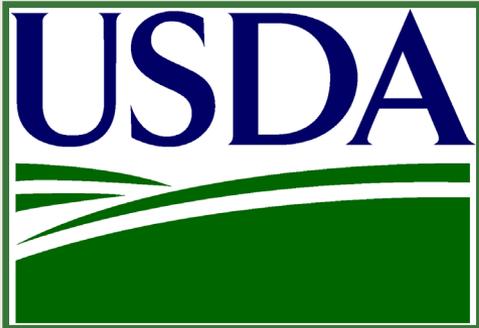


Mycoplasma ovipneumoniae

Beyond Sheep and Goats

USAHA Sheep, Goat, & Camelid Committee



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Mycoplasma ovipneumoniae

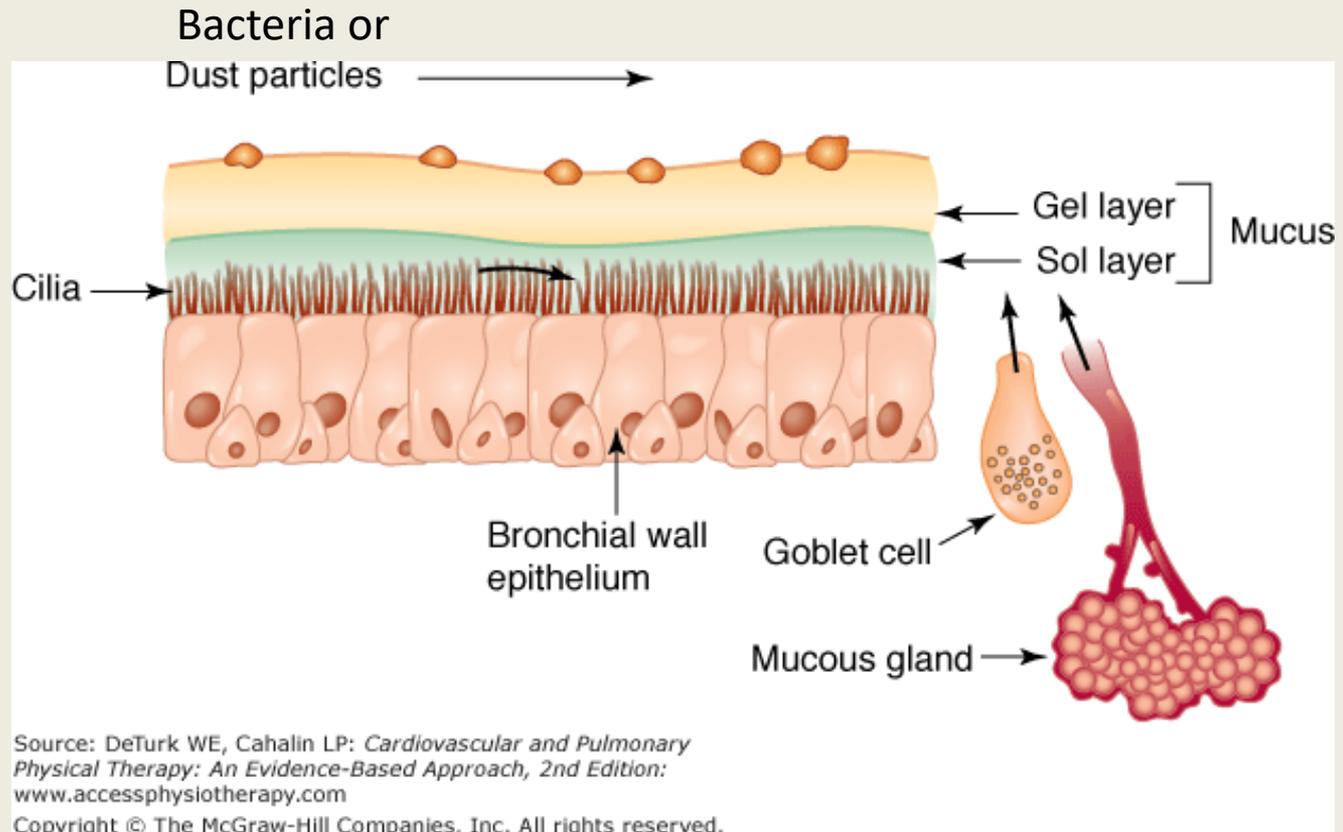
- First identified in New Zealand associated with domestic sheep pneumonia in 1972

(Carmichael LE, *et al.* Isolation, propagation, and characterization studies of an ovine *Mycoplasma* responsible for proliferative interstitial pneumonia. Cornell Vet. 1972;62:654–79.)

- Disease associated with suboptimal environmental conditions (poor passive transfer/nutrition, environmental stressors, etc.)
- Known to infect sheep and goats; primarily affects young
- Infection → lowered production in lambs
 - reports from New Zealand; not all reports confirm this
- Fastidious organism (need special culture and/or PCR to detect)
- Often referred to by nickname “Movi”

Mycoplasma ovipneumoniae

- Pathogenesis
 - Colonizes respiratory epithelium and inhibits mucociliary clearance



- Little known about virulence/virulence factors

The link between domestic small ruminants and bighorn sheep (in-brief)

- Small domestic ruminants have been implicated as a source of pathogens identified in association with bighorn sheep **polymicrobial/multifactorial** pneumonia
 - Captive studies & anecdotal field reports
 - Experimental data suggesting bighorn sheep more “sensitive” to agents of pneumonia
- Implementation of absolute separation
 - Loss of public lands grazing
 - Pressures placed on private land owners

Mycoplasma ovipneumoniae

- Discovered in the last decade to be in high association with the complex phenomenon of bighorn sheep pneumonia
 - Impacts adults and lambs, but not always – healthy carriers, as with domestics (infection ≠ disease)
 - “Pasteurellas” and other mixed bacteria found but not as consistently as *M. ovipneumoniae* is reported

Besser TE, Highland MA, Baker K, Cassirer EF, Anderson NJ, Ramsey JM, et al. Causes of pneumonia epizootics among bighorn sheep, Western United States, 2008-2010. *Emerg Infect Dis.* 2012;18(3):406-14.

- Current proposals to create “*M. ovipneumoniae*-free” domestic small ruminants
- Reported by some to be species specific to members of subfamily Caprinae (goats/sheep/muskox)

Mycoplasma ovipneumoniae

Previous reports in non-Caprinae species

Beira antelope at a wildlife preserve in Qatar (2005-2006)

Gull JM, Hebel C, Deb A, Arif A, Clauss M, Hatt JM, et al. Blood values of captive beira antelope (*Dorcatragus megalotis*) prior to and during an outbreak of fibrinous pleuropneumonia syndrome (FPPS). *J Zoo Wildl Med*. 2014;45:735–43.

Cattle in Colorado (2007-2008)

Wolfe LL, Diamond B, Spraker TR, Sirochman MA, Walsh DP, Machin CM, et al. A bighorn sheep die-off in southern Colorado involving a *Pasteurellaceae* strain that may have originated from syntopic cattle. *J Wildl Dis*. 2010;46:1262–8.

“assumptions about restricted host range of mycoplasmas, based on the host from which they were first or frequently isolated, are usually made in the context of nearly complete absence of representative sampling of the vast majority of potential vertebrate hosts”

Excerpt from textbook:

Mycoplasmas: molecular biology pathogenicity and strategies for control

Chapter: Emerging mycoplasmoses in wildlife

Mycoplasma prevalence and surveillance

Determining the true host range

Alaska study – investigating respiratory associated mycoplasmas

- Surveillance of wild and domestic sheep and goats and non-Caprinae species for carrying/ shedding *M. ovipneumoniae*
 - Alaska Dept. of Fish and Game
 - State of Alaska Division of Environmental Health – State Veterinarian
- >1000 wildlife animals tested to date (mtn. goat, Dall's sheep, caribou, moose, muskox, reindeer, wood bison)

Lower 48 states

Sample wild ungulates as samples are available

Mycoplasma ovipneumoniae

Non-Caprinae species

Detection to date:

- White tailed deer
 - captive and wild upper Midwest
- Mule deer
 - zoologic facility in Southwest
- Caribou
 - 43 of 590 tested from Alaska
- Moose
 - 16 of 500 tested from Alaska
- American bison
 - 1 of approximately 20 now tested in West

Mycoplasma ovipneumoniae

Non-Caprinae species

Tested with no detection to date:

- Antelope (~60; Wyoming)
- Elk (~200; Colorado, Idaho)
- Moose (few tested from Northeastern U.S.)

Mycoplasma ovipneumoniae

Non-Caprinae species

Association with respiratory disease in

- White tailed deer in upper Midwest
 - polymicrobial pneumonia (Pasteurellaceae bacteria)
- One caribou calf
 - Found dead; emaciated body condition
 - Pneumonia identified on gross, confirmed on histopathological examination
 - *M. ovipneumoniae* and two species of Pasteurellaceae (*Pasteurella multocida*, *Mannheimia granulomatous*)

Publications

Margaret A. Highland, David R. Herndon, Scott C. Bender, Lisa Hansen, Robert F. Gerlach, Kimberlee B. Beckmen. ***Mycoplasma ovipneumoniae* in Wildlife Species beyond Subfamily Caprinae.** Emerg Infect Dis. December 2018; 24(12).

[Ahead of print]

Emma R. Rovani, Kimberlee B. Beckmen, Margaret A. Highland. ***Mycoplasma ovipneumoniae* associated with polymicrobial pneumonia in a free-ranging yearling caribou (*Rangifer tarandus tarandus*) from Alaska, USA.** [Under peer-review]

Chasing down another mycoplasma

“Mycoplasma-conjunctivae-like” (Mc-I) bacterium

- Nicknamed this only due to its similarity to *M. conjunctivae* in the variable region of the 16S rRNA gene
 - False positive with published assays used to identify *M. ovipneumoniae* (PCR and real-time PCR)
 - McAuliffe L, Hatchell FM, Ayling RD, King AIM, Nicholas RAJ. 2003. Detection of *Mycoplasma ovipneumoniae* in *Pasteurella*-vaccinated sheep flocks with respiratory disease in England. *Vet. Rec* 153:687-688.
 - Ziegler JC, Lahmers KK, Barrington GM, Parish SM, Kilzer K, Baker K, Besser, TE. 2014. Safety and Immunogenicity of *Mycoplasma ovipneumoniae* Bacterin for Domestic Sheep (*Ovis aries*). *PLoS ONE* 9(4): e95698.
 - More similar to *Mycoplasma dispar/bovoculi* in other genome regions
- Currently uncharacterized - working on isolation & sequencing
- Identified in wild and domestic sheep and goats, elk, antelope, American bison, mule deer, white tailed deer, caribou, moose

Testing method

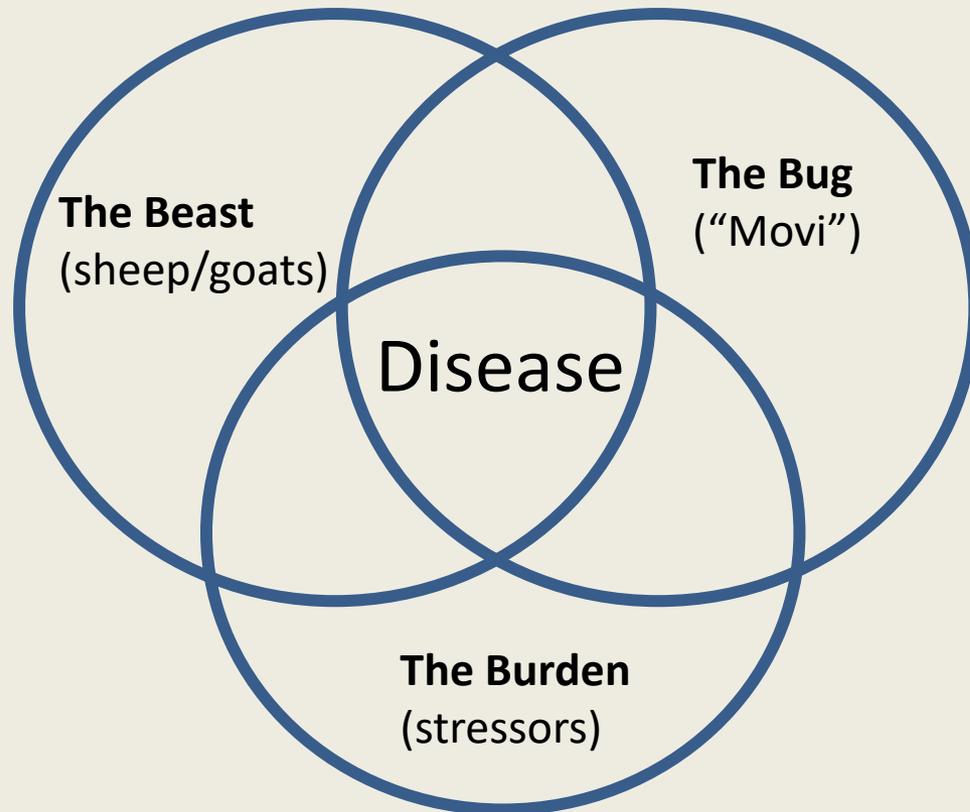
- PCR followed by sequencing
 - McAuliffe, *et al.* PCR/primers to initially screen for *M. ovipneumoniae* and “Mc-1”
- Detection limitations
 - PCR detects 10^1
 - Equates to 7,500 to 10,000 (roughly 10^4) bacteria being picked up on nasal swab sample

Research in Progress

- Improve detection method limits
- Sequence additional regions of each positive sample to determine genotypes (strains)
 - Goats and sheep seem to have species differences in *M. ovipneumoniae* genotypes (and phenotypes)
- Isolate and full length sequence *M. ovipneumoniae* from multiple animals of each species, wild and domestic, for phylogenetic analyses
- Complete surveillance distribution analyses and wildlife/domestic genotype comparisons analysis in AK
- Isolate and characterize “Mc-I”

The foundation of infectious disease

Diseases are not “transmitted”, infectious agents are transmitted
Disease is an outcome of transmission and is dependent on.....



The etiology of pneumonia in lambs is considered to be extremely complex and relates to synergistic effects of both management practices and infectious agents. A wide variety of microorganisms have been recovered from the respiratory tract of pneumonic sheep (Stevenson, 1969) but the etiological significance of many of them is in doubt. *Pasteurella* sp. and mycoplasmas were the most common organisms isolated from pneumonic as well as normal sheep. Challenge experiments indicated that these organisms alone have limited ability to induce pneumonia and require predisposing factors.

Excerpt from "Respiratory infection of lambs with *Mycoplasma ovipneumoniae*"
(dissertation author: Mumtaz Ahmad Khan, Iowa State University 1993)

Thanks to.....

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