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| הפקולטה להנדסה כימיתע"ש וולפסון |  |  |
| The Wolfson Department of Chemical Engineering |  |  |

**Wolfson Department of Chemical Engineering Seminar**

**Monday, July 15th, 2024 at 13:30**

**Room 4**

**Memory in Reconfigurable Capillary Networks**

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Capillary networks are ubiquitous in nature and biology. Understanding these networks is fundamental to comprehending vascular systems in animals, capillary networks in plants, and has extensive applications in medicine and science. However, many questions remain about how these networks regulate and control flow. While we grasp the general principles of capillary networks and their functions, ongoing research explores how these networks dynamically respond to changes, adapt to varying conditions, and whether they retain memory of past states. Establishing a model system of capillary networks allows us to ask new and exciting questions, such as: "Do capillary networks have memory?"

Creating a model system of capillary networks in nature presents two main challenges. First, the ability to dynamically change the nature of bonds in the networks and it influence transport. Second, designing networks that can evolve dynamically in response to external stimuli. Achieving these two aims could revolutionize our ability to reconfigure macroscale flow through the active control of local bonds in capillary networks.

Here, I propose a novel experimental model system of capillary networks, composed of hundreds of interconnected liquid diodes. Analogous to electric diodes, these microscale surface structures guide liquids in specific directions while preventing reverse flow. However, under certain conditions, liquid diodes can fail, allowing bidirectional flow. This introduces bonds of different natures into the capillary networks.

This system will enable us to determine whether the wetting state of the liquid in the network depends on the history of actuation—essentially, whether capillary networks can possess memory. This intriguing question opens a new realm of possibilities, such as the potential to encode information within capillary networks, understand how transport responds to external stimuli, explore the interplay between global actuation and local fluid dynamics, investigate the coupling between mechanics and flow, and elucidate how information propagates through capillary networks.

References:

(1) Sammartino, C.; Rennick, M.; Kusumaatmaja, H.; Pinchasik, B.-E. Three-Dimensional Printed Liquid Diodes with Tunable Velocity: Design Guidelines and Applications for Liquid Collection and Transport. Phys. Fluids 2022, 34 (11), 112113.

(2) Sammartino, C.; Shokef, Y.; Pinchasik, B.-E. Percolation in Networks of Liquid Diodes. J. Phys. Chem. Lett. 2023, 14 (34), 7697–7702. https://doi.org/10.1021/acs.jpclett.3c01885.