Bar-Ilan University
אוניברסיטת בר-אילן

Faculty of Exact Sciences
Department of Chemistry

הפקולטה למדעים מדויקים
המחלקה לכימיה

S P E C I A L S E M I N A R

Thursday 3/1/19, 10:00 am

Building 211, seminar room 112

SPEAKER:

Dr. Aharon Azagury

Departments of Biomedical Engineering &
Molecular Pharmacology, Physiology and Biotechnology
Biomedical Center, Providence, RI

TOPIC:

ENHANCING MASS TRANSPORT ACROSS BIOLOGICAL MEMBRANES

Controlled drug delivery has been the focus of many types of research for decades while noninvasive drug delivery is one of its fundamental aspects. Noninvasive drug delivery routes use external accessible membranes such as the skin, nasal and tympanic cavities, chorioamnion membrane, and oral drug delivery. Since most of these membranes are not naturally permeable, it is thus crucial to enhance the mass transport across them for drug delivery purposes. In order to achieve effective enhancement one first need to understand the structure of these membranes and more importantly the rate limiting step for mass transport. Many approaches have been used throughout the years to enhance mass transport across biological membranes, mainly for the skin. Among these methods are chemical penetration enhancers (CPEs) and ultrasound (US). In this presentation, the effect of US on transdermal mass transport and its mechanism of action would be discussed followed by the effects of US and

CPEs (separately and in tandem) on the mass transport across the chorioamnion membrane (CAM). The aim of latter research was to enhance the mass transport across the CAM for early sampling of the amniotic fluid in a non-invasive manner, in order to detect abnormalities and assess the fetus's health. Another option is to deliver drugs directly to the fetus. In order to achieve that, first CPEs were encapsulated inside nano-PLGA (nPLGA) particles resulting in an increased CPEs effect with lower concentration of CPEs. The mechanisms of actions were determined by experiments evaluation permeability with dyes, cryo-TEM & SEM, FTIR, biomimicking colorimetric screening measurements, and custom made image analysis.

Enhancing mass transport across the gastrointestinal (GI) track is probably the most challenging approach. Nanoencapsulation approaches for oral drug delivery is one of the solutions and investigation of their interactions with the different segments of the GI would be discussed. First, a novel double-walled (DW) method termed single step DW nanoparticles for oral drug delivery was developed in our lab. DW morphology was confirmed via FTIR, DSC, and a unique AFM mode. Second, the interactions between polymeric nanoparticles and the GI membrane were investigated using DLS and Zeta potential measurements, followed by presenting my newly developed method for detection of polymers in biological specimens using FTIR. Lastly, a brief description of a novel method currently under development for calculating effective diffusion coefficient using 3D SEM would be presented.