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Resistance is futile... Wait! Maybe it's not.

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Back in 2007, resistance of influenza virus strains against the most used and stockpiled antiviral drug, oseltamivir, was of no concern. The main mutation which led to resistance also led to a significant decrease in the fitness of flu virus strains which carried it. But in the 2007-2008 season, a drug-resistant variant of the circulating flu H1N1 strain that year (A/Brisbane/59/2007) carried the mutation successfully and spread effectively, even in the absence of favourable drug pressure: the mutation was no longer a liability and resistance disseminated quickly. Then came the 2009 influenza pandemic... could oseltamivir resistance establish itself in that strain too?

Our work is in the field of virophysics, utilizing physical models to resolve the temporal (and sometimes spatial) dynamics of viral infection spread within a cell culture (in vitro) or a host (in vivo). These physical models allow us to extract the key viral replication parameters (e.g., viral production rate, infectious cell lifespan) from experimental flu infections. This information enabled us to determine whether resistance could establish itself in the 2009 flu H1N1 pandemic strain. But the accurate nature of our method has also allowed us to identify problems with experimental protocols used to evaluate the efficacy of antivirals or the virulence of certain influenza strains. In this talk, I will review what we learned about the physics of flu and the challenges the field of virology faces which physicists are uniquely positioned to take on.

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