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Northwestern Engineering

2010 Dow Lecture

Department of Materials Science and Engineering

"Top-down nanofabrication technologies for the production of uniform, shape-specific carriers for vaccines, biologics, and small-molecule drugs"

Presented by

Joseph M. DeSimone

Chancellor's Eminent Professor of Chemistry,
University of North Carolina at Chapel Hill;
William R. Kenan Jr. Distinguished Professor of
Chemical Engineering, North Carolina State University

Tuesday, March 30, 2010

Lecture 4 p.m.

Technological Institute, L211, 2145 Sheridan Road, Evanston

Reception to follow at 5:15 p.m., in the Cook Hall atrium

Robert R. McCormick School of
Engineering and Applied Science
Northwestern University

Top-down nanofabrication technologies for the production of uniform, shape-specific carriers for vaccines, biologics, and small-molecule drugs

To translate promising molecular discoveries into benefits for patients, DeSimone's laboratory is taking a pharmaco-engineering systems approach to developing the next generation of delivery systems with programmable multifunctional capability. His laboratory has pioneered the development of a technique called PRINT (particle replication in nonwetting templates), a top-down particle synthesis method that extends the nanofabrication techniques from the semiconductor industry to a high throughput, continuous roll-to-roll process. PRINT enables the fabrication of precisely defined micro- and nanoparticles with control over particle size (20 nm to >20 microns), shape, chemical composition, cargo (proteins, adjuvants, therapeutics, oligonucleotides, siRNA, imaging agents), modulus (stiff, deformable reb blood cell mimics), and surface chemistries (antibodies, PEG chains, metal chelators), including the spatial distribution of proteins on the particle. In the history of delivery, particles have never had the uniformity, precision, and chemical and shape control afforded by PRINT.

Joseph M. DeSimone

Joseph DeSimone is the Chancellor's Eminent Professor of Chemistry at the University of North Carolina at Chapel Hill and the William R. Kenan Jr. Professor of Chemical Engineering at North Carolina State University. He has published more than 240 scientific articles and has more than 115 issued patents in his name with more than 120 patents pending. In 2005 DeSimone was elected into the National Academy of Engineering and the American Academy of Arts and Sciences.

DeSimone has received 40 major awards and recognitions, including the 2009 NIH Director's Pioneer Award, a $500,000 Lemelson-MIT Prize for Invention and Innovation, the 2007 Collaboration Success Award from the Council for Chemical Research, and the 2005 American Chemical Society Award for Creative Invention.

Among DeSimone's inventions is an environmentally friendly manufacturing process that relies on supercritical carbon dioxide instead of water and biopersistent surfactants (detergents) for the creation of fluoropolymers such as Teflon®. In 2002 DeSimone, along with Richard Stack, a cardiologist at Duke University, cofounded Bioabsorbable Vascular Solutions (BVS) to commercialize a fully bioabsorbable, drug-eluting stent. BVS was acquired by Guidant Corporation in 2003, and these stents are now being evaluated in a series of international clinical trials enrolling more than 1,000 patients for the treatment of coronary artery disease.

DeSimone's research group is focused on learning how to bring the precision, uniformity, and mass-production techniques associated with the fabrication of nanoscale features found in the microelectronics industry to the field of nanomedicine for the fabrication and delivery of vaccines and therapeutics for the treatment and prevention of diseases. DeSimone recently launched Liquidia Technologies (www.liquidia.com), which employs nearly 50 people and has raised more than $30 million in venture financing. His laboratory and the PRINT technology are the foundation for the new $20 million Carolina Center for Cancer Nanotechnology Excellence funded by the National Cancer Institute.

DeSimone received his BS in chemistry in 1986 from Ursinus College in Collegeville, Pennsylvania, and his PhD in chemistry in 1990 from Virginia Polytechnic Institute.