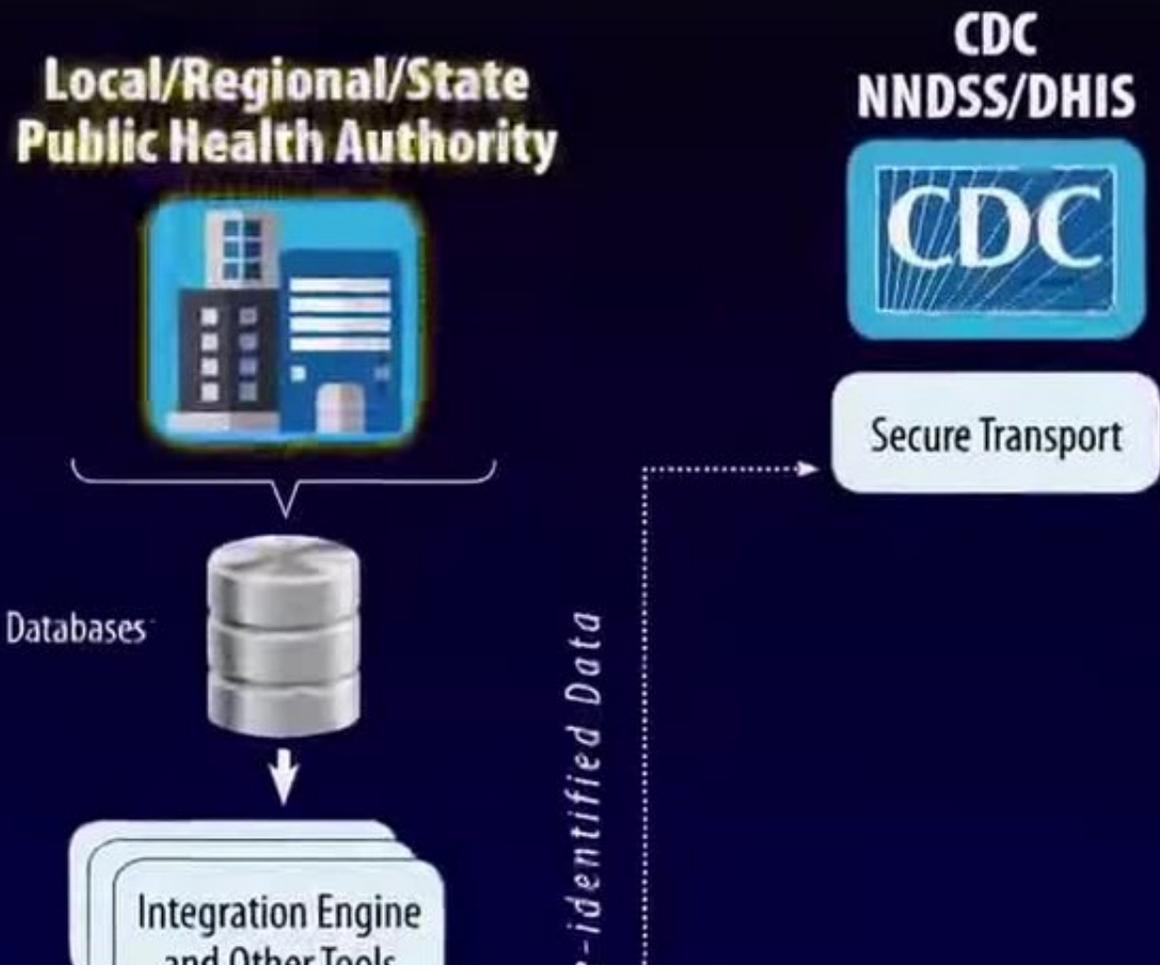
A transmission electron micrograph showing several spherical bluetongue virus particles. The particles are approximately 25-30 nanometers in diameter and exhibit a characteristic outer shell with a granular appearance. They are scattered across a dark, textured background. The image is presented in a circular field of view.

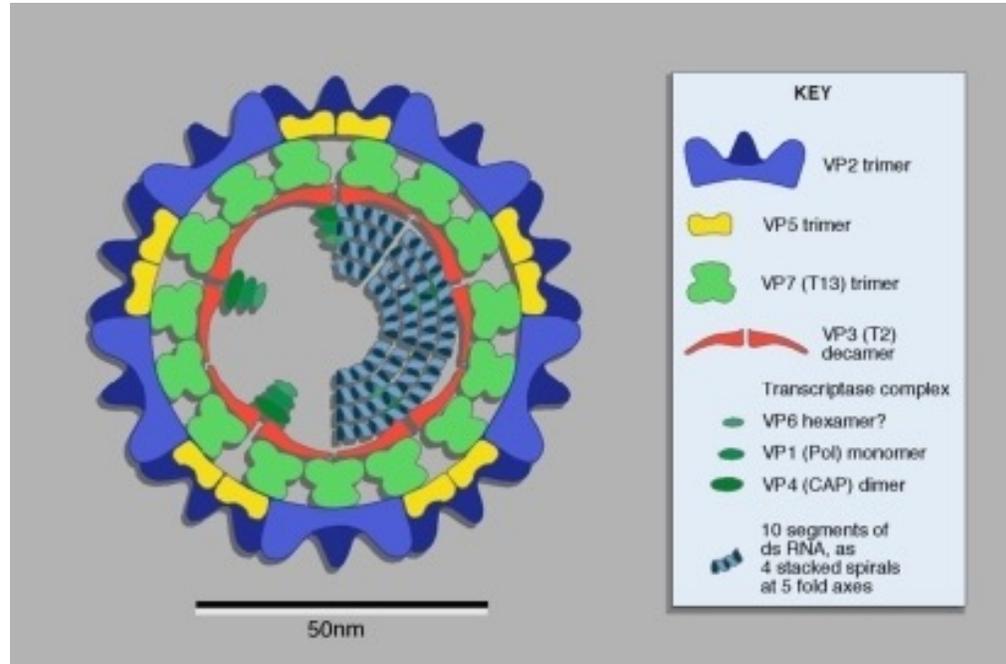
# BLUETONGUE DISEASE



## NOTIFIABLE DISEASE

# Etiology

- *Reoviridae: Orbivirus*
- *Reoviridae* (family), *Sedoreovirinae* (subfamily), *Orbivirus* (genus), **Bluetongue virus (1-27)** 29
- dsRNA, segmented
- Non-enveloped
- **Double-stranded RNA**
- Can persist in the environment



# Serotypes

- To date, 27 serotypes have been identified, including BTV25 identified in Switzerland in 2007, BTV26 from Kuwait in 2010 and BTV27 detected in goats in Corsica (France) in 2014. In addition, two putative new serotypes, respectively BTV28 and BTV29 were recently detected.



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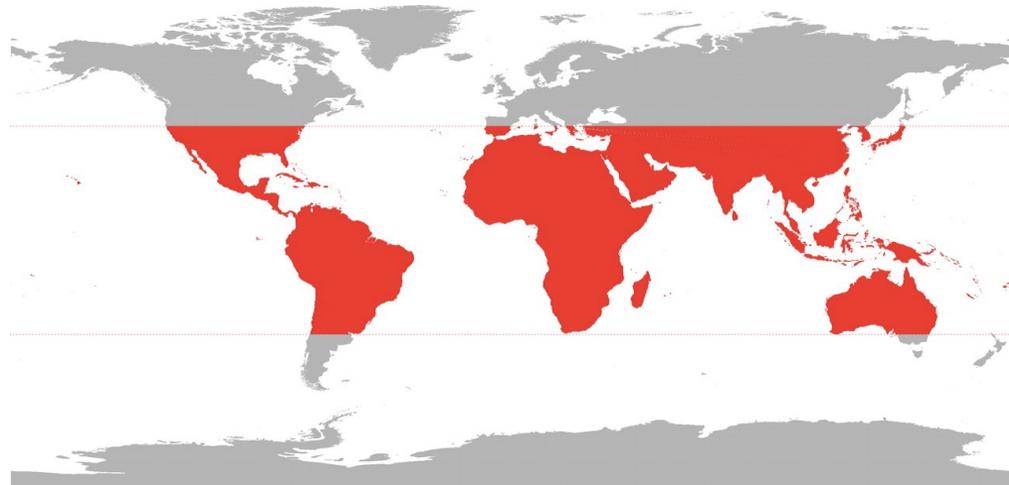
**Affecting:**

Sheep, Cattle, Deer, Goats, Camelid and some carnivores.



# Epidemiology

- Endemic areas exist in Africa, Europe, the Middle East, North and South America and Asia, as well as on numerous islands (e.g., Australia, the South Pacific, the Caribbean).
- Multiple serotypes can be found in many regions.



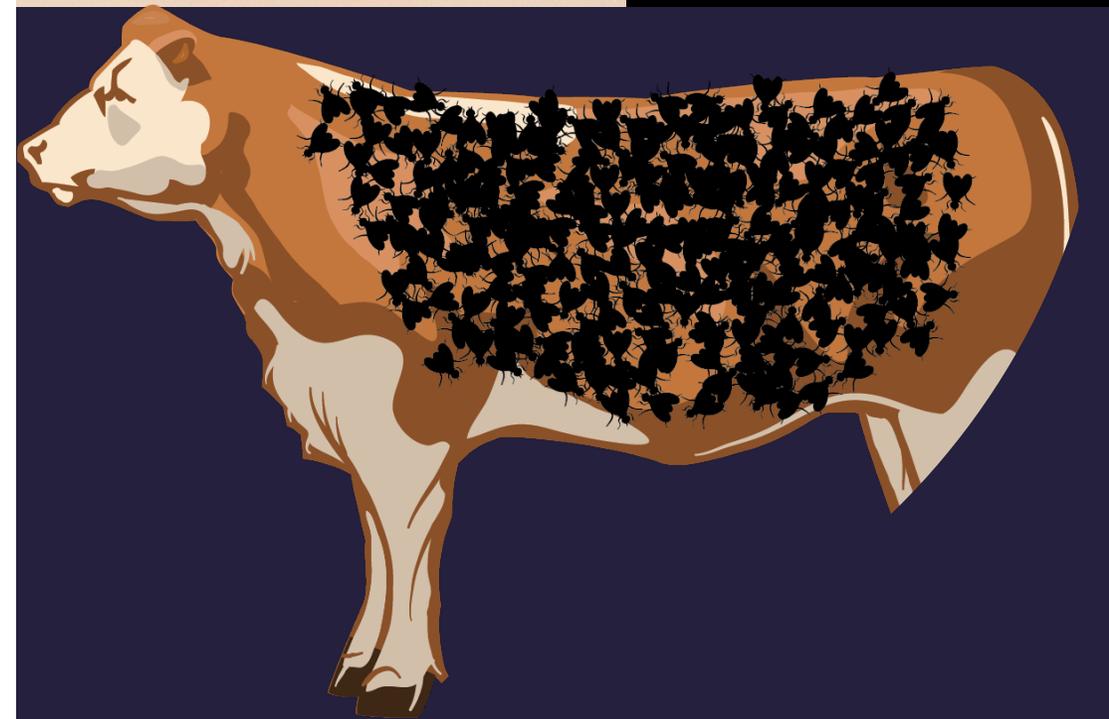
Map of the estimated global range of bluetongue virus prior to 1998.

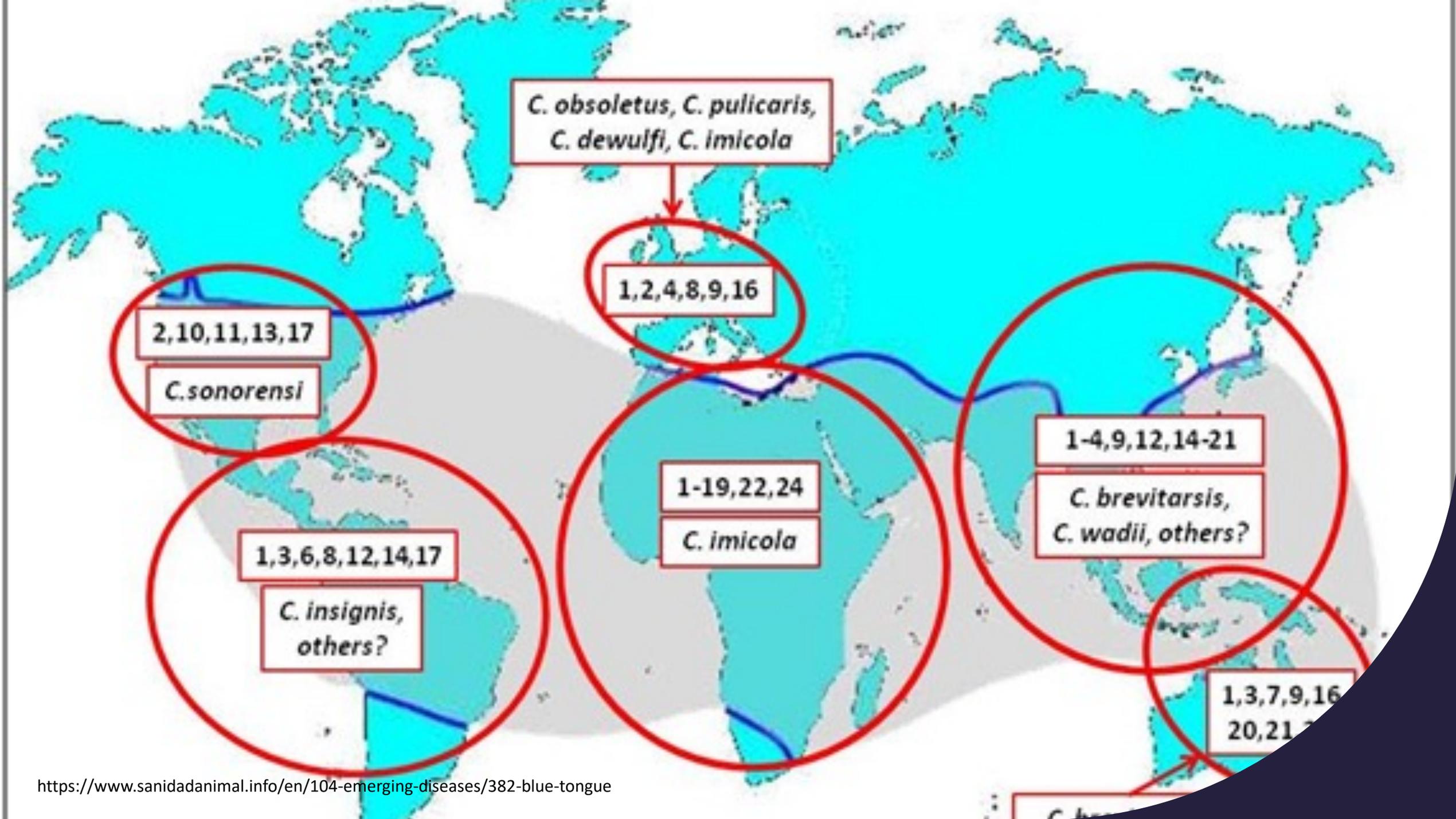
# Transmission

- Bluetongue virus is mainly transmitted by biting midges in the genus *Culicoides*, which are biological vectors. These midges can fly short distances of 1- 2 km.
- Ticks and mosquitoes might be capable of transmitting the virus mechanically, but their role, if any is minor.



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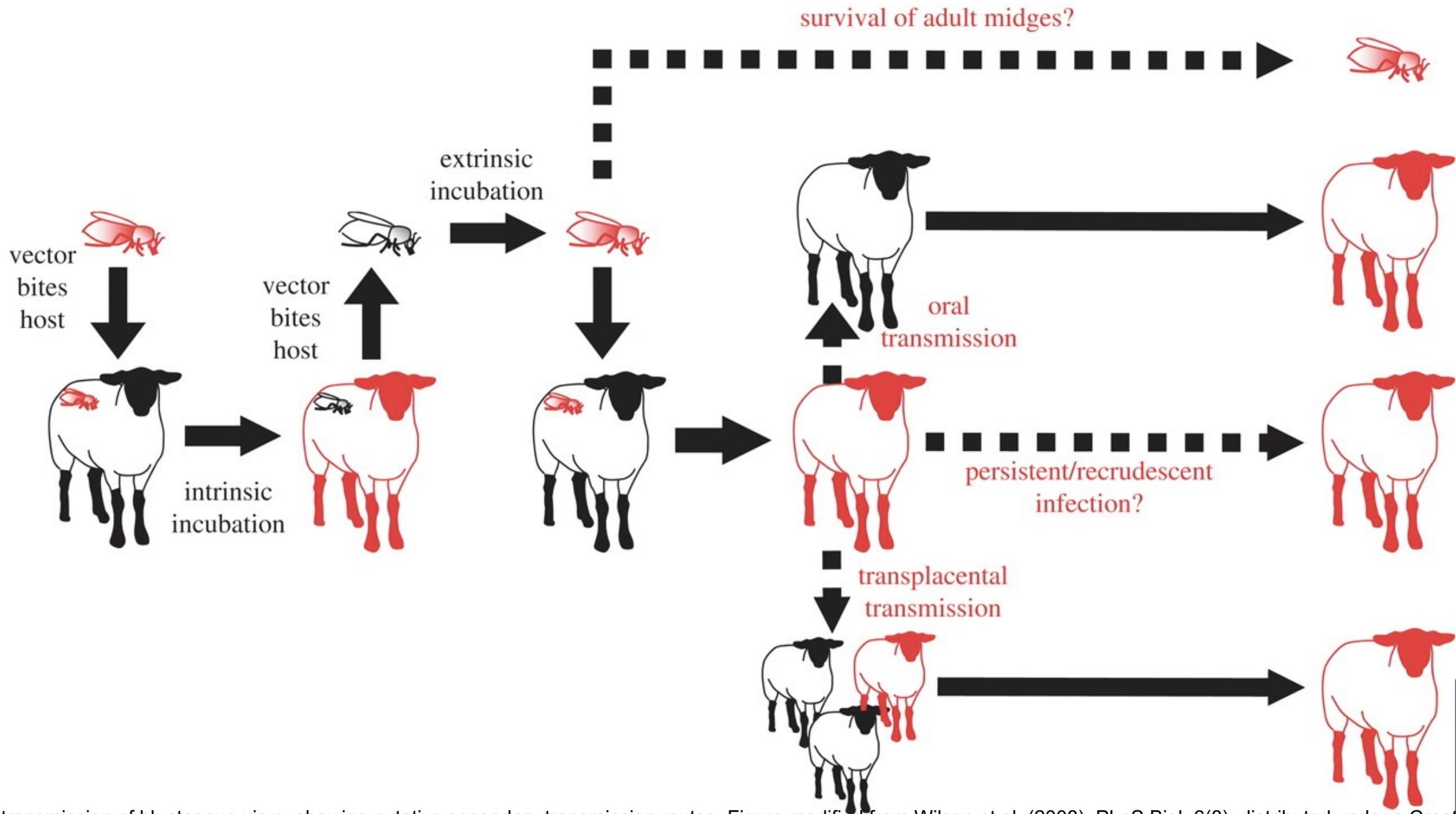
## Transmission

Culicoides

Through placenta to the fetus

Blood

Semen



The transmission of bluetongue virus, showing putative secondary transmission routes. Figure modified from Wilson et al. (2008). PLoS Biol. 6(8); distributed under a Creative Commons Attribution License

# Transmission

- Bluetongue virus can **persist** in the blood of some animals for relatively long periods.
- The most important reservoir is the Cattle. Bluetongue virus can survive for **14 weeks** in cattle blood.
- Some bluetongue strains can be transmitted directly between ruminants in **close contact**.

Population density (person per square km)



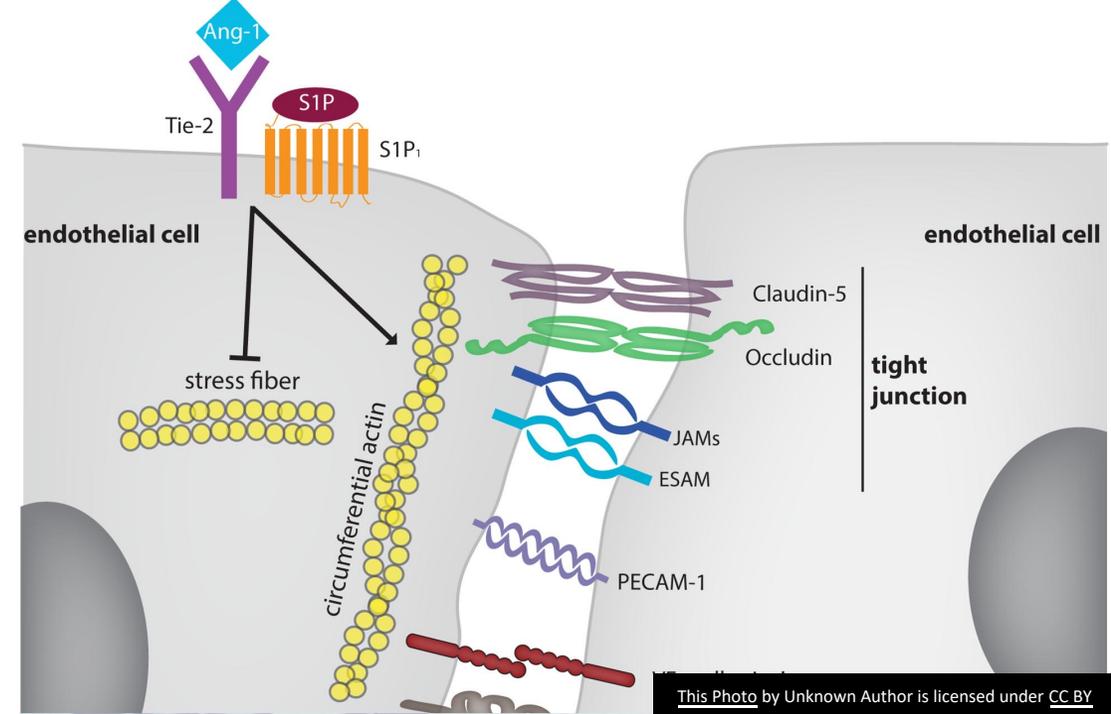
# Serotypes in Turkey

Type 4, 8, 9, 16

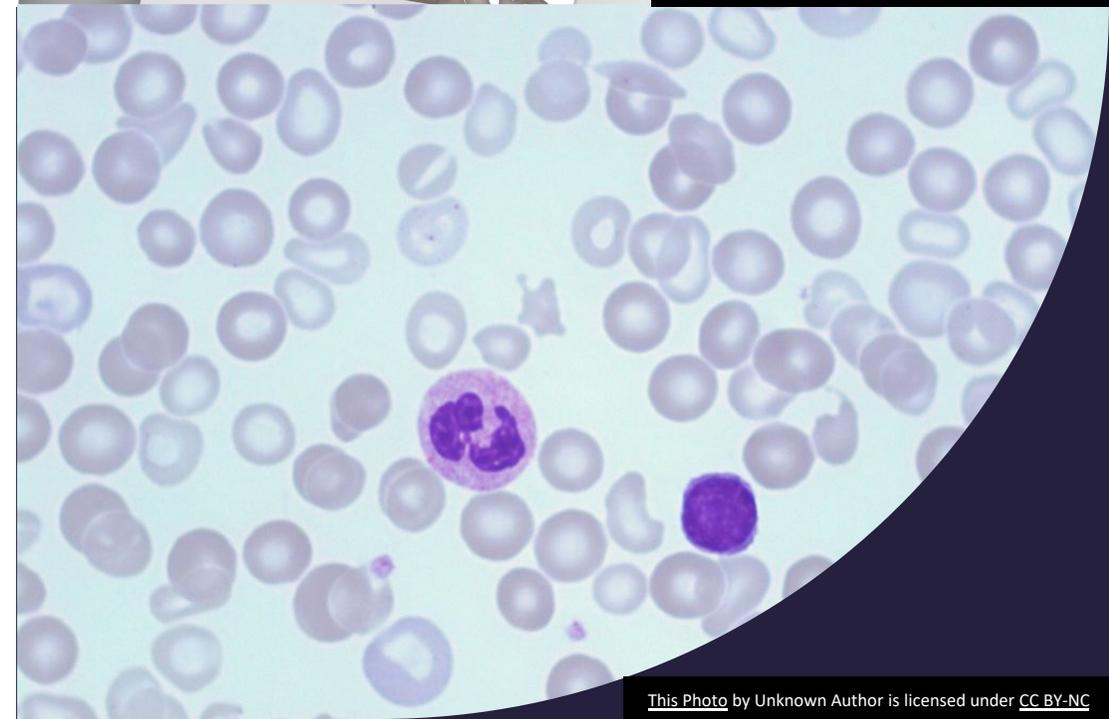


# Pathogenesis

- After cutaneous instillation; the virus travels to the regional lymph node, where initial replication occurs and replicates within mononuclear phagocytic and endothelial cells, lymphocytes and possibly other cell types in lymphoid tissues, the lungs, skin and other tissues.



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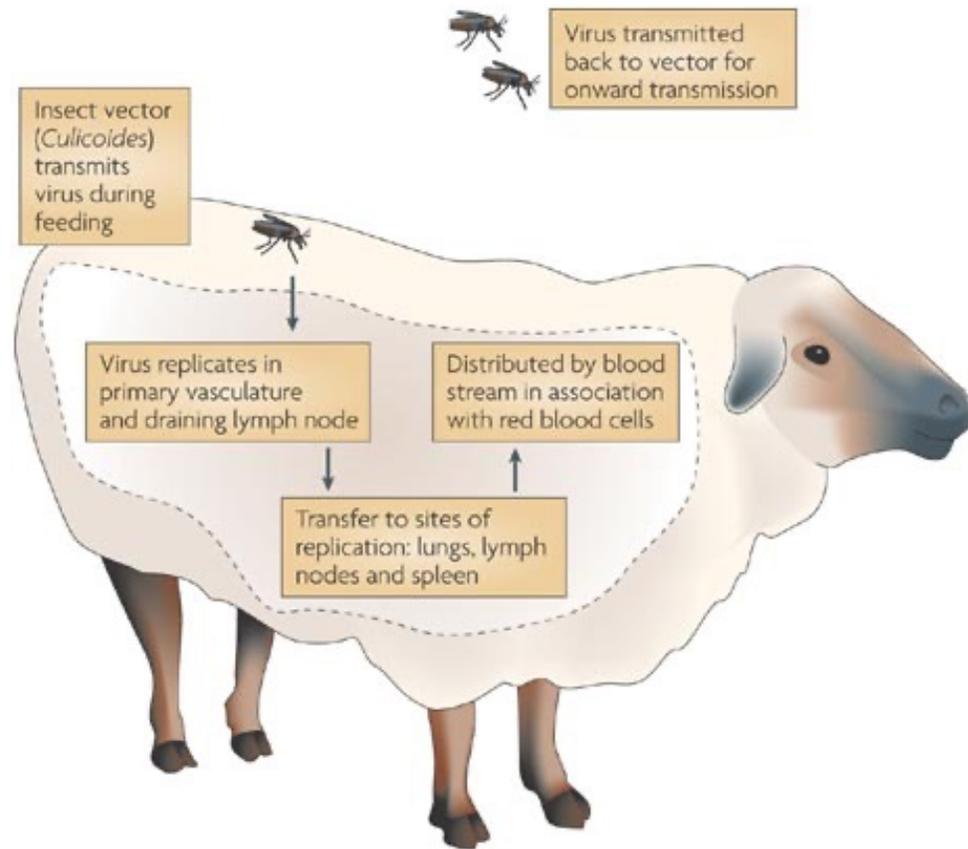
# Pathogenesis

- Viraemia is highly cell associated and may be prolonged but not persistent in domestic ruminants.
- BTV associates with all blood cells during viraemia.
- BTV is quantitatively associated most with platelets and erythrocytes.



# Pathogenesis

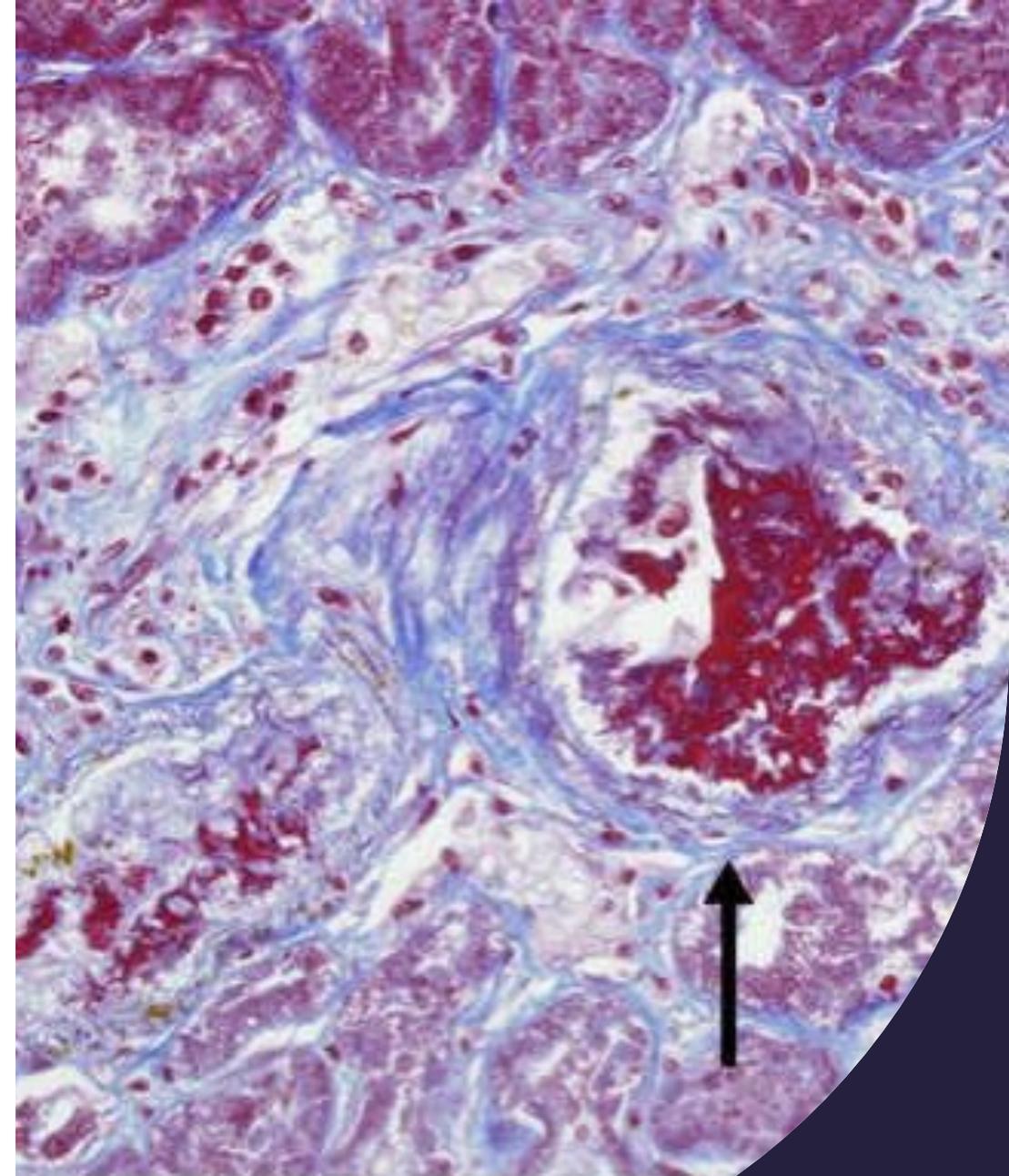
- Disease expression is different between cattle and sheep. It can be due to a different response of the endothelial cells following infection: in contrast to sheep, cattle usually develop only a subclinical infection with the exception of infection with serotype 8 as has occurred in northern Europe.



Nature Reviews | Microbiology

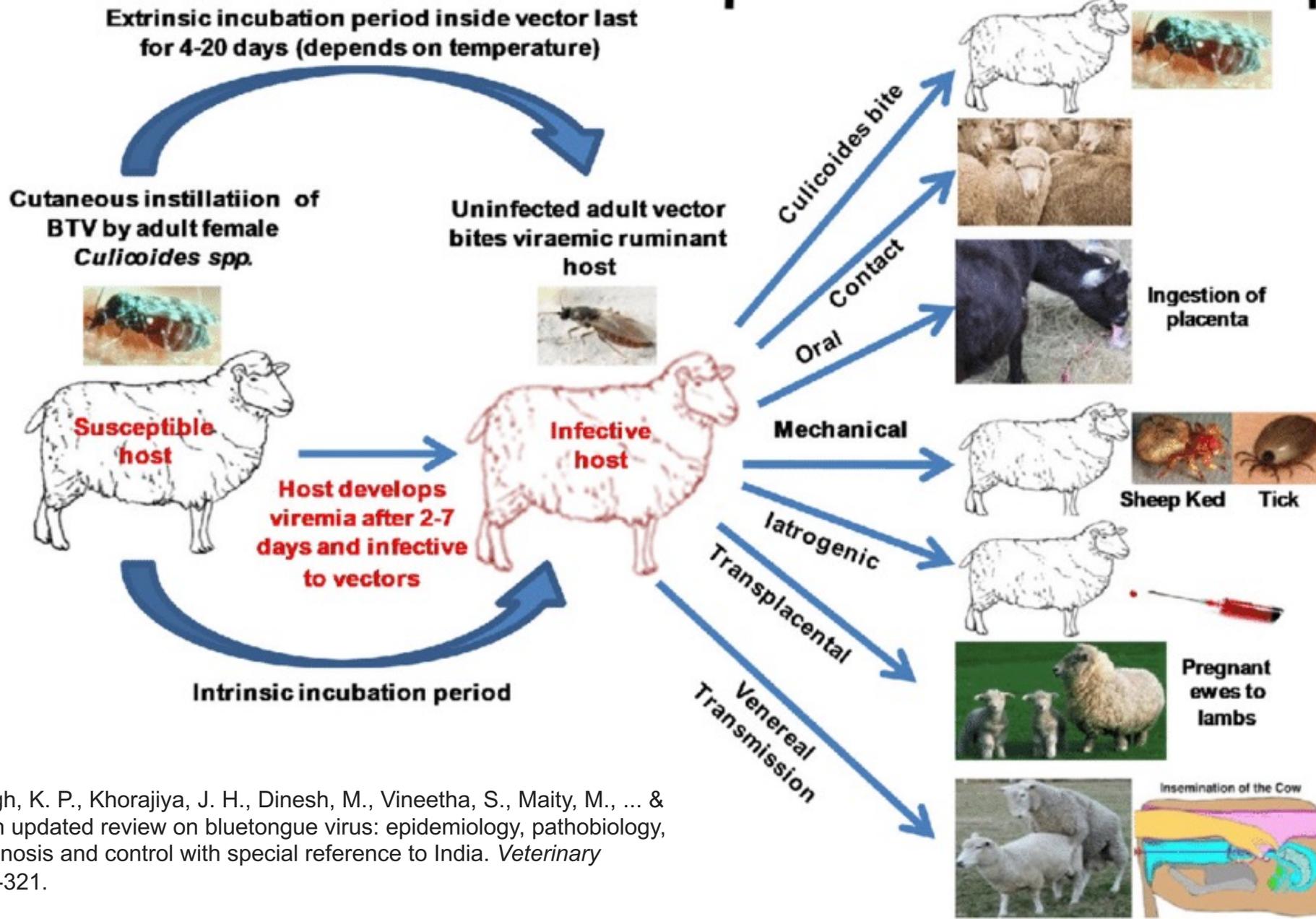
# Pathogenesis

- In sheep, lesions in the endothelial cells of small blood vessels provoke vascular thrombosis and ischemic necrosis of the affected tissue. These lesions result in buccal ulcers, inflammation of the coronary band, muscular necrosis, and extravasation leading to facial and pulmonary edema and pleural and pericardial effusions.



Nefrologia (Engl)

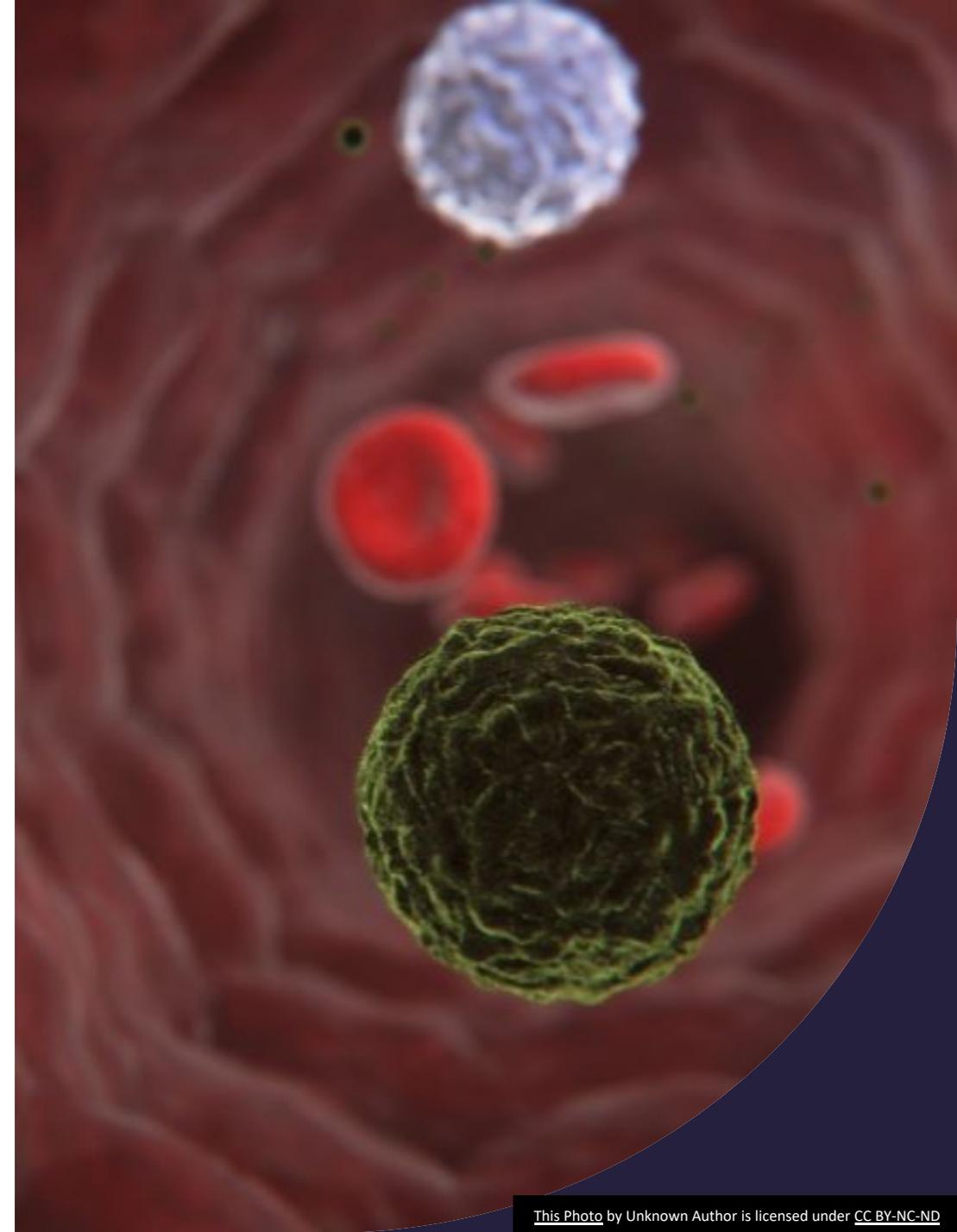
# Different modes of BTV transmission



Saminathan, M., Singh, K. P., Khorajiya, J. H., Dinesh, M., Vineetha, S., Maity, M., ... & Dhama, K. (2020). An updated review on bluetongue virus: epidemiology, pathobiology, and advances in diagnosis and control with special reference to India. *Veterinary Quarterly*, 40(1), 258-321.

# Prolonged Viremia

- Infected ruminants may exhibit a prolonged but not persistent viremia and BTV is associated with erythrocytes during the late stages of this prolonged viremia.



## Clinical Signs

The incubation period is estimated to be approximately a week, with a range of 2-10 days.

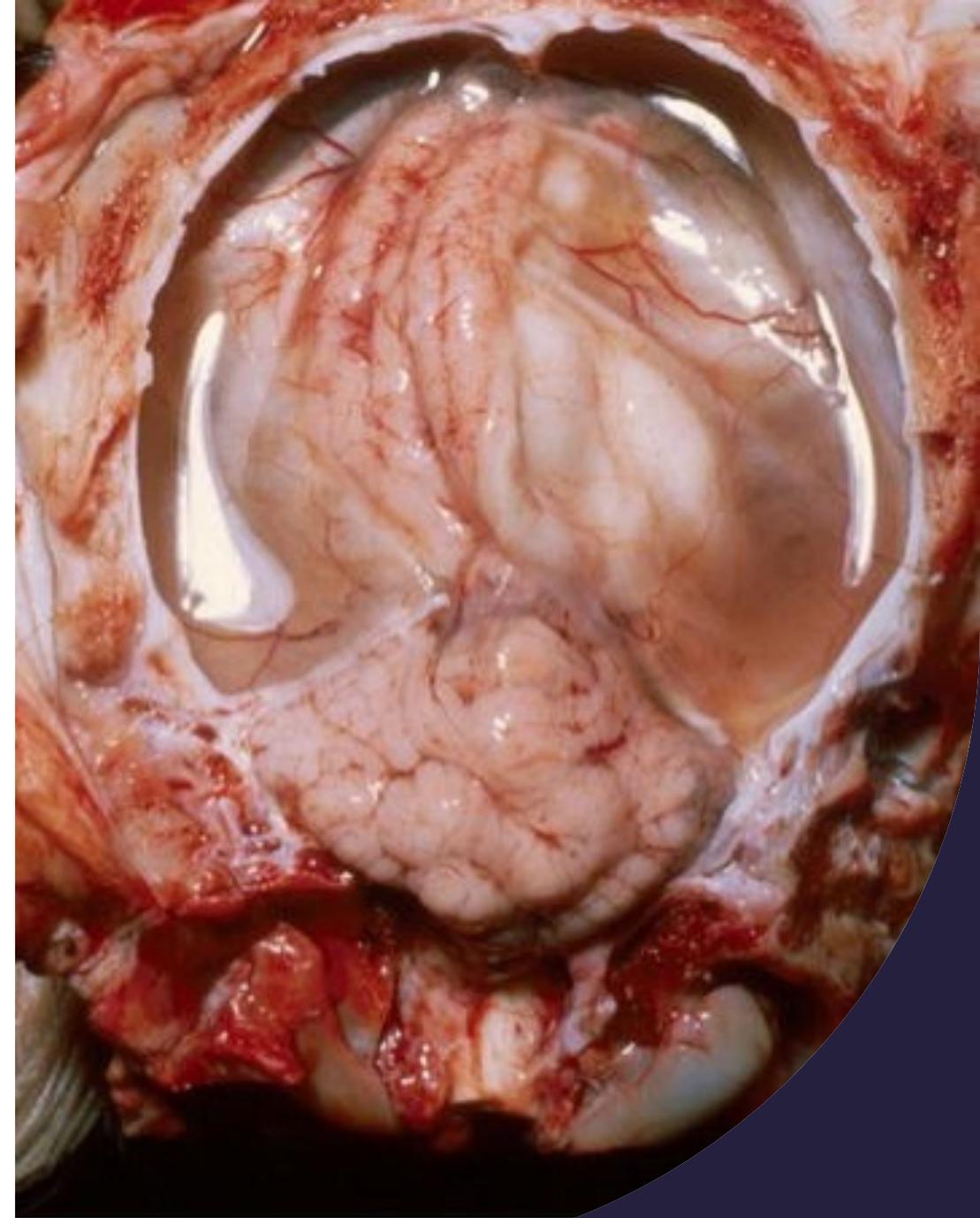
Sheep infected with bluetongue virus may remain asymptomatic or become mildly to severely ill.

Common clinical signs include

- **Fever,**
- **hemorrhages and ulcerations of the oral and nasal tissue,**
- **excessive salivation, and nasal discharge and swelling of lips, tongue, and jaw,**
- **weakness, depression, weight loss**
- **profuse diarrhea, vomiting, pneumonia,**
- **'blue' tongue as a result of cyanosis (rare),**
- **may have 'break' in wool growth in recovering sheep resulting in partial or complete loss of wool.**

## Clinical Signs

- Hyperemia, hemorrhages and/or edema may also be detected in other internal organs.
- In addition, the skeletal muscles may have focal hemorrhages or necrosis, and the intermuscular fascial planes may be expanded by edema fluid.
- In fetuses and newborn lambs hydranencephaly, porencephaly, retinal dysplasia and skeletal abnormalities can be seen.      A.H. SYNDROME
- Abortion or birth of malformed lambs



# Clinical and Postmortem Signs

Congestion, oedema, hemorrhages and ulcerations of digestive and respiratory mucosae.

Severe bilateral broncho lobular pneumonia in fatal cases, lungs may show interalveolar hyperemia, severe alveolar edema.

Hemorrhages found in the pulmonary artery.

Congestion of coronary band.

Facial edema  
Submandibular edema

Hypertrophy of lymph nodes and splenomegaly.

Pericardial, pleural and abdominal effusions.



Sheep. There is bilateral nasal exudate, erosion of the nasal planum, and excessive salivation



Sheep, mouth. There is linear erosion and reddening of the right buccal mucosa.



Sheep. There are multiple erosions and crusts on the muzzle and lips.



Bovine. The muzzle is covered by an adherent crust, and the underlying (eroded) tissue is hyperemic.



Sheep, mouth. Most of the dental pad is eroded; the remaining pale mucosa is necrotic.



Bovine, mammary gland. There is extensive coalescing ulceration of the teat skin.



Sheep, pulmonary artery. There are multiple ecchymoses on the intimal surface

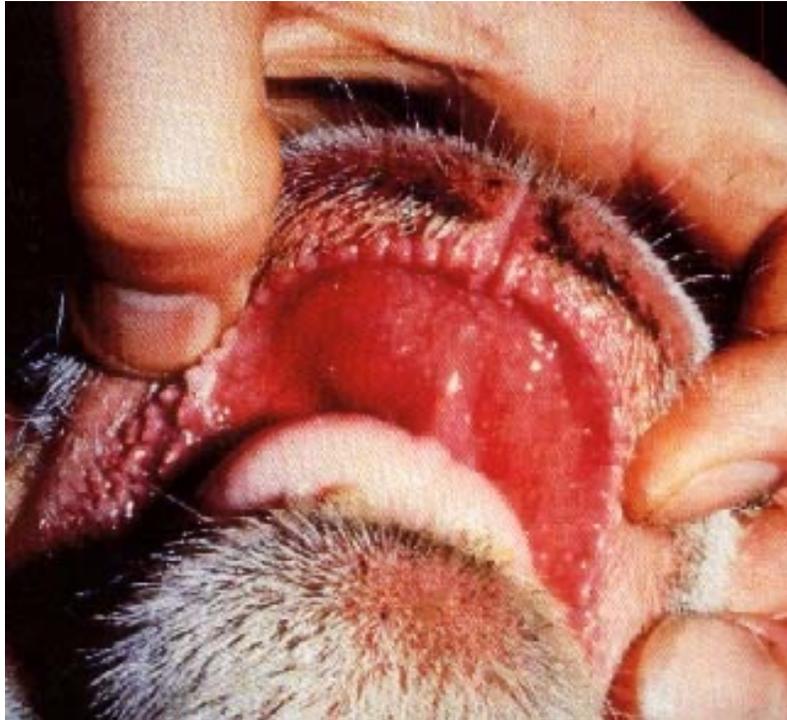


Sheep, fetuses. The larger of these aborted macerated fetuses exhibits torticollis.



**Edema on the face and lips, hyperemia in the nose wings (followed by hemorrhage), hypersalivation.**





**Upper lip and palate swelling and hyperemia**



**Hard palate lesions, hemorrhagic and erosive**



**coronitis and pododermatitis**

# Morbidity and Mortality

- High rates of mortality and morbidity.
- Seroprevalence rates vary widely in endemic regions, 1% - 80% in domesticated and wild ruminants.
- Sheep are usually the most severely affected species,
- Morbidity rates in sheep range from < 5% to 50-75% and can reach 100%.
- Mortality between 30% and 70% in sheep.



- Infections in cattle and goats are usually subclinical in endemic areas, although many cattle became ill during recent serotype 8 outbreaks in Europe, but mortality remained below 1%.
- Generally, cases in cattle and goats are milder than in sheep, and the mortality rate is lower.
- Few cases have been documented in llamas and alpacas, and they were generally fatal.



***Clinical diagnosis- contact your veterinarian***

whole blood in heparin or EDTA

Paired sample sera

From dead animals; spleen, liver, bone marrow, blood, lymph nodes can be collected.

All samples have to be preserved at 4°C, and **not frozen.**

RT-PCR

Virus isolation

Immunofluorescence

ELISA

AGID

Neutralization

## Diagnosis

	many laboratories		antigens
Dot immunoblotting	Not widely used	Sensitive for serotypes 1–18 and 20	Detection of virus
Electron microscopy	Not widely used for diagnosis	Identification of virus as well as cellular pathology caused by the virus	Diagnosis of unknown etiology virus
Standard RT-PCR	In use but replaced by real time RT-PCR	Sensitivity	Detection of BTV RNA
Real-time RT-PCR	In use	Analytically sensitive and reduced contamination	Detection of BTV RNA
Multiplex PCR	In use	Identified multiple serotypes simultaneously	Detection of BTV RNA
Sequencing	In use	Classification into serogroup, serotype, and topotype	Obtain full genomic sequence of BTV
Antibody detection techniques			
Agar gel immunodiffusion	Into abeyance	Easy and quick to perform	Detection of BTV antigens
i-ELISA and c-ELISA	Most commonly used	Reliable and robust, commercially available	Detection of BTV antigens
VNT	Diminished use due to cost and labor	Very useful in epidemiology studies	Detection of serotype-specific antibodies
IgM-capture ELISA	Complementary to current tests	New technologies	Detection of BTV antibodies in newly infected cattle
Immunochromatographic strips	Not widely used	Rapid and high specificity	Detection of antibodies to
Protein chips	Not widely used	New technique under development	Detection of antibodies
Latex agglutination test	Not widely used	New technique under development. Good for large number of samples	Detection of

## **Differential Diagnosis**

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Food and Mouth Disease

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Stomatitis Vesicularis

---

Sheep Pox

---

Bovine Viral Diarrhoea

---

Peste des Petits Ruminants

---

Akabane

---

Iberaki

---

Malignant Catarrhal Fever

---

Parainfluenza-3 infection

---

Contagious ecthyma

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Epizootic haemorrhagic disease of deer

# Immunology

Type-specific immunity occurs.

Neutralizing antibodies provide immunity for 2 years.

Antibodies pass through the colostrum. Passive immunity protects the lambs/calves for 2-6 months.

# Prevention and Control

- Bluetongue is mainly controlled by vaccination.
- Vaccines should be matched to the viral serotype; protection against other serotypes can be limited or nonexistent.
- Multivalent vaccines are available.
- Attenuated vaccines are considered to be more effective than killed vaccines; however, midges may transmit these vaccine strains to unvaccinated animals during the vector season.
- Attenuated vaccine strains can also cause fetal malformations in pregnant ewes thus vaccine are not implemented to them.



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# Prevention and Control

- Surveillance of sentinel animals may detect bluetongue viruses before outbreaks occur.
- Insect control measure.
- In Turkey, attenuated Serotype 4 Vaccine is available.



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DOI: 10.1098/rstb.2009.0091