Michigan State University
Science at the Edge
Engineering Seminar

October 25th, 2013
11:30 a.m.
Room 3540 Engineering Building
Refreshments served at 11:15 a.m.

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Yale University

Polymer materials for delivery of antibodies and nucleic acids

Abstract

There is an urgent need to develop new strategies for the prevention and protection against sexually transmitted infections (STIs) – particularly safe, female-administered approaches. We have investigated the use of biocompatible materials fabricated into vaginal rings or nanoparticles as delivery vehicles for antibodies and genetic agents in the female reproductive tract. Our work has focused on two platforms using polymers as vehicles for delivery of agents: 1) vaginal rings made of poly(ethylene-co-vinyl acetate), and 2) non nanoparticles made of poly(lactic-*co*-glycolic acid) (PLGA). Vaginal rings are safe and effective vehicles for long-term, local delivery of antibodies, whereas nanoparticles provide protection against nucleic acid degradation in the vaginal environment, penetration through mucus barriers, and intracellular delivery in tissues. We have further enhanced the properties of PLGA particles for nucleic acid delivery by incorporating internal and surface modifications. First, we modified the polymer to achieve enhanced encapsulation efficiency and a highly controllable strategy for release of nucleic acids from the particles. Second, we functionalized the nanoparticle surfaces with ligands to either improve transport within the cervical mucosa or to increase mucoadhesion. In our latest work, we have shown that these nanoparticles produce site-specific gene editing of human cells *in vivo* when they are loaded with triplex forming oligonucleotides and donor DNAs. With collaborators, we have taken the first steps to apply these technologies to prevention and treatment of HSV and HIV infections.

Bio

W. Mark Saltzman is an engineer and educator. Dr. Saltzman's research in the fields of drug delivery, biomaterials, nanobiotechnology, and tissue engineering is described in over 200 research papers and 15 patents. He is the author of three textbooks: Biomedical Engineering (2009), Tissue Engineering (2004), and Drug Delivery (2001).

The grandson of Iowa farmers, Mark Saltzman earned degrees in chemical engineering (B.S. Iowa State University 1981 and M.S. MIT 1984) and medical engineering (Ph.D. MIT 1987). He served on the faculty at Johns Hopkins (1987-1996), Cornell (1996-2002), where he was the first BP Amoco/H. Laurance Fuller Chair, and Yale, where he has been the Goizueta Foundation Professor since 2002. He became the founding chair of the Yale's Department of Biomedical Engineering in 2003.

Dr. Saltzman has been recognized for his excellence in research and teaching. He received the Camille and Henry Dreyfus Foundation Teacher-Scholar Award (1990); the Allan C. Davis Medal (1995); the Controlled Release Society Young Investigator Award (1996); and the Professional Progress in Engineering Award from Iowa State University (2000). He has been elected a Fellow of the American Institute for Medical and Biological Engineering (1997); a Fellow of the Biomedical Engineering Society

(2010); and a Member of the Connecticut Academy of Science & Engineering (2012). He has delivered over 200 invited lectures including the Britton Chance Distinguished Lecture at the University of Pennsylvania (2000) and the Distinguished Lecture of the Biomedical Engineering Society (2004).

Dr. Saltzman has taught dozens of college courses including Heat & Mass Transfer, Material & Energy Balances, Introduction to Biomedical Engineering, Drug Delivery & Tissue Engineering, Physiological Systems, and Molecular Transport & Intervention in the Brain. His course Frontiers of Biomedical Engineering is available to everyone through Open Yale Courses (http://oyc.yale.edu).

For further information please contact Prof. Christina Chan, Department of Chemical Engineering and Materials Science at krischan@egr.msu.edu

Persons with disabilities have the right to request and receive reasonable accommodation. Please call the Department of Chemical Engineering and Materials Science at 355-5135 at least one day prior to the seminar; requests received after this date will be met when possible.