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Kavli Frontiers of Science Symposium Series

Ninth Annual Chinese-American Kavli Frontiers of Science Symposium

National Academy of Sciences
October 26-28, 2006
Irvine, California

Polymeric Nanopharmaceuticals: Good Things in Small (Plastic) Packages

Justin Hanes, Johns Hopkins University

Funding in the US and abroad is being poured into the “new” field of nanomedicine by venture capitalists and a variety of governmental agencies, leaving the public to wonder: is there reason to hope that the hype will eventually translate into major medical breakthroughs? This talk will focus on the branch of nanomedicine that relates to advanced methods for delivery of drugs and genes to enable improved therapies. Nano-sized particles, designed to protect and enhance the effectiveness of the parent drug or gene molecules, have already reached the market in some forms and have shown promise in enhancing the effectiveness of a variety of drugs and genes for a wide range of diseases, including cancer. Many systems in use or under study utilize a polymer to enhance the longevity of the parent molecule in the body, improve its targeted delivery to a diseased tissue, or even facilitate the delivery of therapeutics across target cell membranes. However, sustained drug and gene delivery to target tissues is often limited by a lack of suitable polymeric materials and inefficient nanoparticle transport within complex biological environments, including the blood and the cell cytoplasm. Obstacles to the development of improved “nanopharmaceuticals” will be discussed, with examples of how engineers, scientists, and clinicians are working together to meet the challenges that must be overcome if the field is to live up to its considerable hype.

Citations of interest related to the talk:

Sakhalkar HS et al. (2003) Leukocyte inspired biodegradable particles that selectively and avidly adhere to inflamed endothelium in vitro and in vivo, Proc Natl Acad Sci USA, 100:15895-15900.

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Dawson M., Wirtz D., and Hanes J. (2003) Enhanced viscoelasticity of human cystic fibrotic sputum correlates with increasing microheterogeneity in particle transport, *J. Biol. Chem.*, 278:50393-50401.

Fu J, Fiegel J, Hanes J, (2004) Synthesis and characterization of PEG-based ether-anhydride terpolymers: New polymers for controlled drug delivery, *Macromolecules*, 37:7174-7180.

Suh J, Dawson M, Hanes J, (2005) Real-time particle tracking: Applications to drug and gene delivery, *Adv Drug Del Rev*, 57:63-78.

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