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| The Wolfson Department of Chemical Engineering | Interdisciplinary Program for Nanoscience & Nanotechnology |  |

**Wolfson Department of Chemical Engineering Seminar**

**Wolfson Department of Chemical Engineering, Lecture Hall No. 6**

**Wednesday, September 29th, 2021 at 13:30**

**Synthetic Cells Communicate and Self-Activate**

**Using Bioluminescent Signaling**

**Omer Adir**

The Interdisciplinary Program for Nanoscience and Nanotechnology, Technion-Israel Institute for Technology

**PhD Seminar**

Advisor: Assoc. Prof. Avi Schroeder

The field of synthetic cells (SCs), micron-sized constructs designed from the bottom-up, is rapidly developing with potential applications for basic and translational research. Recently, SCs have been used as models to investigate the origin of life, isolate and study cellular processes and as potential therapeutic and diagnostic systems. Controlling cellular processes inside SCs and integrating them with living tissues is important for realizing these applications, particularly for the utilization of SCs as diagnostic and therapeutic devices inside the body. Although light offers an attractive way for regulating cell functions, its use is limited by its restricted penetration depth into tissues. We engineered SCs that produce light through bioluminescent reactions and activate cellular processes in synthetic and natural cells, dismissing the need for an external light source. These engineered SCs communicate with innate fungal cells through bioluminescence, and activate fungal sporulation in a quorum-sensing like mechanism. To achieve intracellular signaling in SCs, we designed bioluminescent self-activating fusion proteins that employ bioluminescence resonance energy transfer to activate an inherent light-responsive domain and mediate transcription and membrane recruitment of proteins. These functionalities lay the groundwork for utilizing SCs as embeddable light sources that stimulate cellular processes inside tissues and set the stage for advancing from single SCs to synthetic tissues.

**Refreshments will be served at 13:15**

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**Wolfson Department of Chemical Engineering Seminar**

**Wolfson Department of Chemical Engineering, Lecture Hall No. 6**

**Wednesday, September 29th, 2021 at 13:30**

Lung Targeted Liposomes Loaded with Two Drugs

in the Treatment of ARDS

**Sivan Arber Raviv**

Department of Chemical Engineering, Technion-Israel Institute for Technology

**MSc Seminar**

Advisor: Assoc. Prof. Avi Schroeder

Acute respiratory distress syndrome (ARDS) is a type of respiratory failure characterized by diffuse lung damage, inflammation, and alveolar collapse that impairs gas exchange making it difficult or impossible. Unfortunately, to this day patient prognosis remains poor with mortality of over 40%. Moreover, current treatment routine is mainly supportive. Covid-19, the widespread pandemic originating since December 2019, is a main cause that increased ARDS diagnosis frequency. We developed an effective **Dual liposomes** system for lung targeting, loaded with both methylprednisolone (MPS), a steroid, and N-acetyl cysteine (NAC), expectorant and an antioxidant. Liposome’s composition, as well as drug active loading process, were optimized to fit lung surfactant composition and to encapsulate both MPS and NAC with high encapsulation efficiency. Liposomes exhibited accumulation in LPS induced mice’s lungs for more than 48 hours for both IV and ET administrations. Dual liposomes treatment on LPS-stimulated macrophage cell line, RAW 264.7, showed a significant decrease in nitric oxide (NO) and TNFα cytokine. Results showed an equal or a slight advantage for liposomal delivery treatment in comparison to free drugs treatment, which demonstrate high drug bioavailability of the liposomal system. TNFα, IL-6 and IL-1β cytokines decrease trend was displayed in an *in vivo* efficacy experiment conducted on LPS-induced mice model, following dual liposomes treatment. 6 hours after LPS exposure, mice were subjected to IV, ET and both IV and ET dual liposomes administration. 24 hours later, results indicated that dual liposomes successfully targeted lungs and had a positive therapeutic effect overall. Here, we show that our Dual liposomes possess tremendous potential in the prevention of ARDS development.

**Refreshments will be served at 13:15**