidant, anti-inflammatory, and lung cancer cells cytotoxicity effects (Sivakumar et al., 2023). Lastly, in Construction and Building Materials, she co-authored a paper on biomineralisation to improve properties of polymer modified concrete for chloride environments (Mohammed et al., 2023). These diverse research efforts underscore CNPD's commitment to advancing the field of natural products discovery.

Nutraceuticals Functional Foods

The leader for this section is Dr Pattanathu Rahman. This dedication to finding answers in nature is exemplified by a recent collaboration, showcasing a green approach to plant pathogen control using rhamnolipid biosurfactant and fungal chitosan nanoparticles (Karamchandani et al., 2022). This innovation promises a more sustainable and eco-friendly future for agriculture. Dr Rahman's Biosurfactant related R&D work (Fox-Skelly, Rahman and Burgess, 2023) is included in Global innovators of Indian Origin category in the Top100 Indian Innovations- 2023 List. He was included in the List of World's Top 2% Scientists as of Oct 2023 (Ioannidis, 2023).

Concluding remarks

The accomplishments of the Centre for Natural Products Discovery (CNPD) send a clear message: pharmacy and biomolecular sciences are more than just academic disciplines; they are potent instruments for instigating positive change. At CNPD, our dedication to devising practical, impactful solutions to present and future health challenges embodies the spirit of LJMU, which is committed to actively assisting local communities, the nation, and the world. Amidst this rich tapestry of influential research, CNPD emerges as a distinctive strand, interlaced with expertise in all aspects of natural product research. This comprehensive approach, coupled with our steadfast commitment to promoting health through natural means, constitutes the true strength of CNPD. It bears testament to the collaborative ethos of LJMU, encapsulated in the concept of "Togetherness" that defines this university. As we bid farewell to 2023, we extend our warmest New Year wishes to you and invite you to contribute to our research by publishing in our platinum open access Journal of Natural Products Discovery, participating in our online conference between June 19-21, 2024 (https://ysm2018.wixsite.com/cnpd2024),or collaborating with us.

REFERENCES

Adekunle YA, Samuel BB, Ezeuduji JU, Adedokun OA, Oluyemi WM, Nahar L, Fatokun AA, Sarker SD. 2023a. Acute and sub-acute oral toxicity assessment of the methanol root extract of Olax subscorpioidea Oliv. (Olacaceae) in mice and rats South African Journal of Botany, 163 :157-164 DOI Publisher Url

Adekunle YA, Samuel BB, Nahar L, Fatokun AA, Sarker SD. 2023b. Cytotoxic triterpenoid saponins from the root of Olax subscorpioidea Oliv. (Olacaceae) Phytochemistry, 215 :113853-113853 DOI Author Url Publisher Url Public Url

Ajayi BE, Oboh B, Minari JB, Sexton DW, Sarker SD, Fatokun AA. 2023. Cola rostrata K. Schum. constituents induce cytotoxicity through reactive oxygen species generation and mitochondrial membrane depolarisation Exploration of Targeted Anti-tumor Therapy, 4 :1328-1344 DOI Publisher Url

Ajibade PA, Fatokun AA, Paca AM. 2023. Synthesis, crystal structure, and anticancer studies of organoruthenium(II) p-cymene N-phenyldithiocarbamate complex. Journal of Molecular Structure, 1292 DOI Publisher Url Public Url

Algellay M, Roberts M, Bosworth L, Sarker S, Fatokun AA, Ehtezazi T. 2023. The Use of Micro-Ribbons and Micro-Fibres in the Formulation of 3D Printed Fast Dissolving Oral Films. Pharmaceuticals, 16 DOI Author Url Publisher Url Public Url

Al-Hashimi O, Hashim K, Loffill E, Nakouti I, Faisal A, Marolt Cebasek T. 2023. Eco-friendly remediation of tetracycline antibiotic from polluted water using waste-derived surface re-engineered silica sand Scientific Reports, 13 :1-17 DOI Author Url Publisher Url Public Url

Cherian T, Ragavendran C, Remesh RKV, Jacob J, Jamal W, Kamaraj C, Nakouti I. 2023. Bio-functionalization, stabilization and potential functionalities of hyaluronate macromolecules capped copper oxide nanoparticles. Journal of Environmental Chemical Engineering, 11 DOI Publisher Url Public Url

Dade M, Prieto-Garcia JM, Francini F, Schinella GR (2023) Apoptotic Activity of *Boswellia carterii* Extract On Human Neutrophils. Journal of Natural Products Discovery, 2(3):1-9.

Dale JJ, Stanley J, Dop RA, Chronowska-Bojczuk G, Fielding AJ, Neill DR, Hasell T. 2023. Exploring inverse vulcanisation mechanisms from the perspective of dark sulfur European Polymer Journal, 195 DOI Publisher Url Public Url

Ehtezazi T, Kteich A, Abdulkarim R, Lynch R, Algellay M, McCloskey AP, Roberts M, Sarker SD. 2023. Quantification of Linalool in 3D Printed Fast-Dissolving Oral Films by A High-Pressure Liquid Chromatography Method Journal of Natural Products Discovery, 2 :1-9 DOI Publisher Url Public Url

Ehtezazi T, Rahman K, Davies R, Leach AG. 2023. The Pathological Effects of Circulating Hydrophobic Bile Acids in Alzheimer's Disease. Journal of Alzheimer's disease reports, 7 :173-211 DOI Author Url Publisher Url Public Url

Fielding A. 2022. Applications of Electron Paramagnetic Resonance Spectroscopy in Natural Product Research Journal of Natural Products Discovery, 1 DOI Publisher Url Public Url

Fox-Skelly J, Rahman P.K.S.M, Burgess G. 2023. Green Washing. Chemistry & Industry, 87 :30-33 Author Url Publisher Url

Hanafi MMM, Yaakob H, Gibbons S, Prieto JM. 2023. In Vitro Pro-Apoptotic and Anti-Migratory Effects of Marantodes pumilum (syn. Labisia pumila) Extracts on Human Prostate Cancer Cell Lines: Bioguided Isolation of 5-Henicosene-1-yl-resorcinol Plants, 12 DOI Author Url Publisher Url Public Url

Ioannidis, John P.A. (2023), “October 2023 data-update for "Updated science-wide author databases ofstandardized citation indicators”, Elsevier Data Repository, V6, DOI:10.17632/btchxktzyw.6, https://elsevier.digitalcommonsdata.com/datasets/btchxktzyw/6 (PDF) World Ranking of Top 2% Scientists (2023). Available from: https://www.researchgate.net/publication/374674898_World_Ranking_of_Top_2_Scientists_2023 [accessed Dec 28 2023].

Ismail FMD, Nahar L, Sarker SD. Application of INADEQUATE NMR techniques for directly tracing out the carbon skeleton of a natural product. Phytochem Anal. 2021 Jan;32(1):7-23. doi: 10.1002/pca.2976. Epub 2020 Jul 15. PMID: 32671944.

Karamchandani BM, Maurya PA, Dalvi SG, Waghmode S, Sharma D, Rahman PKSM, Ghormade V, Satpute SK. Synergistic Activity of Rhamnolipid Biosurfactant and Nanoparticles Synthesized Using Fungal Origin Chitosan Against Phytopathogens. Front Bioeng Biotechnol. 2022 Aug 9;10:917105. doi: 10.3389/fbioe.2022.917105. PMID: 36017342; PMCID: PMC9396382.

Maiztegui B, Villagarcía HG, Román CL, Flores LE, Prieto JM, Castro MC, Massa ML, Schinella GR, Francini F. 2023. Dietary Supplementation with Yerba Mate (Ilex paraguariensis) Infusion Increases IRS-1 and PI3K mRNA Levels and Enhances Insulin Sensitivity and Secretion in Rat Pancreatic Islets Plants, 12 :2620 DOI Author Url Publisher Url Public Url

McCloskey AP, Bracken L, Vasey N, Ehtezazi T. 2023. 3D printing–an alternative strategy for pediatric medicines Expert Review of Clinical Pharmacology, 16 :613-616 DOI Author Url Publisher Url

Miller AH, Nguyen HTT, Nery JG, Fielding AJ. 2023. Electrochemical sensor based on epoxy-functionalized BEA nanozeolite and graphene oxide modified glassy carbon electrode for bisphenol E determination Journal of Applied Electrochemistry, DOI Publisher Url Public Url

Mohammed H, Giuntini F, Simm A, Sadique M, Shaw A, Nakouti I, Bras A. 2023. Biomineralisation to improve properties of polymer modified concrete for chloride environments Construction and Building Materials, 379 DOI Publisher Url Public Url

Muller AG, Sarker SD, Fatokun AA, Hutcheon GA. 2023. Formulation of resveratrol into PGA-co-PDL nanoparticles increases its cytotoxic potency against lung cancer cells RPS Pharmacy and Pharmacology Reports, 2 :1-11 DOI Publisher Url Public Url

Paca AM, Benson SO, Fatokun AA, Ajibade PA. 2023. Synthesis, spectroscopic characterization and anticancer potential studies of organoruthenium(II) arene dithiocarbamate complexes Journal of Sulfur Chemistry, :1-12 DOI Publisher Url

Prieto JM, Hanafi MMM. 2023. Advances in Molecular Regulation of Prostate Cancer Cells by Top Natural Products of Malaysia Current Issues in Molecular Biology, 45 :1536-1567 DOI Author Url Publisher Url Public Url

Prieto-Garcia JM, Graham L, Alkhabbaz O, Mazzari ALDA. 2023. Potential Pharmacokinetic Interactions of Common Cardiovascular Drugs and Selected European and Latin American Herbal Medicines: A Scoping Review Plants, 12 DOI Author Url Publisher Url Public Url

Radapong S, Chan K, Sarker SD, Ritchie KJ. 2021. Oxyresveratrol modulates gene expression of cell cycle control, apoptosis, autophagy and DNA repair in MCF-7 cells Frontiers in Pharmacology, 12 DOI Author Url Publisher Url Public Url

Sarker SD, Al Groshi A, Nahar L, Evans AR, Ismail FMD. 2023. Can Ruta chalepensis from Libya treat cancer. International Conference on Biotechnology in Sustainable Development

Shao L, González-Cardenete MA, Prieto-Garcia JM. 2023a. In Vitro Cytotoxic Effects of Ferruginol Analogues in Sk-MEL28 Human Melanoma Cells International Journal of Molecular Sciences, 24 DOI Author Url Publisher Url Public Url

Shao L, Zhao Y, Heinrich M, Prieto JM, Manzoni C. Active natural compounds perturb the melanoma risk-gene network. G3 (Bethesda). 2023b Nov 30:jkad274. doi: 10.1093/g3journal/jkad274. Epub ahead of print. PMID: 38035793.

Sivakumar S, Subban M, Chinnasamy R, Chinnaperumal K, Nakouti I, El -Sheikh MA, Purusottapatnam Shaik J. 2023. Green synthesized silver nanoparticles using *Andrographis macrobotrys* Nees leaf extract and its potential to antibacterial, antioxidant, anti-inflammatory and lung cancer cells cytotoxicity effects Inorganic Chemistry Communications, DOI Publisher Url Public Url

Sulyman AO, Fulcher J, Crossley S, Fatokun AA, Olorunniji FJ. 2023. Shikonin and Juglone Inhibit Mycobacterium tuberculosis Low-Molecular-Weight Protein Tyrosine Phosphatase a (Mt-PTPa) BioTech, 12 :59-59 DOI Author Url Publisher Url

Taiwo BJ, Miller AH, Fielding AJ, Sarker SD, van Heerden FR, Fatokun AA. 2023. Ceibinin, a new positional isomer of mangiferin from the inflorescence of *Ceiba pentandra* (Bombacaceae), elicits similar antioxidant effect but no anti-inflammatory potential compared to mangiferin Heliyon, 10:e23335-e23335 DOI Publisher Url