

In this issue:

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Co-Editor in Chief Perspective: Othman Almusaimi

I have been honoured to be part of the PharmaSEL-Prosperity Partnership. Not only I was part of WP3, but as Co-editor in Chief, I was also regularly enjoying interacting with all people across all work packages! Featuring other researchers' achievements has been an achievement in and of itself for me. I believe in teamwork, and this was my main motivation to contribute to shedding light on others' research journey.

As a Co-editor in Chief, I have learnt a lot from this role, advanced my network, felt the story behind each piece of research featured, and most importantly the journey of featured early career individuals, as well as their motivation, challenges, and the dream each one of them is chasing up. I am truly grateful for the people who chose me for this job, in particular Claire and Cleo. Malak and I, in addition to the fantastic team including Jana and Angela started to shape the newsletter in July 2021. The story has been continued with our fantastic Co-editor in Chief Hamish! Tremendous efforts have been invested to deliver your newsletter in its current structure. Sal was always supportive, and his valuable input has really helped boost the quality of the newsletter. A BIG thank you to every and each one of who had a role in this brilliant endeavour.

As I am moving to the next chapter of my career, this issue is going to be my last one I am editing with Hamish, and Lucia will be taking over my role. I'm sure that having Lucia on board will be valuable for the newsletter. I would like to take the chance to urge people to give themselves an opportunity to explore such roles as they will definitely find it very useful for their career. Finally, I would like to thank all the people involved in this amazing collaboration, from whichever institute they come from.



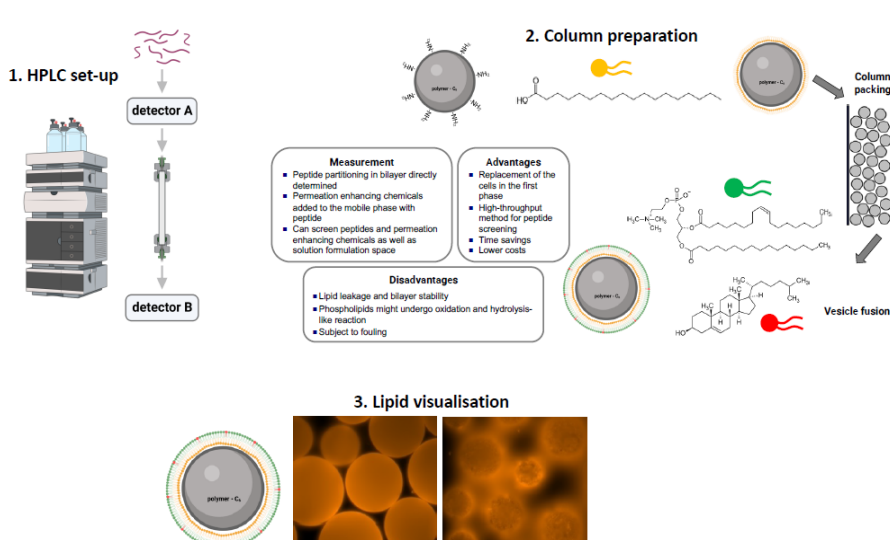
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Research Highlight: Understanding the mechanisms of peptide drug absorption via chromatography (Lucia Lombardi, WP4)

WP4 focuses on the following questions:

1. How can we accelerate the development and production of drugs based on peptides?
2. How can we improve the poor solubility of these drugs?
3. Is there a way to avoid injections but administer drugs orally? If so, how can the absorption at the gastric and intestinal levels be increased?
4. Can we also control and reduce the enzymatic degradation naturally occurring in the gastrointestinal tract?

Specifically, the project is based on the third question and on developing a method to accelerate understanding of the primary and essential mechanisms of peptide absorption. I am developing an analytical system based on chromatography. It consists of a homemade chromatography column, where the beads are chemically modified and then used to pack glass columns. The bead treatment allows to have a lipid layer, as a monolayer or bilayer, that mimics the cell membrane. By varying the lipid composition, I can simulate different cell membranes. The development started with a simple mixture composed of 1-palmitoyl-2-oleoyl-sn-glycero-3-phosphocholine (POPC), cholesterol and sphingomyelin (SM), which are the lipids representing the major constituents of eukaryotic membranes. Microscopic images performed with labelled lipids show the successful preparation of "lipid column". The system also has two detectors, before and after the column. This allows to accurately know how much has been injected into the column and how much passes through the column and to determine the partition coefficient.



Currently, a limited number of peptides have been chosen in order to maximise the chemical-physical variety, i.e. different hydrophobicity, charges, and linear and cyclic structures. As a future plan, the method will be investigated against a more extensive set of peptides. At the moment, optimising the chromatographic procedure is being carried out. Extensive work is being done to minimise elution times and to find the best elution solvents that is able to give the most information about the peptides in use. The optimisation process will also take the next few months before moving on to a more extensive set of peptides.

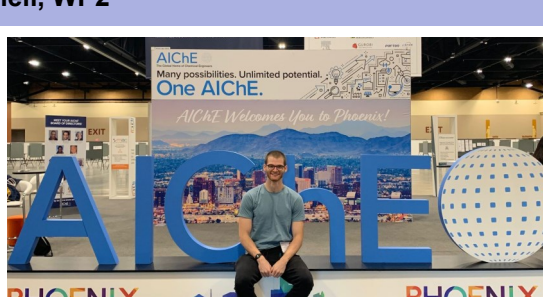
At the beginning, the methods were programmed to elute peptides for several hours, up to 24, but for the developed system, 3 hours seem to be enough to differentiate between peptides. Furthermore, various solvents have been tested. Ethanol proved to be the solvent that can give the most information without interfering or triggering the precipitation phenomena of peptides in the column.

This work couldn't have been achieved without the amazing collaborators from Lilly are Phenil Patel, Donald Risley and Aktham Aburub. We meet once a month and discuss data and experiments and the plan for the subsequent experiments. Collaboration is productive and effective.

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Researcher Spotlight: Hamish Mitchell, WP2

Hamish completed his master's degree in chemical engineering at Imperial College London in 2020, with his final year project focused on the use of neural networks as surrogates for mechanistic models and their use in design space exploration and characterisation. This project was supervised by Professors Nilay Shah and Benoit Chachuat, as well as receiving a lot of support from (now) Dr. Kennedy Kusumo. Unbeknownst at the time, this project became part of the work of WP5!



After finishing his undergraduate degree and in the chaos of the COVID-19 pandemic, Hamish decided to continue pursuing his interest in research by pursuing a PhD at Imperial. He joined the Prosperity Partnership in September 2020 with a focus on the application of peptide crystallisation as a purification strategy. His work focuses on three main topics: (1) attempting to purify single-chain peptides (~40 amino acid residues) via crystallisation, as well as structural determination via single crystal x-ray diffraction (2) Process modelling of crystallisation and parameter estimation of peptide nucleation and growth kinetics, and (3) the use of solid additives, termed 'heteronucleants', to expedite the crystallisation process. The PhD has been mostly experimental work, which is a change from the fully computational research project he did as part of his undergraduate degree, but has been a great opportunity to develop his experimental skillsets. As well as this, the opportunity for industrial collaboration throughout his work has been a great way to understand where the work he does in the lab fits into the wider scope of the project and pharmaceutical production as a whole.

Alongside his research, Hamish also enjoys working as a graduate teaching assistant within the Department. As he has completed the undergraduate course himself, he has a strong grip of what is expected from each module and has been teaching modules such as process analysis, fluid mechanics, and various design projects since the start of his PhD. He has also helped with numerous MSc and final-year research projects, as well as outreach events and summer camps such as the London International Youth Science Forum.

Upon completion of his PhD (scheduled for late 2024), Hamish is currently undecided as to whether to continue to pursue research, teaching, or industry, and is keeping his options open.

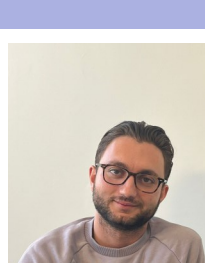
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Awards



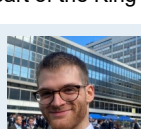
Eva Sorensen

Has been awarded an MBE for her services to education and chemical engineering as part of the King's Birthday Honours list.

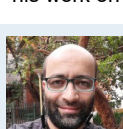


Kostas Katsoulas

Came in 2nd place at the IChemE 'What's New in Fluid Separations?' symposium for his work on in-silico optimisation of HPLC.



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