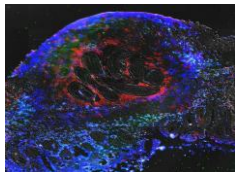


# SHEEP PARASITE MANAGEMENT

*Past, Present and Future*

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Division of Animal and Nutritional Sciences



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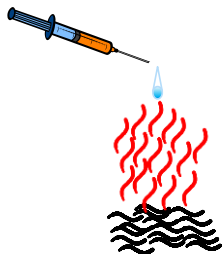
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## How does drug-resistance develop?

Assumption: All de-wormers are 100% effective



Dead worms!

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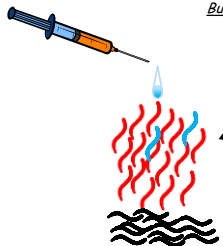
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## How does drug-resistance develop?

Reality: No dewormers are 100% effective

*But are most effective when they are new!*



Everyone say hello to our new drug-resistant little friends

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## How does drug-resistance develop?

New Reality: De-wormer doesn't work anymore!



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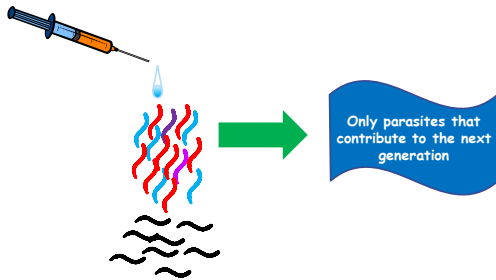
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## Maintaining Refugia

Every time you de-worm your animal you change the worm population



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## FAMACHA

- Deworming only the animals that need it.
- Allowed maintenance of drug-susceptible parasites. (Refugia)
- Preserving efficacy of a finite number of deworming drugs.
- Excellent tool to manage parasitism within your flock.

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### Band-aid solution to a bigger problem

We (sheep producers) forgot how to (or never learned to) raise animals with disease resistance.

*"The prime requisite of economic sheep production is to raise animals that are resistant to the effects gastrointestinal nematode parasite infection"*

How do we manage parasitism while improving parasite resistance in the host population?

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### Hygiene Hypothesis

- Early childhood exposure ex: children eating mud pies?
- The hypothesis is based on observations of autoimmune diseases in people in 3<sup>rd</sup> world countries.
- Early childhood exposure to different pathogens helps in the development of "learned" regulatory immune responses.
- Ex: mice with T1D

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### Hygiene hypothesis...*applied to sheep!*

- Since the discovery of avermectins we have been raising sheep in a helminth-parasite sterile environment

**Until recently**

*So essentially we have been creating sheep that forgot how to generate an effective immune response to parasite infection?*

**Maybe?**

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## Quick experimental explanation

- All lambs were born on elevated floor barn at WVU
- Six weeks after weaning, 5 St. Croix lambs and 5 Suffolk crossbred lambs were given 10,000 L3 *H. contortus*
  - 5 weeks later lambs were dewormed with levamisole and rested for 4 weeks
- During "real" experiment 10 St. Croix and 10 Suffolk cross lambs were given 10,000 L3 *H. contortus*
  - Naïve lambs = did not receive a dose of larvae
  - Primary infection = first exposure to *H. contortus*
  - Challenge infection = Infection given to lambs that have developed memory

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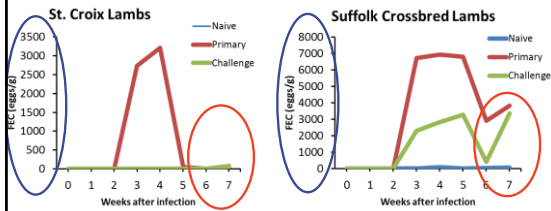
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## Fecal egg count after infection




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## Parasite exposure and memory

- During challenge infection Suffolk crossbred lambs had:
  - half the FEC of their primary infected contemporaries
  - an FEC comparable to primary infected St. Croix lambs

Might consider exposing lambs to parasites (pre-weaning)

Bring them into barn, deworm and hold for 4 weeks and grass finish those lambs?

Managing parasitism using the immune response of the animals!

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### What is so special about St. Croix sheep?

*Nothing in particular!*

- These sheep haven't been dewormed for generations.
- They come from an environment where they are constantly challenged with parasites.
- During a challenge infection they seem to generate a greater inflammatory immune response.

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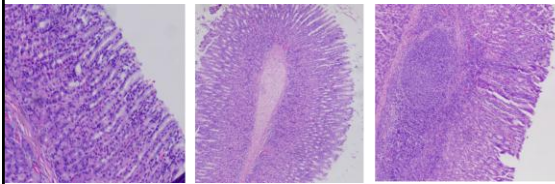
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### Inflammation in the abomasum



***Our commercial crossbred sheep have an impaired immune response to parasite infection.***

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### Should I begin crossbreeding St. Croix sheep?

- NO! well maybe?
- Impaired ability to accurately select parasite resistant F1 progeny
- Too many questions as to the profitability of the St. Croix cross
  - Reduced carcass weight
  - Lighter muscled
  - Hair in pelt
- What is their role??

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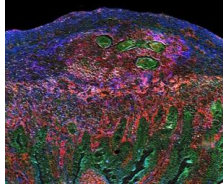
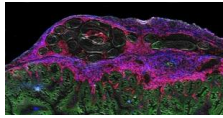
## The importance of inflammation in response to helminth infection

Inflammation is critical for the recruitment of other arms of the protective immune response

Antibody differences between a primary and challenge infection

Can we capitalize on our knowledge of immune responses to improve immunity in commercial crossbred sheep?

What if we were able to give sheep a feed additive or a shot prior to exposure to parasitism that would improve immunity?



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## The future of sheep parasite management

- 1.) Managing parasite exposure of commercial lambs to allow for development of sufficient immunologic memory.
- 2.) Discovering the crossbreeding "dose".
- 3.) To make commercial breeds of sheep more like St. Croix sheep in their immune responses:

***"Immunomodulation"***

Can we stimulate or "wake up" immunity in crossbred lambs

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## Questions



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