Advancing solutions for sheep infectious disease problems

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Overview

• In each case:
  • Problem
  • Research So Far
  • Future Plans

• Ovine Respiratory Disease, including *Mycoplasma ovipneumoniae* and potential interface with bighorn sheep
• Malignant Catarrhal Fever
• Coxiellosis/Q Fever
• Scrapie

• ADRU solves infectious disease problems for the sheep industry
Ovine Respiratory Disease

• Disease in domestic sheep
• Bighorn interface
  • Grazing rights threaten long-standing family operations

• Genetics of *M. ovipneumoniae* nasal shedding
• Foundational data for vaccine development
• Genomics of *M. ovipneumoniae* for vaccine development and diagnostic test improvement

Ovine Respiratory Disease

- Genetics of *M. ovipneumoniae* nasal shedding
- Genome-wide association (GWA)
  - Search up and down each chromosome for major gene(s)
  - Nasal shedding of *M. ovipneumoniae*
  - There are major genes!
- Suggests will be possible to identify genetically low shedders of *M. ovipneumoniae*
- Future work needed to develop and validate DNA tests to identify those animals
Ovine Respiratory Disease

• Comparative Immunology of Domestic versus Bighorn sheep
• Differential abundance of immune cells (neutrophils; Highland et al 2016)
• Differential abundance of immune molecules on cell surface (Highland et al 2016)
• Differential immune responsiveness on experimental challenge of older animals with *M. ovipneumoniae* (in preparation)
Ovine Respiratory Disease

• Comparative genomics of *M. ovipneumoniae*
  • Input for vaccine development and improved diagnostic tests

• Future:
  • Comparison of domestic vs bighorn sheep in younger animals
  • Expanded comparative genomics of *M. ovipneumoniae* and related species
  • Leading to vaccine development
Malignant Catarrhal Fever

- Most sheep carry virus (OvHV-2) that is not harmful to sheep, but can be transmitted to bison or cattle
- Can cause fatal disease in bison or cattle
- Separation distance has been a successful but limited intervention shown by ADRU

- Rare cases of MCF disease in sheep

Malignant Catarrhal Fever

• Vaccine development to protect bison or cattle would enable closer housing or possibly co-grazing

• Promising vaccine candidates in testing right now

• Vaccine development expertise add to Mycoplasma/bighorn pneumonia research program moving forward
Coxiellosis & Q Fever

• Zoonotic – can spread to humans
• Billion organisms per gram of sheep placenta
• Human minimum infectious dose is one organism
• Airborne transmission – many cases where people did not have direct contact with sheep or other ruminant livestock but had Q Fever traced to them
• No vaccine in U.S. – largely because of BSL3 production
• Potential for $1 Billion outbreak in U.S.

http://www.goatworld.com/articles/abortion/abortion1.shtml viewed 01/24/17
Coxiellosis & Q Fever

• Vaccine – produce in BSL2 conditions
  • Mouse model of placental shedding currently underway

• Antimicrobial treatment – often opposed for animals, but this is human health risk
  • Meaningful reduction in shedding would help human health (One Health approach)
  • May be some ways to reimagine treatment that dramatically improve results – data coming soon

• Genetics of shedding/transmission
Scrapie

• U.S. Scrapie Eradication has made great strides
• Export markets remain closed until we get 7 years without a single classical scrapie case

• ADRU has provided:
  • First live animal lymphoid testing
  • Reagents for diagnostics
  • Many genetic insights, including resistant goats (DNA testing now available)

https://www.iowaagriculture.gov/animalindustry/scrapieprogram.asp viewed 01232020
Scrapie

- Improved diagnostic testing/surveillance
- Basic understanding of protein misfolding as it happens in the cell
  - Especially factors beyond the prion protein itself
  - For example, chaperone proteins that help guide folding
  - May help investigate rare exceptions to resistance

- Maintain research infrastructure for readiness as needs develop
2020 USDA-ARS Animal Health National Program

Assessment and Priorities Evaluation Form
Purpose

• The purpose of the survey is both retrospective as well as prospective

• It gives the ARS Office of National Programs information that is used to define the next 5-years of Animal Health Research

  • **Retrospective**- Measurement of impact; Did we accomplish what we said we would?
  • **Prospective**- What animal health disease research would have the most impact for your industry? What research should we be doing or continue to do?
Details

• A link will be shared electronically (target date is February-March pending approvals)

• Targeted towards stakeholders (producers, researchers, veterinarians, government agencies etc.)

• Will remain open until we get over 500 respondents.

• ~15 minutes to complete
Summary of Proposed Research Areas

• Ovine Respiratory Disease, including potential bighorn pneumonia interface
• Coxiellosis/Q Fever
• Scrapie/TSEs
Thank You

• American Sheep Industry
• Producers
• ADRU scientists & staff
• Numerous collaborators
• USDA-ARS funding