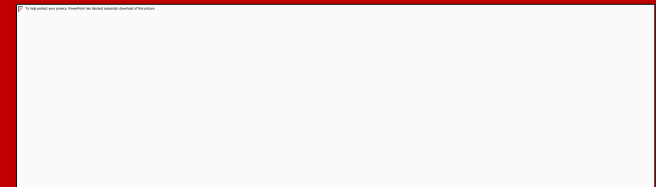




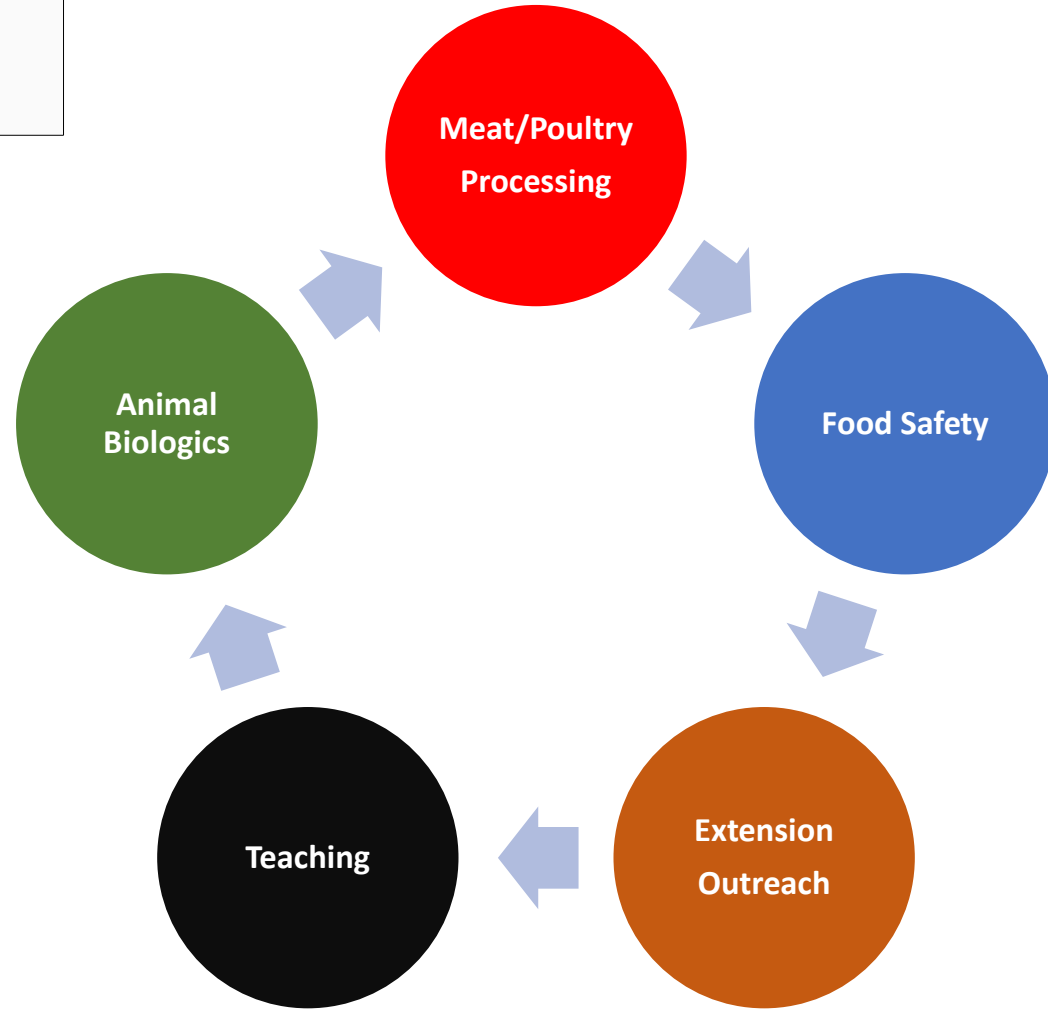
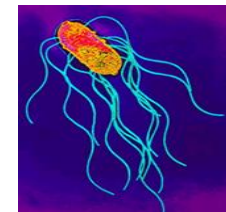
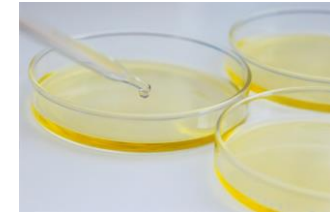
Food Safety Research Prospects for The Meat Science & Animal Biologics Discovery Program

Steven C. Ricke

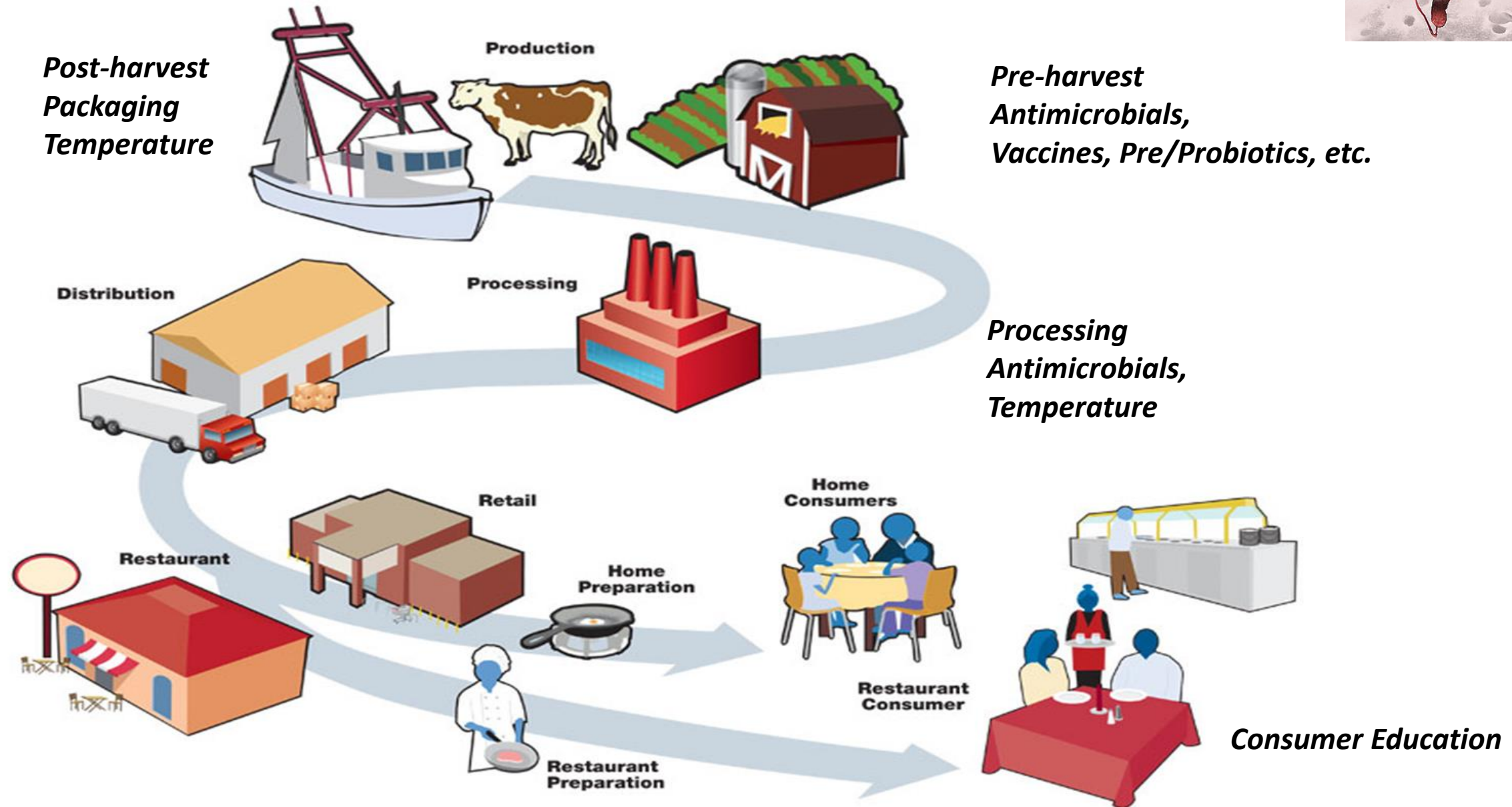
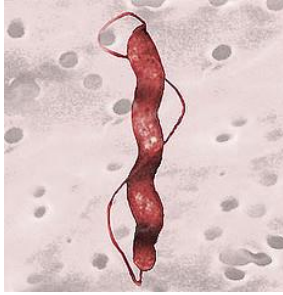
**Director – Meat Science & Animal Biologics
Discovery Program (MSABD)
Dept. of Animal and Dairy Sciences
University of Wisconsin**



Current and Future Prospects for Meat Science and Animal Biologics Discovery Program



Food Animal Microbial Ecology





Strategy for Pre-Harvest Food Safety and Gut Health



Pathogen Screen

Pathogen

Pathogen challenge studies *in vitro/in vivo*



Microbiome

16S rRNA gene-targeted sequencing of entire microbial communities

Gut Ecology

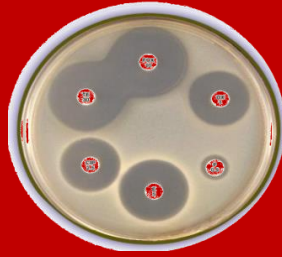
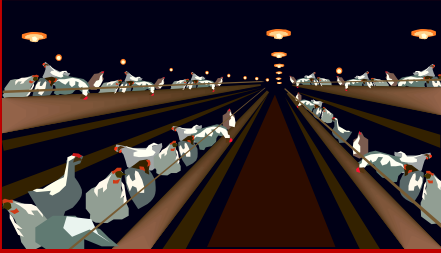
Taxa: Identification of representative gut microbes = core microbiome for a feed additive



Diversity: Identification of differences in gut microbe populations among feed additives

Animal performance

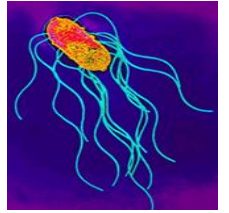
-Host gut response: Metabolomics, transcriptomics, immunology, proteomics
-Longitudinal studies: Meat microbiology and meat quality post harvest



Potential Outcomes for Preharvest Food Safety Research

• Standardization of Feed Additives Evaluation

- Gut **microbiome** composition and **metabolome**
- Pathogen **reduction** and animal **performance**
- Farm to fork: **Longitudinal** studies



• Prebiotic Mechanisms and Discovery

- **Complex** prebiotic = **complex** gut microbe response
- Gut microbiome to identify active grain **bran** components
- Pathogen **transposon** mutagenesis



• Commercialization/discovery opportunities:

- **Probiotic** and **prebiotic** candidates



Strategy for Meat Processing Microbial Ecology/Food Safety

Sequencing



NGS

✓ **Next Generation Sequencing**

Microbiome

**16S rRNA gene-targeted
sequencing of entire microbial
communities**

Applications



**Conventional plating; Microbiome mapping of meat processing steps
Pathogen Quantitation**

**Taxa identification of representative indicator microbes; Signature
microbial populations for interventions**

**Screening of culture nonselective and selective plating methods; Validation
of plating methods by NGS**

Potential Outcomes for Meat Processing and Food Safety Research



Pathogens



Processing



Data Analytics



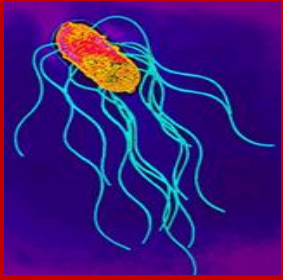
- **Rapid quantitative methods** for pathogens: Molecular typing for *Salmonella* identification, **CRISPR** typing; DNA **barcoding** for tracking
- **Quantitative microbiome mapping**: Designing protocols for **quantifying** general microbial populations on red meat and poultry
- **Postharvest microbial indicators**: Identifying indicator microbial profiles for **optimal** intervention performance and **shelf life prediction** = **evaluation of commercial antimicrobials; sanitizers**
- **Data analytics**: WGS, microbiome mapping; risk assessment = Need **collaboration** for advanced computer programming
- **Commercialization**: Rapid pathogen **ID quantitation** kits, **Assays** for precise spoilage prediction



Current and Future Trends in Food Safety



- **Organic, natural** and the removal of antibiotic growth promoters
- **Alternative** meats, animal welfare, sustainability
- Labor shortage = **Automation** in processing
- Big vs. small animal agriculture: **Retail** vertical integration
- “**Big data**” revolution: Block chain, traceability, cyber security, and sequencing



DNA sequence of
bacteria in sample

```
ACTGAGTTCCCTGGAACGGGACGCCATAG
TACTGAGTTCCCTGGAACGGGACGCCATAG
CCGTCTGGTAGGACACCCAGCCCCCTG
TTCCGAGTTCCCTGGAACGGGACGCCATAG
CTTCCGAGTTCCCTGGAACGGGACGCCATAG
TCCGAGTTCCCTGGAACGGGACGCCATAG
GGATAACCGTGGTAATTCAGAGCTAAT
ACGCCATAGAGGGTGAGAGCCCCCTG
TTCCGAGTTCCCTGGAACGGGACGCCATAG
CGGGACGCCATAGAGGGTGAGAGCCCCCTG
CGTCTGGTAGGACACCCAGCCCCCTG
```



Food Safety Opportunities for MSABD



- Science-based identification of novel **feed additives** and mechanisms
- Defining concept of “**meat microbial ecology**”
- **Animal biologics**: Maximize use of animal = Search for unique biologicals and microbes
- **Collaborate** with computer engineers to develop more advanced sequencing bioinformatics
- **Generate** groundbreaking/innovative peer reviewed research

Thank You

Questions

