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Modeling Epidemic Spread in a Predator-Prey Evolutionary Ecosystem Simulation

Epidemics that spread in wide geographic areas for both animals and humans, impose a threat to global public health security. Studying dynamics of the infections in ecosystems and factors regulating the epidemics is of high importance. We have implemented EcoDemics; which extends EcoSim, for modeling the spread of an epidemic. In this simulation we model infectious diseases in prey agents and we study the effects of predation on infection dynamics. We analyzed three different control strategies: quarantine, pharmaceutical interventions and vaccination. We explored the effect of the vaccination technique with various timing and population percentage parameters. Our experiments revealed that there is a threshold value for the percentage of the population which is vaccinated. This is the same result that has been observed in a herd immunity study. This study highlighted the importance of effective vaccination policies in mitigating the infection and confirms the fundamental role of increasing individuals' immunity over a relatively wide area to inhibit stochastic jumps of infection. EcoDemics can easily be extended to tackle numerous difficult open problems. We will monitor the spread of infection in our virtual world to study the effect of predation in infection dynamics. Sexually transmitted diseases can also easily be integrated. It will permit the study of the specific properties of sexually transmitted diseases in large multi-species populations. Co-evolution of diseases and hosts could also be represented and the way one affects the other and has influence on its evolution could be tracked and analyzed for very long time periods.