

Personalized Cancer Nanomedicine

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The field of medicine is taking its first steps towards patient-specific care. Our research is aimed at tailoring treatments to address each person's individualized needs and unique disease presentation. Specifically, we are developing nanoparticles that target disease sites, where they perform a programmed therapeutic task. These systems utilize molecular-machines and cellular recognition to improve efficacy and reduce side effects.

Two examples will be described: the first involves a nanoscale theranostic system for predicting the therapeutic potency of drugs against metastatic cancer. The system provides patient-specific drug activity data with single-cell resolution. The system makes use of barcoded nanoparticles to predict the therapeutic effect different drugs will have on the tumor microenvironment.

The second system makes use of enzymes, loaded into a biodegradable chip, to perform a programmed therapeutic task – surgery with molecular precision. Collagenase is an enzyme that cleaves collagen, but not other tissues. This enzyme was loaded into the biodegradable chip and placed in the periodontal pocket. Once the collagenase releases from the chip, collagen fibers that connect between the teeth and the underlying bone are relaxed, thereby enabling enhanced orthodontic corrective motion and reducing pain. This new field is termed BioSurgery.

The clinical implications of these approaches will be discussed.



Avi Schroeder is an Assistant Professor of Chemical Engineering at the Technion – Israel Institute of Technology where he heads the Laboratory for Targeted Drug Delivery and Personalized Medicine Technologies since October 2012.

Dr. Schroeder conducted his Postdoctoral studies at the Massachusetts Institute of Technology with Professor Robert Langer, and his PhD in the Hebrew and Ben Gurion Universities.

Avi is a current Horev Fellow – Leaders in Science and Technology, an Alon Fellow; a former recipient of the Intel Nanotechnology-, TEVA Pharmaceuticals-, and the Wolf Foundation PhD-student Awards, one of six 2013's Young Talents in Advanced Polymer Technologies. Avi is the author on 25 papers and 11 patents.