



Wolfson Department of Chemical Engineering Seminar

Monday, October 12th, 2026 at 13:30

Room 6

**Engineering Exosomal Volatile Organic Compounds for
Cancer-Associated Immune Modulation**

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PhD Seminar

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Tumors communicate with their surroundings through complex networks of soluble factors, extracellular vesicles, and metabolic products. Volatile organic compounds (VOCs) are increasingly recognized as components of this communication, yet their capacity to actively regulate immune-cell behavior remains poorly understood. This doctoral research investigates exosomal VOCs as functional immunomodulatory signals and develops a nanotechnology platform for their controlled delivery. The work focuses on octanal and 2-butanone, two VOCs associated with cancer-related extracellular-vesicle signaling. Using wild-type and NF-kappaB1/p50-deficient monocytes, we first examined how these molecules influence inflammatory signaling and established that their effects depend on both VOC identity and cellular NF-kappaB context. To overcome the volatility, hydrophobicity, and dosing limitations of free VOCs, PEGylated liposomes were engineered, physicochemically characterized, and evaluated for encapsulation efficiency and biological activity. A broader formulation library was subsequently screened in macrophages to assess cellular compatibility and cytokine-response profiles, revealing formulation-dependent biological patterns that motivate further mechanistic investigation. The translational phase evaluated selected liposomal formulations in an LLC-luc tumor-bearing mouse model using repeated intravenous administration. Tumor growth, bioluminescence, body weight, hematology, systemic cytokines, and tumor and spleen immune phenotypes were assessed across two cohorts. The in vivo studies supported administration feasibility and short-window tolerability and established a framework for evaluating systemic and tumor-associated responses to VOC-based nanomedicines. Together, this work advances VOCs from overlooked metabolic products toward experimentally tractable signaling molecules and establishes liposomal delivery as a platform for investigating their immune-modulatory potential across molecular, cellular, and in vivo systems.

Refreshments will be served before the seminar.