הטכניון - מכון טכנולוגי לישראל

TECHNION - ISRAEL INSTITUTE OF TECHNOLOGY

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

**Wolfson Department of Chemical Engineering Seminar**

**Monday, February 26st, 2024 at 14:00**

**Room 1**

# Breast Milk Biomimetic Nano-Particles as a Versatile, Non-Invasive, Oral Drug Delivery Tool

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**PhD Mid-Seminar**

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Oral delivery of therapeutic agents is the most patient-preferred route of administration because it is painless and convenient. Still, every day, millions of patients across the globe are subjected to injections of vaccines and multiple other drugs. The main reason for this is that macromolecular-therapeutic agents - such as messenger RNA and proteins, are subjected to enzymatic degradation, an extreme physiological condition in the gastrointestinal (GI) tract, and the impermeability of the intestine. Surprisingly, although cells are thousand-fold bigger than these large molecules, breast milk cells successfully survive the extreme conditions in the GI tract and cross the intestinal barrier to reach blood circulation safely. Understanding how breast milk cells cross the GI tract into our body can facilitate the development of a novel tool for the oral delivery of therapeutic agents. This research aims to develop an innovative strategy for oral drug delivery utilizing breast milk cells' unique properties. Through Fluorescence-Activated Cell Sorting (FACS) and RNA single-cell sequencing, maternal cell populations crossing the gastrointestinal (GI) tract are identified. "MILKOSOMES," biomimetic phospho-lipid nanoparticles, are engineered using NanoAssembler, characterized via dynamic light scattering (DLS) and transmission electron microscopy (TEM), and assessed for stability in simulated gastric fluids. *In vitro* and *ex vivo* studies confirm MILKOSOMES' stability and enhanced ability to cross the intestinal barrier. These findings highlight MILKOSOMES' potential as a transformative drug delivery platform, particularly for large molecular drugs, with implications for the oral administration of crucial medications like insulin and chemotherapy agents.