Canine Vaccines, Titer Testing and Nomographs

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1

Introduction – Dr. Larson

- NDSU – Microbiology, VDL
- ISU – DVM
- Mixed and small animal practice
- Joined Schultz laboratory in 1991
- Member AAHA canine vaccine guidelines taskforce
- "Team Labrador"

2

Dedication:

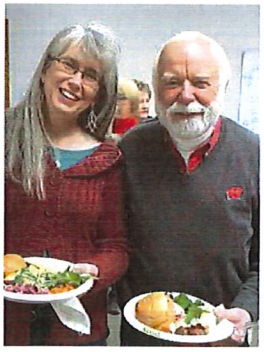
To the memory of my grandmother, Grace Corbin

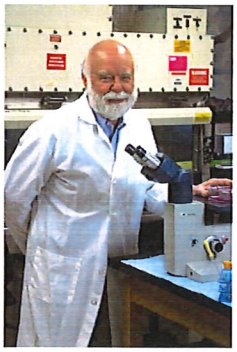
- a hobby miniature

3

Gratitude:

To Dr. Ronald Schultz





4

RD Schultz Laboratory

- Development and Testing
  - Veterinary Vaccines
  - Veterinary Diagnostics
- Antibody Testing Service
  - Veterinarians
  - Pet Owners
  - Breeders
  - Animal Shelters
- Infectious Disease Consultation and Education
- Multiple industry collaborations

5

RD Schultz Laboratory → CAVIDS Laboratory

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Companion Animal Vaccines
And Immuno-Diagnostic
Service Laboratory – CAVIDS
University of Wisconsin-Madison
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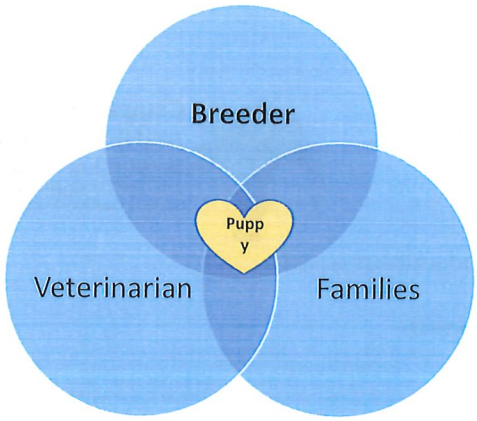
6

Discussion Objectives

- Explain some basics of vaccines
  - Types of vaccines
  - How vaccines work
  - Vaccine schedules
- Discuss the canine immune response to vaccination
- Compare types of titer tests
- Review passive transfer of antibody
- Show how nomograph is calculated and factors affecting it
- Discuss limitations to nomograph
- Consider approaches for high risk situations
- Share stories from the field
- Questions and discussion

7

Discussion Objectives: "Big Picture"



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Recent History of Canine Vaccination

- Annual Revaccination of dogs and cats was the standard of practice for many years
- Feline Vaccine Associated Sarcoma recognized in early 1990s
- American Association of Feline Practitioners Vaccine Taskforce
- Feline vaccine guidelines first developed in 1998

9

American Animal Hospital Association (AAHA)

- Canine Vaccine Guideline Taskforce – Dr. Schultz remains a member of this group.
- First developed guidelines for canine vaccination in 2003 and updated multiple times since.
- The canine vaccine guidelines are available to the public at:
  - https://www.aaha.org/professional/resources/canine_vaccine.aspx

10

Classes of Canine Vaccines

- Core Vaccines – provide long-term, highly effective immunity against disease agents that cause significant clinical signs, including death.
  - **ALL DOGS** SHOULD RECEIVE THESE VACCINES
- Non-Core Vaccines – provide partial immunity, for a short term, and/or protect against diseases that are neither highly virulent nor universally prevalent.
  - THESE VACCINES SHOULD BE USED (OR NOT) BASED ON RISK OF THE DISEASE FOR EACH INDIVIDUAL DOG

11

Types of Vaccine

- Avenomous
- Recombinant Vectored
- Recombinant Subunit
- Bacterin
- Killed Viral
- Avirulent Live Bacterial - Infectious
- **Modified Live Viral -Infectious**

12

Terminology

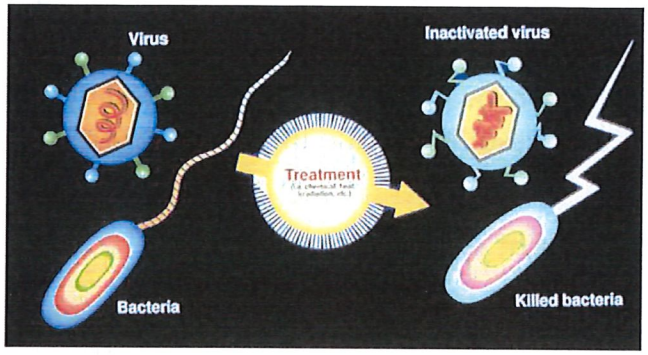
- Protection from Infection – "sterile immunity"
- Protection from Disease – agent can infect, but disease is lessened by the immune response
- **"Vaccination" ≠ "Immunization"**

13

How do Vaccines Work?

14

Killed Virus or Bacterin Vaccine



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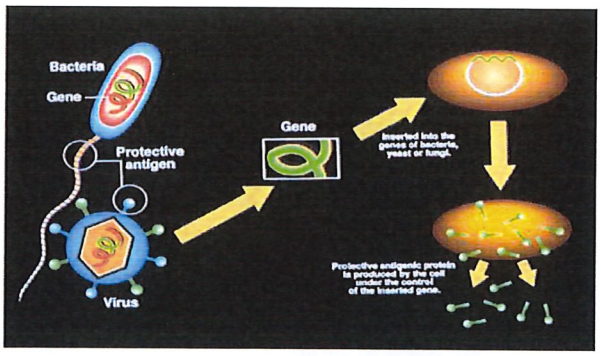
Recombinant Subunit Vaccine



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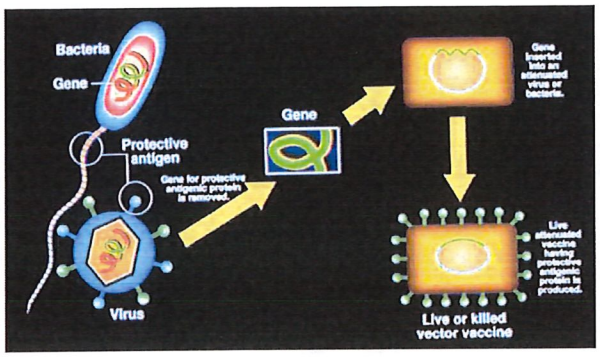
Recombinant Vector Vaccine



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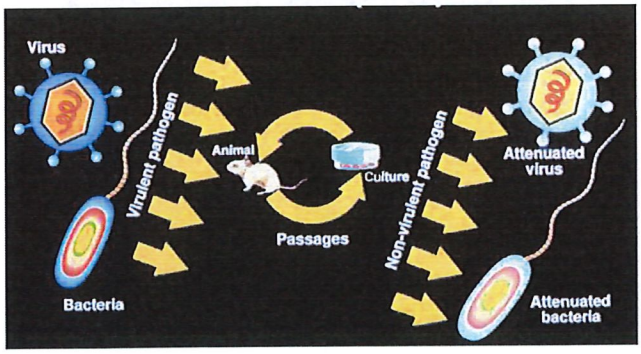
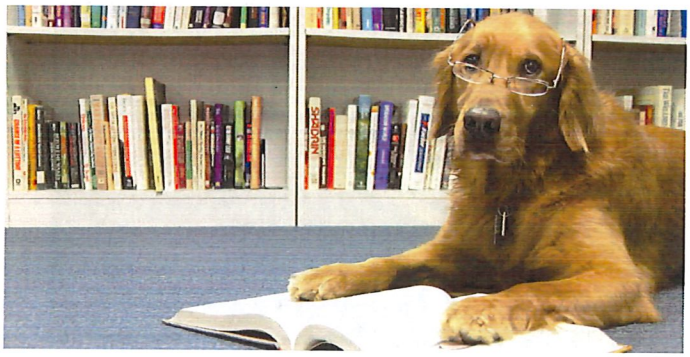
Modified Live Viral (Avirulent Bacterial) Vaccine



18

Is this going to be on the test??

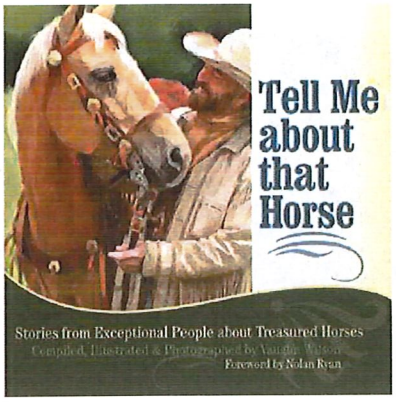


19

Virulent Virus

20

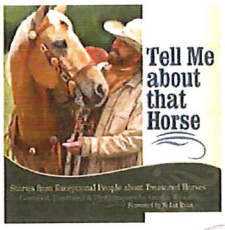
Killed Vaccine



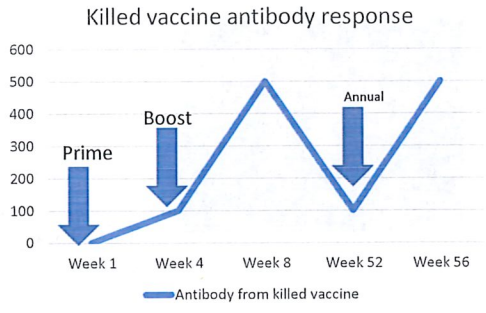
Adjuvant

21

Killed Vaccine



Adjuvant

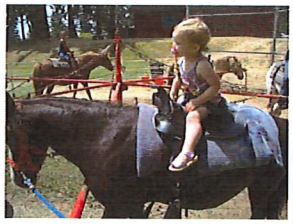


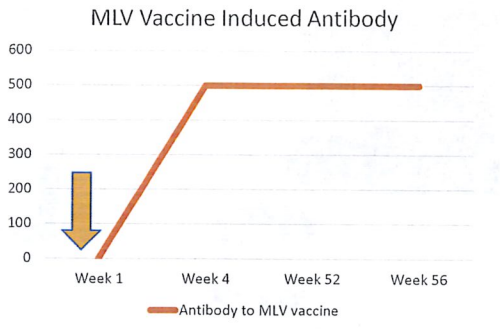
22

MLV Vaccine

23

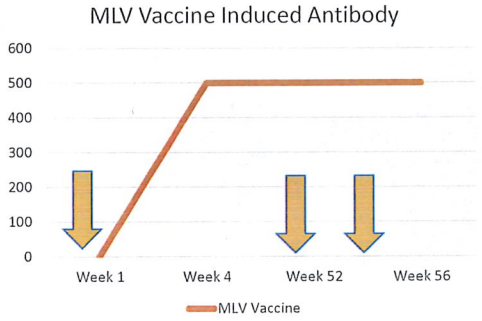
MLV Vaccine





24

MLV Vaccine



25

What about Nosodes?

- **No efficacy as a preventative against infection with CDV, CPV-2**
- Should NOT be used in lieu of core vaccines in initial immunization of puppies (or kittens)
- May have use as adjunct treatment or immune support

26

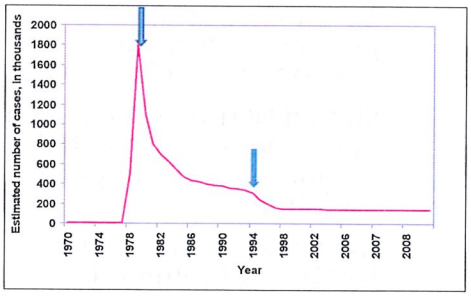
What about "Natural Immunization"?

- aka: Let the puppy get the disease and hope he survives
- Just....no. MLV Core vaccines are highly effective and pose a low risk of adverse event.
- When a less virulent virus returns to susceptible host, it will gain virulence and be shed in increasingly higher numbers to the next one

27

Results of MLV Core Vaccine Success

- "Community Immunity" or herd health excellent where core vaccination is common



Parvovirus cases in United States

28

Potential Adverse Reactions to Vaccines

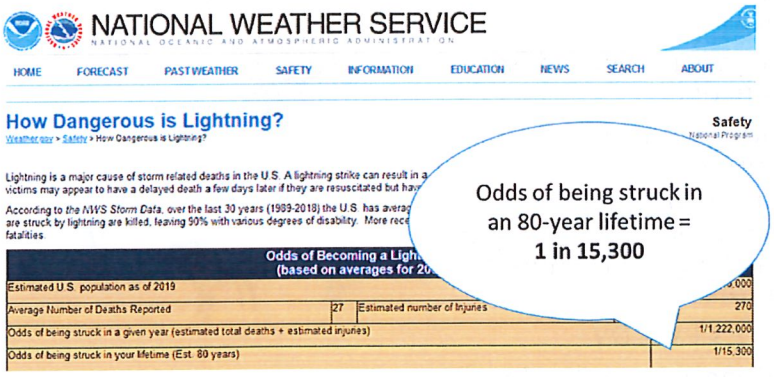
- Allergic reactions
- Anaphylaxis
- Neurologic disease
- Immune mediated diseases
- Tumor formation

Courtesy of Dr. Alice Villalobos

- Adverse reactions are not common, but may be triggered by vaccine in a dog that is predisposed

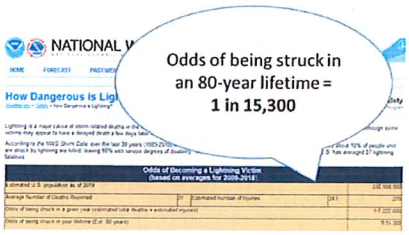
29

How big a risk are vaccine adverse reactions?



30

How big a risk are vaccine adverse reactions?



- Odds of canine severe vaccine reaction:

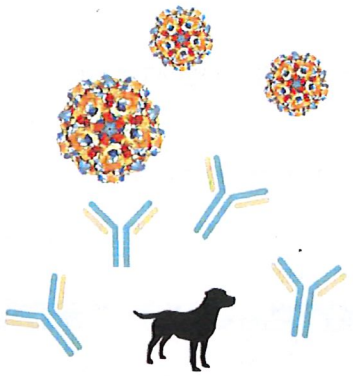
  ~1 in 10,000

Is this risk worth taking?

31

Sterile Immunity

- Antibody binds to the virus
- Virus is prevented from infecting
- Virus can't replicate – it is sterilized
- Titer threshold determined by multiple challenge of immunity studies
- CAV, CPV, CDV
- "Deadbolt on the door"



32

Causes of Vaccine Failure

- Improper vaccine handling
- Insufficient dosing
- Wrong kind of vaccine used
- Genetic non-responder
- Given too late– dog already infected
- **Given too soon - Maternal Antibody Interference (sterile immunity)**

33

Canine Non-Core Vaccines

- *Leptospira* spp
- Canine Influenza Virus
- *Bordetella bronchiseptica*
- Lyme disease *(Borrelia burgdorferii)*
- Rattlesnake Antivenom

- Titer Testing not meaningful
- Many are killed vaccines with adjuvants
- Protection is not complete
- Use based on RISK
- If given to puppies, wait until core series has been completed
- If given to adults, wait 2 weeks after core vaccine

34

Canine Core Vaccines – Adult Dogs

- Once an ***active immune response*** is proven, protection against infection is excellent and long lasting in most cases
- Best practice: give CDV, CPV-2, and CAV-2 vaccines only ***as needed*** based on titer testing
- Not more frequently than every three years

35

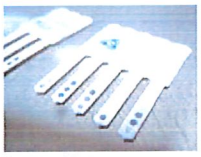
Canine Core Vaccines – Antibody Testing

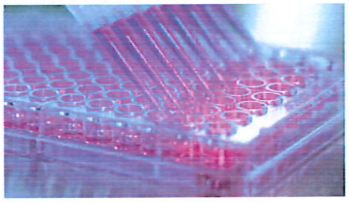
- Adult dogs titer test at 3 year intervals
- Breeding dams – test for nomograph before each breeding is best
- Important to test puppies after the core series is completed. (**Quantitative** is better able to differentiate passive vs active responses.)

36

Types of Antibody Testing

- Screening (qualitative) – "yes/no" answer
- Gold Standard (quantitative) – highest dilution of antibody that can be detected. More sensitive
- Must be correlated to challenge data –CAVIDS laboratory Gold Standard tests are.





37

Duration of Immunity – Core Vaccines

- Multiple Schultz laboratory studies showed that MLV distemper combination vaccines provided protection from challenge with virulent CDV, CPV-2, and CAV-1 up to 7-9 years after previous vaccination
- Protection can be expected to last many years to a lifetime
- Circulating antibody above protective threshold correlates 100% with protection
- Client owned dogs tested by our laboratory show antibody duration up to 13 years post previous vaccination

38

Canine Core Vaccines – Puppy Series

- Canine Parvovirus -2
- Canine Distemper Virus
- Canine Adenovirus – 1,2

- **A SINGLE effective dose of MLV "distemper combo" is enough to immunize the pup!**

39

Why do we give puppies multiple doses of Core vaccines?

High Risk Environment

- 6 weeks of age
- 8 weeks of age
- 10 weeks of age
- 12 weeks of age
- 14 weeks of age
- 16 weeks of age
- 1 year old

Standard schedule = 8-9 weeks, 12-13 weeks, and 16 weeks

40

Why do we give puppies multiple doses?

- **Because, most of the time, we are shooting in the dark!**
- We don't know when passively derived maternal antibody is no longer able to block vaccination

41

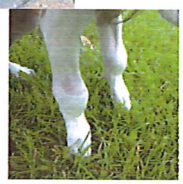
Maternal Antibody Interference

- Colostrum contains antibodies from the mother
- During the first 12 hours after birth, the puppy is able to absorb the antibody directly from gut to bloodstream
- Passive antibody protects puppies from specific diseases, and breaks down over the first few months of life
- Temporary

42

Reasons to Minimize Number of Puppy Shots

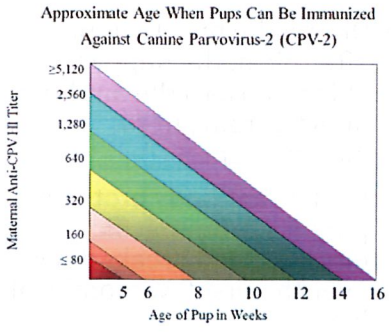
- Hypertrophic Osteodystrophy
- Allergic sensitization
- Immunosuppression
- Other potential adverse reactions
- Breeders of HOD highly susceptible breeds (Irish Setters, Weimaraners, etc) have increasingly requested **nomographs** from our service



43

Nomograph Antibody Titer

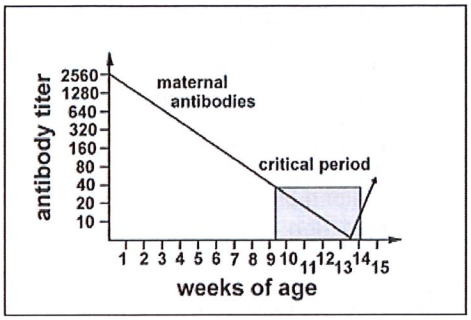
- By knowing the dam's titers against CDV and CPV-2, we can get a better idea of when the maternal antibody will no longer interfere with vaccination
- Fewer doses are needed in the puppy series as a result
- **Window of susceptibility** can be estimated



44

Window of Susceptibility – Puppy Vaccination

- Mostly concerned with CPV-2
- Virulent virus can overcome a higher titer of passive antibody than the vaccine can
- For most currently available CPV-2 vaccines, this time frame is roughly 2 weeks



45

Why tailor a vaccine schedule for a litter?

Low levels of MDA

- Susceptible earlier in life
- Can finish series earlier
- Follow-up testing proof of protection early
- Critical socialization period peace of mind
- Better long-tern bonding

High levels of MDA

- Could block vaccine beyond standard series end at 16 weeks
- Significant risk for pups in first year of life due to failure to immunize
- "Fully vaccinated" dog that is not immune

46

Limitations of Nomograph

- Failure of Passive Transfer
  - Dam doesn't make colostrum
  - Dam leaks colostrum
  - Dam has extremely large litter
  - Extended or difficult whelping
  - Maiden bitch
  - C-section
- Don't expect that a nomograph will guarantee time frame that pups are protected from disease

47

Factors affecting Maternal Antibody in pups

- First born/Last born
- Ability of dam to concentrate antibody in colostrum
- Breed related catabolic rate
- Caloric restriction
- Timing of dam blood draw

48

Antibody Testing in High Risk Situations

- Excellent biosecurity is a must!
- Test at least one pup from litter before vaccination is begun
- Include history of presence of infectious disease on submission form
- Re-test pups after vaccination to be sure of response

49

Canine Vaccination, Titer Testing and Nomograph - Summary

- Vaccination is a medical procedure that warrants careful consideration
- Judicious use of core vaccines provides excellent protection from disease
- Overuse of core and non-core vaccines increases risk of adverse events with questionable benefit
- Antibody testing is an important tool for clinical decisions regarding core vaccination
- Differing types of antibody tests have variable applications

50

Time to let the dogs out....

Questions?

51