Targeting Tick-Pathogen-Host Interactions

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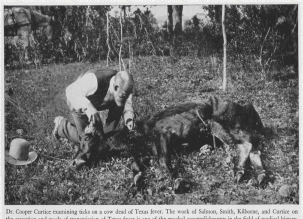
Why are Tick-Borne Diseases Important?

- Ticks transmit the majority of vector-borne pathogens to humans in the USA and to domestic animals worldwide
- Four of five major bovine vector-borne diseases are tick-borne



Dr. George Curtice examining ticks on a cow dead of Texas fever. The work of Salmon, Smith, Kilborne, and Curtice on the causation and mode of transmission of Texas fever is one of the epochal accomplishments in the field of medical history, since it was the first to show that arthropods were capable of acting as carriers of diseases of mammals. Curtice championed the "tick theory" of the transmission of this disease and he was responsible to greater degree than any other person in proving that the southern cattle tick (*Margaropus annulatus*) was the sole carrier of this disease. (Courtesy of *Tile Nation's Business*.)

Hagan's Infectious Diseases of Domestic Animals, Burner and Gillespie (5th Ed.), ©1966

Major Vector-Borne Diseases of Cattle Worldwide

Disease	Etiologic Agent	Vector
Nagana	*Trypanosoma brucei*	Tsetse Flies (*Glossina* spp.)
East Coast Fever	*Theileria parva*	*Rhipicephalus* spp.
Redwater	*Babesia bigemina, B. bovis*	*Rhipicephalus (Boophilus)* spp.
Heartwater	*Ehrlichia (Cowdria) ruminantium*	*Amblyomma* spp.
Anaplasmosis	*Anaplasma marginale*	*Rhipicephalinae & Biting Flies*

- Human tick-borne diseases are zoonotic
  - Most zoonotic tick-borne pathogens infect dogs
  - Ticks that parasitize humans also parasitize dogs
  - *Dogs have several potential roles in the investigation of tick-borne-zoonoses*
    - *Models*
    - *Sentinels*
    - *Reservoirs*

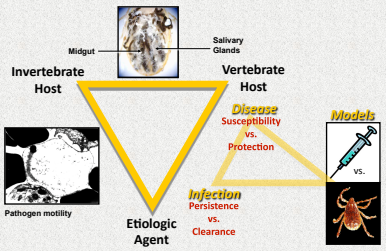
Tick-borne Zoonoses in the USA

Disease	Etiologic Agent	Vector
Lyme disease	*Borrelia burgdorferi*	*Ixodes* spp.
Rocky Mountain spotted fever	*Rickettsia rickettsii*	*Dermacentor* spp.
Human Monocytic Ehrlichiosis	*Ehrlichia chaffeensis*	*Amblyomma americanum*
Human Anaplasmosis	*Anaplasma phagocytophilum*	*Ixodes* spp.
Human Granulocytic Ehrlichiosis	*E. ewingii*	*A. americanum*
Human Babesiosis	*Babesia microti, et al.*	*Ixodes* spp.

- Six of the tick-borne diseases tabulated above are caused by bacteria classified in the order Rickettsiales
  - *Five of these rickettsial diseases are enzootic to Missouri*
  - Bacteria classified in the Order Rickettsiales are:
    - *Obligate* intracellular parasites (analogous to viruses)
    - Utilize an invertebrate host at some point in their life cycles
    - Divided into families Rickettsiaceae and Anaplasmataceae
      - ✓ Rickettsiaceae are free in the host cell cytoplasm
      - ✓ Anaplasmataceae reside within a parasitophorous vacuole

Our Interests

- Mechanisms affecting rickettsial infection of acarine and mammalian hosts
  - Manipulation of host cell actin
  - Interference with tick acquisition and transmission of infections
- Immunology and pathology of anaplasmosis and ehrlichiosis
  - Immune responses associated with ehrlichiosis
  - Influence of vector feeding on outcomes of infection
  - Immunoprophylaxis of clinical disease
  - Iatrogenic risk factors for exacerbation of clinical disease



Our Capabilities

- Tick feeding and pathogen transmission with large animal models
  - Canine
  - Bovine
- Large animal disease models
  - Anaplasmosis
  - Ehrlichiosis
- PCR assay development and implementation
- Immunological, proteomic, cellular and molecular biological methods to identify vaccine candidate antigens

Our Facilities

- Colleges of Medicine, Veterinary Medicine and Agriculture on the same campus, including MU Veterinary Medical Diagnostic Lab
- BSL2 facilities to investigate tick-pathogen-host interactions
- BSL3 facilities are planned for work with tick-pathogen-host interactions (e.g., with *Rickettsia rickettsii, Coxiella burnetii* and *Francisella tularensis*)
- Access to graduate programs at MU
  - Pathobiology Area Program
  - Joint Program in Veterinary Pathobiology/Molecular Microbiology and Immunology
  - Comparative Medicine and Pathology Residents
- Access to international collaborations for affordable projects involving food and companion animal populations