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The Future of Pharmaceutics; showcasing emerging leaders in drug delivery.

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Drug delivery is inherently a multidisciplinary field, a nexus of synthetic and physical chemistry, molecular biology, pharmacokinetics, engineering, *in silico* modelling, imaging, and disease pathology, with progress traditionally driven by researchers in both academia and industry. The interdisciplinary nature of our work is exemplified by the rapid collaborative response to development of mRNA vaccines for COVID-19, where epidemiology, immunology, drug delivery, and manufacturing technology became common terms in our daily news cycles. Ours is a field rapidly expanding, and with it, our researchers become increasingly interdisciplinary, navigating multifaceted projects and adapting to new developments. This special issue was designed to showcase what the future holds through the work of talented emerging leaders in drug delivery.

As a team of early career editors, we compiled this special issue taking care to ensure representation from colleagues around the world, in different fields of research and in research contexts within academia and industry. Our intent was to engage a broad audience, to highlight important research topics and to platform the researchers who lead this innovative work. Immediately, unifying themes and focus areas at the forefront of drug delivery emerged, from advanced delivery of nuclear medicine, to *in silico* and *in vitro* models of drug solubilization and release.

Oral drug delivery and the establishment of predictive *in vitro-in vivo* correlations (IVIVC) remains an important goal for drug delivery researchers. In this special issue, multiple groups have tackled this problem using advanced *in silico* and in *vitro* techniques to aid understanding of drug uptake from the gastrointestinal tract. Computational fluid dynamics informed the work of Salehi et al[1], and Li et al[2], providing insight into the impact of dissolution and diffusion on drug solubilization and luminal absorption respectively. Orsuzlak et al[3], and Marks et al[4], report on the use of polymers and impact of polymer topology in the generation of amorphous solid dispersions for oral delivery. Gleeson and colleagues at Merck[5], demonstrate the utility of a gut-on-chip model of intestinal absorption in evaluating the impact of permeation enhancers on peptide uptake. This work on improving our understanding of oral IVIVIC is complemented by a detailed and insightful report from Galetin et al[6], who demonstrate the impact of free drug association with albumin on renal clearance. A study that will have a broad impact on many facets of drug delivery.

A second clear theme emerged from this special issue; understanding the impact of radionucleotide carrier design for the treatment of diseases. Larkina et al[7], investigated linker site and chemistry for ^{99m}Tc labelled DARPIN-G3 radiotracers, showing that relocating a chelator for the radionucleotide from the N terminus to C-terminus improved reaction efficiency but did not confer an advantage in imaging contrast in mice bearing HER2 positive ovarian cancer xenografts. Kang et al[8], demonstrated the diagnostic and therapeutic effect of radiolabelled VEGF-trap Aflibercept, in

the treatment of renal tumours in mice. This bifunctional fusion protein demonstrated utility in hypervascularised Renca tumours. In two complementary, but unrelated studies, Jiang and team[9], and Chen et al[10], investigated the use of the fibroblast activation protein inhibitor (FAPI-04) for targeting radiotracers to fibroblasts. The former developed a FAPI-maleimide which acted as an albumin 'hitchhiker' to enhance tissue distribution and tumour retention[9]. Chen et al, developed a heterobivalent probe using FAPI-04 and the somatostatin receptor-2 binding LM3 peptide to allow early detection of pulmonary fibrosis[10]. These radiotherapeutic approaches, from small molecule binders to VEGF fusion proteins, show the importance of chelator, carrier, protein position, bivalency and endogenous protein interactions on the success of radiotheranostic and therapeutic drug delivery design.

The third and final area of growing interest is highlighted by two articles. In the first, Agrawal and colleagues present a study on Hesperidin-loaded exosomes as a treatment for melanoma[11]. The second, a perspective article by Chi-An Cheng[12,] outlines the inherent challenges in developing robust methods to define and evaluate exosomes and extracellular vesicles (EVs) for drug delivery. This insightful article highlights the promise of EVs as personalised therapeutics and diagnostics, infinitely customisable trojan horses with huge potential, yet suffering from a lack of cohesive approaches to their generation, interrogation, and validation.

We hope you will agree that this virtual special Issue highlights a global network of emerging leaders in the pharmaceutical sciences, across both academia and industry. With insight into longstanding questions in drug delivery, such as predicting oral absorption from the gut, alongside new exciting ideas on the use of cell-derived drug carriers for treatment of diseases. The future of pharmaceutical sciences is bright, with emerging leaders ready to tackle pressing challenges and seize new opportunities. We look forward to witnessing their progress in the years to come.

References:

1. Comparative Evaluation of Dissolution Performance in a USP 2 Setup and Alternative Stirrers and Vessel Designs: A Systematic Computational Investigation. Niloufar Salehi, Jozef Al-Gousous, Bart Hens, Gordon L. Amidon, Robert M. Ziff, and Gregory E. Amidon. Molecular Pharmaceutics 2024 21 (5), 2406-2414
2. The Particle Drifting Effect: A Combined Function of Colloidal and Drug Properties. Da Hye Yang, Saeed Najafian, Bodhisattwa Chaudhuri, and Na Li. Molecular Pharmaceutics 2024 21 (11), 5510-5528
3. The Influence of PVP Polymer Topology on the Liquid Crystalline Order of Itraconazole in Binary Systems. Luiza Orszulak, Taoufik Lamrani, Roksana Bernat, Magdalena Tarnacka, Daniel Żakowiecki, Karolina Jurkiewicz, Patryk Zioła, Anna Mrozek-Wilczkiewicz, Andrzej Zięba, Kamil Kamiński, and Ewa Kamińska. Molecular Pharmaceutics 2024 21 (6), 3027-3039
4. 6-Carboxycellulose Acetate Butyrate: Effectiveness as an Amorphous Solid Dispersion Polymer. Joyann A. Marks, Brittany L. B. Nichols, Laura I. Mosquera-Giraldo, Sara T. Yazdi, Lynne S. Taylor, and Kevin J. Edgar. Molecular Pharmaceutics 2024 21 (9), 4589-4602
5. Head-to-Head Comparison of Caco-2 Transwell and Gut-on-a-Chip Models for Assessing Oral Peptide Formulations. John P. Gleeson, Stephanie Y. Zhang, Natalia Subelzu, Jing Ling, Becky Nissley, Whitney Ong, Rebecca Nofsinger, and Filippos Kesisoglou. Molecular Pharmaceutics 2024 21 (8), 3880-3888
6. Albumin-Mediated Drug Uptake by Organic Anion Transporter 1/3 Is Real: Implications for the Prediction of Active Renal Secretion Clearance. Shawn Pei Feng Tan, Annika Tillmann, Susan J. Murby, Amin Rostami-Hodjegan, Daniel Scotcher, and Aleksandra Galetin. Molecular Pharmaceutics 2024 21 (9), 4603-4617
7. Comparative Preclinical Evaluation of HYNIC-Modified Designed Ankyrin Repeat Proteins G3 for the 99mTc-Based Imaging of HER2-Expressing Malignant Tumors. Maria Larkina, Ruslan Varvashenya, Feruza Yuldasheva, Evgenii Plotnikov, Ekaterina Bezverkhniaia, Maria Tretyakova, Roman Zelchan, Alexey Schulga, Elena Konovalova, Anzhelika Vorobyeva, Mikhail Belousov, Anna Orlova, Vladimir Tolmachev, and Sergey Deyev. Molecular Pharmaceutics 2024 21 (4), 1919-1932
8. Enhanced Theranostic Efficacy of 89Zr and 177Lu-Labeled Aflibercept in Renal Cancer: A Viable Option for Clinical Practice. Zhao Chen, Qi Yang, Lele Song, Yongkang Qiu, Tianyao Wang, Sitong Wu, Wenpeng Huang, Xinyao Sun, Aixiang Wang, and Lei Kang. Molecular Pharmaceutics 2024 21 (5), 2544-2554
9. Development and Evaluation of DOTA-FAPI-Maleimide as a Novel Radiotracer for Tumor Theranostic with Extended Circulation. Lixia Feng, Wenzhu Hu, Xinying Zeng, Zheng Wei, Yu Long, Mengting Li, Si Sun, Zhide Guo, Xiaoli Lan, Xianzhong Zhang, Rongqiang Zhuang, and Dawei Jiang. Molecular Pharmaceutics 2024 21 (9), 4386-4394
10. Enhanced Detection of Early Pulmonary Fibrosis Disease Using 68Ga-FAPI-LM3 PET. Jianhao Chen, Doudou Luo, Yaqing Dai, Yangfan Zhou, Yizhen Pang, Hua Wu, Long Sun, Guoqiang Su, Qin Lin, Liang Zhao, and Haojun Chen. Molecular Pharmaceutics 2024 21 (7), 3684-3692
11. Enhanced Therapeutic Efficacy Against Melanoma through Exosomal Delivery of Hesperidin. Dulla Naveen Kumar, Aiswarya Chaudhuri, Deepa Dehari, Armin M. Gamper, Dinesh Kumar, and Ashish Kumar Agrawal. Molecular Pharmaceutics 2024 21 (6), 3061-3076
12. Before Translating Extracellular Vesicles into Personalized Diagnostics and Therapeutics: What We Could Do. Chi-An Cheng. Molecular Pharmaceutics 2024 21 (6), 2625-2636