Innovative Systems for Effective Delivery of Therapeutics

Abstract: Effective delivery of therapeutics is a major problem in today’s healthcare. For example, in the case of protein and peptide drugs such as insulin, growth hormones, and vaccines, a key challenge is their stabilization and delivery without having to use needles. All proteins are currently delivered by needles, which have several limitations including pain, needle-phobia, and contamination caused by dirty needles. Our laboratory is addressing this challenge by delivering proteins using transdermal patches and oral pills. Neither of these routes is inherently suited for protein delivery since they offer significant diffusive and enzymatic barriers for protein transport. We have developed a number of technologies that overcome these barriers to deliver proteins for the treatment of diabetes, osteoporosis, psoriasis and several other diseases. I will present an overview of these technologies with respect to their principles and applications. Targeting of drugs to specific tissues is also a key challenge in therapeutic delivery. This is especially problematic for cancer and cardiovascular diseases, where the effectiveness of drugs is limited by their poor accumulation at the disease tissue and high accumulation in healthy tissues. Many tumors or cardiovascular lesions are small and structurally similar to the healthy tissue. Our laboratory is developing nanoparticles that can encapsulate chemotherapeutic drugs and target them to tumors. Our strategy explores biomimetic designs that leverage the principles of natural cells such as platelets and red blood cells to accomplish excellent targeting. I will present an overview of some the targeting strategies for the treatment of breast cancer and vascular bleeding after trauma.