

WILDLIFE DISEASE ECOLOGY

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Why Should We Know About Disease?

- mortality factor in dense populations
- threat to endangered / rare species
- human & domestic animal health
 - rabies, brucellosis, Lyme disease, etc.

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Definitions

- **Disease**
 - disturbance of normal bodily function or structure
- **Zoonosis**
 - disease of animals transmissible to humans

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Etiology = the cause of disease

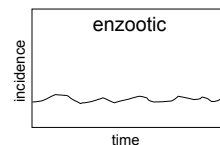
- Infectious
 - Microparasites: viruses, bacteria, fungi, protists
 - Macroparasites: worms, arthropods
 - Prions
 - Cancer cells
- Congenital
- Nutritional Deficiency
- Toxic substances
- Trauma
- Tumors

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Terms in Epidemiology

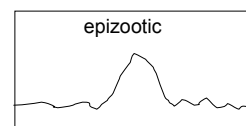
- **Occurrence** - pattern of disease in time and space
 - **prevalence**: proportion (or %) infected at a given time/place
 - **incidence**: number of new cases per unit time at a place
- **Susceptibility** – likelihood of contracting disease given exposure
 - **Resistant**: contracting disease is unlikely
 - **Immune**: contracting disease is impossible
 - **Infectious** – capable of infecting other hosts
- **Virulence** – speed & severity of pathological effects

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Enzootic (endemic)- constantly present in the population at some predictable rate (usually low); usually low morbidity.

Epizootic (epidemic)- increase above normal levels, often with high morbidity and/or mortality.



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Terms in Epidemiology

- **Transmission** - spread from infectious to susceptible hosts
 - **Direct** = spread via contact
 - **Vertical** = parent to offspring
 - **Horizontal** = other than parent to offspring
 - **Sexual** = spread via sexual contact
 - **Indirect** = spread by contaminated food or water or via vectors
 - **Vector-borne** = spread by an intermediary organism
 - example: ticks are vectors of Lyme disease
- **Reservoir** – host that sustains a disease agent
 - ex.: mice are reservoirs of Lyme disease
 - often experiences low morbidity/mortality

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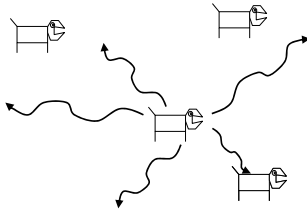
Transmission

- **An infectious disease will spread if each infected individual (on average) infects ≥ 1 other individual in its life.**
- **Highly virulent agents kill rapidly, so there is less time to infect others.**

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Transmission

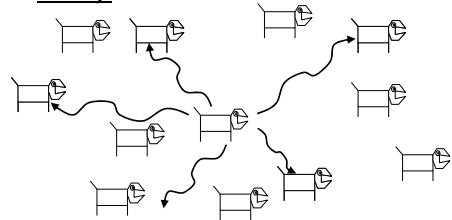
- **For most diseases, transmission is density dependent**



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Transmission

- **For most diseases, transmission is density dependent: probability of getting infected (**force of infection**) depends on density of infected animals**



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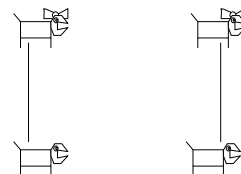
Density-Dependent Transmission

- Force of infection increases with the density of infectious animals ($\# \text{ infected} / \text{ area}$)
 - Increased number of contacts of individuals
 - Impaired immune system due to fewer resources & more stress
- Factors that concentrate animals in space can increase opportunities for transmission
 - habitat fragmentation
 - concentrated food or water sources (e.g., artificial feeders)
 - overpopulation
 - captivity

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Transmission

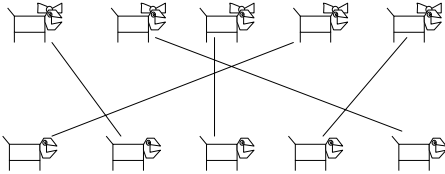
- **Vector-borne and sexual transmission may be frequency-dependent**



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Transmission

- Vector-borne and sexual transmission may be frequency-dependent



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Frequency-Dependent Transmission

- Force of infection increases with the proportion of animals infected (# infected / total)
 - Happens when contact rate is independent of population density
 - Transmission can stay high as population drops
 - Can cause host extinction if highly virulent

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Things To Remember

- Terms & definitions
- Necessary conditions for disease to spread
- How population density affects transmission
 - density dependent vs. frequency dependent