CANINE DISTEMPER VIRUS (CDV)

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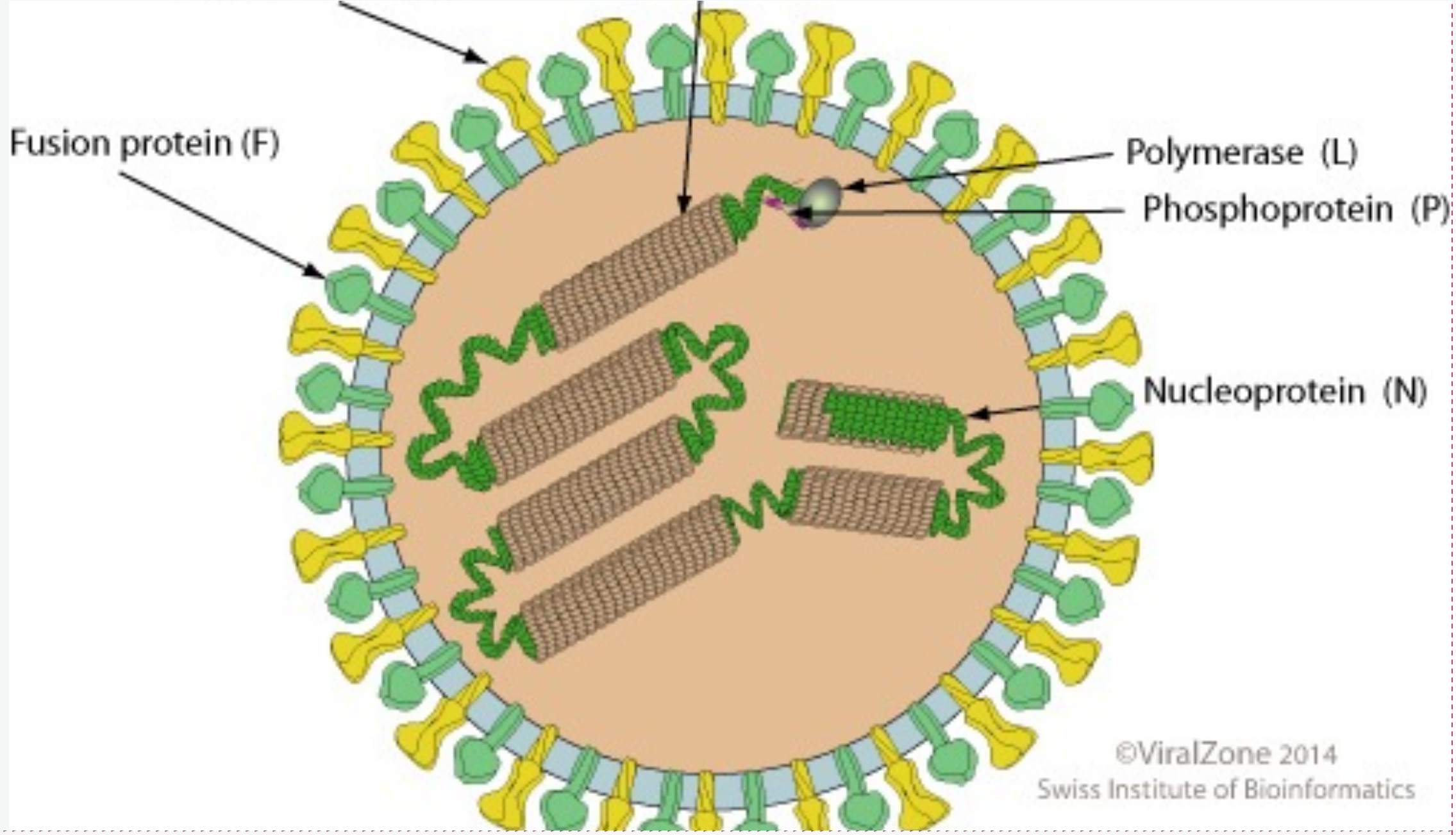
Associate Professor


Fusion protein (F)
Polymerase (L)
Phosphoprotein (P)
Nucleoprotein (N)
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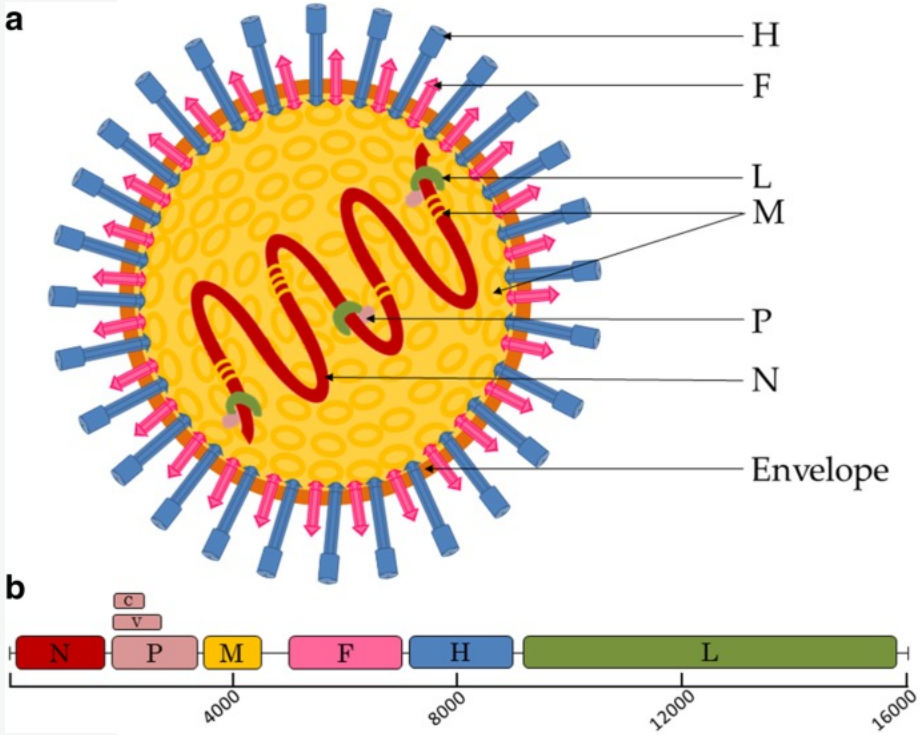
Swiss Institute of Bioinformatics

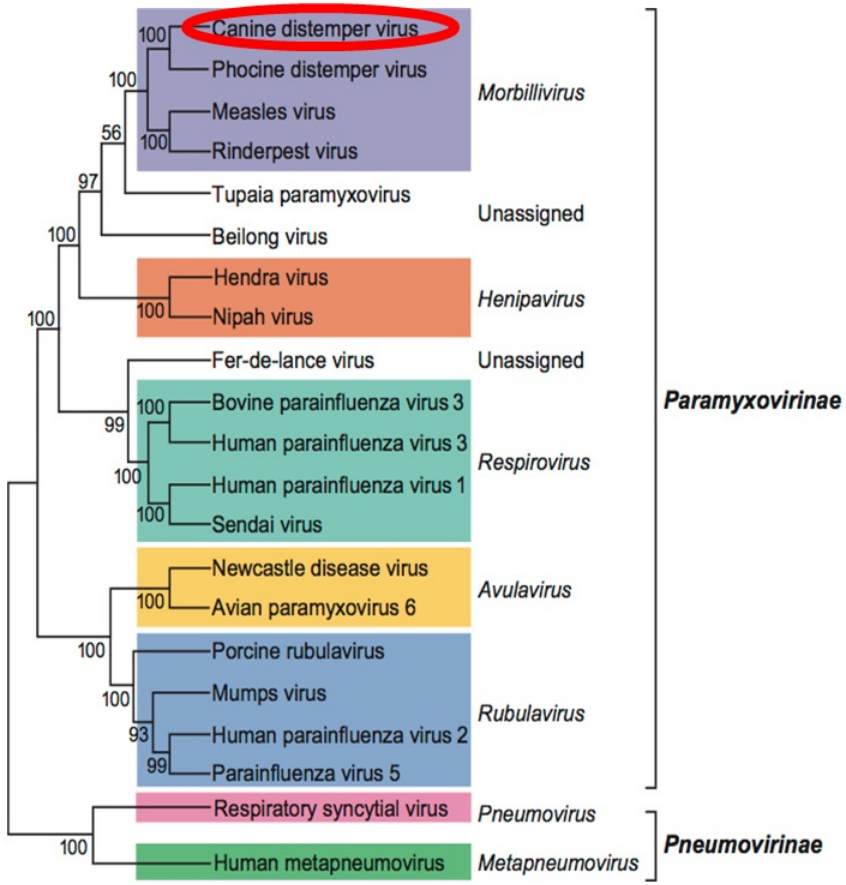
ETIOLOGY



Realm:	Riboviria
Kingdom:	Orthornavirae
Phylum:	Negarnaviricota
Class:	Monjiviricetes
Order:	Mononegavirales
Family:	**Paramyxoviridae**
Genus:	**Morbillivirus**
Species:	**Canine morbillivirus**

ETIOLOGY

- RNA
- Helical symmetry
- Enveloped
- It is in close antigenic relationship with all other morbilliviruses (rinderpest and measles).

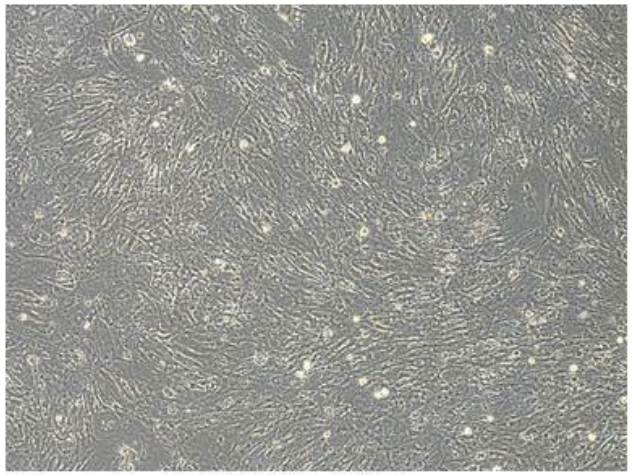


Phylogenetic analysis of the L proteins of members of the family *Paramyxoviridae*. Phylogenetic analysis using MEGA4.1 was performed on the amino acids sequence of L proteins from various members of the family *Paramyxoviridae*. The tree shown was based on maximum parsimony.

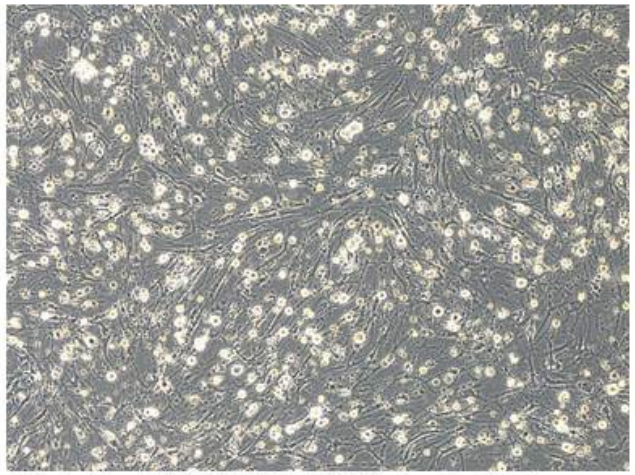
Fenner's veterinary virology: Fifth edition
Nigel J Maclachlan, Edward J. Dubovi, Stephen W Barthold, David E. Swayne, James R. Winton. Chapter 17 - *Paramyxoviridae* and *Pneumoviridae*

- As a tissue culture, Vero, MDCK and Dog Kidney Cell cultures are used and virus forms CPE and a Giant Cell.

ATCC® Number: **VR-128™**
Agent: **Canine distemper virus**
Strain: **Lederle**



Uninfected host (ATCC® CRL-1590™)



Infected host (ATCC® CRL-1590™) showing CPE

Host Range

- Canidae (dog, fox, wolf, raccoon dog),
- Mustelidae (ferret, mink, skunk, wolverine, marten, badger, otter),
- Procyonidae (raccoon, coatimundi),
- Viveridae (binturong, palm civet),
- Ailuridae (red panda),
- Ursidae (bear),
- Elephantidae (Asian elephant),
- Primates (Japanese monkey),
- Felidae.

Transmission

Directly,

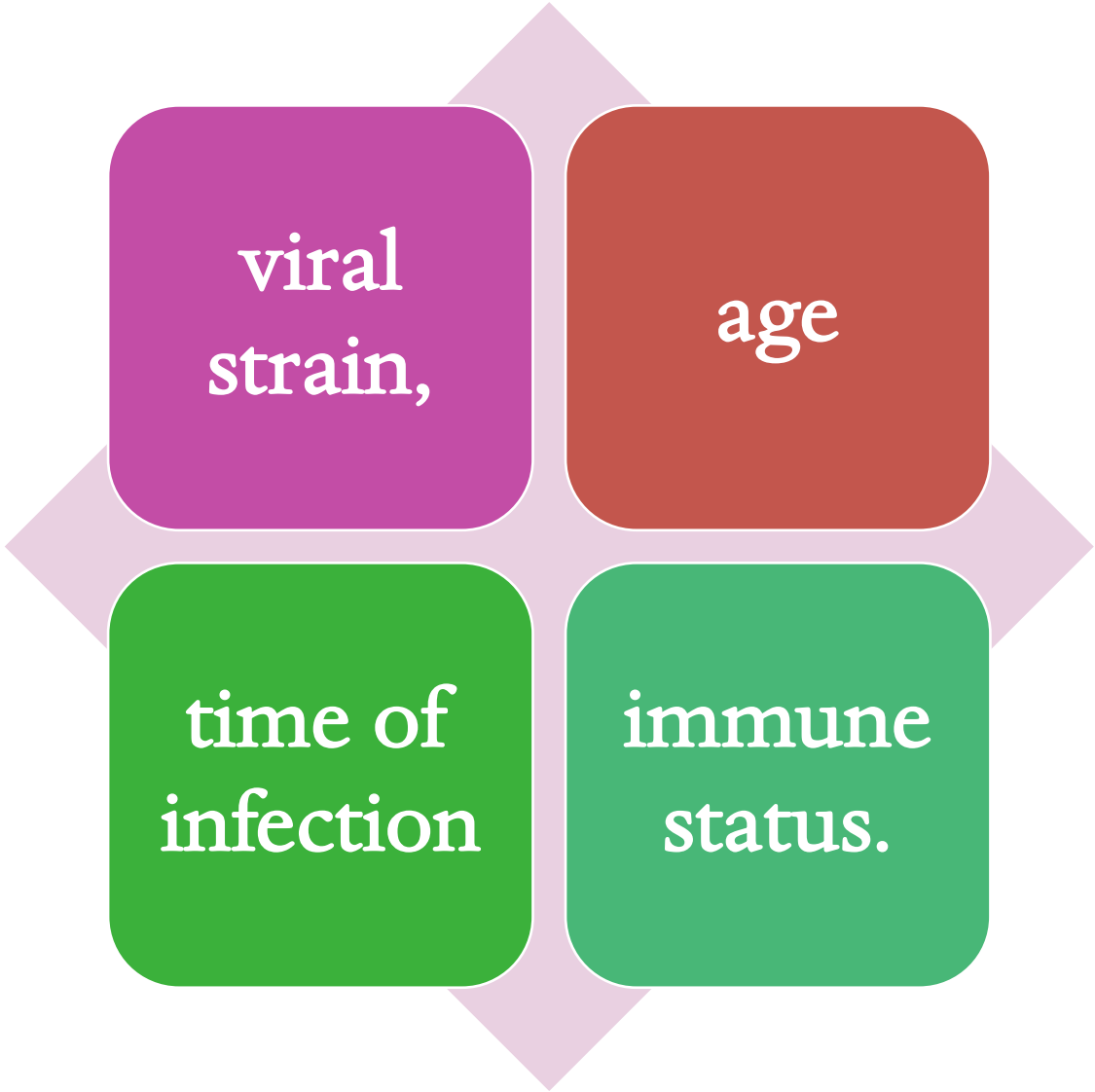
- Nasal discharge, tear, saliva, urine and stool.
- Through the droplets.

Indirectly,

- Feed and infected material.

Some infected dogs may shed virus for several months.

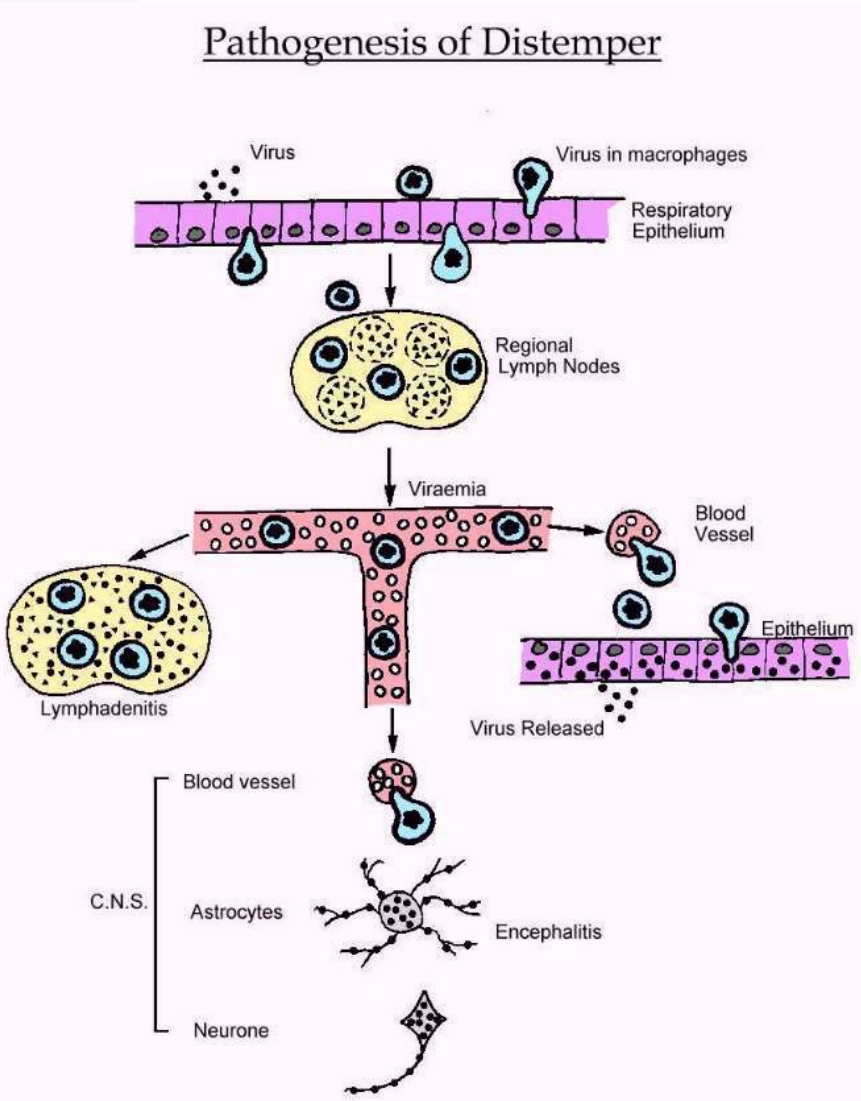
Incubation period can change from 1 to 4 weeks.



Animals are at risk?

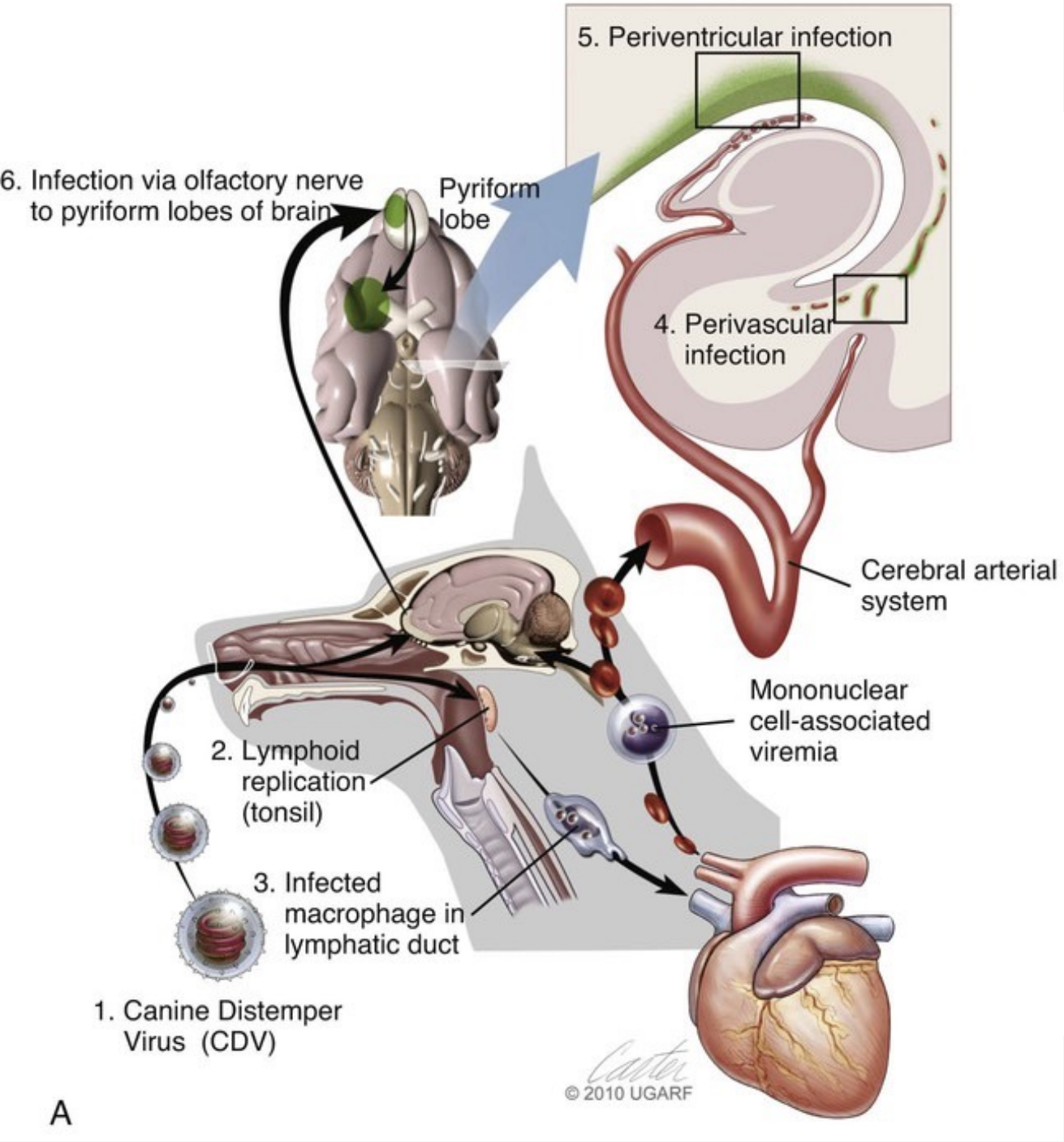
- 3–6-month-olds.
- Mixed races.
- Unvaccinated or improperly vaccinated animals.
- Immunosupressed animals (individuals with T-cell deficiency).
- Animals that contact the infected dog.

Figure 2: Involuntary movement of jaw (Distemper myoclonus)

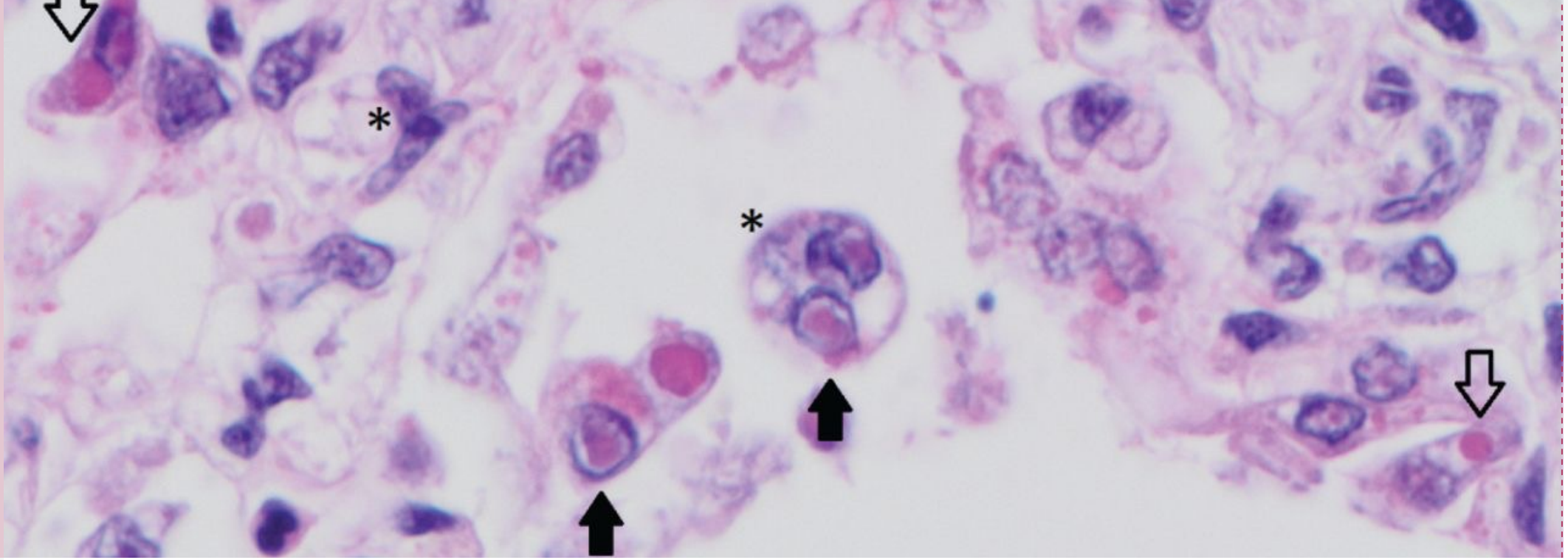


Pathogenesis

- Virus initially replicates in the lymphatic tissue of the respiratory tract.
- A cell-associated viremia results in infection of all lymphatic tissues, which is followed by infection of respiratory, GI, and urogenital epithelium, as well as the CNS and optic nerves.
- Disease follows virus replication in these tissues.



1. CDV enters the respiratory tract via aerosols and colonizes the local lymphoid tissues such as the tonsils.
2. Primary viral replication occurs in the tonsils, retropharyngeal nodes, bronchial lymph nodes, and GI lymphoid tissue.
3. From these sites of primary replication, macrophages containing CDV enter lymphatics traveling back to the heart, where they enter the blood as a mononuclear cell-associated viremia.
4. Virus enters the CNS via the cerebral circulation. There it is deposited in the perivascular spaces of fine blood vessels.
5. Alternatively, virus enters the vessels of the choroid plexus and eventually the cerebrospinal fluid and ventricular system.
6. As an uncommon phenomenon in dogs, CDV can travel from the nasal passage, through the cribriform plate and anterograde via the olfactory nerve to the olfactory bulb and CNS. There it localizes, predominantly in the pyriform lobes of the cerebral cortex

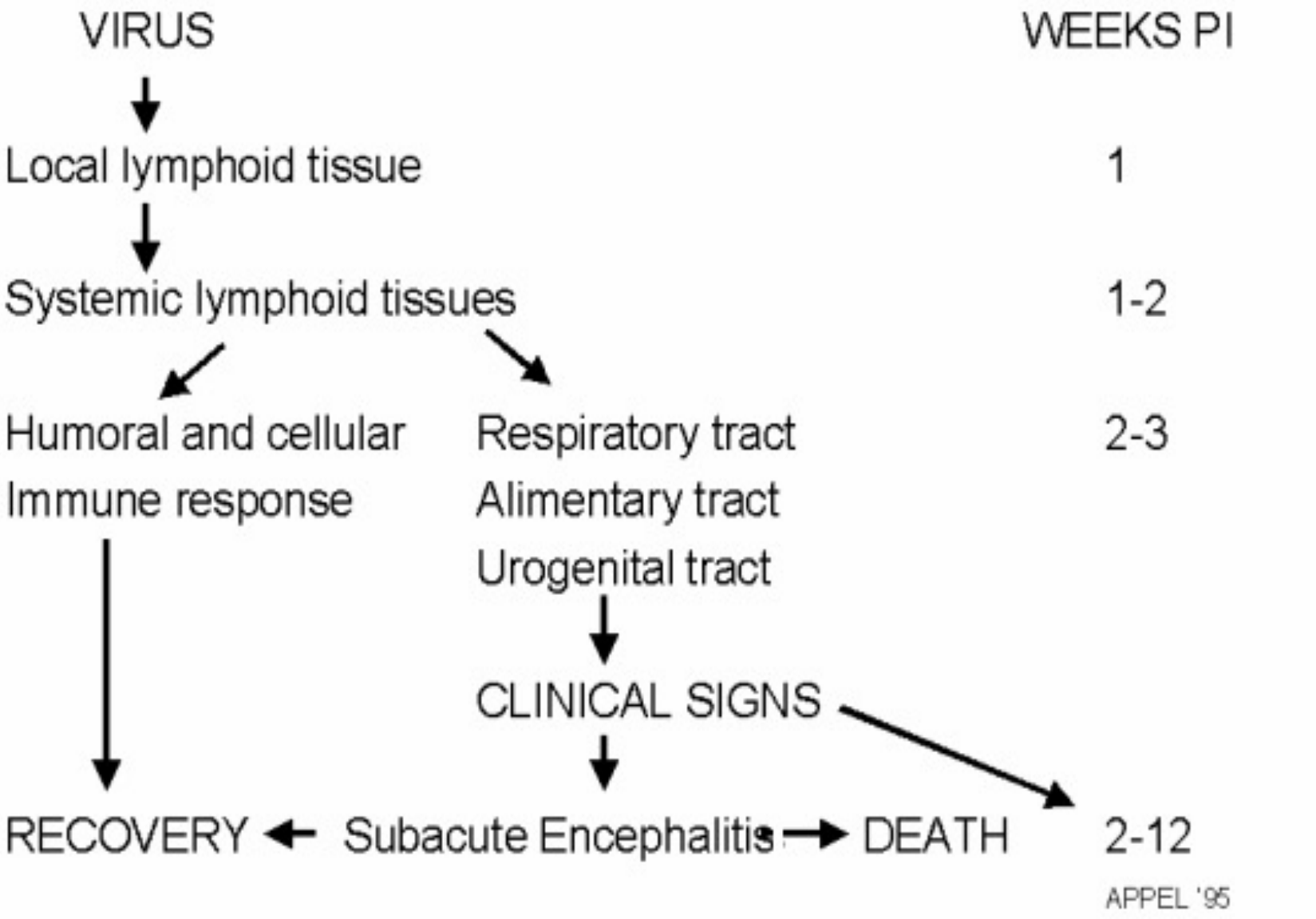


The inclusion body in the epithelial cells is pathognomic!

- Histopathology of the lung of a puppy with canine distemper, showing inclusion bodies in nuclei (solid arrows), the cytoplasm (open arrows), and multinucleate cells (asterisks).

- WALKER, David, et al. Canine distemper imported into the UK. *The Veterinary Record*, 2014, 175.17: 433.

PATHOGENESIS OF CANINE DISTEMPER



Pathogenesis and Clinical Stages

- Infection of the alveolar macrophages or or pharynx .
- Viraemia and virus infection of macrophages and dendritic cells.
- Spread to **most epithelial tissues and skin**.
- Opportunistic bacteria cause pyogenic discharges and diarrhoea.
- Hyperkeratosis of the pads (hardpad) and nose, skin rash.
- Late infection of neurones.
- Demyelination.
- Incoordination or muscle tremors which may progress to paralysis and coma or to convulsions.
- Death.
- Recovered animals may have a persistent or spasmodic chorea.

Clinical Signs Systemic Disease:

It usually starts with cold-like symptoms from following 8 to 14 days of the introduction of the agent.

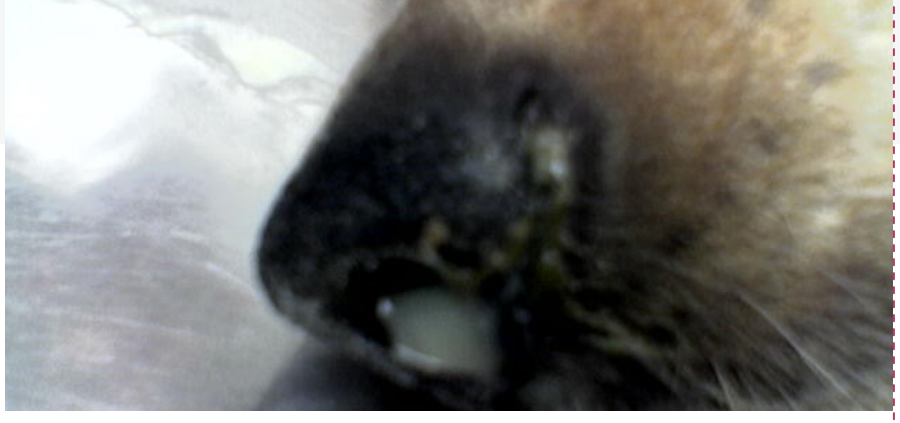
Pneumonia, conjunctivitis, dark nasal discharge, diarrhea, coughing and vomiting could be seen. Other findings, lethargy, enlarged lymph glands, weight loss, loss of appetite.

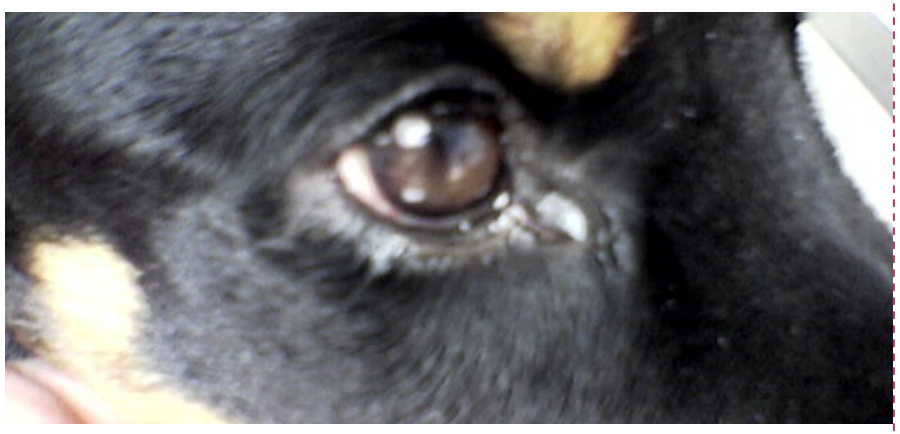
Systemic disease can sometimes be followed by other forms of disease

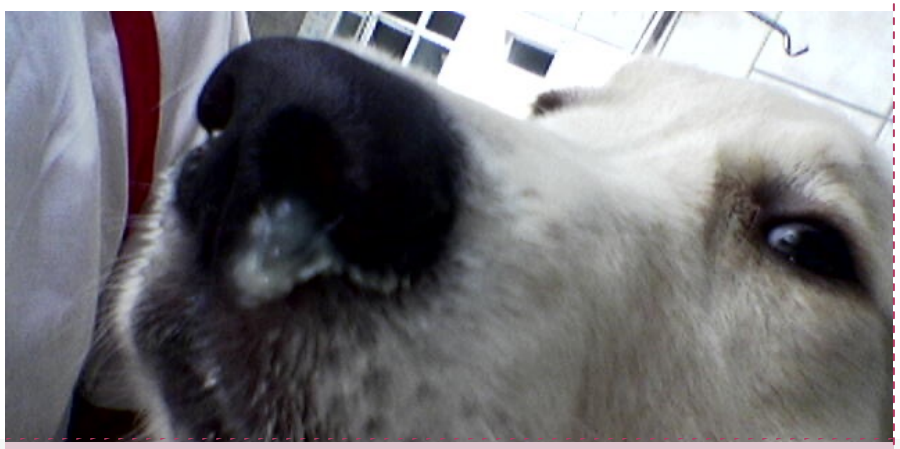
- CNS Disease
- Ocular Disease
- Skin Disease
- Fetal disease

Ocular Diseases

- Inflammation (redness, pain, swelling, loss of function),
- Blindness,
- Dilated pupils,
- Corneal dryness,
- Eye discharge







Mortality

Mortality is variable (average 20%) due to the virulence of the strain; some cases may be subclinical.

CNS involvement often causes >90% mortality.

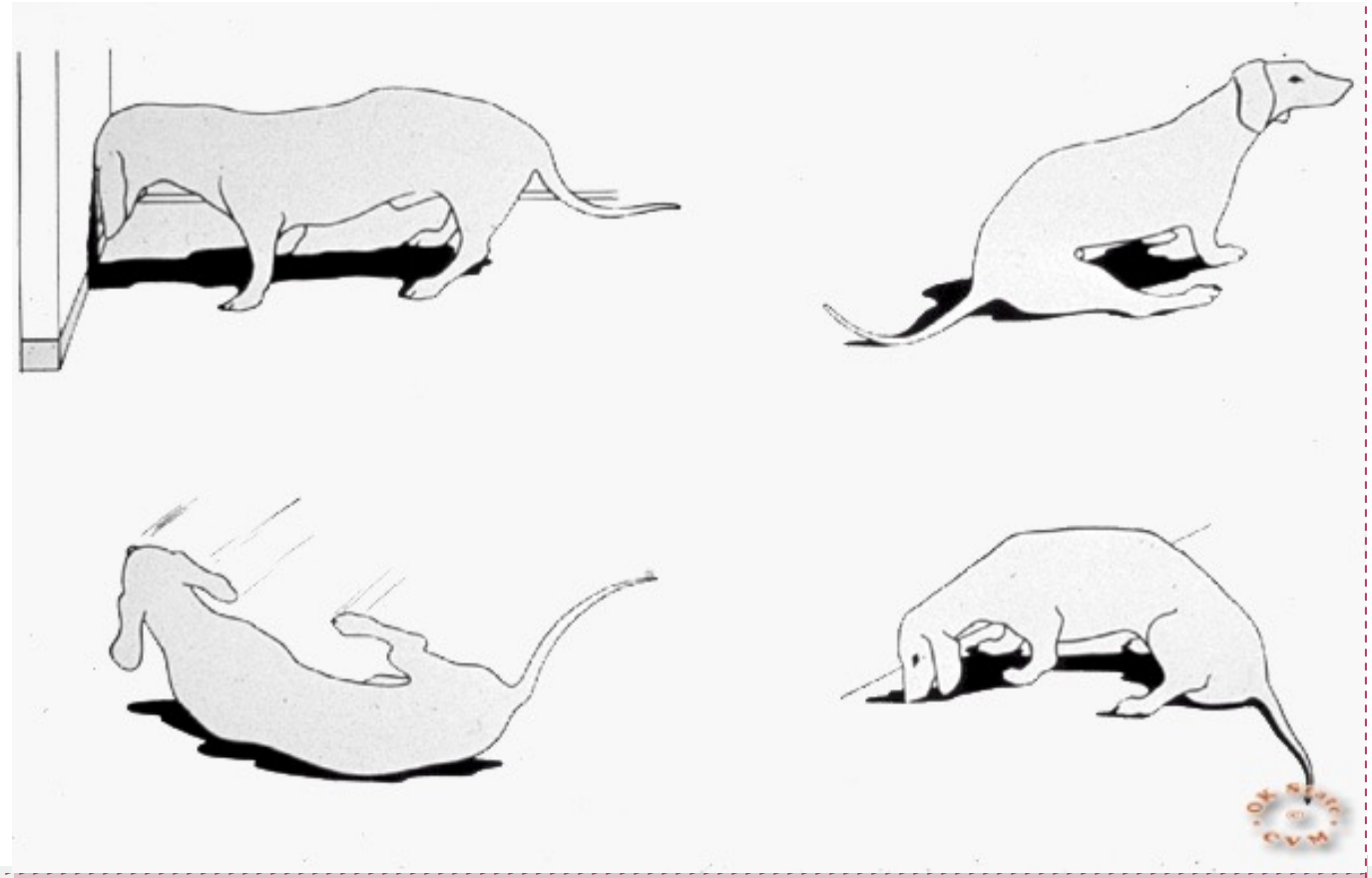

OK State
©
CVM

Clinical Signs

CNS Disease;

- CNS signs include circling, head tilt, nystagmus, paresis to paralysis, and focal to generalized seizures.
- Localized involuntary twitching of a muscle or group of muscles (myoclonus, chorea, flexor spasm, hyperkinesia) and convulsions characterized by salivation and, often, chewing movements of the jaw ("chewing-gum fits") are considered classic neurologic signs.

- These symptoms may continue until day 21 after systemic disease. The disease is progressive and if worsens the prognosis is not good.
- IMPORTANT 30% of CNS disease occurs without systemic symptoms.



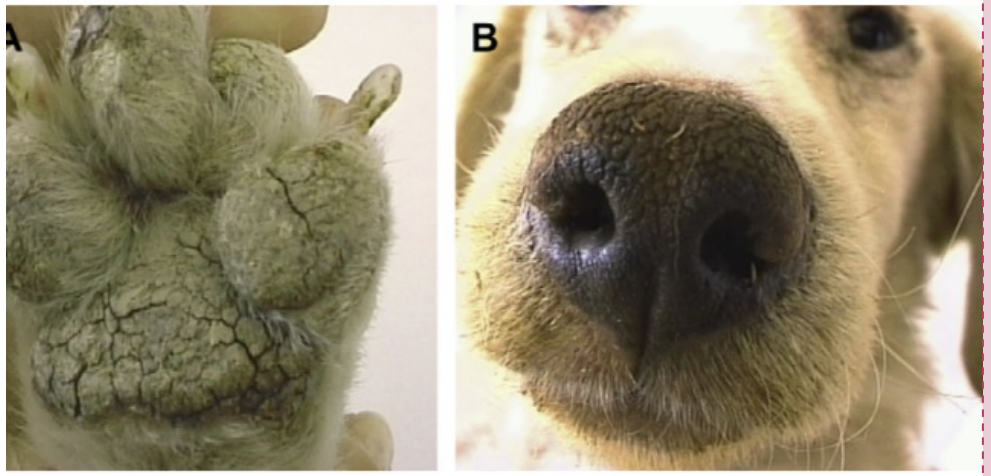
Head tilt

Spasms

Skin Disease (Hard Pad Disease)

- Characterized by a thickening of the nasal tip and soles.
- Vesicular and pustular dermatitis in puppies is rarely associated with CNS disease.

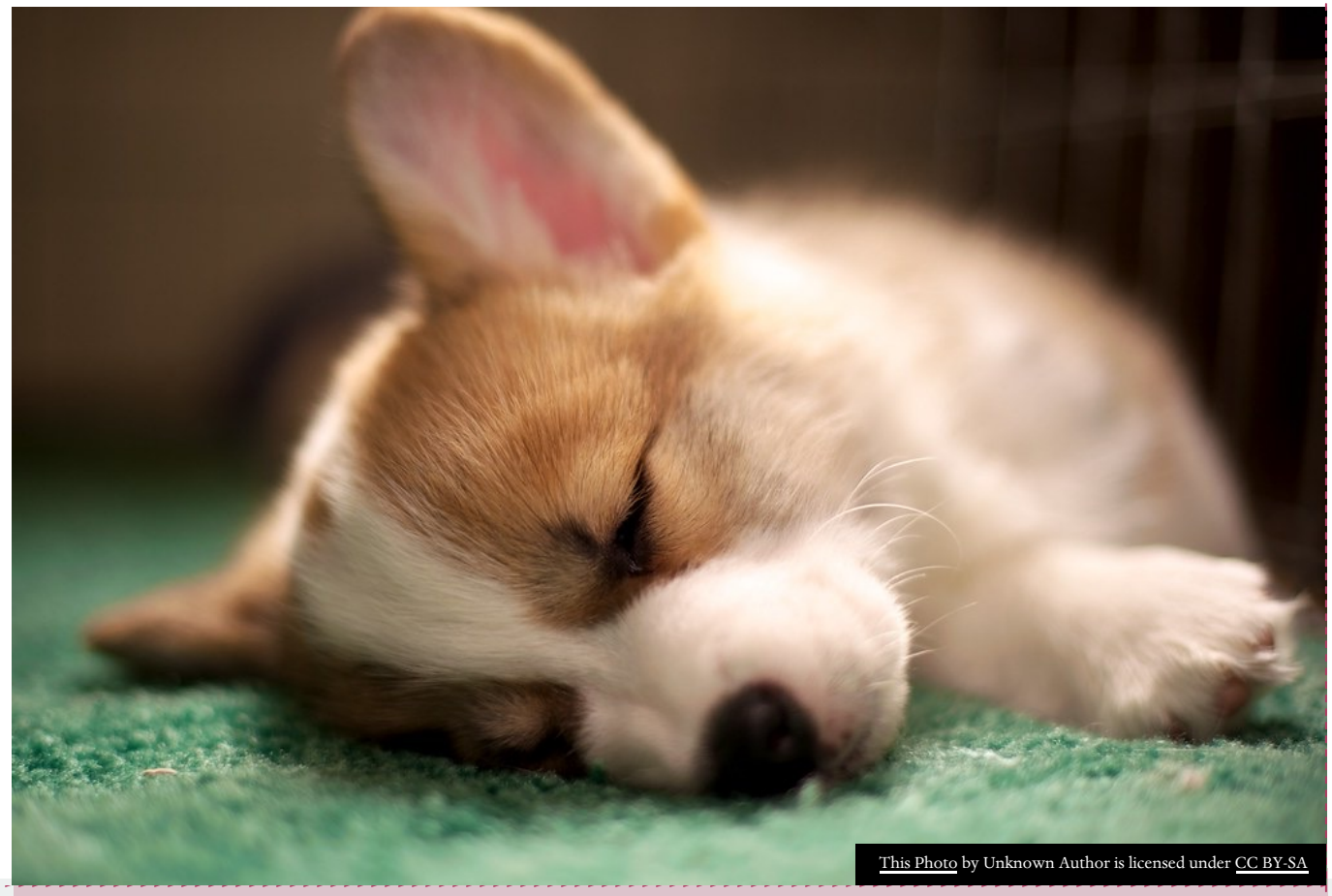
Thickening of the nasal tip and soles

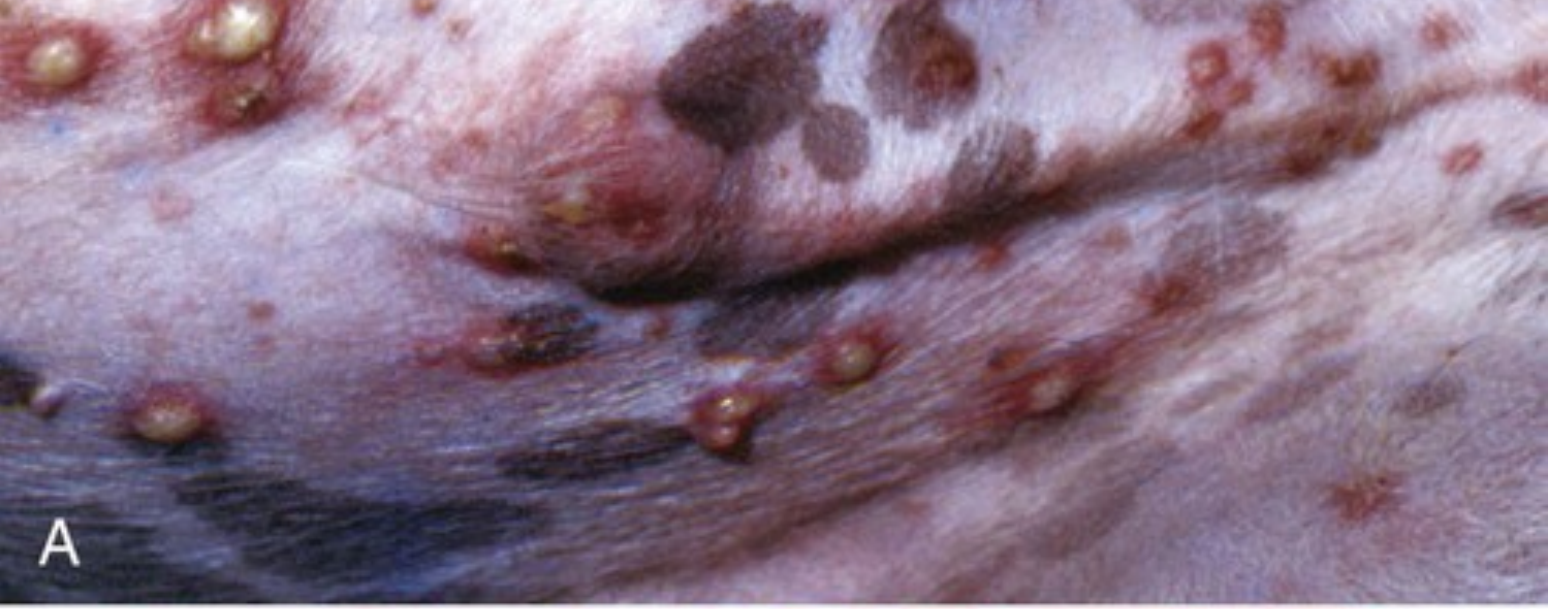


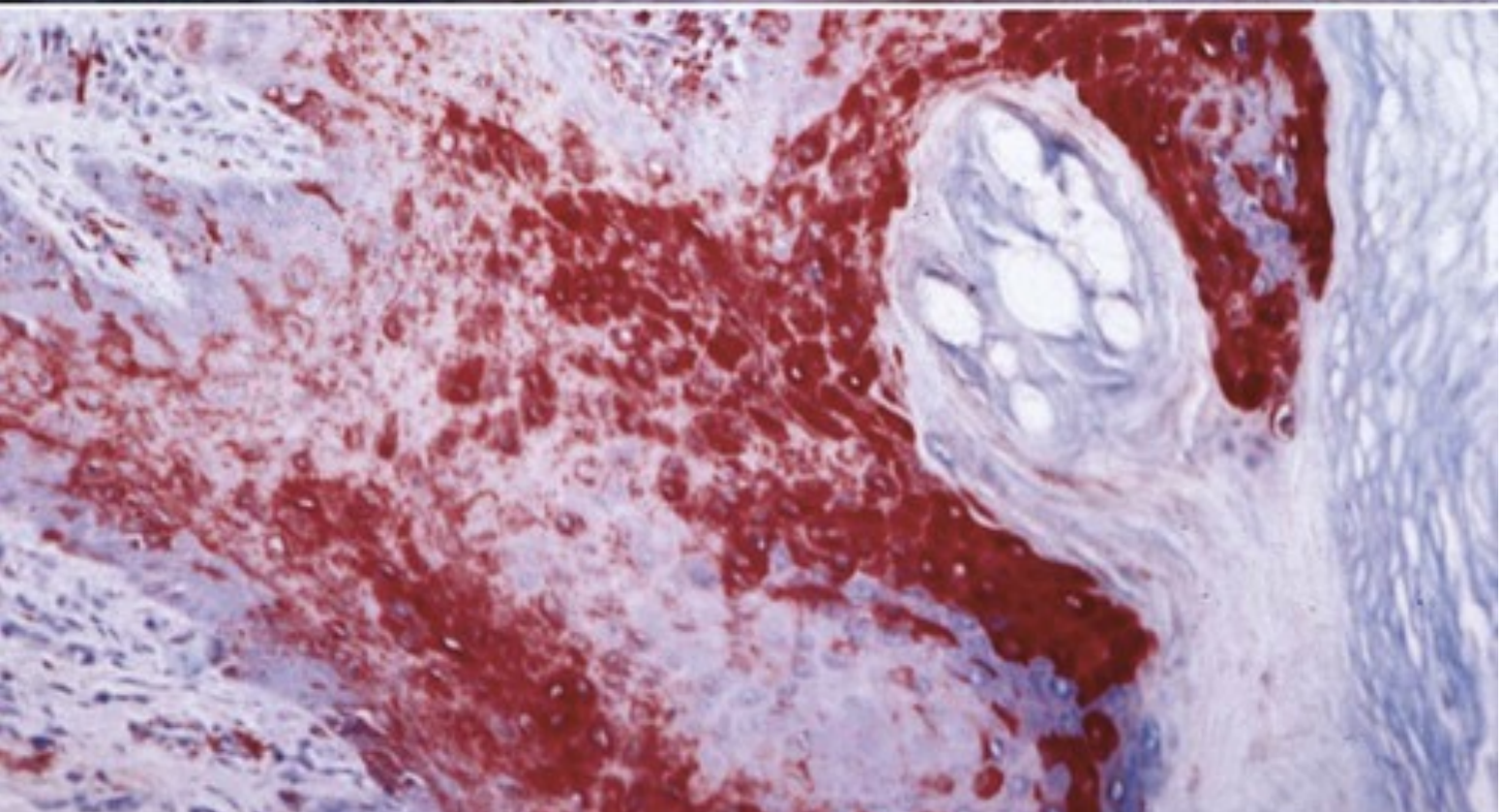
g. 5. Dog with CDV infection. There is hyperkeratosis of the foot pads (*A*) and nose

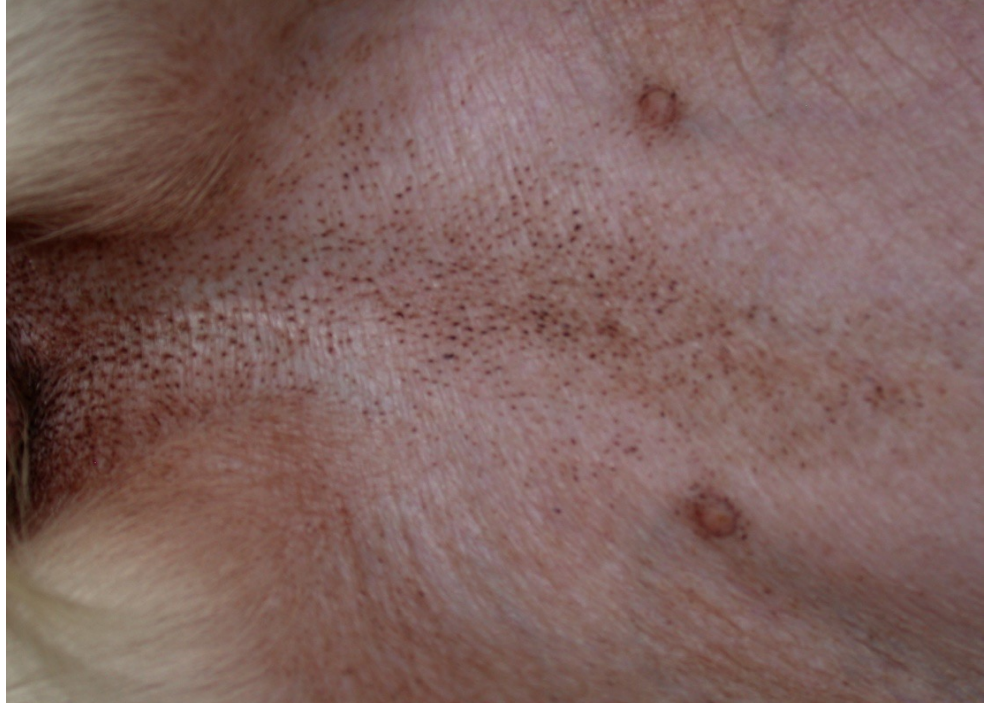
Fetal disease

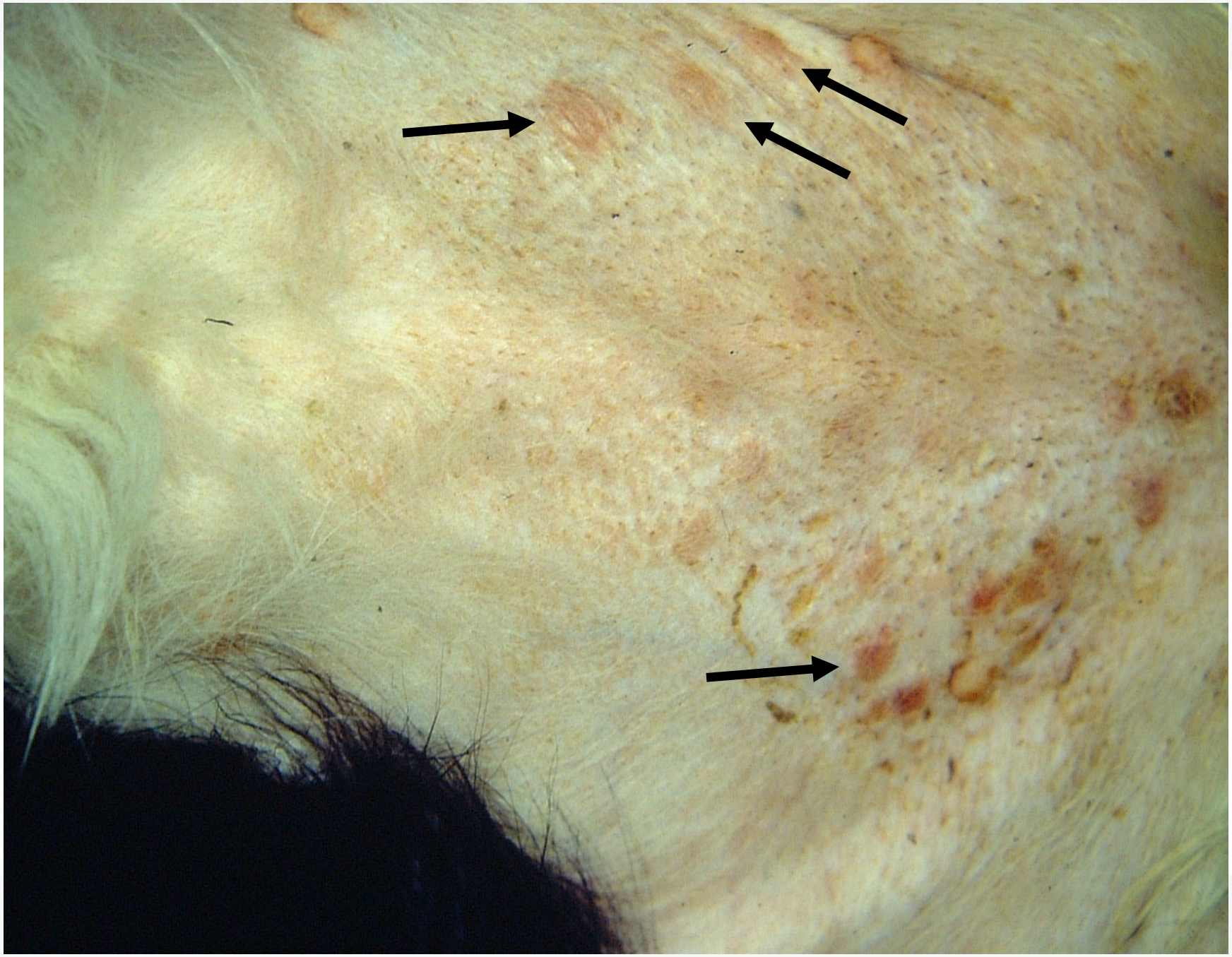
- Pregnant animals can abort or give birth infected puppies. Symptoms of CNS can be observed in these puppies.

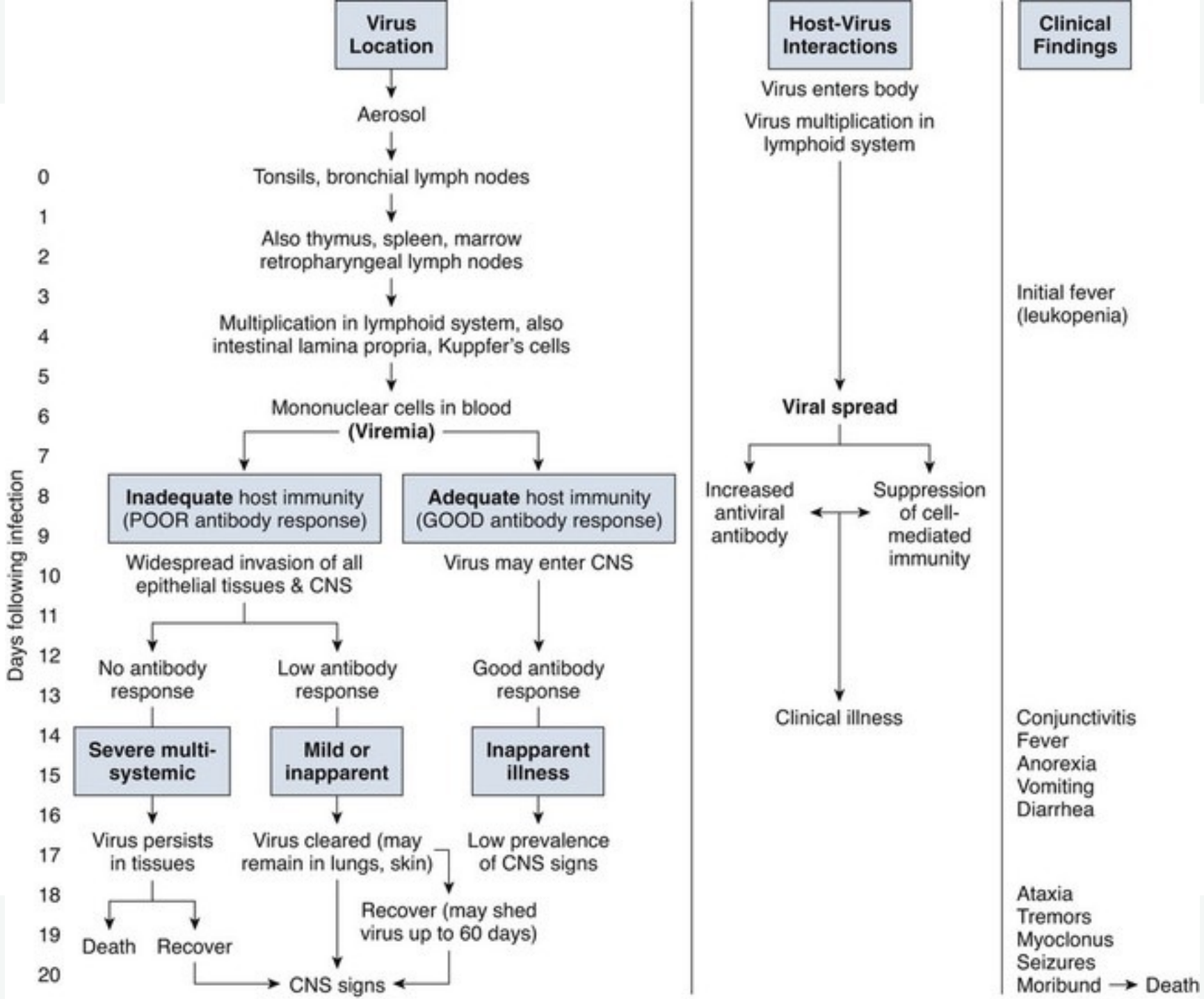



A








Virus Location
Host-Virus Interactions
Clinical Findings
Aerosol
Virus enters body
Virus multiplication in lymphoid system
Tonsils, bronchial lymph nodes
Also thymus, spleen, marrow retropharyngeal lymph nodes
Multiplication in lymphoid system, also intestinal lamina propria, Kuppfer's cells
Initial fever (leukopenia)
Mononuclear cells in blood
(Viremia)
Viral spread
Inadequate host immunity (POOR antibody response)
Adequate host immunity (GOOD antibody response)
Increased antiviral antibody
Suppression of cell-mediated immunity
Widespread invasion of all epithelial tissues & CNS
Virus may enter CNS
No antibody response
Low antibody response
Good antibody response
Clinical illness
Severe multi-systemic
Mild or inapparent
Inapparent illness
Conjunctivitis
Fever
Anorexia
Vomiting
Diarrhea
Virus persists in tissues
Virus cleared (may remain in lungs, skin)
Low prevalence of CNS signs
Recover (may shed virus up to 60 days)
Ataxia
Tremors
Myoclonus
Seizures
Moribund → Death
Death
Recover
CNS signs
Days following infection
0
1
2
3
4
5
6
7
8
9
10
11
12
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19
20

Chronic Distemper Encephalitis (Old Dog Encephalitis)

It is an extremely rare, chronic, active progressive inflammatory disease of the gray matter of the cerebral hemispheres and brainstem of the CNS.

Ataxia, compulsive movements such as head pressing or continual pacing, and incoordinated hypermetria, may be seen in fully vaccinated adult dogs without a history suggestive of systemic canine distemper infection.

Dogs with ODE are not infectious, and replication-competent virus has not been isolated.

The disease is caused by an inflammatory reaction associated with persistent canine distemper virus infection in the CNS, but mechanisms that trigger this syndrome are unknown.

Diagnosis

Laboratory findings,	Hematology; Lymphopenia, neutropenia
	Histopathology; Inclusion body in epithelial cells. PATOGNOMIC !!
Serology	Control of IgM and IgG responses (ELISA, SN)
Virology	Virus isolation (eye and nasal swab, blood, stool, tissue sample)
	RT-PCR

Differential Diagnosis

- Leptospirosis
- Rabies
- infectious canine hepatitis
- Rocky Mountain spotted fever
- Intoxicants such as lead or organophosphates can cause simultaneous GI and neurologic signs.

Treatment and Control

- Treatments are symptomatic and supportive, aimed at limiting secondary bacterial invasion, supporting fluid balance, and controlling neurologic manifestations.
- Broad-spectrum antibiotics, balanced electrolyte solutions, parenteral nutrition, antipyretics, analgesics, and anticonvulsants are used.
- No single treatment is specific or uniformly successful.

Vaccination

- Most current vaccines are live viruses. They evoke antibody against both F and H antigens and are protective.
- Repeating every year again.

Vaccination

- Successful immunization of pups with canine distemper modified-live virus (MLV) vaccines depends on the lack of interference by maternal antibody.
- To overcome this barrier, pups are vaccinated with MLV vaccine when 6 wk old and at 3- to 4-wk intervals until 16 wk old.
- Alternatively, measles virus vaccine induces immunity to canine distemper virus in the presence of relatively greater levels of maternal distemper antibody.

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