LIQUIDIA PRESENTS NOVEL APPROACH TO VACCINE, INHALATION AND TARGETED SYSTEMIC DELIVERY TO DEPARTMENT OF DEFENSE

On August 3rd, 2011, Dr.'s Joseph DeSimone and Peter Mack presented data at the United States Department of Defense SMART Drug Delivery Workshop supporting the rational design of potentially highly effective vaccines and medical countermeasures that could be used to protect our military.

CONTROL OF NANO- AND MICRO-PARTICLE SIZE, SHAPE, DISPERSITY AND ELASTICITY: DEVELOPMENT OF VACCINE AND THERAPEUTIC PARTICLES FOR USE IN PARENTERAL AND INHALATION ROUTES OF ADMINISTRATION

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Advances in photolithography have taken the minimum feature size of transistors down from about 10 microns in 1970 to 0.045 microns (45 nm) today. In biological terms, this corresponds to going from the size of a red blood cell to the size of a single virus particle! This top-down nano-fabrication technology from the semiconductor industry is, for the first time, in the size range to be relevant for the design of next generation medicines and vaccines. As such, we describe the design, synthesis and efficacy of organic nano- and micro-particles using a top-down nano-fabrication technique we developed called PRINT (Particle Replication in Non-wetting Templates)[1]. PRINT is a continuous, roll-to-roll, high resolution molding technique that allows the fabrication of precisely defined micro- and nano-particles with control over chemical composition, size, shape, deformability and surface chemistry. With these 'nanotools', we are establishing definitive biodistribution and pharmacodynamic maps to elucidate the interdependent roles that size, shape, deformability and surface chemistry play on particle distribution, including cellular uptake, as a function of different dosage forms (IV, IP, inhaled, subcutaneous, intramuscular, etc)[2,3] and pathological states. This information should ultimately enable the design of highly effective vaccines and medical countermeasures to protect the warfighter.

1. Rolland JP, et al. (2005), Direct fabrication and harvesting of monodisperse, shape-specific nanobiomaterials. *J Am Chem Soc.* Jul 20;127(28):10096-100.
2. Gratton SE, et al. (2008), The effect of particle design on cellular internalization pathways. *Proc Natl Acad Sci U S A.* Aug 19;105(33):11613-8.
3. Merkel TJ, et al. (2011), Using mechanobiological mimicry of red blood cells to extend circulation times of hydrogel microparticles. *Proc Natl Acad Sci U S A.* 2011 Jan 11;108(2):586-91.