Epidemiology of vector-borne diseases

- Prevalence has increased
  - Globalization of commerce
  - Rapid transportation
  - Mobile society
  - State and federal resources are challenged
- Movement of vectors and disease agents into new geographical areas
  - Arthropods adaptable to change
    - Size, reproduction, short generational time, habitat exploitation
    - Expanded their distribution and have become established
  - Outbreaks of vector-borne pathogens – emerging infectious diseases

**Bluetongue**
- Distribution extended in Europe since 1998
- 3 year period 10 countries affected, 6 never experienced BT disease
- 2006 BTV serotype 8 isolated in 4 countries
- 2007 BTV serotype 1 in southern Europe
- Due to spread of vector, *Culicoides imicola*

**Schmallenberg virus**
- 1st detected in 2011 in Germany
- Spread/detected in 15+ countries in 2 years
- Vector, *Culicoides obsoletus* group

**West Nile Virus**
- Entered NA in 1999
- Rapidly spread across US
- Devastating impact on humans, birds and horses (zoonotic disease)

**Chikungunya virus**
- Tanzania 1953
- Epidemics in Africa and Asia, recently in Europe
  - *Aedes albopictus* a competent vector
Epidemiology of VBD

- Investigation of natural history and movement of diseases
- Basic concepts:
  - Detect/identify pathogen – agent isolated and identified
  - Determine mode of transmission among vectors and vertebrate hosts
  - Conduct field and lab studies
    - Transmission cycles, maintenance of pathogen, vector competence, field infection rates, vector ecology
  - Surveillance, predict and control

Pathogen
Virus, bacteria, protozoa
Pathogen causes disease

Vector
Responsible for pathogen transmission

Vertebrate host:
Primary host
Amplifying host
Reservoir host
Dead-end/incidental host

Primary Transmission Cycle

Birds
Mosquito
Incidental host

Mosquito
Horse

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MODES OF TRANSMISSION

- **Vertical**
  - Passage of parasites by adult to progeny (egg = transovariola) or larva to pupa to adult (transstadial)
- **Horizontal**
  - Passage of parasites between vector and vertebrate hosts.
    - Mechanical
      - Carried on mouthparts, no multiplication of parasite
    - Biological
      - Pathogen multiplies inside vector

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**Surveillance**

- Disease surveillance
- Active and passive
- Report morbidity and mortality data

- Local health departments
- Montana Department Health and Human Services
- Centers for Disease Control and Prevention
Surveillance

Vector

- Develop sampling tools and techniques
- Presence and abundance in time and space
- Testing vectors for infection
- Calculate vector infection rates
- Sentinel animals
- Periodic bleeding, test for exposure