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 Special Seminar
Lecture Hall 6, Wolfson Department of Chemical Engineering,
Monday January 22nd at 1:30pm

Zvi Yaari

PhD student (advisor: Prof. Avi Schroeder)
Chemical Engineering, Technion

Developing Barcoded Nanotherapeutics for Treating Metastatic Cancer

Selecting the proper drug, that addresses each patient's unique disease presentation, is the primary goal of personalized medicine. We describe here a nanoparticle-based barcoded system for predicting the therapeutic potency of drugs against cancerous lesions. The screen is performed inside the patient's body using extremely low drug doses, and generates insights regarding drug potency with single-cell sensitivity. This approach was tested on BALB/c mice bearing metastatic breast cancer tumors (4T1).

The diagnostic system is based on 100- nm liposomes loaded with a drug and a corresponding unique DNA barcode. Once a tumor is detected, a cocktail of DNA-barcoded nanoparticles, each containing a different drug, is injected intravenously. The particles accumulate in the cells that compose the tumor microenvironment, utilizing the enhanced permeability and retention (EPR) effect. Two days later, enabling each of the drugs to take action, a biopsy is taken from the tumor and the tissue is homogenized, to form a single-cell suspension. The cells are sorted by FACS according to cell type and to their live/dead viability state (potency screen). Then, the DNA barcodes are extracted from the cells and expanded using RT-PCR. The cell viability data is correlated with the type of drug/s found inside each of the cells, thereby identifying which drug or drug combination is optimal for treating the lesion. Based on the screen, a treatment protocol was selected, generating a successful outcome in vivo. Interestingly, we found that barcodes can be detected even inside a single cell. This allows screening multiple drugs not only in the primary tumor but also in various of metastatic nieches such as lungs, liver, spleen and brain. The screening analysis of the primary tumor together with metastatsis grants the physician a bteer tool for strategizing cancer care.

This approach, in which nanoparticles act as theranostic gauges for examining the therapeutic potency of a drug or drug combination may prove effective for personalizing medicine.

Refreshments will be served at 1:15pm