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הפקולטה להנדסה כימית
ע״ש וולפסון
The Wolfson Department of Chemical Engineering

Wolfson Department of Chemical Engineering Seminar

Tuesday, July 14th, 2026 at 11:00

Conference room, 3rd floor

Breast Milk Biomimetic Nanoparticles as a Versatile, Non-Invasive, Oral Drug Delivery Tool

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PhD Final Seminar

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Oral administration is the preferred route because it is convenience and non-invasive. However, most macromolecular therapeutics, including proteins, peptides, and nucleic acids, still require injections because they are degraded in the gastrointestinal (GI) tract and exhibit poor intestinal absorption. Interestingly, breast milk cells, despite being substantially larger than these therapeutic agents, can survive the harsh GI environment and cross the intestinal barrier during breastfeeding. Understanding this natural biological phenomenon may provide new strategies for overcoming the barriers to oral drug delivery.

In this work, we investigated the mechanisms underlying the GI transfer of breast milk cells and translated these insights into the development of breast milk-inspired biomimetic nanoparticles, termed “Milkosomes.” Using *in vivo* murine models, we characterized the transfer of maternal cells during breastfeeding and identified the cell populations capable of crossing the intestinal barrier. Building on these findings, we engineered Milkosomes and demonstrated their stability under simulated GI conditions, enhanced intestinal permeability *in vitro*, and favorable biodistribution following oral administration *in vivo*. In addition, we identified the breast milk protein corona as a key factor promoting nanoparticle interaction with the intestinal epithelium and facilitating transport across the intestinal barrier.

Together, these findings establish a new biomimetic strategy for oral drug delivery that bridges synthetic nanotechnology and naturally evolved biological mechanisms. This work lays the foundation for the development of non-invasive oral therapies for biologics and other macromolecular drugs. By improving bioavailability and reducing reliance on injections, Milkosomes have the potential to enhance patient compliance and treatment outcomes while opening new avenues for the treatment of GI and systemic diseases.