Evolution of Respiratory Vaccines

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What's on the "Menu" today?

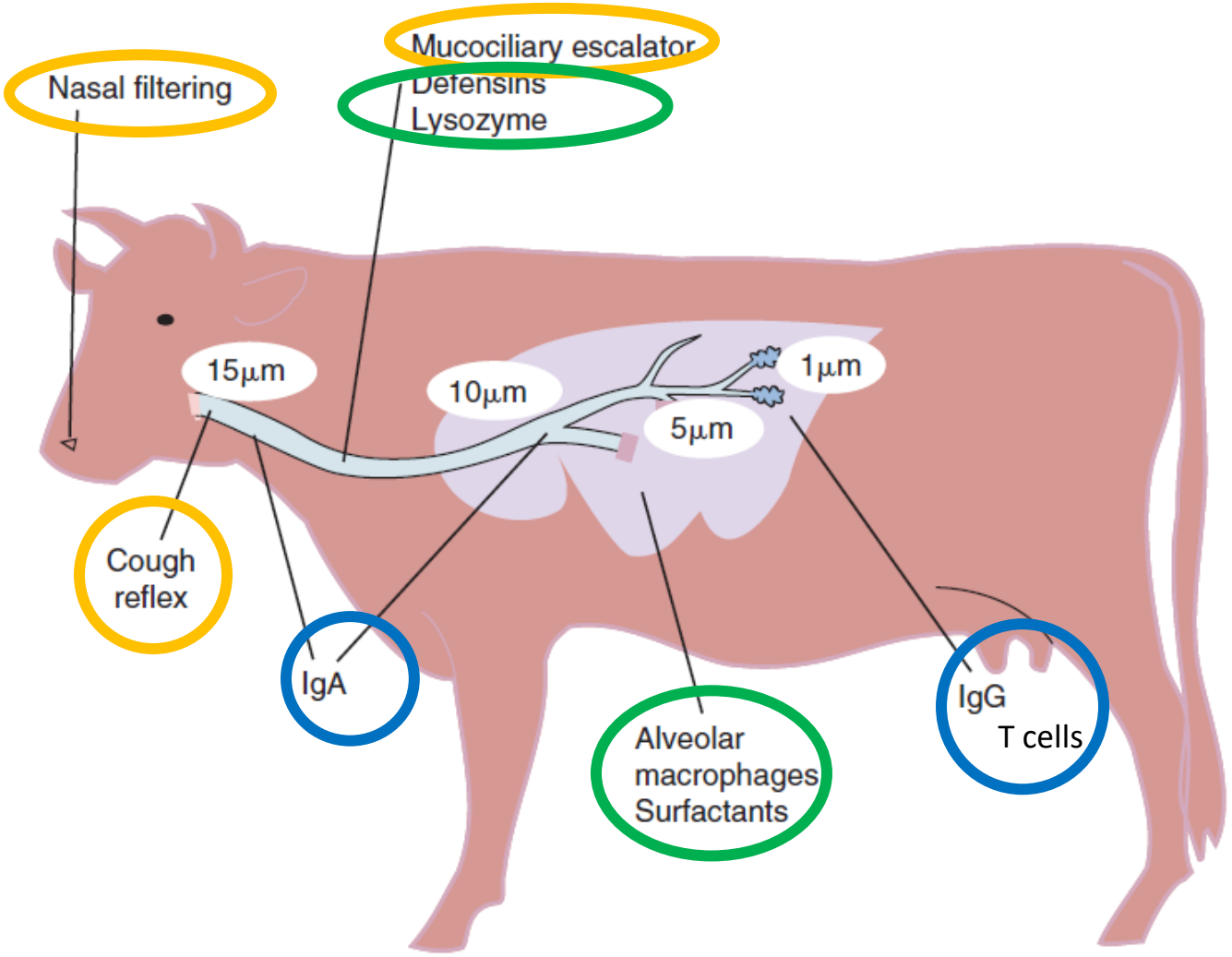
- Some basic Immunology
- Types of vaccines and how they work
  - Some evidence to show they *actually* work
  - How we can maybe improve the way they work by re-thinking how we give them

How do you or a steer defend against the world: 3 layers of defense

NON-SPECIFIC DEFENCES		SPECIFIC DEFENCES
1. SURFACE BARRIERS	**2. INNATE IMMUNITY**	**3. ADAPTIVE IMMUNITY**
• Intact skin • Mucous membranes • Chemical secretions	• Phagocytic leukocytes • Inflammation • Fever	• Lymphocytes • Antibodies • Memory cells

https://ib.bioninja.com.au/lines-of-defence/

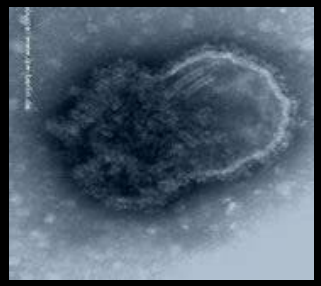
Overview of "Barriers" and Innate and Acquired **Immune Responses** in the bovine respiratory tract….



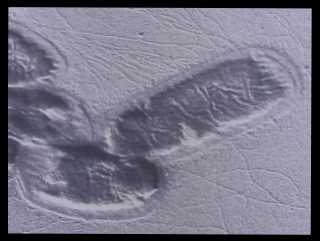
From Tizard, Veterinary Immunology, 9th edition

Generally, the life style of the "Bug" determines the immunological Response

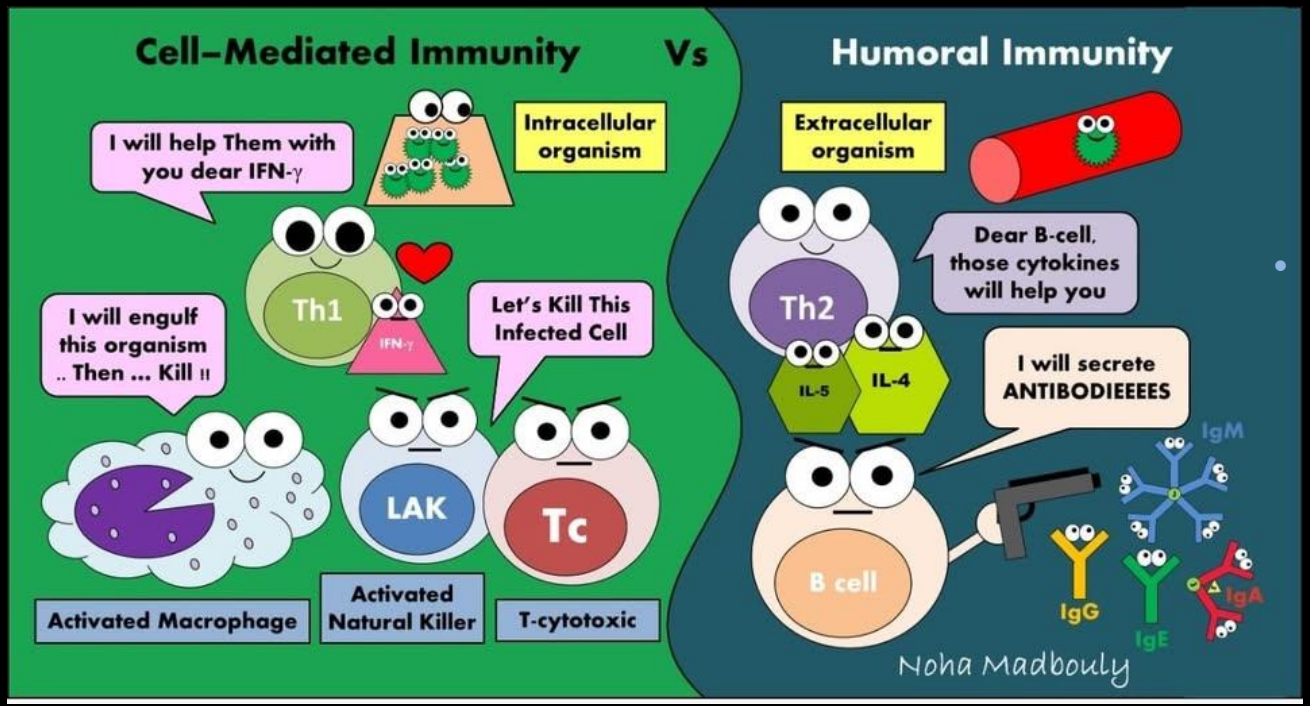
- **Intracellular pathogens (viruses)**



- **Extracellular pathogens (Bacteria)**

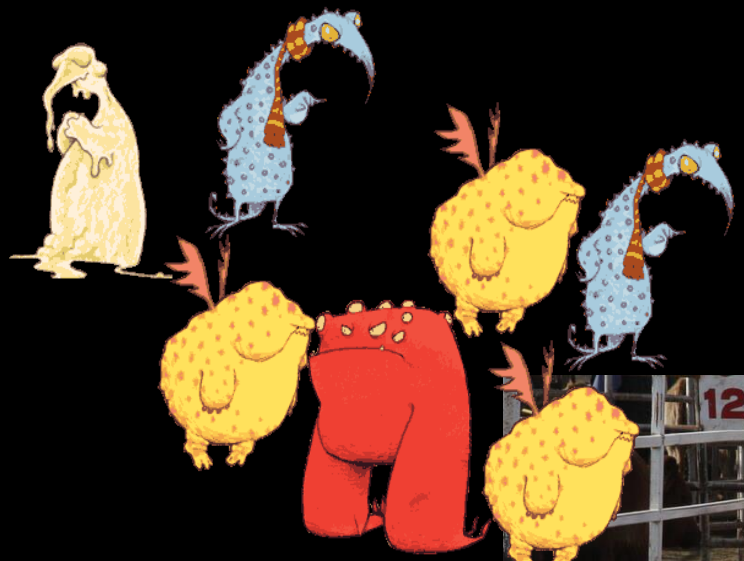


T cells recognize "processed" antigens

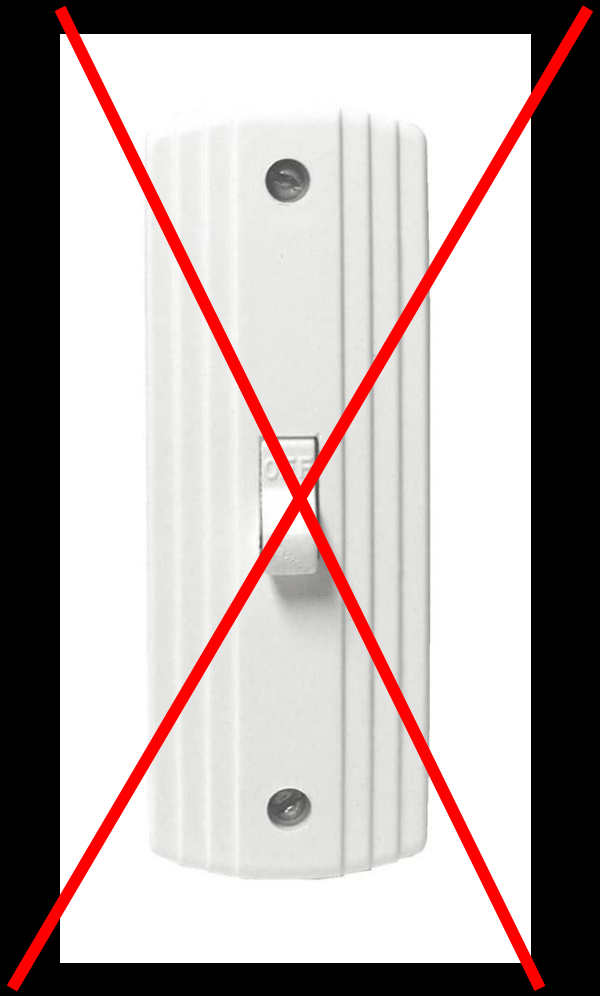


- **B cells recognize native whole antigens**

Think of infectious disease as a RACE between a “bug” and a host……

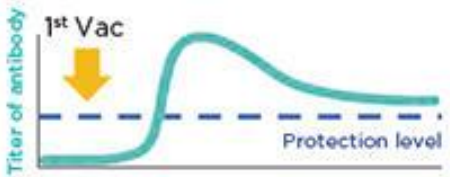
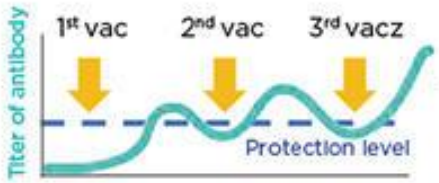


Think of the immune response as a rheostat, *not* an on-off switch!



Reasonable Expectation: Vaccines, properly applied, *reduce* the size of the dead pile, they don't *prevent* it!

Basic vaccine types used in cattle for the last 50 years

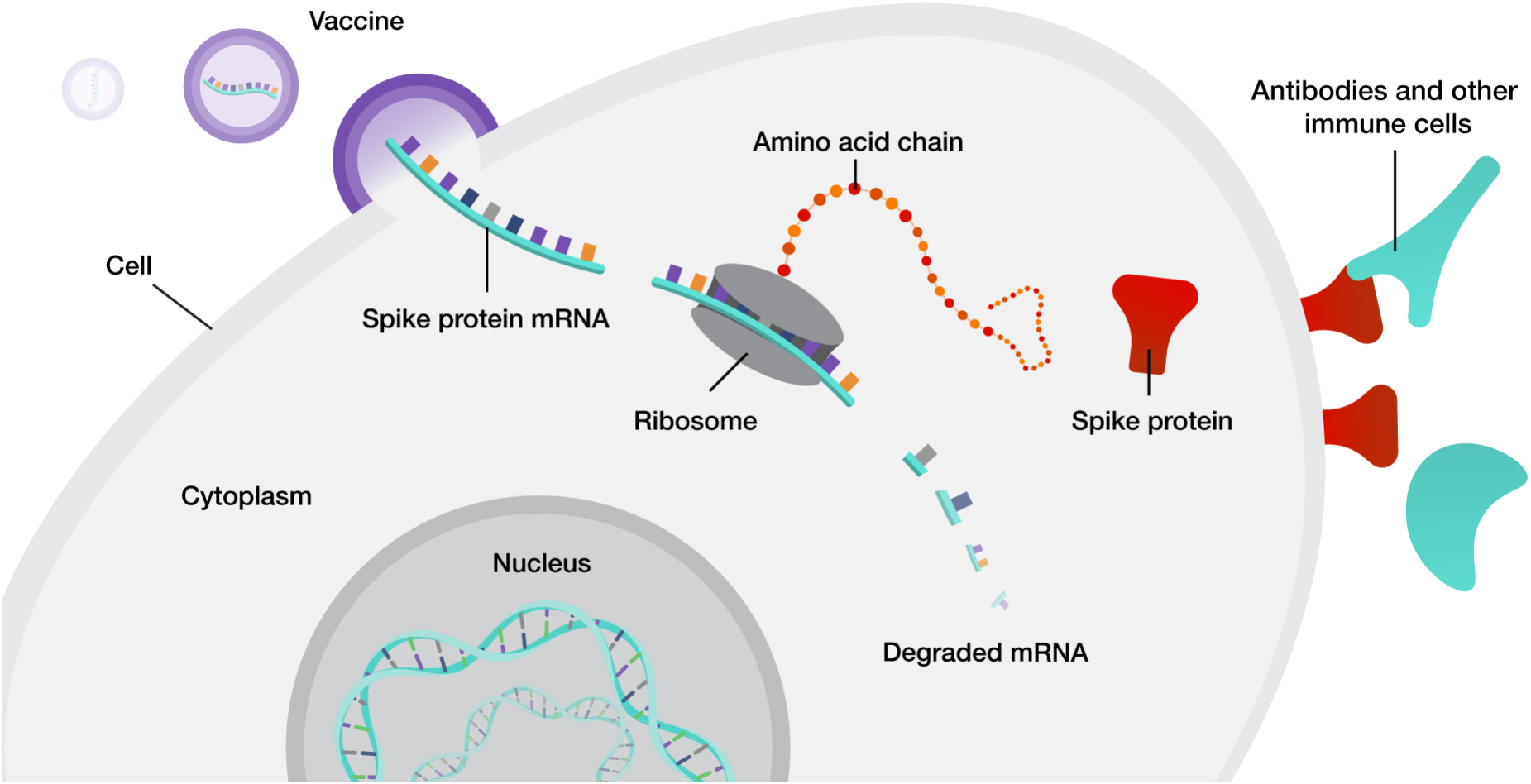
	Live vaccine	Inactivated vaccine
	Attenuated virus Replicate in the host Induce antibody and cellular immune response	Inactivated form of virus, protein etc. Non-replicating in the host Induce only antibody
1. Development	Takes time for safety testing	Capable of rapid preparation
2. Effectiveness	Strong immune response Long-term vaccine efficacy	Weak, transient Short-term vaccine efficacy
		
3. Safety	Potential reversion to virulence	Non-replicating
4. Economical aspect	Lower cost of manufacturing	Need Large number of vaccine

Titer of antibody is decreased in a short period.

Seasonal vaccination is also required.

https://www.iis.u-tokyo.ac.jp/en/news/3529/

How do RNA vaccines work?

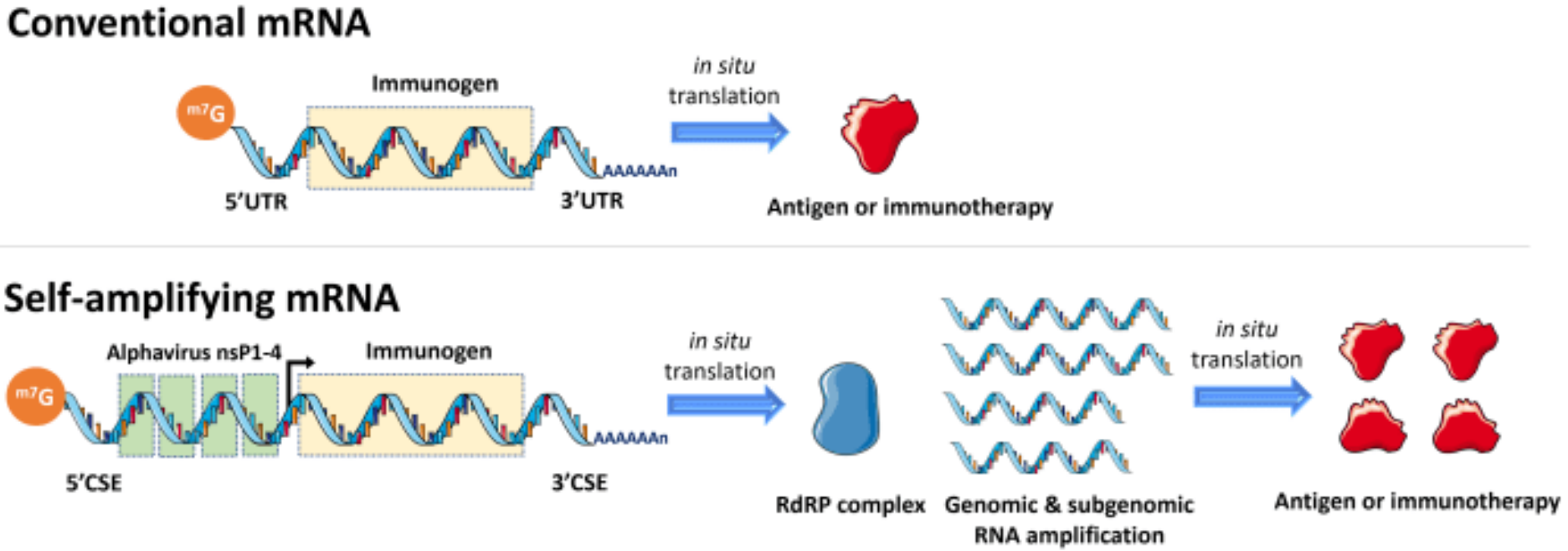


Key Facts for Consumers

- **No Genetic Modification:** mRNA vaccines do not alter the animal's DNA; they provide temporary instructions to cells to build a protein that triggers an immune response.
- **No Residue in Meat:** mRNA is highly unstable and degrades within hours or days. Additionally, mandatory **withdrawal periods** ensure that any vaccine components are cleared from the animal's system long before processing

NIH National Human Genome Research Institute

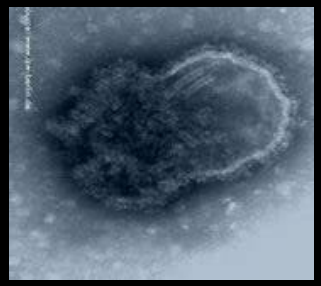
The ***FUTURE***? "self-amplifying" RNA vaccines



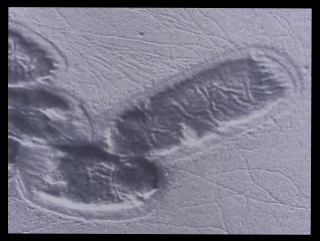
RNA and saRNA vaccines act like MLV vaccines: they stimulate ***both*** **CMI** and **antibody** responses

Generally, the life style of “Bug” determines the type of vaccine to use

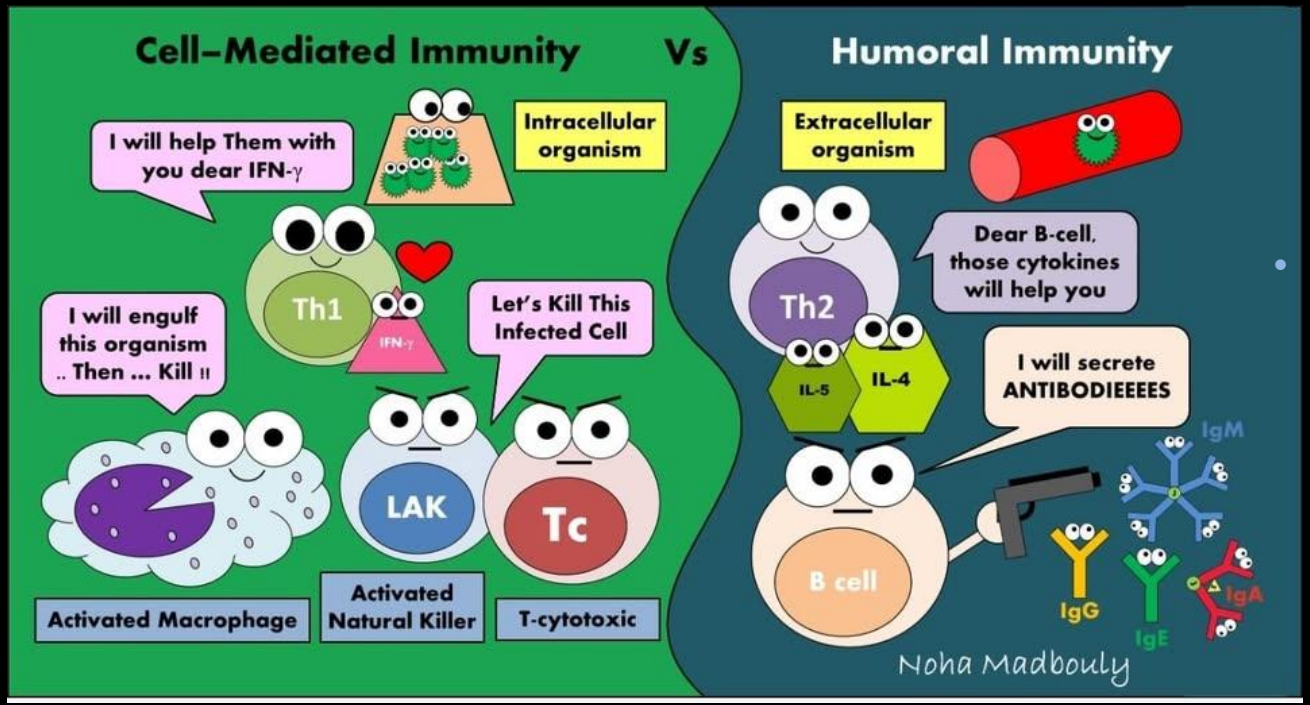
- **Intracellular pathogens (viruses)**



- **Extracellular pathogens (Bacteria)**

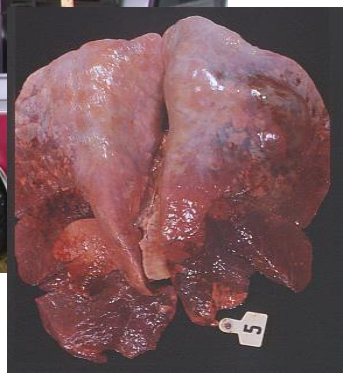


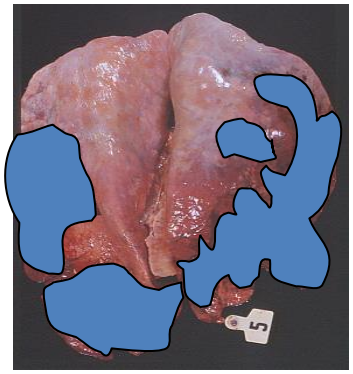
Modified-live vaccines



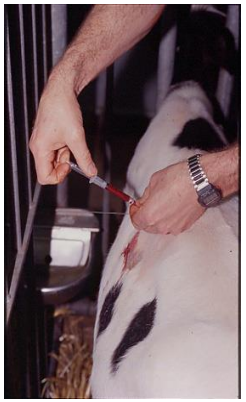
- **Inactivated (“killed”) vaccines**

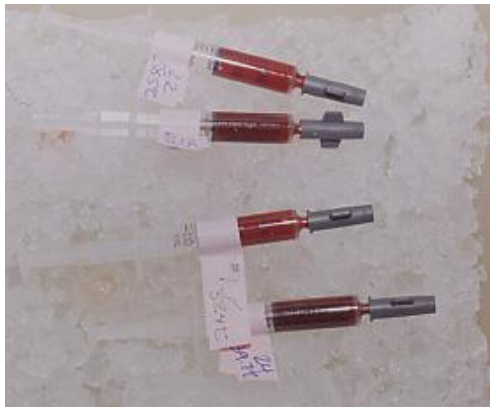
Outcome variables of efficacy in **BRSV** challenge model





- **% pneumonic lung**
  - **Image analysis**





- **Arterial pO_2**
  - **Percutaneous aortic puncture**
- Nasal shed
- Clinical signs
  - Respiratory rate / character
  - Rectal temperature

How well do commercial injectable MLV vaccines for **BRSV** "work"?

Vaccine 18 (2000) 907–919

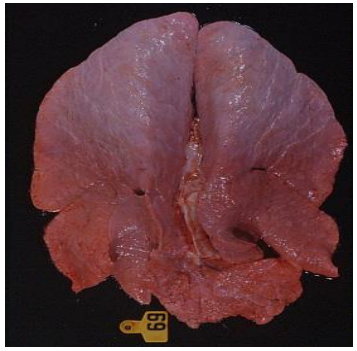
The efficacy of modified-live bovine respiratory syncytial virus vaccines in experimentally infected calves

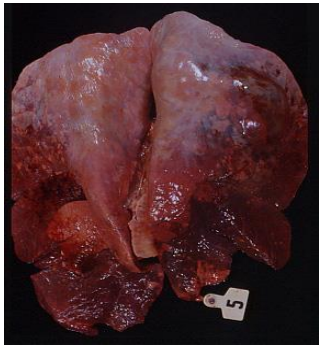
Keith West[a,*], Lyall Petrie[b], Carrie Konoby[a], Deborah M. Haines[a], Victor Cortese[c], John A. Ellis[a]

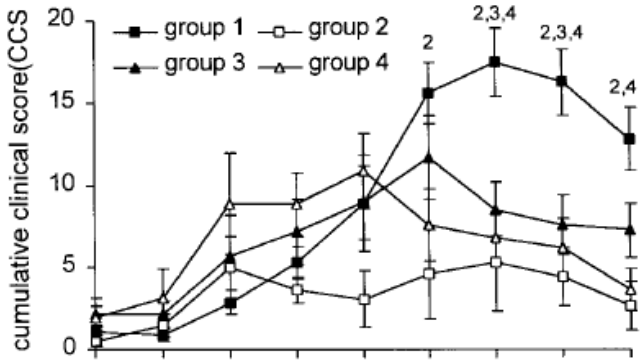
[a]*Department of Veterinary Microbiology, Western College of Veterinary Medicine, University of Saskatchewan, 52 Campus Drive, Saskatoon, Sask., Canada S7N 5B4*
[b]*Department of Veterinary Internal Medicine, Western College of Veterinary Medicine, University of Saskatchewan, 52 Campus Drive, Saskatoon, Sask., Canada S7N 5B4*
[c]*Animal Health Group, Pfizer Inc., 812 Springdale Dr, Exton, PA 19341-2803, USA*

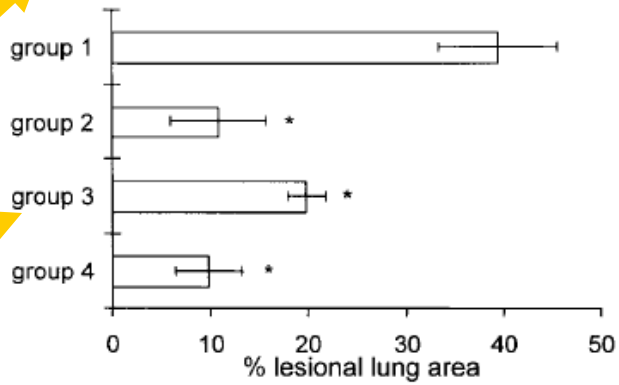
Received 26 January 1999; accepted 30 June 1999

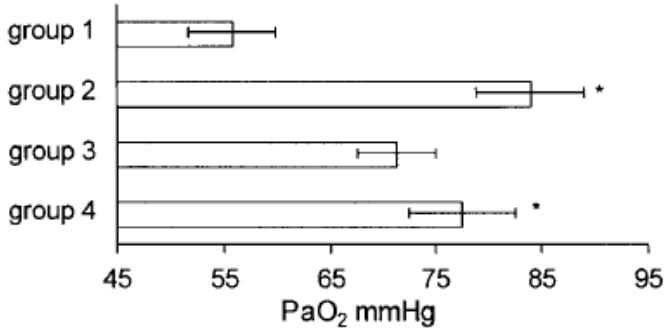
- Seronegative calves
- Vaccinated with 1 of several *injectable* MLV vaccines; challenged 2 weeks later
- *Reduction* in clincal signs, (viral shed)
- *Reduction* in pulmonary lesions
- *Reduction* in compromise of pulmonary function (pO2)











Parenteral **BHV-1** vaccines…how well do they work????

Efficacy of a combination viral vaccine for protection of cattle against experimental infection with field isolates of bovine herpesvirus-1

John A. Ellis, DVM, PhD, DACVP, DACVM; Sheryl P. Gow, DVM, PhD; Noriko Goji, DVM; Clinton Jones, PhD; Aspen Workman; Gail Henderson; Carrie Rhodes, BSc; Glenn Alaniz, BS; Todd R. Meinert, PhD; Cassius M. Tucker, DVM

Objective—To determine whether a combination viral vaccine containing a modified-live bovine herpesvirus-1 (BHV-1) would protect calves from infection with virulent field strains of BHV-1 for weeks or months after vaccination.

Design—Randomized controlled trial, performed in 2 replicates.

Animals—63 weaned 4- to 6-month-old crossbred beef calves seronegative for antibody

Conclusions and Clinical Relevance—Administration of the combination modified-live BHV-1 vaccine yielded significant disease-sparing effects in calves experimentally infected with virulent field strains of BHV-1. (*J Am Vet Med Assoc* 2009;235:563–572)

- ***Reduction*** **in clinical signs**
- ***Reduction*** **in viral shedding**
- ***Reduction*** **in lesions**

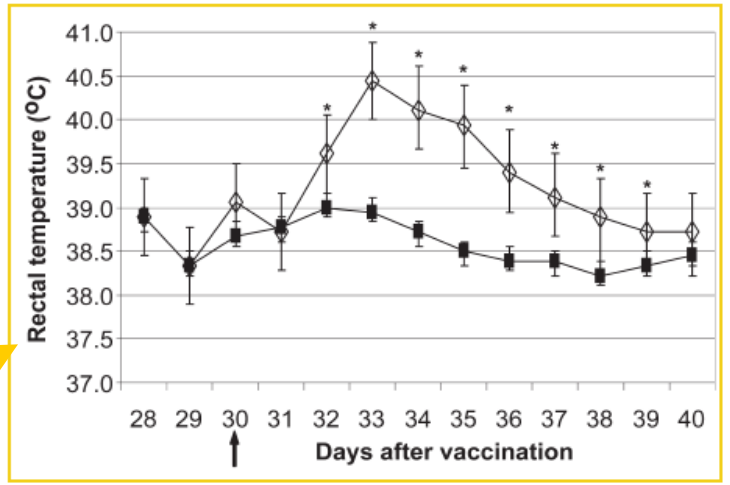


Figure 1—Mean ± SE rectal temperatures at various time points in calves vaccinated with a combination modified-live vaccine with (squares; n = 20) or without (diamonds; 10) BHV-1 8 days after weaning and challenged with BHV-1 strain P3 30 days after vaccination. Arrow indicates time of challenge. To convert temperature from Celsius to Fahrenheit, multiply value by 9/5 and add 32. *Values are significantly ($P < 0.05$) different between groups on indicated day.

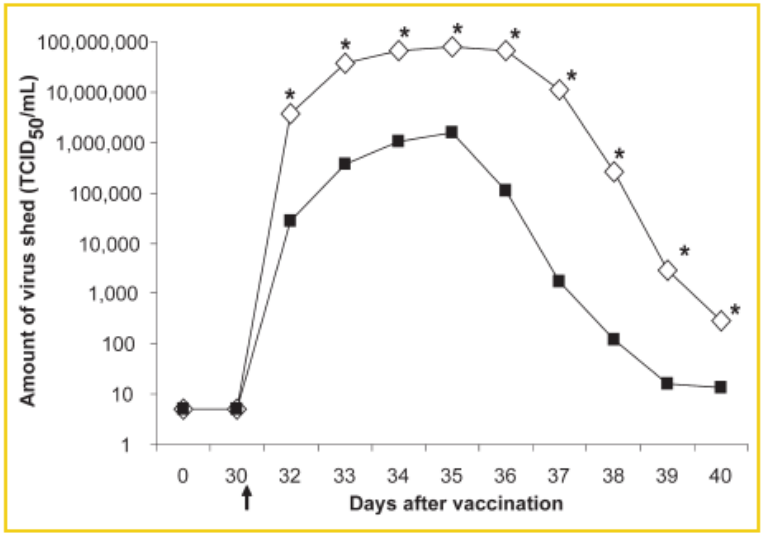
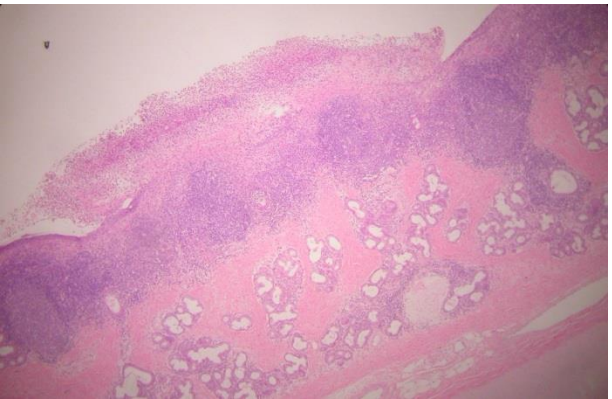
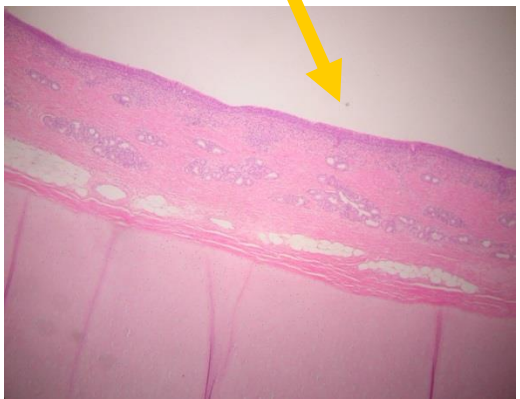


Figure 5—Mean amount ($TCID_{50}$/mL) of virus shed in nasal secretions at various time points in calves vaccinated with a combination modified-live vaccine with (squares; n = 20) or without (diamonds; 10) BHV-1 8 days after weaning and challenged with BHV-1 strain P3 30 days after vaccination. *See* Figure 1 for remainder of key.





Clinical immunity to **BHV-1**…how long does it last?

- Given the logistical difficulties in maintaining cattle in isolation for extended periods after vaccination and prior to experimental infection, there have been relatively few studies that have examined duration of immunity to BHV-1 vaccines. Available data indicate the duration of immunity to conventional parenteral BHV-1 vaccines is at least 4-6 mo….*but begins to wane shortly after vaccination!!!*

Longevity of protective immunity to experimental bovine herpesvirus-1 infection following inoculation with a combination modified-live virus vaccine in beef calves

John Ellis, DVM, PhD, DACVP, DACVM; Cheryl Waldner, DVM, PhD; Carrie Rhodes, BSc; Van Ricketts, DVM

Objective—To determine whether a combination viral vaccine containing modified-live bovine herpesvirus-1 (BHV-1) would protect calves from infection with a recent field isolate of BHV-1.

Design—Randomized controlled trial.

Animals—Sixty 4- to 6-month-old beef calves.

Procedure—Calves were inoculated with a placebo 42 and 20 days prior to challenge (group 1; n = 10) or with the combination vaccine 42 and 20 days prior to challenge (group 2; 10), 146 and 126 days prior to challenge (group 3; 10), 117 and 96 days prior to challenge (group 4; 10), 86 and 65 days prior to challenge (group 5; 10), or 126 days prior to challenge (group 6; 10). All calves were challenged with BHV-1 via aerosol. Clinical signs, immune responses, and nasal shedding of virus were monitored for 14 days after challenge.

Results—Vaccination elicited increases in BHV-1–specific IgG antibody titers. Challenge with BHV-1 resulted in mild respiratory tract disease in all groups, but vaccinated calves had less severe signs of clinical dis-

causal organism was eventually identified as a herpesvirus, and **bovine herpesvirus-1 (BHV-1)** was first isolated in 1956 from affected cattle in California and Colorado.[3] A subsequent study[6] revealed that BHV-1 was a common predisposing factor for shipping fever pneumonia in feedlot cattle.

Because of the substantial economic losses associated with BHV-1 infection in feedlot cattle, modified-live[7] and inactivated[8] virus vaccines were developed shortly after the initial isolation of the virus and are still commonly used today to control the clinical effects of BHV-1 infection.[9] Despite label instructions recommending vaccination of healthy cattle prior to exposure to the agent in high-stress situations, BHV-1 vaccines have traditionally been administered to calves at the time of feedlot arrival and are tacitly expected to induce immunity lasting throughout a feeding period of 180 days or more. However, losses associated with BHV-1 infection continue despite routine vaccination of cattle, and in recent years, there has been an apparent increase in the number of reports of outbreaks of IBR among vaccinated feedlot cattle (so-called vaccine

RUMINANTS

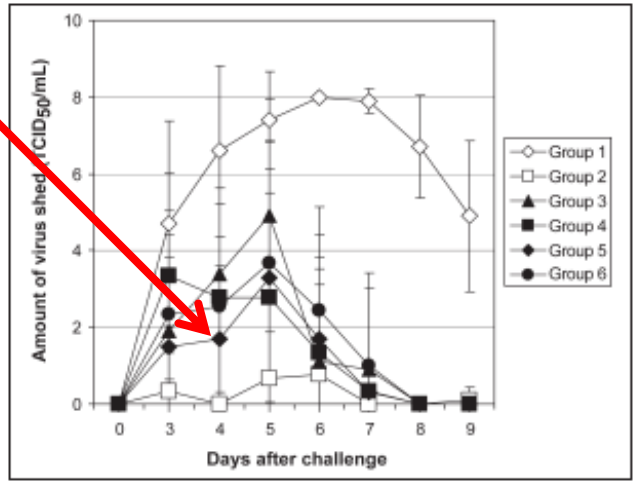


Figure 2—Mean ± SD amount of virus shed ($TCID_{50}$/mL) in nasal secretions following challenge of feedlot calves with virulent BHV-1. *See* Figure 1 for key.

Standard of Practice

- Vaccinating on arrival at feedlot……

….and then hoping for an immunological miracle…

or blaming the vaccine (company) if there is no miracle…

A systematic review and network meta-analysis of bacterial and viral vaccines, administered at or near arrival at the feedlot, for control of bovine respiratory disease in beef cattle

O'Connor, A. M. and Hu, D. and Totton, S. C. and Scott, N. and Winder, C. B. and Wang, B. and Wang, C. and Glanville, J. and Wood, H. and White, B. and Larson, R. and Waldner, C. and Sargeant, J. M.

Anim Health Res Rev (2019) 20: 143–162

DOI: 10.1017/s1466252319000288

Summary of findings:

- Identified **53 vaccine studies** reporting BRD within 45 days of arrival.
- Included **17 vaccine protocols** across 14 studies in the connected network.
- Found **little compelling evidence that arrival vaccination — of any vaccine type or route — reduces BRD morbidity** in feedlot cattle.

So, should we just stop vaccinating?

🧠 Key Takeaways

- **Do not stop vaccinating** — but adjust protocols based on risk.
- **High-risk cattle** benefit most from aggressive vaccination, including intranasal + injectable combinations.
- **Arrival vaccines have limited short-term BRD effect in low-risk cattle**, but viral immunity must still be maintained.
- The O'Connor vaccine meta-analysis **does not argue against vaccination**, but rather against relying on arrival vaccination alone for short-term BRD control.

Developing **LOW RISK** cattle should be the goal!

J Am Vet Med Assoc. 1955 Jun;126(939):463-7.

Infectious necrotic rhinotracheitis of cattle

N J MILLER

Miller (1955)

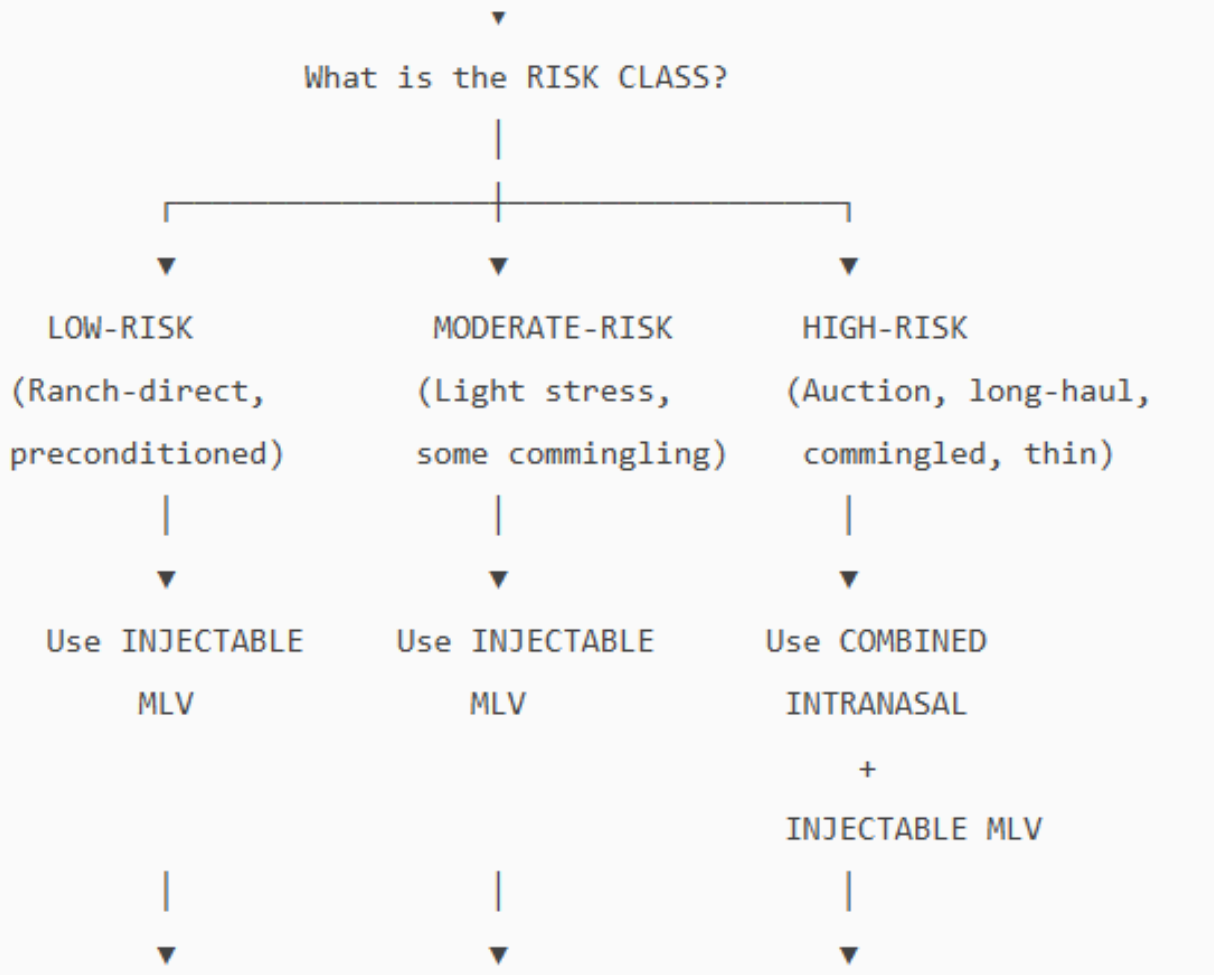
- **Typical morbidity:** ~**30%**
- **Peak morbidity:** reached within **12–15 days**
- **Potential morbidity:** up to **100%** in acute outbreaks

OSU

Modern Data

Modern IBR rarely appears as explosive, high-morbidity outbreaks in feedlots due to:

- Widespread vaccination
- Latent virus dynamics
- Improved management
- IBR often acting as *part* of BRD, not a standalone epidemic


What is the RISK CLASS?
LOW-RISK
(Ranch-direct, preconditioned)
MODERATE-RISK
(Light stress, some commingling)
HIGH-RISK
(Auction, long-haul, commingled, thin)
Use INJECTABLE MLV
Use INJECTABLE MLV
Use COMBINED INTRANASAL + INJECTABLE MLV
Reason: No added benefit from IN; field studies show equal outcomes.
Reason: No proven benefit from IN; systemic vaccine adequate.
Reason: Only scenario where intranasal + injectable reduces BRD retreatments & trends toward lower mortality. (Strongest evidence.)

🎯 Bottom Line

- **High-risk vaccinated cattle** still experience more BRD than low-risk cattle, but **combined intranasal + injectable vaccination provides significant clinical benefit**, reducing retreatments and likely reducing mortality.

  cambridge

- **Low-risk vaccinated cattle** have low morbidity/mortality regardless of vaccine route, and **no field trial shows improvement** with intranasal or prime-boost methods.

  avma

- **Injectable MLV alone** remains the standard for low-risk cattle.
- **Combined IN + IJ** is the evidence-supported strategy *only* for high-risk groups.

No published field studies show that giving an intranasal (IN) respiratory vaccine on arrival *worsens* BRD outcomes.

Developing **LOW RISK** cattle should be the goal!

Standard of Practice

- Vaccinating young calves with *injectable* vaccines…

….is this really the best way to develop **LOW RISK** cattle…….. Why or why not?

NO! It's because maternal antibodies block injectable vaccines... but, remember, the "blocking" (inhibitory) effect of maternal antibodies is a rheostat; *not* an on-off switch!

Do *maternal antibodies* block priming of *injectable* BRSV vaccines..???

Can Vet J 2014;55:1180–1185

Inhibition of priming for bovine respiratory syncytial virus-specific protective immune responses following parenteral vaccination of passively immune calves

John Ellis, Sheryl Gow, Michael Bolton, William Burdett, Scott Nordstrom

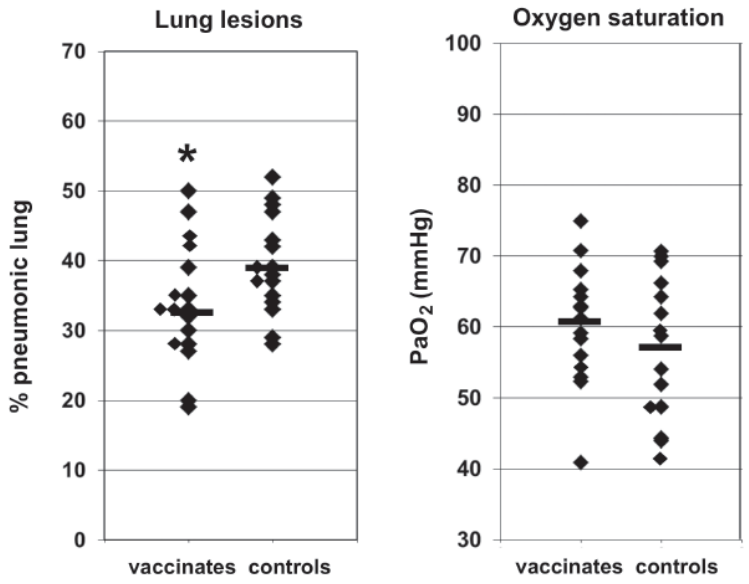


Figure 2. Scatter plots of the percentage of lungs affected with pneumonic lesions and arterial oxygen concentrations after BRSV challenge of BRSV-seropositive calves that were either vaccinated parenterally with a commercial combination modified-live virus vaccine containing BRSV, or control-vaccinated, and that were challenged with BRSV approximately 11 weeks after vaccination. Lines indicate median values in each group. *indicates significant difference between groups.

Calves vaccinated at *3-9 days of age*; mean *VN titer 1:64*

Vaccine 38 (2020) 298–308

Protection against bovine respiratory syncytial virus in calves vaccinated with adjuvanted modified live vaccine administered in the face of maternal antibody

Elizabeth A. Kolb [a,1], Robin E. Buterbaugh [a], Carol L. Rinehart [a], Douglas Ensley [b], George A. Perry [c], Karim W. Abdelsalam [a], Christopher C.L. Chase [a,d,*]

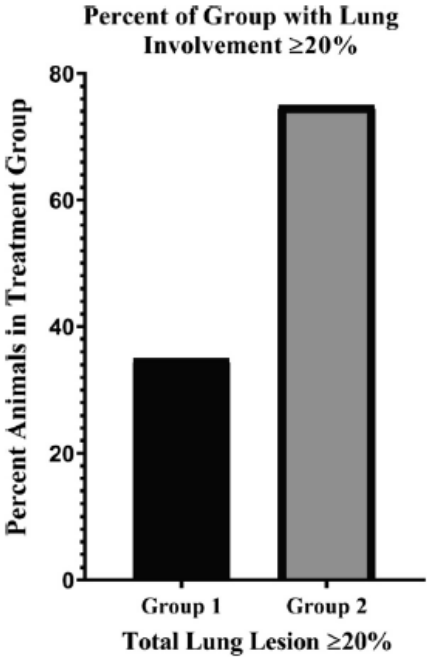


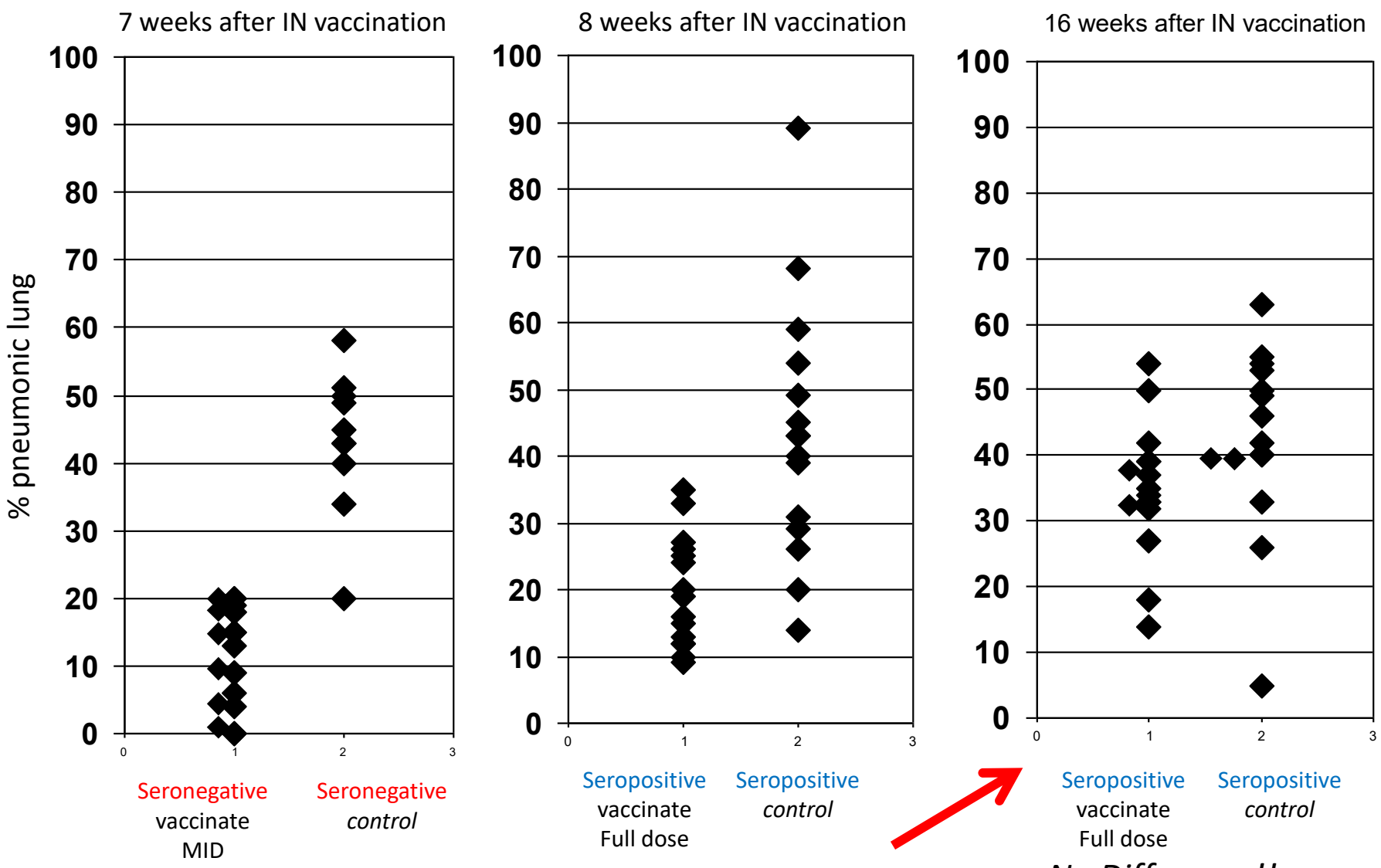
Fig. 4. Percentage of Animals with Total Lung Lesion Involvement ≥20%. Group 1 (Vaccinates) and Group 2 (Control). The number of animals in each group with a total lung lesion involvement of 20% or more were compiled. The remaining percent of animals by group had lesion scores that were less than these parameters. There was a statistically significant reduction in lung lesions in Group 1(vaccinates) compared to the controls ($P < 0.05$) as well as a reduction in the number of animals with significant lung involvement.

Calves vaccinated at *30 days of age*; mean *VN titer 1:16*??

YES!, at levels consistent with *good passive transfer*; it's not all or none!!!

What happens in a “herd” to assure its survival from infectious diseases…and how can we improve on that with vaccination?

IN BRSV vaccines "override" maternal antibodies…



but have short DOI; ***what's the best boost*** *??….*

No Difference!!

Ellis, et al. *JAVMA*, 2013

The (Heterologous) *Prime/Boost* approach to Immunization

- The Concept: Expose the immune system to *different forms* of an antigen by *different routes* to achieve broadest most durable response

Review Vaccine 34 (2016) 413–423

Prime-boost vaccine strategy against viral infections: Mechanisms and benefits

Kimia Kardani [1], Azam Bolhassani [*,1], Sepideh Shahbazi

Department of Hepatitis and AIDS, Pasteur Institute of Iran, Tehran, Iran

>2,700 papers in "prime/boost" search on Medline

Table 1
Preclinical and clinical trials for prime-boost vaccine strategies.

Pathogen	Prime	Boost	Type	Antigen	Response	Preclinical (Animal model)	Clinical (Phase)	Ref.
HIV	DNA	MVA	DNA/virus	HIV-1 IIIB Env, Gag, RT, Rev, Tat, Nef; SIV Gag, Pol	High Antibody and CTL; Low viral load	Macaques	–	[55]
	MVA + cholera toxin	MVA + cholera toxin	Virus/virus	HIV-1 IIIB Env	High Antibody, cyt chemokine and CTI			
	DNA	Replicon-defective adenoviral vector (ADV)	DNA/virus	HIV-1 Gag, Pol, Nef/Env	High IFN-γ and protection			
	DNA	ADV, or recombinant *vaccinia* virus (VV)	DNA/virus	HIV-1 IIIB Env gp120	High Ab, CTL, IFN-γ			
	DNA	MVA or VV	DNA/virus	TAB 13	High IFN-γ, IL-10			
	DNA	Protein (p55Gag virus-like particles)	DNA/VLP	Env proteins, Gag	High Ab and lymph proliferation, Poor neutralization			
	DNA	p55Gag virus-like particles	DNA/VLP	HIV Gag	High IFN-γ and Cytotoxicity			
	DNA	ADV	DNA/virus	HIV Env (gp120, gp140, gp150)	High Ab and IFN-γ, neutralization			
	DNA	Packaged amplicon particle (HSV)	DNA/virus	HIV gp120	High CD8+ T cell an term response			
	ADV (E1-deleted adenoviral vector)	ADV (E1-deleted adenoviral vector)	Virus/virus	HIV Gag	No change in immu response against cc			
	DNA	DNA/Protein	DNA/protein	Env	High Ab and protec			
	HIV-1 gp160 DNA	Peptide HIV-1 gp41	DNA/peptide	HIV-1 gp160/gp41	High Ab, Long term neutralization Ab			
	DNA	VV/Protein	DNA/Virus or protein	Env	Long term Ab, High and neutralization			
	DNA	MVA	DNA/virus	CTL epitopes	High CD8+ T cell			
	DNA	MVA	DNA/virus	Tat, Rev, Nef, Gp41	High T cell respons			
	DNA	Protein	DNA/protein	HIV-1 Gp120	High Ab and neutra Ab			
	MVA	FPW	Virus/virus	V3 loop of gp120	High IFN-γ			
	SFV	MVA	Virus/virus	HIV immunogen from HIV-1 clade A	High IFN-γ/Long te CTL induction			
	CpG + protein	ADV	Protein/virus	Gag	High IFN-γ			
	Rabies virus	VSV	Virus/virus	Env	High Ab, IFN-γ and neutralization activ			
	SFV	FPV	Virus/virus	TAB9 multi-epitopes	High IFN-γ, Low vi titer, 60% protectio			
	Influenza virus (V3 loop of gp120)	VV/MVA (gp160)	Virus/virus	V3 loop of gp120/gp160	High IFN-γ, and IgG IgG1 ratio			
	DNA gp160/Rev	VLP	DNA/VLP	gp160/Rev	Increase the env-sp humoral and cellul immune response, compared to the homologous protoc			
	Multigene DNA gp160subtypes A,B,C/RevB/ GagA,B/RTmutB	MVA (HIVIS03) CRF01-AEHIV-1Env subtype E/Gag- Pol subtype A	DNA/virus	gp160subtypes A,B,C/RevB/GagA,B/ RTmutB/CRF01-AEHIV-1Env subtype E/Gag- Pol subtype A	Low dose intraderm HIV DNA elicits hig and broader immu responses compare higher dose intramuscular injec High levels of (ADCC)-mediating antibodies			

Table 1 (*Continued*)

Pathogen	Prime	Boost	Type	Antigen	Response	Preclinical (Animal model)	Clinical (Phase)	Ref.
	Adenovirus serotype 26 (Ad26)	Env glycoprotein	Virus/protein	Prime: SIVsmE543 Env, Gag, and Pol Boost: AS01B-adjuvanted SIVmac32H Env gp140	Env-specific antibody responses, complete protection	Rhesus monkeys	–	[105]
SHIV	Env/Nef	Sendai virus	DNA/virus	Env/Nef//Gag	Low viral load	Monkey	–	[106]
SIV/HIV	DNA	VV	DNA/virus	SIV Gag, Pol, Vif, Vpx, Vpr/HIV Env, Tat, Rev	Low Ab, High T cell response, Low viral load	Monkey	–	[107]
	DNA	VV/MVA	DNA/virus	CTL epitopes	High CD8+ T cell/Low viral load/Partial protection	Mice/Monkey	–	[108–110]
HCV	ADV	Protein + MF59 adjuvant	Virus/protein	E1E2	High neutralizing antibody; Broad HCV-specific CD8+ and CD4+ T cell responses and functional Th1-type IgG responses	Mice, Guinea pigs	–	[51]
	DNA	Canarypox	DNA/virus	Capsid/E1/E2/NS2/NS3 proteins	High IFN-γ, Low virus titers	Mice	–	[111]
	DNA	lambda nanoparticles	DNA/virus	HCV core	Highest level of lymphocyte proliferation, Th1 response	Mice	–	[27]
	DNA HCV 1a NS3/4A (chronVac-C)	Modified *vaccinia* virus Ankara vaccine expressing genotype 1b NS3/4/5B (MVATG16643)	DNA/virus	NS3/4/5B	A significant increase in polyfunctional IFN-γ/TNF-α	Mice	–	[112]
HBV	DNA	Liposome-encapsulated protein	DNA/protein	HBsAg	High Th1 response	Mice	–	[113]
HSV-2	DNA	MVA	DNA/virus	Glycoprotein D	High Ab and cytokines	Mice	–	[114]
Equine herpesvirus1	DNA	*baculovirus*-expressed protein	DNA/protein	EHV-1 Glycoprotein D	High Ab and virus clearance from lungs	Mice	–	[115]
Human T cell Leukemia/ Lymphoma virus type 1 (HTLV-1)	DNA Env	NYVAC	DNA/virus	Env/Gag	100% protection	Monkey	–	[116]
Classical Swine fever virus	DNA	ADV	DNA/virus	Gp55/E2	100% protection	Pigs	–	[117]
HPV	E6/E7 DNA	Recombinant *Vaccinia* or *Adenovirus* or fowlpox/tumor cell-based vaccine	DNA/viruses or cells	E6/E7	CD8+ T-cell response, antitumor activity	Mice	–	[118–122]
	pNGVL4a/Sig/E7 (detox)/HSP70 DNA	*Vaccinia* expressing HPV16/18 E6 and E7 (TA-HPV)	DNA/virus	E7/HSP70	Therapeutic effects	–	Phase I	[123,124]
	Recombinant fusion protein HPV16 E6/E7/L2 (TA-CIN)	Recombinant *Vaccinia* virus encoding HPV16/18 E6/E7 (TA-HPV)	DNA/Virus	E6/E7/L2	No serious adverse effects	–	Phase II	[125]

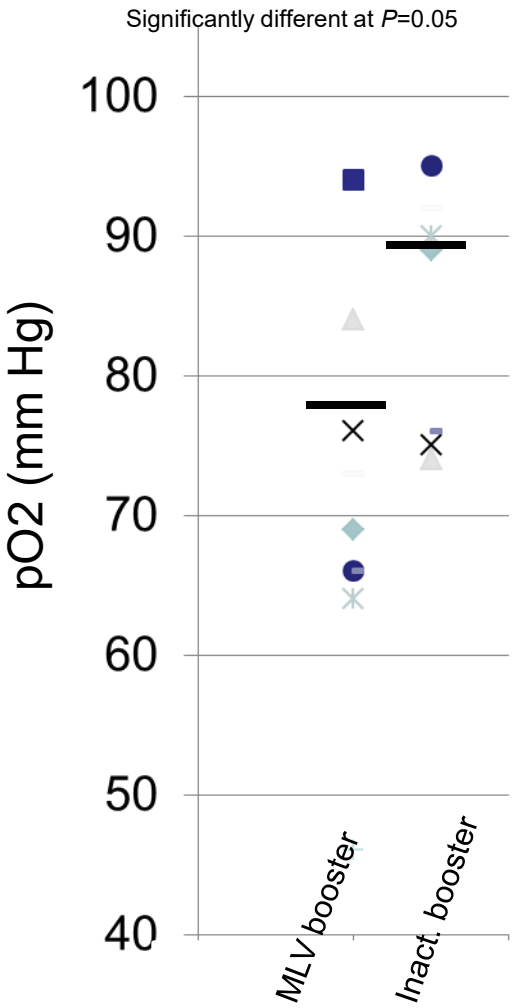
Comparing responses to MLV versus Inactivated boosters for BRSV: The inactivated booster conferred superior clinical immunity when neonatally IN-primed calves were challenged at weaning(6 months of age)……..

Mean total clinical scores on day 7:

Inactivated vaccinees 0.3

MLV vaccinees 1.1

Arterial pO2 day 7 after challenge



Ellis, et al., CVJ, 2018

Comparison of virus-neutralizing and virus-specific ELISA antibody responses among bovine neonates differentially primed and boosted against bovine coronavirus

Nathan E.N. Erickson, Stacey Lacoste, Michelle Sniatynski, Cheryl Waldner, John Ellis

- Study 1 and Study 2 had 33 and 22 **commercial cross neonatal beef calves**, respectively.
- **Procedure** Study 1 compared BCoV-neutralizing antibody concentrations of control calves with 3 groups of calves differentially vaccinated with mucosal and/or systemic BCoV modified live virus (MLV) vaccines. Study 2 compared specific and neutralizing antibody concentrations among mucosally BCoV primed groups of calves that were differentially systemically boosted.
- **Bottom line results:** In Study 1, calves that were mucosally primed and systemically boosted had higher BCoV-neutralizing antibody concentrations than the only control group at weaning. In Study 2, boosting mucosally primed calves by injecting inactivated or MLV vaccine resulted in anamnestic BCoV-specific antibody responses at weaning
- **Conclusion:** Neonatal mucosal priming and systemic boosting resulted in anamnestic BCoV antibody responses at weaning.

Comparison of postweaning bovine respiratory disease treatment rates between non-vaccinated control beef calves and calves variably primed and boosted using commercially available bovine coronavirus vaccines

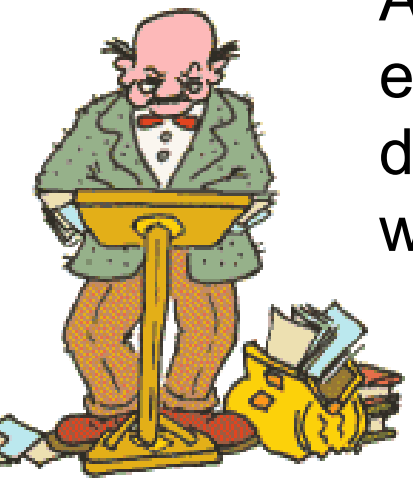
Nathan E.N. Erickson, Sharlene April, John R. Campbell, Elizabeth Homerosky, Tommy Ware, Craig Dorin, Cheryl L. Waldner, John A. Ellis

- **Commercial heifer and steer beef calves** born in April and May 2022.
- **Procedure** Calves were randomly enrolled into 3 treatment groups. Those in 2 groups [V1 (n = 160) and V2 (n = 160)] were administered a mucosal priming dose of 1 of 2 commercial BCoV vaccines; those in the 3rd group [CTL (n = 151)] were unvaccinated against BCoV. The V1 and V2 groups were boosted by intramuscular injection pre-weaning with the same vaccine used for priming
- **Bottom line results:** Postweaning BRD treatment rates for V1, V2, and CTL were 7%, 9%, and 14%, respectively. The CTL calves had 2.23 greater odds of receiving treatment for BRD than V1 calves. There were no differences in odds of treatment between CTL and V2 calves or V1 and V2 calves
- **Conclusion:** In a herd with previously diagnosed BCoV BRD cases, prime-boost vaccination of calves is associated with a difference in odds of BRD treatment post-weaning compared to not vaccinating calves against BCoV.

Comparison of pre-weaning bovine respiratory disease treatment rates between non-vaccinated control and variably primed and boosted beef calves receiving commercially available bovine coronavirus vaccines

Nathan E.N. Erickson, Tommy Ware, John Campbell, Kathy Larson, John A. Ellis, Cheryl L. Waldner

- **Beef calves** of mixed sex and breed at a privately owned ranch in north-central Alberta with a history of BRD were randomized into a clinical vaccine trial.
- **Procedure** At birth, 447 calves were enrolled into the vaccine (VAC) group and administered an intranasal dose of BCoV vaccine, and 439 calves were enrolled as controls (CON). Most VAC calves (*n* = 389) also received an intramuscular dose of BCoV vaccine at an average of 49 d (SD: 7 d).
- **Bottom line results:** Weaning weights were higher for VAC calves (*P* = 0.04) and, despite increased costs due to vaccination, revenue for VAC calves was an average of $10.50/head higher.
- **Conclusion:** Vaccination of neonatal calves with BCoV vaccine reduced the frequency of BRD treatment and total mortality and improved weaning weights and revenue potential in this herd.



An approach to improving overall vaccine efficacy…getting **LOW RISK** cattle…….we really don't need new vaccines we just need to rethink the way we're using the ones we have

Suggested protocol for use of ***intranasal*** and ***injectable*** vaccines

- **Prime** with ***intranasal***
  - *Can be safely done at young age*
  - *Override maternal antibodies*
  - *Prime mucosal and systemic immune response*

- **Boost** with ***injectable***
  - *Better (systemic) memory response*
  - *No head gate needed*