**Bio-inspired Engineering: Formulation Principles and Design Strategies for First-in-class Therapeutics**

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Recent advances in pharmaceutical engineering have entailed the development of multifunctional materials that produce tailored pharmacological responses. Concurrently, scientists have taken advantage of naturally occurring materials to design components for incorporation with synthetic agents to produce super-efficient, targeted and intelligent therapeutics that provide sustained therapy. In this poster, I will provide proof-of-concept and design strategies for *two novel, efficient and biologically relevant therapeutics*.

1. Typically, drugs have unique sites of action and mechanisms that are dependent on formulation and administration routes. The associated chemical interaction of drugs with the human body leads to either pharmacologically relevant metabolites or alternative biochemical forms of the compound. One such drug is the riminophenazine dye, clofazimine that is known to have biocrystallized forms. These have been clinically reported but the mechanism of formation has never been investigated. I will describe the *first-in-class biocrystal-based theranostic agents* that mimic the stabilized chemical drug formulation of clofazimine and that pharmacologically, is both a potent anti-inflammatory medication and a fluorescence and photo-acoustic signaling-based diagnostic imaging agent. Most importantly, the design principles are easily translatable for other pharmaceuticals with varied chemical properties such as basicity, lipophilicity and solubility.
2. Most gene therapeutics rely on using either non-viral vectors for packaging genetic cargo or employ modified viruses for their natural ability to insert genetic cargo into cells. I will provide proof-of-concept and design principles of combining enhanced functional capabilities of naturally sourced biomaterials with the remarkable efficiency of viruses into *first-in-class superlative hybrid gene therapeutics.*

Selected References:

1. **RK Keswani**, K Su & DW Pack, 2014, “Efficient In Vitro Gene Delivery by Hybrid Biopolymer/Virus Nanobiovectors”, Journal of Controlled Release, 192, 40-46.
2. **RK Keswani**, IM Pozdol & DW Pack, 2013, “Design of Hybrid Lipid/Retroviral-Like Particle Gene Delivery Vectors”, Molecular Pharmaceutics, 10(5), 1725-1735.
3. **RK Keswani**, J Baik, C Hitzman, L Yeomans, N Rodriguez-Hornedo, KA Stringer, GR Rosania, 2014, “A concentrative chloride transport pathway parallels massive accumulation of a weakly basic drug in mouse macrophages”, Journal of the American Chemical Society, submitted.