

PRACTICAL IMMUNOLOGY AND VACCINOLOGY –

PARTS 1 AND 2

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Infectious diseases are a global force and formidable adversaries.

Vaccines are like a seatbelt to help protect us and our pets from the dangers of infections.

Vaccines are delicate medical instruments that need to be handled with respect and care, notably in terms of temperature control.

In helping prevent or minimize infections vaccines – also known as “biologics” – are an important tool to help minimize need for antibiotics – this is critical in this era of antimicrobial resistance.

Vaccination is the process of administering a vaccine; immunization is what occurs when the animal's immune system responds correctly to the vax.

Vaccines should only be given to healthy individuals.

4 animal health companies manufacture the principal small animal vaccines used today in our profession: Elanco, Zoetis, Merck, and Boehringer Ingelheim.

The major vaccines used today in companion animals largely trace back decades through multiple mergers and acquisitions to the earlier companies which developed them.

AAHA and AAFP both provide excellent and periodically updated recommendations in regards to vaccine protocols, use and handling.

There are less than 15 diseases we can vaccinate dogs against, and even fewer from which we can protect cats.

The typical interval between vaccines in a series is 2-4 weeks.

Removing a vaccine from its “home” in its original vial and drawing it up into a syringe can potentially create instability and disruption in terms of chemical and bond reactions with the plastic or polymer of the syringe, as well as through the shearing effect of forcibly sucking the vaccine through the small bore of a needle. This can also happen during administration as the Venturi effect.

It is best to honor the “Golden Hour” and discard any vaccine that has been drawn up but not used within an hour even if it has been refrigerated.

Proper vaccine storage, including temperature control, is critical to optimally assuring efficacy and safety.

The CDC has really good guidance on vax handling and storage.

The ideal vaccine refrigerator does not have a freezer compartment and is dedicated solely to vaccines.

Water bottles to help maintain temp stability should be placed in the door shelves and on the top and bottom shelves, leaving the middle shelves for vaccines.

It is best to allow space between vaccine trays or units to allow for air flow and better temp regulation.

Vaccine-associated adverse events are relatively rare, reflecting the high level of vaccine safety.

A huge vaccine safety study published in JAVMA by George Moore demonstrated that dogs less than 20 lbs. are more likely to suffer adverse events (AEs).

The 5 breeds most likely to have AEs were Boston terriers, Chihuahuas, min pins, dachshunds, and pugs.

As a general rule, the more vaccine injections a dog receives at one visit, the more likely it is to have an AE.

This is likely due to the risk for increased exposure to extraneous proteins in the vaccines.

Many vets will thus comfortably administer no more than 2 injectable vaccines plus possibly a mucosal vax at one time.

If the patient needs other vaccines, it is best to have them return in 2-4 weeks for the remaining treatment(s).

Acute AEs such as anaphylaxis – manifesting as urticaria, angioedema, vomiting and diarrhea, cyanosis, shock, etc. - are very rare but in an ideal world, all animals would be observed for an hour post-vax to monitor for them.

Vaccines can be classified in many ways.

AAHA and AAFP refer to 2 main groups: “Core” and “Non-Core.”

Earlier editions of vaccine guidelines may also refer to “Not Recommended” vax.

“Core” vaccines are meant for all patients (barring any contraindications, of course).

“Non-Core” vax are meant for all *AT RISK* individuals, based on thorough and consistent risk assessment.

“Not Recommended” vax are those lacking enough data or evidence to suggest they have any consistent benefit or safety.

Vaccines can also be grouped into categories based on the AG type: bacterial, viral, etc...

Another classification scheme is whether the vax is Killed or Modified Live (ML)

ML vaccines are made with attenuated – or blunted – pathogens which are meant to create a much more mild version of the disease to allow the animal’s immune system to mount a solid response

The process of breeding the virulence out of a pathogen is termed “passage”

The hope is that enough virulence is bred out of the microbe, while maintaining key immunoreactive features to trigger immunity, and that the pathogen doesn’t revert back to a virulent state

Killed pathogen vax typically include an adjuvant to enhance the immunoreactivity of the vax

Adjuvants are typically oil- or water (aqueous)-based entities

They also tend to be proprietary, so companies won’t divulge their identity

Killed vax do not generally confer as broad, strong, or long-lived immunity as (parenteral) ML vax

This is because ML vax multiply within the host, thus exponentially increasing the AG load and exposure; a Killed vax delivers to the immune system simply what is in the vial – no more, no less

In the case of a Killed vaccine, the vax is basically made of a killed microbe, or critical antigenic parts thereof

In either case, the vaccine tricks the immune system into thinking it has been exposed to the actual living pathogen

As is true for ML vax, the appearance of 1-3 days of mild illness is not an adverse reaction but instead a normal response indicating the vax and immune system are working properly

Because they do not replicate in the recipient and do not tend to confer long-lived immunity, Killed vaccines require annual boosters

Many Non-Core vaccines are Killed, so they should be boosted annually

Other Non-Core vax may be mucosally delivered – these might be ML vax but because they are directed at the mucosal system rather than injected, they should be boosted annually too

This is yet another way that vax can be classified – Is it parenteral (injected) or mucosally delivered?

Mucosal vax mainly stimulate IgA but also likely stimulate some IgG through the action of dendritic cells and other immune system entities

Maternal antibodies do not interfere with mucosal vax, so these vax do not require an initial series of boosters to confer immunity – they are “one and done”

Nonetheless, mucosal vaccines should be boosted annually

Recombinant vax are a newer technology of vaccine – not necessarily better or worse – that utilize non-pathogenic organisms carrying certain antigens to enter and in some cases even replicate inside the host and thus stimulate immunity

New vaccine technologies continue to be developed, a ripe field for research and study

A few final notes on rabies vaccines: Other than the labels there is no substantial difference between a 1-yr and a 3-yr rabies vaccines - these products come off the same production line

Vets need to be familiar with their state or other jurisdictional rules about rabies vax

While a 3-yr vaccine can be administered in a “1 yr” legal system, it still needs to be repeated annually

Conversely, a 1 yr vax may possibly be given in a setting that allows for 3-yr vaccines, but it will still need to be repeated annually

When in doubt contact the State Veterinarian

Also understand that rabies vax tend to be very effective, as directed by the federal Code of Federal Regs (CFR) – in fact the administration of only one vax is considered highly effective

This feature recognizes the fact that a DVM may get only one opportunity with an animal to try to protect it (and ultimately the public too) against rabies

Nonetheless, it is best if at least a first annual booster be given to help ensure optimal immunity

Here are several excellent references for those wanting more info on the fascinating subject of immunology and vaccines (2 of these references are food animal-oriented, however the expertise of these vets often far exceeds that of small animal practitioners, so please don't dismiss these books as irrelevant. Mammalian immunity is mammalian immunity, and there is much to be learned from our colleagues who figuratively live and breathe herd health and infectious diseases.

<https://www.bookdepository.com/Immunology-Function-Pathology-Diagnostics-Modulation-Issue-Veterinary-Clinics-Small-Animal-Practice-Melissa-Kennedy/9781437718881>

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