Literature Review

Key Topics:

* Pathogen persistence
* Metapopulation disease dynamics
* Bat metapopulation dynamics
* Seasonal changes in bat movement

Resolving the roles of immunity, pathogenesis and immigration for rabies persistence in vampire bats

Blackwood, Streiker, Altizer, Rohai 2013

Abstract

* Bats are important reservoirs for emerging infection diseases, yet the mechanisms that allow highly virulent pathogens to persist within bat populations remains obscure.
* Simulations show that the strong spatial component to transmission dynamics could explain …
* These findings offer spatial dynamics as a mechanism for rabies persistence in bats that might be important for understanding and control of other bat-borne pathogens

Introduction

* Bats host some of the most significant newly emerging viruses
* Predicting the spatiotemporal distribution of pathogen transmission from bats to other species requires understanding of both the ecological factors that encourage cross-species exposures and the transmission dynamics within bat populations
* Understanding viral persistence in bat populations is challenging because seemingly ideal ecological traits for explosive pathogen transmission such as high mobility and colonial aggregation contrast with the limited supply of new susceptible individuals generated by characteristically long-lived and slow-reproducing hosts.
* Consequently, epizootiological models of bat viruses have required complex immunological or behavioral mechanisms to achieve long term persistence, such as waning maternal immunity or an extended incubation period through hibernation
  + 4. George DB, et al. (2011) Host and viral ecology determine bat rabies seasonality and maintenance. Proc Natl Acad Sci USA 108(25):10208–10213.
  + 5. Plowright RK, et al. (2011) Urban habituation, ecological connectivity and epidemic dampening: the emergence of Hendra virus from flying foxes (Pteropus spp.). Proc Biol Sci 278(1725):3703–3712.
  + 6. Pulliam JRC, et al.; Henipavirus Ecology Research Group (HERG) (2012) Agricultural intensification, priming for persistence and the emergence of Nipah virus: A lethal bat-borne zoonosis. J R Soc Interface 9(66):89–101.
* These studies also demonstrate the power of a combined field, experimental, and modeling approach for identifying persistence mechanisms in bats
* We evaluated the determinants of viral persistence in vampire bat colonies by developing a maximum likelihood framework to parameterize and evaluate stochastic epizootiological models

Results

* Depends on immigration of infectious individuals from neighboring colonies and frequent immunizing but nonlethal exposures
* Outcomes require spatial asynchrony in viral dynamics among networks of bat colonies to maintain long-term viral persistence

Abstract

* Spatiotemporally-localized prediction of virus emergence from wildlife requires focused studies on the ecology and immunology of reservoir hosts in their native habitat.