

# The population and evolutionary dynamics of adaptive immunity in bacteria: CRISPR and too much fun

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THE Clustered Regularly Interspaced Short Palindromic Repeats that abound in the genomes of the majority of archaea and nearly half the eubacteria can serve as part of an adaptive immune system (CRISPR-Cas) that protect these prokaryotes against infectious DNAs. When these infectious DNAs are borne on bad-ass viruses (lytic bacteriophage), the advantages of CRISPR-mediated immunity are straight forward and easily demonstrated experimentally as well as theoretical. But not all infectious DNAs are noxious. Some like plasmids bearing resistance genes in the presence of antibiotics, can be very much to the advantage of bacteria, if not their human hosts. In this talk I will consider the upside of CRISPR-mediated immunity, protection against phage, and the downside, preventing the acquisition of plasmids bearing beneficial genes. I will present the results of the work we are doing on the population dynamics of CRISPR using mathematical and computer simulation models and the considerably more real work of experiments with bacteria and their phage and plasmids. In addition to presenting some classy science, my talk will include a pedagogical rant about the use of mathematical and computer simulation models in population biological and evolutionary studies and the critical role of experiments for these models to be of value to researchers other than those publishing them.