1137-60-250 **Sean D Lawley*** (lawley@math.utah.edu), **James P Keener**, **Alla Borisyuk** and **Gregory Handy**. *The curiously strong impact of recharging enzymes, receptors, and predators.*

In phosphorylation reactions, enzymes are inactive for a transitory "recharge" time following each substrate modification. A similar scenario occurs in neuroscience, in which synaptic receptors cannot bind neurotransmitters continuously, but rather must "recharge" after each binding. In ecology, this recharge time is called handling time, and it is the time a predator takes to process captured prey before it hunts additional prey.

In this talk, we formulate and analyze mathematical models of these systems. For enzymatic reactions, we use probabilistic methods to incorporate the spatio-temporal effects of recharge into simple ordinary differential equation models. In contrast, previous work has resorted to computationally expensive agent-based spatial simulations. We use this analysis to predict how reactions on cell membranes compare to reactions in cytoplasm. Moving to recharging receptors, we prove that the number of molecules that bind to receptors grows only logarithmically in the number of released molecules for any nonzero recharge time, whereas the growth is linear in the absence of recharge. We discuss implications of this result in neuroscience and ecology, including a system in which recharge reduces neurotransmitter bindings by several orders of magnitude. (Received February 05, 2018)