Cornell Cooperative Extension
Delaware County

Catskill Regional Agriculture Conference 2022

Immunology & Vaccines

Robert A. Lynch, DVM
Dairy Herd Health & Management Specialist
Cornell University: PRO-DAIRY Program
rlynch@cornell.edu
607.882.5378

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Outline

- Immune suppression
- Reducing Exposure
- Diseases of concern
- Use of vaccines
- Common issues

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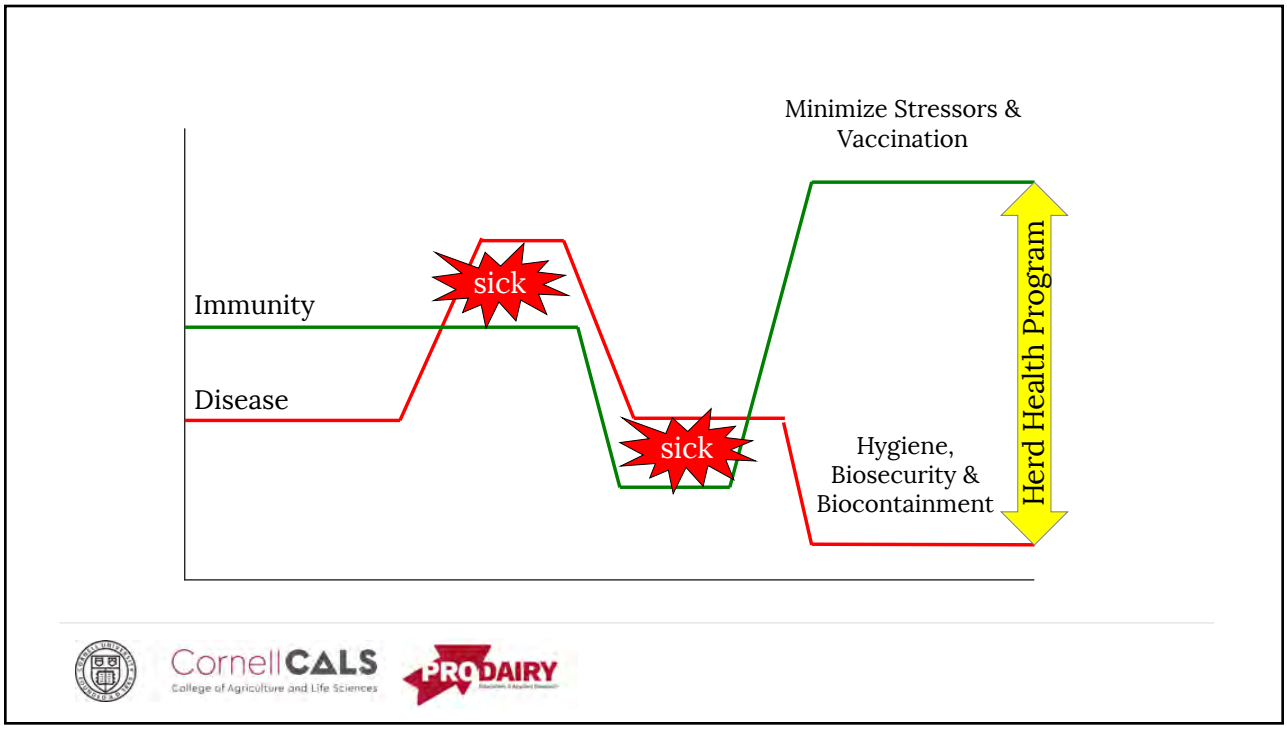
Minimize Stressors &
Vaccination
Immunity
Disease
sick
sick
Hygiene,
Biosecurity &
Biocontainment
Herd Health Program
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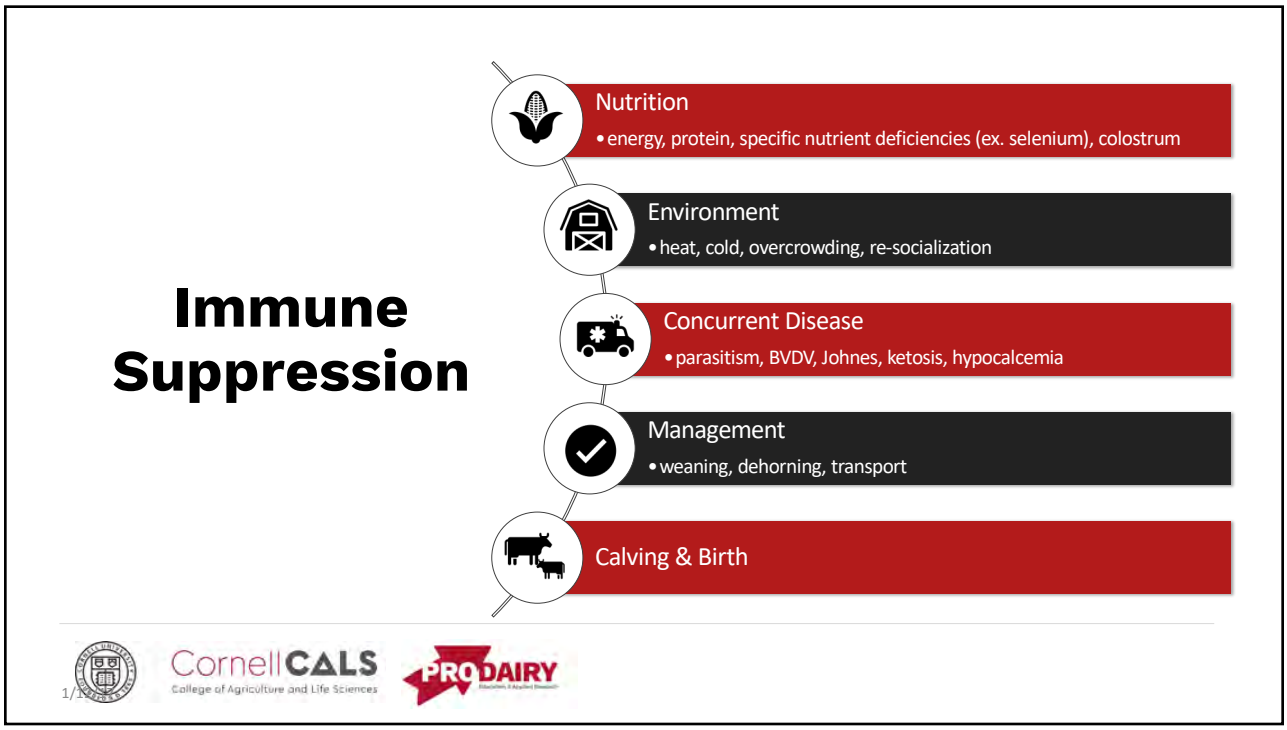
Immune
Suppression
Nutrition
• energy, protein, specific nutrient deficiencies (ex. selenium), colostrum
Environment
• heat, cold, overcrowding, re-socialization
Concurrent Disease
• parasitism, BVDV, Johnes, ketosis, hypocalcemia
Management
• weaning, dehorning, transport
Calving & Birth
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Transfer of Passive Immunity (TPI)

- Successful TPI associated with lower risk of calf disease and death
- Achieved with good colostrum management
- Evaluated by checking calf serum
  - All or periodic subsampling of calf groups
- 12 apparently healthy calves 24 hrs to 7 days of age
- Draw blood ~90min after last milk feeding (maximum hydration)

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Transfer of Passive Immunity (TPI) Ranking

TPI Category	Serum IgG Category (g/L)	Equivalent TP (g/dL)	Equivalent %Brix	Consensus (% Calves)
Excellent	≥ 25.0	≥ 6.2	≥ 9.4	> 40%
Good	18.0 – 24.9	5.8 – 6.1	8.9 – 9.3	~30%
Fair	10.0 – 17.9	5.1 – 5.7	8.1 – 8.8	~20%
Poor	< 10.0	< 5.1	< 8.1	< 10%

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Lombard, et al, JDS, 2020

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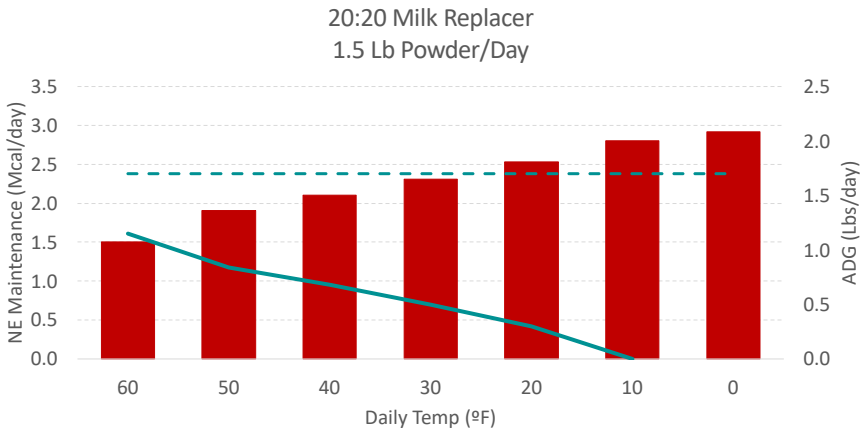
Calf Energy Needs



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Calf Bedding Nesting Scores

- Note nesting score in each pen
- Most observed score = barn nesting score

Nesting Score	Description
1	*Calf on top of bedding*
2	*Part of the legs were visible above bedding*
3	*Legs not visible above bedding*

McGuirk, UofW-Madison

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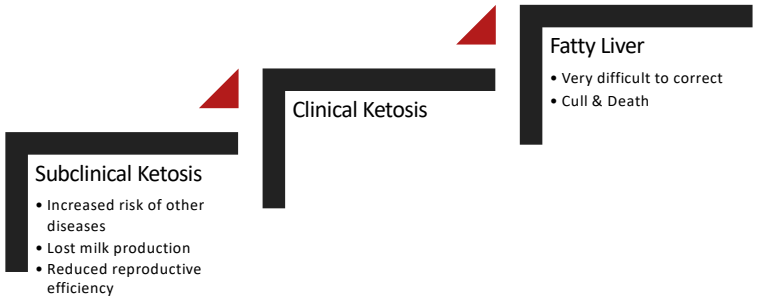
Ketosis

- Excessive fat mobilization, high NEFA & ketone bodies (acetone, acetoacetate, and β-hydroxybutyrate)
- Average Incidence of SCK: 43% (26%-56%)[1]



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[1]McArt, et al, JDS, 2011

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Biosecurity

Bio containment

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Diseases of Concern

Core

- IBR
- BVDV
- PI3
- BRSV
- Lepto
- Coliform Mastitis

Risk Based

- Clostridium
- Calf Sours
- Bacterial Pneumonia
  - Mannheimia
  - Pasteurella
  - Histophilus

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IBR

- Infectious Bovine Rhinotracheitis
- Bovine Herpes Virus 1 (BHV-1)
- Respiratory Disease & Abortion
- IBR Seroprevalence[1]
  - Individual Animals: 20-60%
  - Herd Level: >70%

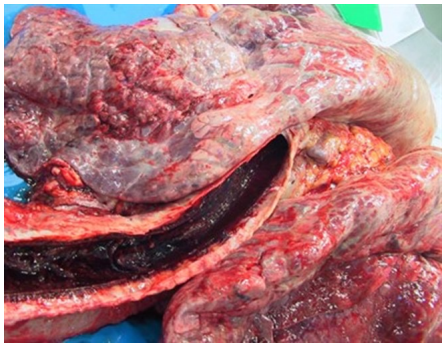

photo credit: www.nadis.org.uk

[1]Newcomer et al., Prev Vet Med, 2017

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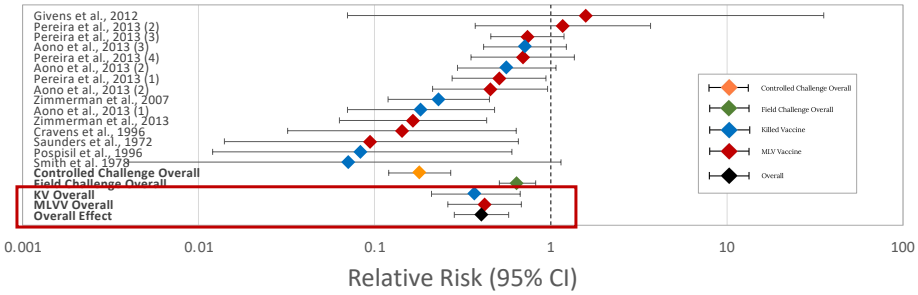
Meta Analysis – Prevention of abortion following vaccination against BoHV1 (IBR)[1]

- Both MLV & Inactivated vaccination ↓ risk of abortion following viral challenge by ~60%
- Ave cost of a pregnancy loss $555[2]



[1]Newcomer et al., Prev Vet Med, 2017
[2]DeVries, J Dairy Sci., 2006

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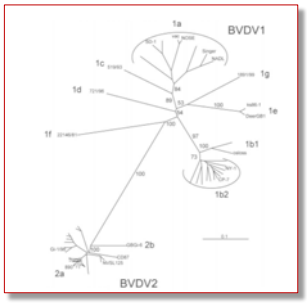
BVDV



- Pestivirus
- Type 1 & 2
- Cytopathic (CP) & Non-cytopathic (NCP) – distinguished by cell culture growth characteristics
  - NCP – responsible for all trans placental infections (abortion, congenital anomalies, persistent infection)
- Acute Disease: fever, leukopenia, depression, anorexia, occulonasal discharge, oral erosions, diarrhea, decreased milk production
  - Type 2 – associated with hemorrhagic syndrome & peracute death
- Infertility, Immunosuppression w/ secondary infections

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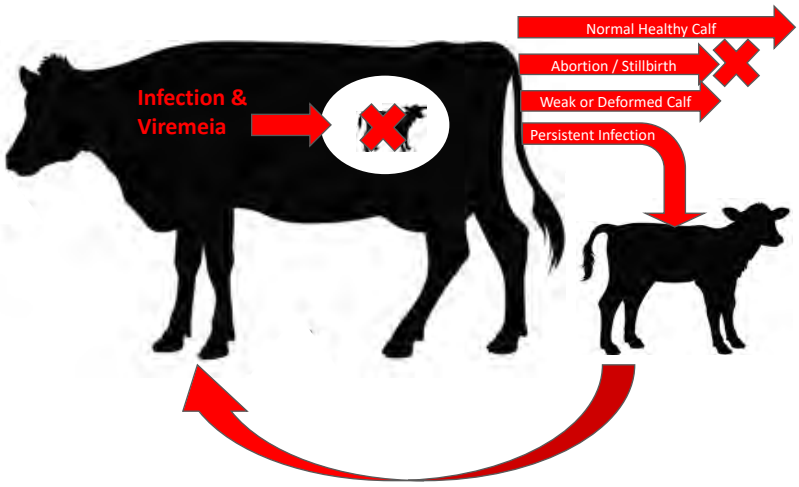
BVDV



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Efficacy of bovine viral diarrhea virus vaccination to prevent reproductive disease: A meta-analysis

- Vaccinates vs. Unvaccinates
  - ↓ fetal infection rate of nearly 85%
  - ↓ abortions of nearly 45%
  - pregnancy risk ↑ 5% in field trials

Measure	Risk Ratio	Lower	Upper	P Value
Fetal Infection (Overall)	0.152	0.103	0.224	<0.001
Abortion Rate (Overall)	0.566	0.455	0.702	<0.001
Pregnancy Rate (Overall)	1.052	0.987	1.121	0.18
Pregnancy Rate (Field Challenge)	1.053	1.022	1.085	0.001

Newcomer, et al, Therio, 2015

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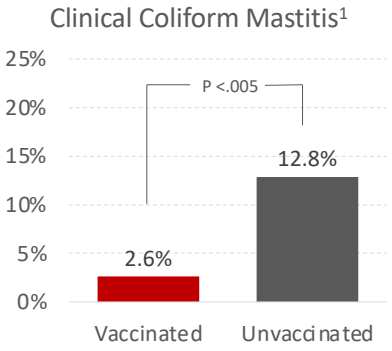
Mastitis

- Coliform mastitis vaccines
  - Reduction in severity
  - Short lived memory
  - Typical protocols: -8 weeks, -3 weeks, +2 weeks
- Staph aureus & Mycoplasma
  - little data to support use as preventive strategy



[1] González, et al, Can J Vet Res, 1985

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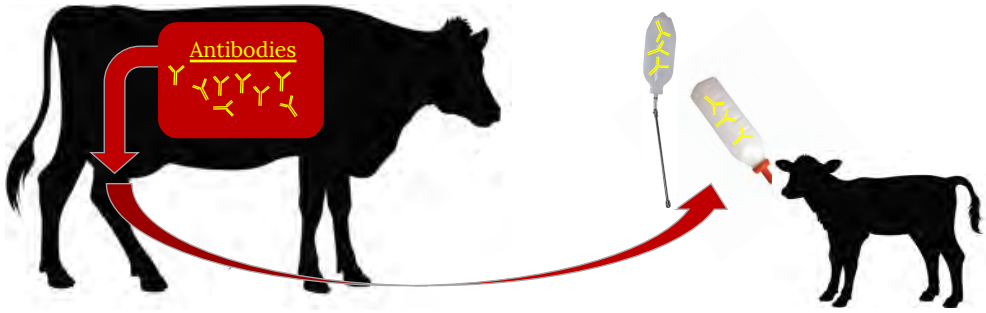
Scours Vaccines

- Serum antibodies begin to move into the mammary gland 5-6 weeks prior to calving

3 Weeks Prior - Primary Vaccination for Springers

Dry Cow Booster



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Scours & Orally Administered Antibodies

- Diarrhea responsible for 56.5% of preweaned heifer deaths[1]
- Rotavirus, E. coli, Coronavirus, and *Cryptosporidium parvum* among the most significant causes of neonatal calf diarrhea
- Rotavirus challenge study to evaluate health improvement provided by orally administered rotavirus specific antibodies[2]

83 colostrum deprived bull calves collected at birth

- **MR:** Milk Replacer (n=28)
- **ABS**: Milk Replacer + Rotavirus Specific Antibodies (n=28)
- **COL**: Colostrum Replacer (with E. coli & coronavirus specific antibodies) + Rotavirus Specific Antibodies (n=27)

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[1] NAHMS, 2010
[2] Bristol, et al, JDS, 2021

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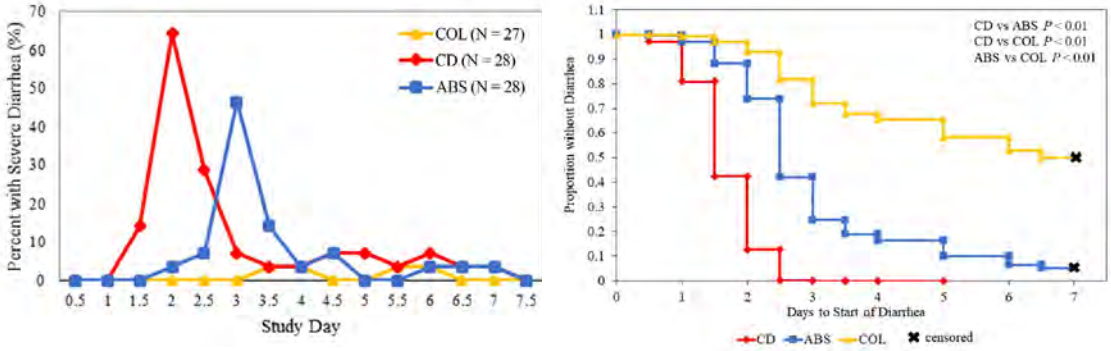
Scours & Orally Administered Antibodies[1]



- Both ABS and COL groups had reduced the onset, duration, and severity of rotavirus induced diarrhea

[1] Bristol, et al, JDS, 2021

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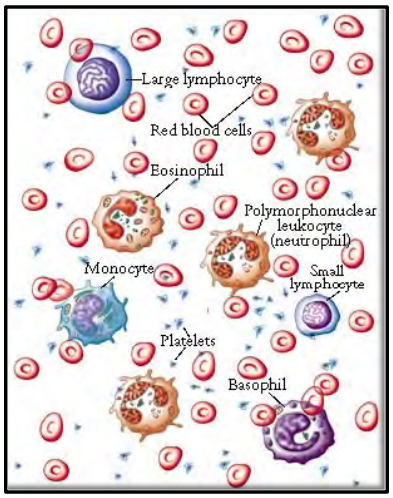
Immunology 101

- Immunity - A natural or acquired resistance to a specific disease.
- The bodies "military"

1. Innate Immunity:
   - Physical Barrier !!
   - Mucosal Immunity
   - White Cells



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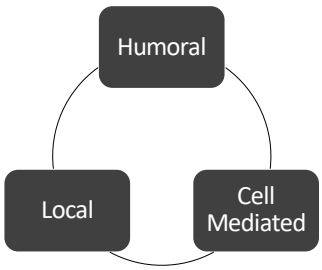
Immunology 101

2. Adaptive Immunity:
   - Humoral Immunity: B Cells
     - antibodies & memory cells
   - Cell Mediated Immunity: T Cells
     - best mechanism for early response
     - best mechanism for inta-cellular organisms
     - also has memory
     - difficult to measure
   - Local Immunity
   - Work together



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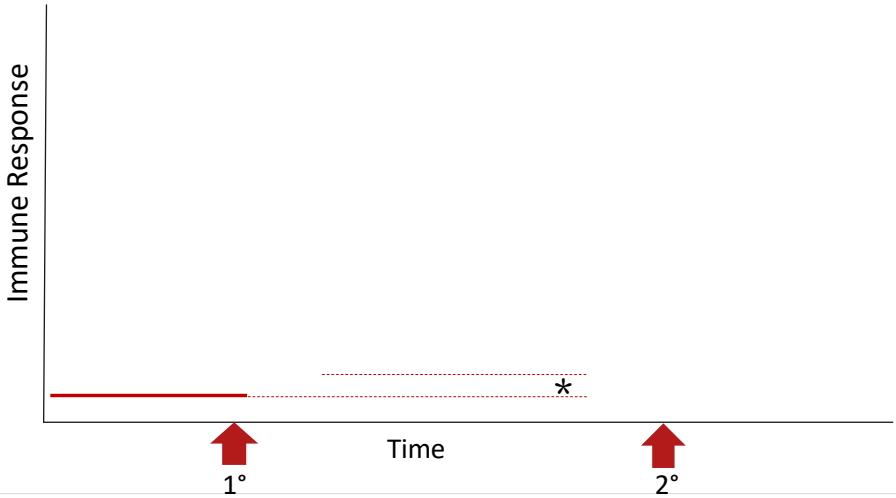
Anamnestic Response



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* Memory

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Age at vaccination

Cell Mediated Immunity (CMI) – functional in the young calf

Mucosal Immunity – improved response in presence of maternal antibodies

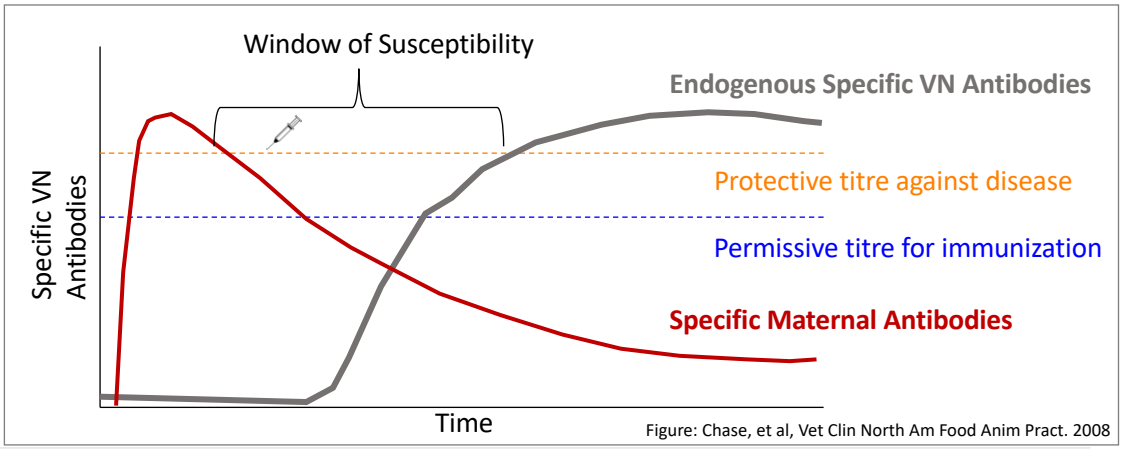

Figure: Chase, et al, Vet Clin North Am Food Anim Pract. 2008

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Passive vs. Active Immunity

Passive	Active
• Immediate • Short Lived • No Memory • Some Reactive • Ex: antibodies, antitoxins	• Delayed • Long Lived • Memory • MLV Vaccines, Bacterins, Toxoids

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MLV Vaccine

Pros	Cons
Robust immune response	Not safe in all animals*
No booster	Can't use later
Lower risk of reaction	Must handle carefully
Lower cost/dose	

Killed Virus Vaccine

Pros	Cons
No unused doses‡	Higher risk of reactions
Safe in all animals	Narrower immune response
Convenient	Must booster
	Higher cost/dose

* Some are safe to use in pregnant cows as long as label directions are followed.

‡ "Use entire contents when first opened."

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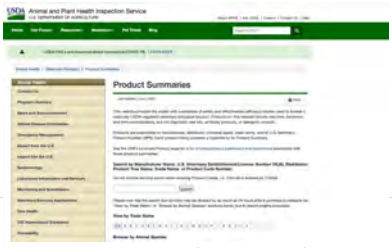
Vaccination Protocols

- **Risk Assessment**
  - Exposure possibilities
  - Facilities
  - Labor
- **Vaccine Selection**
  - Efficacy
  - Safety
  - Timing/Interval
  - Check the insert!
- **USDA Label Claims (Prior to 2011)**
  - 5 Levels of demonstrated efficacy
  - Listed on product insert
- **Single Tier & Efficacy Database (Since 2011)[1]**



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[1]USDA: APHIS: Veterinary Biologics: Product Summaries

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AABP VACCINATION GUIDELINES

- Principles of Vaccination
- Influence of Management on Disease
- Veterinary Label Claims
- Categories of Vaccines
- Adverse Events
- Vaccine Storage and Handling
- Risk-Based Vaccination
- References

American Association of Bovine Practitioners
Committee on Pharmaceutical & Biologic Issues, 2021

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Common Findings

- **Disorganization & Protocol Drift**
  - New challenges, products, people
- **Expired Product**
- **Vaccine Cold Chain**
  - Attenuated vaccine degradation accelerates when reaching higher than recommended temperatures
  - Store at 35-45°F
  - Door storage
  - Also cooling colostrum
  - Outdoors/Freezing
  - High/Low Thermometers

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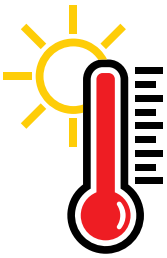
Common Findings

- **Not following directions**
  - Missing booster
  - Wrong route/dose/class of animal
- **Mishandled Vaccine**
  - Warming & UV exposure
  - Contamination/Dirty
  - Disinfectants
- **Vaccination >85°F**
- **Vaccination of already sick animals**
- **Endotoxin Overload**



Gm- Vaccines	
Leptosprirosis	E. Coli Scours
Mannheimia	Salmonella
Coliform Mastitis	Clostridium
Histophilus	Pinkeye

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Thank You

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