

How to Get the Most out of Your Vaccination Program

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On The Road to Control Disease

- Multi-factorial Diseases
- Management
- Vaccination



Credits

- Immunobiology, 6th edition
- David Topham, University of Rochester
- Dr. Chris Schneider, University of Idaho
- Dr. Nichols, Australia



Bovine Respiratory Disease Complex (BRDC)

- Single most significant infectious disease in cattle
- Multifactorial
 - Stress
 - Viruses
 - Bacteria
- All of these pathogens are in the normal bovine population
- Incidence in the first 40 days on feed
 - 10 – 30 days peak challenge
- Up to 90% of morbidity
- Up to 70% of mortality



BRDC

- Major challenge to cattle industry
- 31% of cattle/calf death in US
- \$625 M impact/year
- Feedlot Industry
 - 65-79% of sickness
 - 44-72% of death

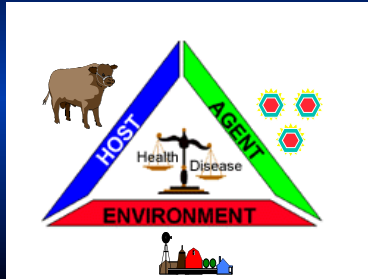


Bovine Respiratory Disease Complex

- Cost of BRD
 - Mortality
 - Morbidity
 - Hospitalization
 - Medication costs
 - Increasing feeding time
 - Labor costs
 - Subclinical
 - Reduction of ADG and FCR



Disease Triangle



Stress

- Stress is anything that reduces immune response capability
- Adaptation to intensive production is stressful
 - Anything that improves adaptation will reduce costs and improve production
- The reason that this condition is seen more in intensive operation rather than extensive



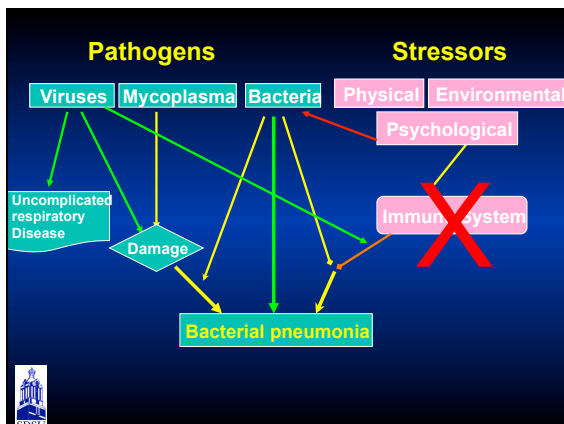
Stress – Prior to Entry

- Weaning
- Saleyards
- Co-mingling or mixing
- Transport
- Dehydration
- Time off feed
- Injury



Stressors at the Feedlot or in the Cow Herd

- Co-mingling
- Injury
- Water - palability and supply
- Feed - time to first
- Pen density
- Pen total number
- Handling and movements
- Pen "add-ons"
- Weather extremes
- Dust
- COMPETITION



Stress Hormones And Adaptive Response

Comparison of Changes in Cell-mediated Immunity GC

Mechanism	Aging	Stress	Treatment
Thymus	↓	↓	↓
T-cell proliferation	↓	↓	↓
Cytotoxicity	↓	↓	↓
T cell memory IL-2, IFN- γ	↓	↓	↓
Anti-inflammatory IL-4, IL-10	↑	↑	↑
Pro-inflammatory TNF- α , IL-1, IL-6	↑ or ↔	↑	↓

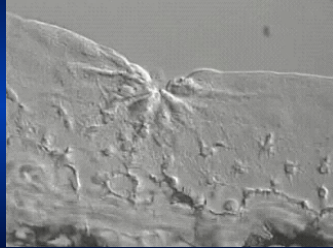
Direction of arrows indicate increase, decrease or no change compared to corresponding control levels

Immunoparalysis

Ramirez et al., 1996; Globerson and Effros, 2000; Sapolsky et al., 2000; Biondi, 2001; Galon et al., 2002

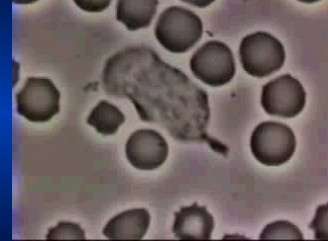


Stress will decrease chemotaxis



Inflammatory Response

What Does Stress Do to Neutrophil Motility and Phagocytosis?



Neutrophil Chemotaxis and Phagocytosis
What Does MLV BVDV Do to Neutrophil Motility and Phagocytosis?

Immune Response-Animal Doesn't Lie

- Immune response
 - Proinflammatory response necessary
 - Expect Some Side effects
 - No side effects- **no response**
 - Higher disease
 - Poorer immunity (passive and/or active response)



Prevention of BRDC

- Management
 - Eliminate stress factors where possible
 - Recognize the "Critical Period" for disease detection (3 weeks that follow weaning; placing on feed; shipping of cattle)



Prevention of BRDC

- Management
 - Avoid co-mingling cattle from different sources during critical 3-week period
 - Keep new cattle close to feed and water
 - Don't over crowd (especially early in feeding period)
 - Control dust and mud



Summary

- Environmental factors
- Reducing group size is desirable
- Ventilation and dust control are important
- Transport time, rest, food water
- Commingling should be avoided
- Weaning before shipping decreases stress
- Gradual feed changes with proper supplements are beneficial

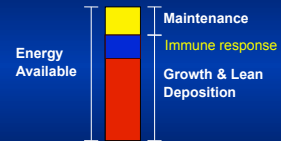


Diet and Immunity

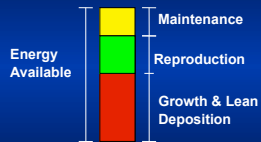
- Immune system doesn't get a free ride- energy consumer- calves on poor nutrition- poor response to vaccines
- Multiple demands on energy for the calf- overvaccination can effect growth and development
- Calves- Vaccinating prior to acclimation to feed (weaning; feedyard) Acidosis, poor vaccine response



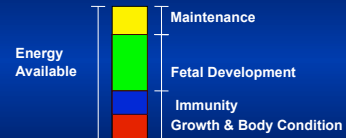
Young Calf



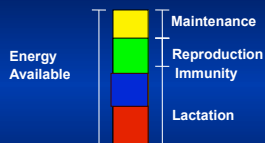
Breeding Heifer



Prepartum Animal + Immunization



Postpartum Beef Animal + Immunization



Nutrition & Immunology

Order of importance of nutrients to immune system

- Energy
- Protein
- vitamin A
- vitamin E
- Copper, Zinc, Selenium
- IRON



Summary

- Energy is important for immune response
- Vitamin A deficiency can decrease mucosal homing
- Zinc is very important at times of stress
- Vitamin E/Selenium important for many immune responses



Harvey Dunn (1884-1952) *Prairie is My Garden, South Dakota*
Art Museum



Prevention of BRDC

- Management
 - Vaccines

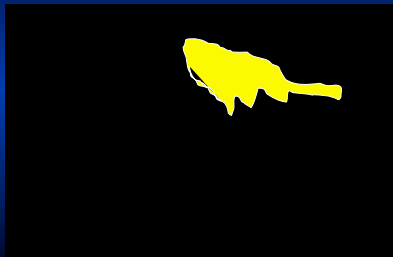


Intranasal Vaccines

- Nasalgen
 - Day old calves
- Onset
 - Conducted in young calves (3-8 days of age)
 - Challenged with virulent strains of IBRV, BVD 1, BVD 2, BRSV, PI₃, Pasteurella multocida – 21 to 28 days post-vaccination
- Enforce -3 BRSV Nasal studies 14 day old calves



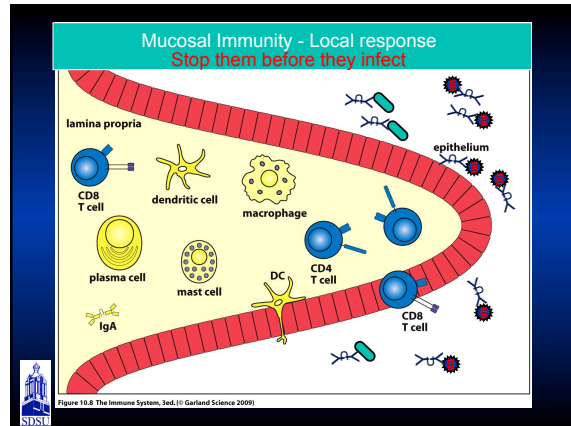
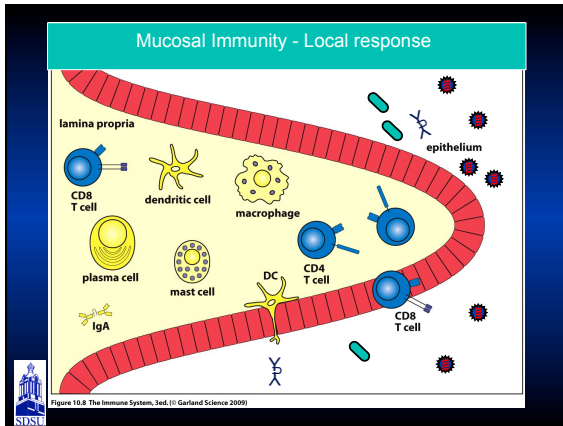
Respiratory Immunology



Respiratory Immunology

- Mucosal Immune Response is the most important defense system
- Almost all bovine pathogens enter via the airways and the mucosa surface
- Viruses- BHV-1, BVDV, PI₃, BRSV, BRCV
- Bacteria- *M. haemolytica*, *P. multocida*, *H. somnus*, *M. bovis*





When Do We Begin Vaccinating Calves?

- At a week of age
- At a month of age
- At 2-3 months of age
- Before they are born by vaccinating the cow-High quality colostrum

Figure 19.8 The Immune System, 3ed. (© Garland Science 2009)

Maximizing Colostrum Production

- Cow management
 - Nutrition
 - Good balanced diet
 - BCS 6.0-7.0 (on a 9)
 - BCS 3.25-3.75 (on a 5)
 - Cu, Se Zn- Immune Minerals

Figure 19.8 The Immune System, 3ed. (© Garland Science 2009)

What Respiratory Infectious Agents are Important

- Calves
 - 3 weeks- 3-4 months
 - *Pasteurella multocida*
 - *Mannheimia (Pasteurella) hemolytica*-herd history
 - Clostridial diseases
 - BRSV- herd history, summer pneumonia
 - Leptospirosis
 - *Mycoplasma bovis* (pneumonia, inner ear)??
 - BVDV???

Figure 19.8 The Immune System, 3ed. (© Garland Science 2009)

What Respiratory Infectious Agents are Important

- Calves
 - 3-4 months- 12 months
 - *Brucella abortus**
 - *Pasteurella multocida*
 - *Mannheimia (Pasteurella) hemolytica*
 - Leptospirosis
 - Clostridial diseases
 - *Mycoplasma bovis-arthritis*
 - BVDV
 - BRSV
 - PI3
 - IBR

Figure 19.8 The Immune System, 3ed. (© Garland Science 2009)

Beef Vaccination Schedules

- Calves (<4 months)
 - Respiratory Diseases
 - MLV
 - Calves on Vaccinated Cows-MLV intranasal vaccines
 - Depends on Maternal Antibody levels-MANY MLV IM or SC **NOT EFFECTIVE**-ONLY adjuvanted MLV IM or SC)
 - Inactivated- Well adjuvanted, not affected by Maternal Antibody
 - NOT Vaccinate with MLV BVDV before 1 month
Better after 2-3 months of age



Beef Vaccination Schedules

- Calves (>4 months)
 - Respiratory Diseases
 - 2-3 weeks prior weaning
 - MLV-1 dose
 - Inactivated-2 doses
 - At weaning- **avoid**
 - MLV-Immunosuppressive
 - Inactivated-2 doses
 - 2-3 weeks post weaning
 - MLV-1 dose
 - Inactivated-2 doses



Stress + Immunosuppressive Viruses= Super Immunosuppression

IBR and BVDV MLV are immunosuppressive



Pregnant Cows and MLV Vaccination



What was the origin of safe in Pregnant Cows Claim?

- Companies requested safe for use in calves nursing pregnant cows (Beef Claim)
- USDA decided that it would extend the claim to safe in pregnant cows
 - Animals vaccinated with the same product prior to breeding (within 12 months)
- Pregnant cow claim is only a safety claim. There is no efficacy data indicating that vaccination during pregnancy had any effect on reproductive health in subsequent pregnancy
- Twelve month duration of safety



Misuse- Opening Pandora's Box

- Safe in pregnant animals vaccinated with the same product prior to breeding (within 12 months)
- **NOT without recent vaccination**



Beef Cow Vaccination Program

- Cows-Precalving
 - Inactivated-1 doses Viral-Lepto
 - 4-6 weeks before calving optimal but often given earlier
 - Enteric Disease Vaccines
 - 4-6 weeks before calving



Beef Cow Vaccination Program

- Cows-post calving
 - MLV or Inactivated-Viral (IBR, BVDV)-Lepto-Vibro?
 - 2-4 weeks prior to breeding



Beef Cow Vaccination Program

- Pregnant Cows
 - Vaccinating after the first 40 days of pregnancy will not prevent BVDV PI
- Precautions
 - MLV-IBR-Corpus Luteum-Necrosis- not in naive animals-
 - Synchronization protocols- break up- give it at least a month before breeding



What about the Effect in Previously Vaccinated Animals?

- Literature- single paper- MLV no effect on conception
- Active Interference? Why vaccinate?
- What about susceptible animals?



Summary

- Pregnant cows have two targets-
- Pregnant cow claim-Safety- not efficacy
- Pregnant cow is immunosuppressed
- MLV vaccines can be abortifacient and immunosuppressive



Laws of Immunological “Common Sense”

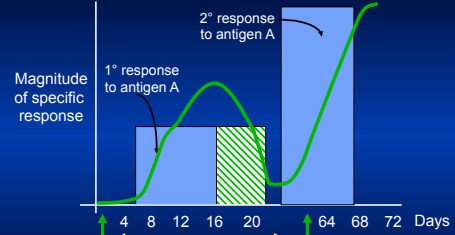
- Vaccination of dams 4-6 weeks prior to calving improves colostrum antibodies
- Passive antibodies (colostrum) are protective
- Vaccinate before shipping
- Vaccinate at least a few days after shipping- a week or two later is best
- Interval for boosting needs to be more 21 days- length depends on vaccine
- Too short a vaccination interval can cause problems



Timing of Boosters



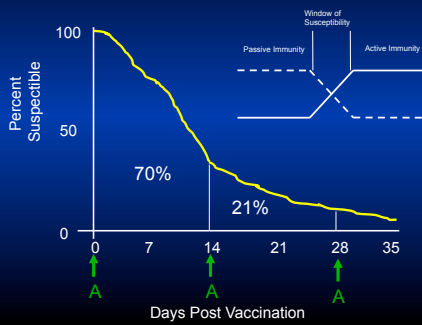
Timing and the Adaptive Immune Response- Anamnestic Response



What is the Best Time Interval for Boostering?

■ Lymphocyte proliferation to Ag A
■ Lymphocyte apoptosis

Timing and Immune Response- Young Animals Primary vs Booster Response



Booster Time Interval and Response

451 Calves
Branding time 67 days
3 weeks prior to weaning 167 days
Weaning 190 days

Group 1 vacc 67d and 190d ~120d interval
Group 2 167d and 190d ~25d interval
0% seroconverted to each virus was same
o No difference in morbidity and mortality,
feedlot performance or carcass quality
Kirkpatrick et al. 2008 JAVMA 233:136-142



Timing of Boosters

- MLV 2-3 doses by time 8-10 months
- Inactivated 2-3 doses by time 8-10 months
- Combination of MLV and inactivated vaccines



Boostering MLV vs Inactivated-

Use them in combination-Better adjuvants

- Evidence in either sequence
MLV/Inactivated or Inactivated/
MLV results in similar
responses

Grooms et al 2002; Royan 2009



Summary

- Vaccination of dams 4-6 weeks prior to calving improves colostral antibodies
- Passive antibodies (colostrum) are protective
- Vaccinate before shipping
- Vaccinate at least a few days after shipping- a week or two later is best



Summary

- In general we vaccinate calves too much and too soon
- No need to vaccinate for BVD before 2-3 months of age (don't do it before 1 month)
- Better colostrum management, less need to vaccinate
- Intranasal vaccines in young calf especially for BRSV important- if BRSV is a problem



Summary

- Interval for boosting needs to be more 21 days- length depends on vaccine
- Too short a vaccination interval can cause problems

