TROY DAY, Queen's University
Optimal control of drug resistant pathogens and the mixing versus cycling controversy

The evolution of drug resistance presents a major challenge for the control of infectious diseases. Numerous recent simulation studies suggest that deploying drugs at an intermediate level in the population can sometimes minimize the total size of infectious disease outbreaks. In this talk I will revisit this issue from the standpoint of optimal control theory. I will demonstrate that the optimal drug deployment strategy is, in fact, one that uses a maximal treatment level but that times the treatment appropriately during the outbreak. From this conclusion I will then go on to consider the optimal deployment of two drugs. Again, optimal control theory will be used to shed light on recent controversies about drug mixing versus drug cycling. I present analytical results demonstrating how some situations lead to mixing being optimal and others lead to a form of cycling being optimal. These results help to partially resolve some discrepancies among other studies.