

TEMPLE UNIVERSITY  
Department of Mathematics

# Applied Mathematics and Scientific Computing Seminar

Wednesday, 30 November 2016, 1:30 p.m.  
Room 617 Wachman Hall

(refreshments and social at 2:30 p.m)

## Intradermal Delivery of Biologics: Understanding Absorption and Pharmacokinetics

by Yash Kapoor and Mikolaj Milewski  
Merck Research Laboratories

**Abstract.** Biologics such as peptides and proteins are not amenable for oral delivery and thus, the primary delivery methods for these larger molecules are limited to subcutaneous (SC), intramuscular (IM) or the intravenous (IV) injections. Apart from these routes, intradermal (ID) delivery has gained acceptance and popularity. Comparing ID and SC delivery for various peptides highlights a very atypical pharmacokinetics response of high maximum plasma concentration ( $C_{max}$ ) and shorter time to reach the maximum concentration ( $T_{max}$ ) for ID delivery suggests that the physiological differences between these two routes of administration lead to varied absorption kinetics. This work highlights how we can start thinking of absorption from first principles followed by inclusion of physiology to discern the outcomes from an ID vs SC delivery. We adapted a physiological-based mathematical model developed for ID delivery with certain modifications to address the problem statement. This model incorporates multiple relevant features such as protein binding, differences in absorption due to the physiochemical properties of the drug and basic understanding of blood vs. lymphatic absorption. The first round of predictions matched closely with observed outcomes. We are currently working towards incorporating the physiological changes to better our predictions and provide a clear mathematical understanding of observed absorption differences between the two tissues.