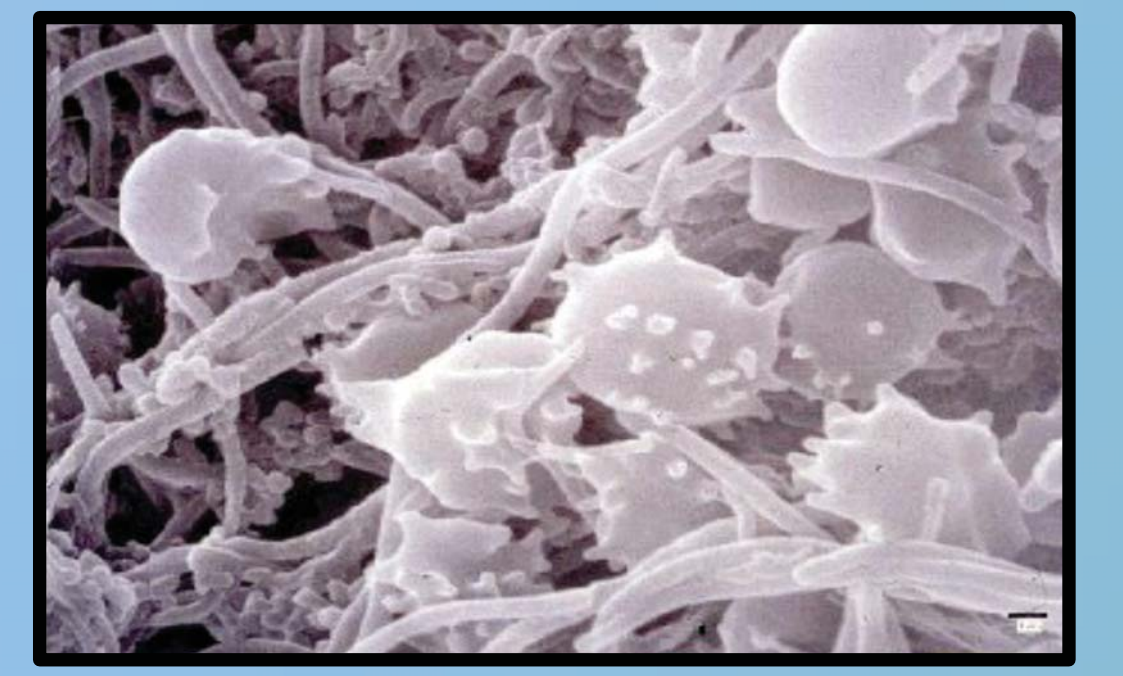


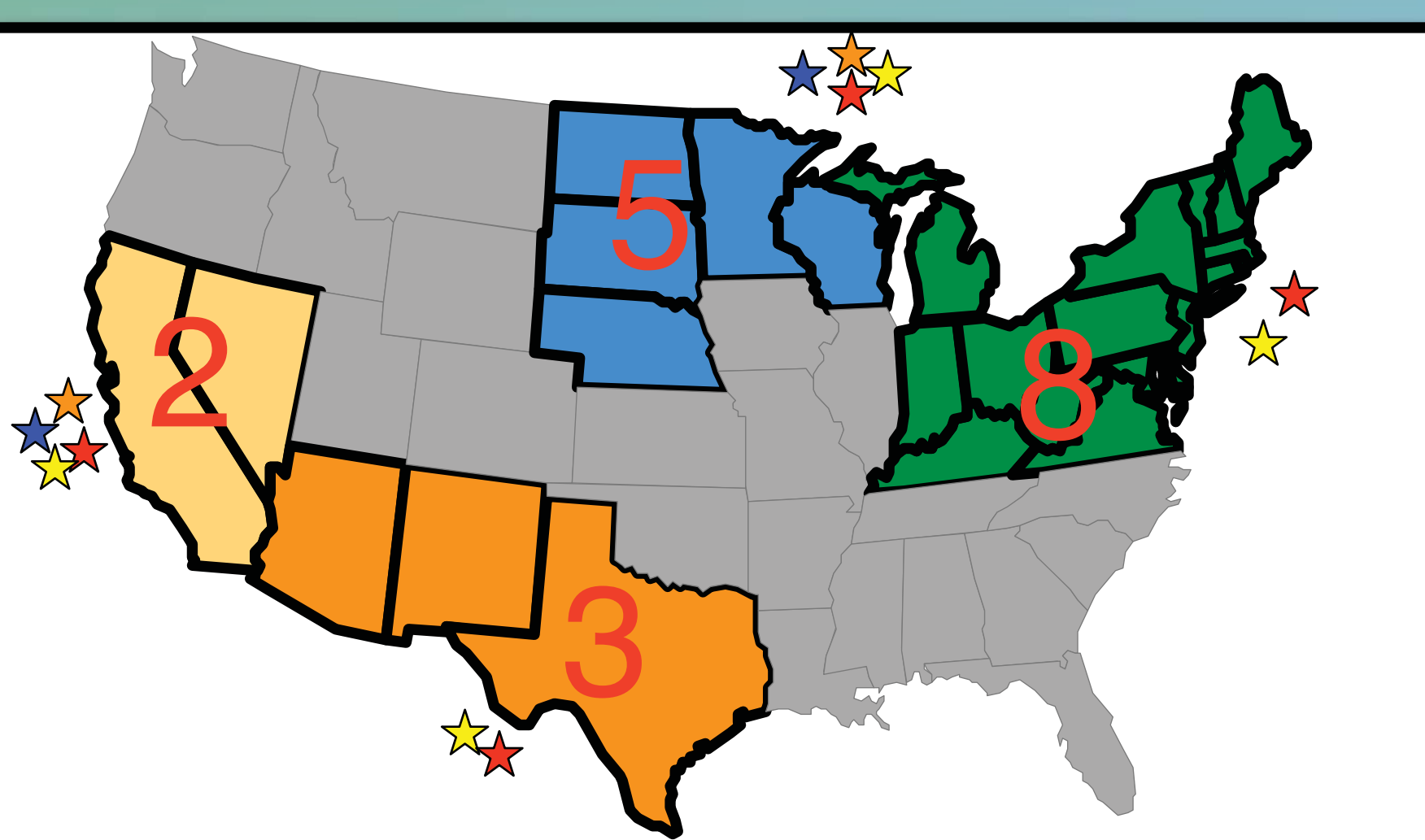
USMARC Research Findings on *Salmonella* in Cattle Production Environments

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ABSTRACT

Contamination of beef with the foodborne pathogen *Salmonella* can significantly impact consumers and the beef processing industry. The emergence of multi-drug resistant (MDR) *Salmonella* is an important health problem as drug treatment options may become limited, especially for cases of invasive salmonellosis. Here we report the prevalence of MDR *Salmonella* associated with cull and fed cattle presented for slaughter in the United States. The average prevalence of *Salmonella* on hides, pre-evisceration and post-intervention carcasses was found to be 89.6%, 50.2% and 0.8% respectively. The proportion of samples in which MDR *Salmonella* were detected was on average 17.4%, 11.8% and 0.33%, on hides, pre-evisceration and post-intervention carcasses respectively. Hide and carcass levels of MDR *Salmonella* were not significantly different for fed or cull cattle slaughtered at the same abattoir. In this study, 16,218 *Salmonella* hide and carcass isolates were screened for drug resistance. Of these, 981 (6.0%) MDR *Salmonella* isolates were identified and serotyped. The predominant MDR *Salmonella* serotypes were Newport (52.3%), Typhimurium (16.7%) and Uganda (10.1%). Additionally, MDR *Salmonella* Agona, Anatum, Reading, Muenster and Dublin were identified. Our results suggest that transportation and lairage of cattle affect the levels of *Salmonella* on hides of cull and fed cattle at slaughter. We also observed regional differences in MDR *Salmonella* prevalence. In spite of these differences, multiple hurdle processing interventions were quite effective and decreased carcass contamination with *Salmonella* on average by 98.4% (95% CI 97.6 - 99.7).

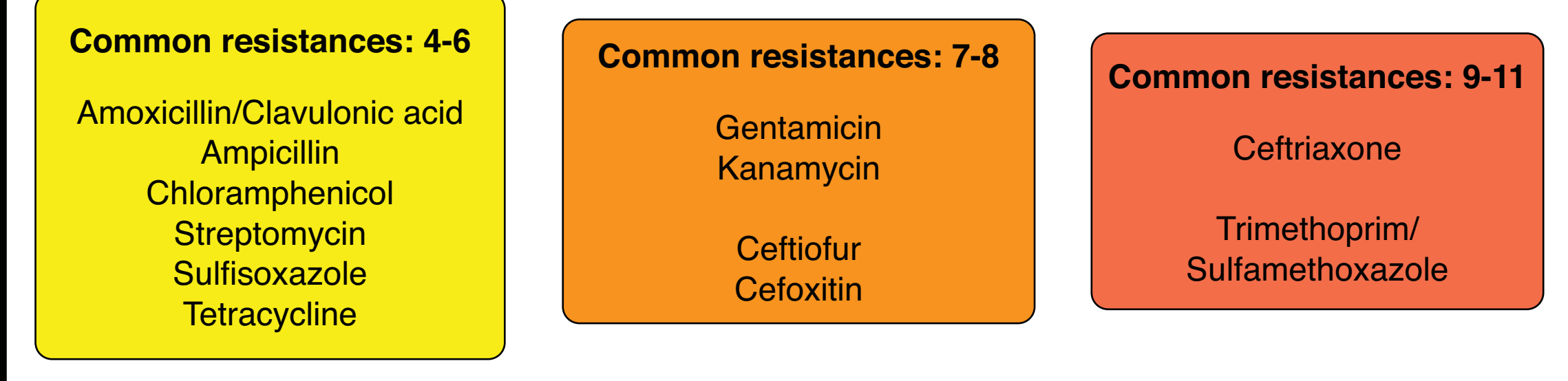
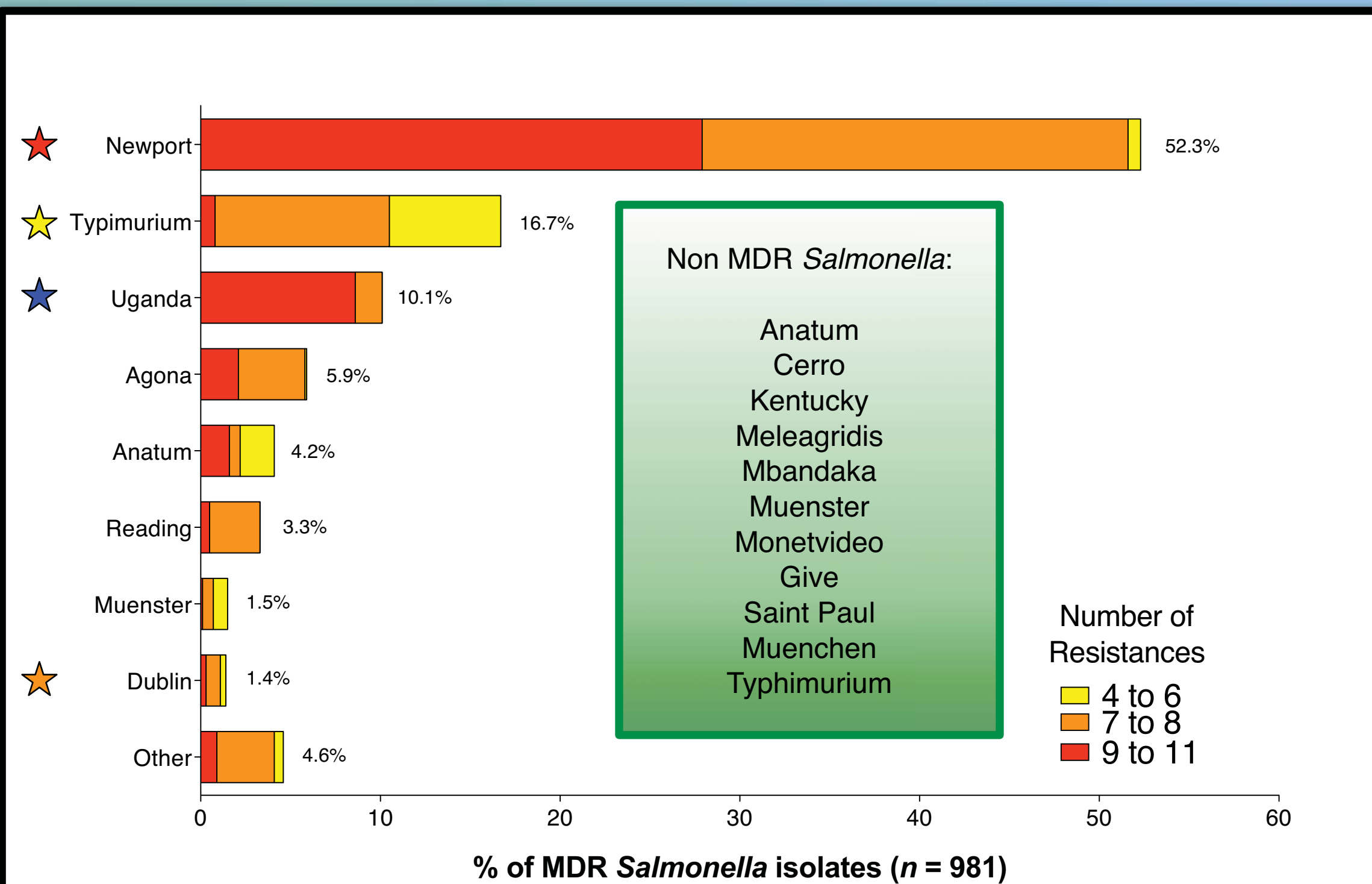


Map of the Beef Industry Food Safety Consortium (BIFSCO) regions sampled in this study.

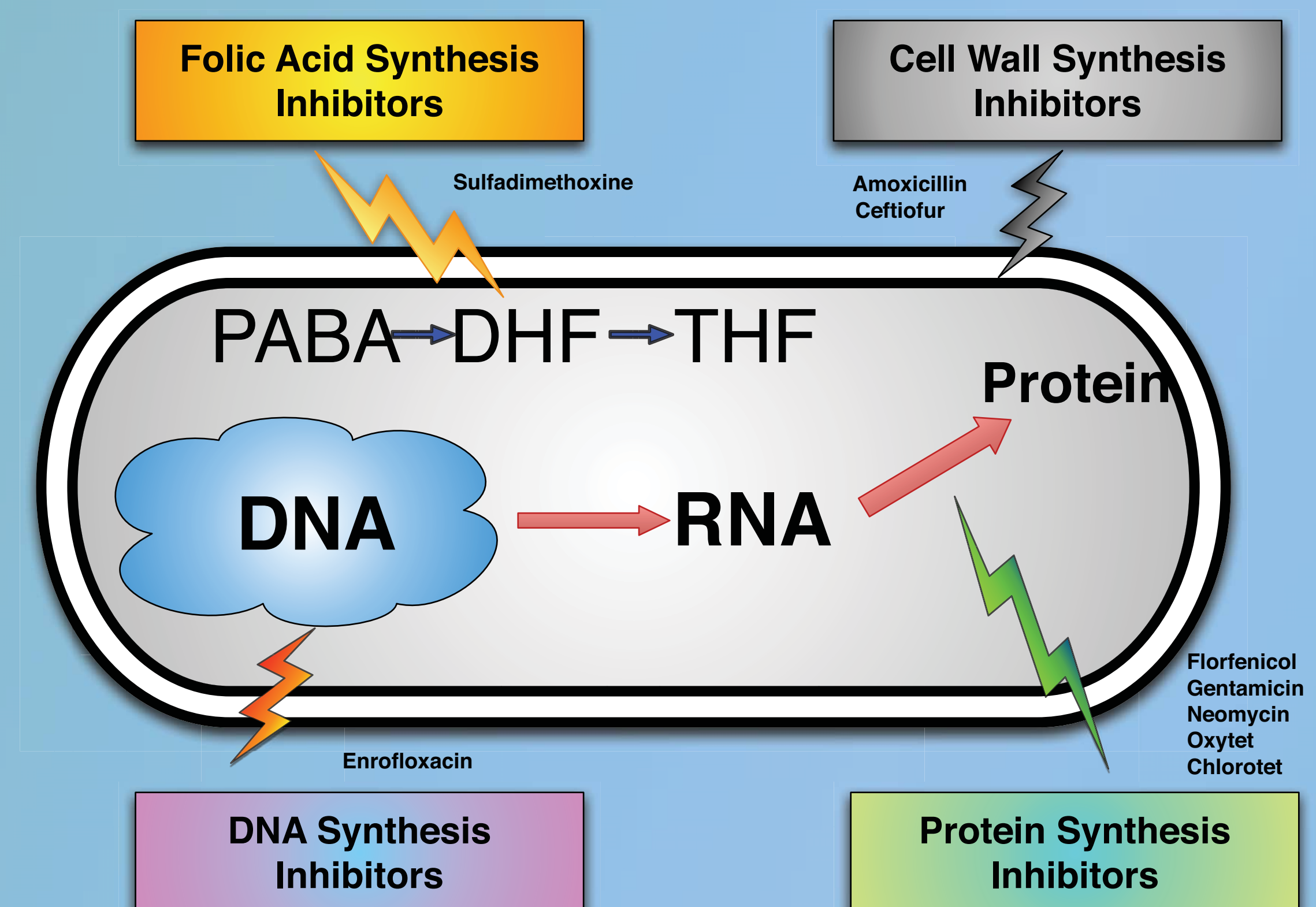
Study Design

- 4 Processing plants across the U.S.
- 4 Sample Seasons (2 days/plant/season)
- 3,797 Cattle sampled: Hide (1000 cm²), Pre-evisceration and Post-intervention carcasses (8000 cm²)

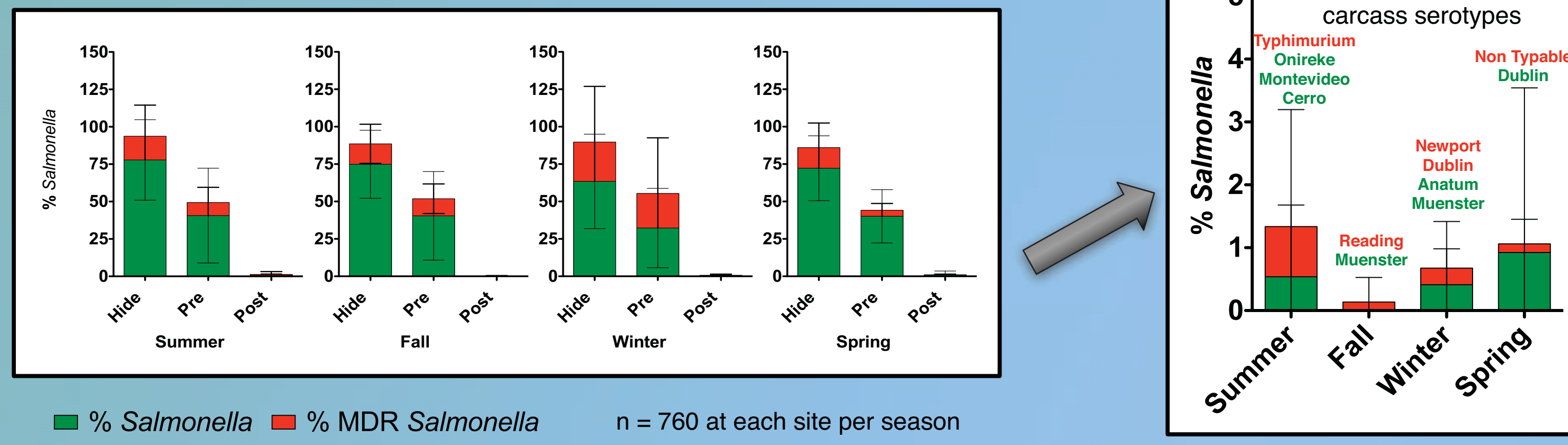
MDR *Salmonella* Serotypes and Drug Resistance Phenotypes



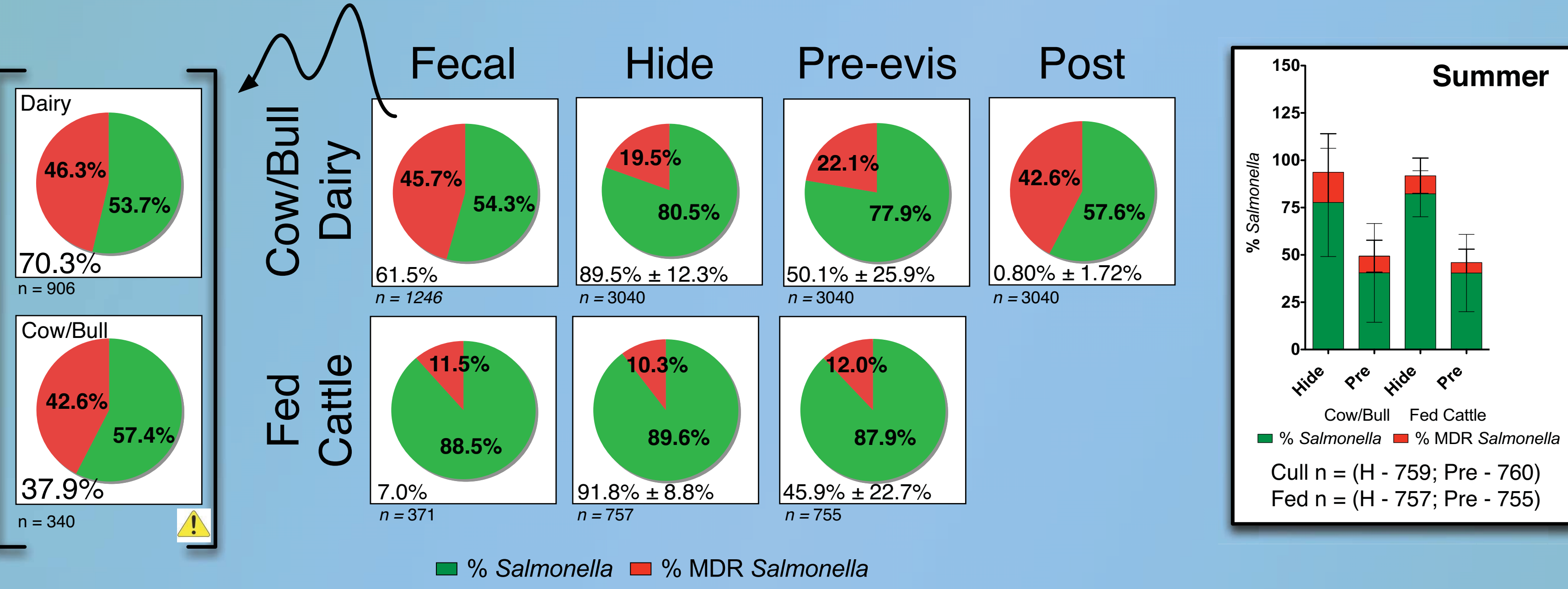
Major Classes of Antibiotics:



MDR *Salmonella* Prevalence by Season



MDR *Salmonella* in Cull vs. Fed Cattle



Cow/Bull Dairy Cattle



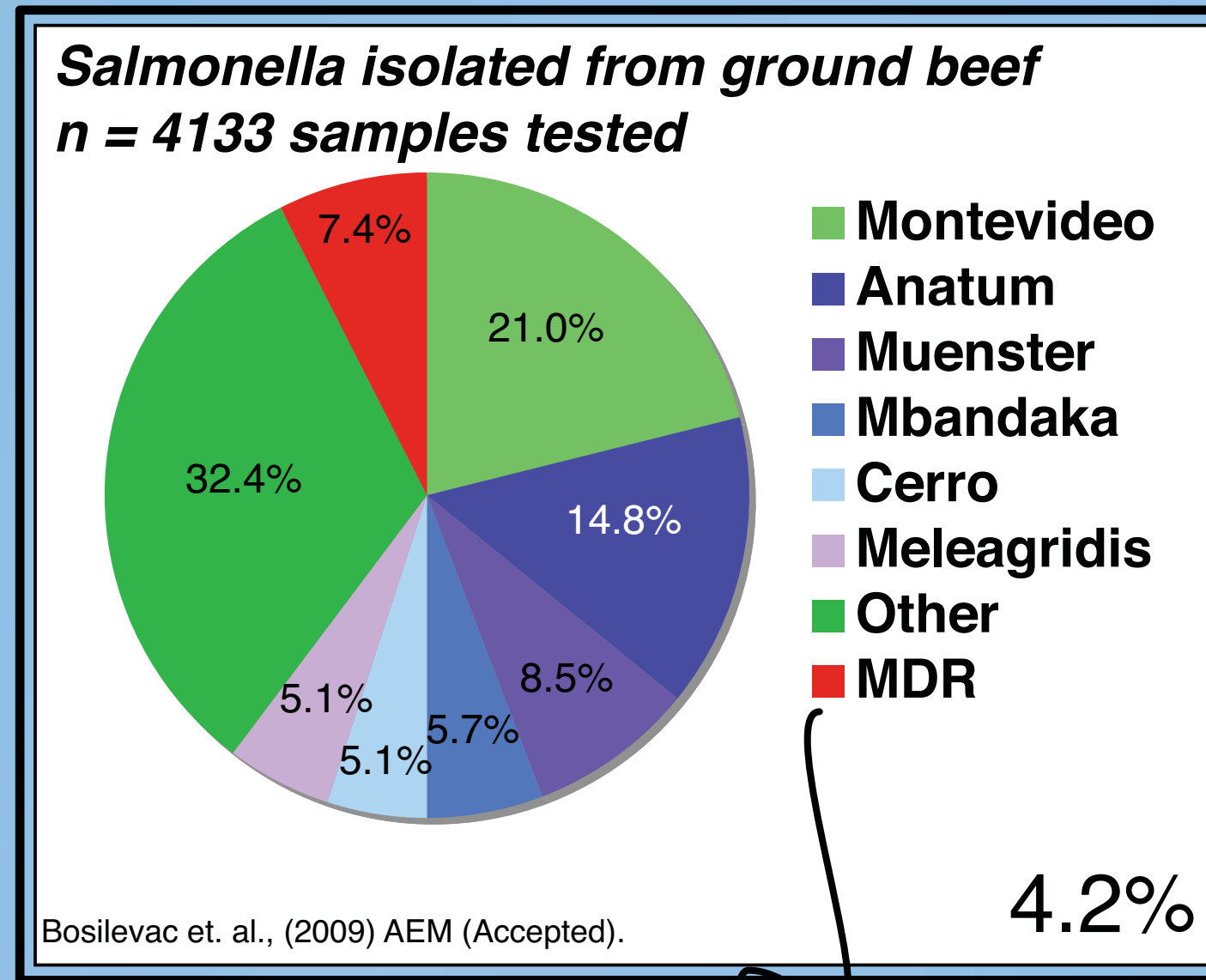
Fed Cattle



Salmonella prevalence ~5 - 30%
Transportation and Lairage
Arthur et al., (2008) JFP 71:1752-1760

Salmonella prevalence ~60 - 80%
Hide
Image of a hide with Salmonella contamination.

Salmonella in Ground Beef and Trim



Salmonella serotypes found in trim:
Montevideo
Anatum
Enteritidis
No MDR detected in US trim samples
n=487 0.8%

MDR *Salmonella* in Ground beef:
Dublin
Reading
Agona
Typhimurium
Newport

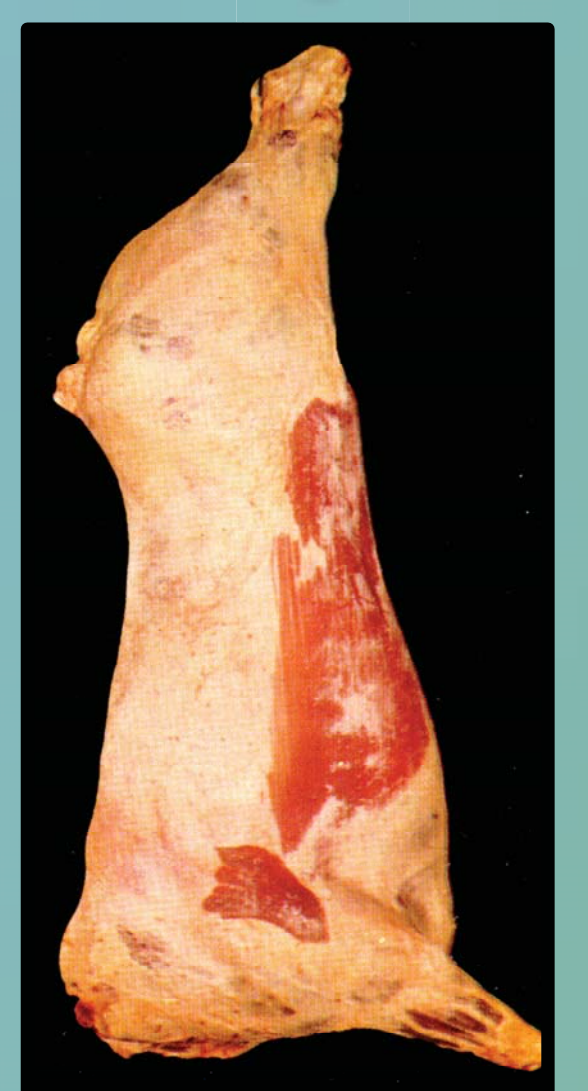
Ground Beef



Trim



Post-intervention



Pre-evisceration

Multiple Hurdle Interventions

Key Findings

- * *Salmonella* are prevalent on hides at slaughter and MDR *Salmonella* are a small fraction of that population -- MDR *Salmonella* levels are generally higher with Cull Cattle than with Fed Cattle.
- * Hide to carcass transfer occurs and is in part dependent on hide pathogen load, but processing interventions significantly reduce *Salmonella* levels on final carcasses.
- * The percentage of *Salmonella* that are MDR appears to increase along the beef production chain -- Are some *Salmonella* better than others at resisting processing interventions...?

Ongoing Research and Future Experiments

Salmonella Transcriptome studies:

We will determine the genes expressed by *Salmonella* when exposed to processing interventions -- this will tell us about the *tools* that *Salmonella* are using to "persist" in post processing environments -- we can take advantage of this knowledge and develop new ways to kill them!

Contact Information

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