

Modes of viral transmission

Dr Vandana Sharma

PhD, Science

Viral transmission

Viral transmission is the process by which viruses spread between hosts. It includes spread to members of the same host species or spread to different species in the case of viruses that can cross species barriers.

Modes of virus transmission

Persistent and nonpersistent

One of many possible classifications of transmission modes, to illustrate the use of the terms 'mode' and 'route', with the former term being used for the method of getting from point to destination, and the latter for the path taken, which includes the points of exit and entry.

- In the 1930s, Watson and Roberts proposed modes of virus transmission in plants by insects.
- Plants are rooted and lack independent mobility. Therefore, many viruses depend on insects for transport among hosts (unlike animals that, by their own mobility, transport the virus to new niches).
- The majority of plant viruses rely on vectors for plant-to-plant spread.

Plant viruses can be transmitted by insects in various ways. These have been classified on the basis of on the length of the period the vector can harbour infectious particles

➤ **Nonpersistent** , minutes to hours.

Non-persistent plant viruses are retained in the insect stylet. Viruses become attached to the distal tip of the stylet of insect and inoculate the next plant it feeds on within few minutes to hours.

➤ **Persistent**, to live-time and even inheritance by the insect progeny.

Persistent viruses are taken up into and retained by insect tissues and are characterized by invading the salivary glands. It takes its time and can also be inherited.

<https://youtu.be/-tQ7PumXzCk> (go through this video for better understanding)

Persistent transmission of viruses

Aphids are the most important vectors of viruses. They transmit viruses in potatoes in a persistent and non-persistent manner.

Persistent transmission

In persistent transmission, the aphid cannot transmit the virus directly to healthy plants after it has fed on a diseased plant. For the uptake of the virus (acquisition), the aphid has to feed on the infected plant (a short probing by the aphid is not sufficient for virus uptake). The acquisition time for the persistent virus PLRV is 10-30 minutes. After the uptake the virus first has to circulate in the aphid before it can infect healthy plants. This circulation takes around 12-24 hours. The aphid is then able to infect healthy plants for the rest of its life. This means that persistent transmitted viruses can be transmitted over quite a long distance.

Non-persistent transmission of viruses

Aphids are the most important vectors of viruses. They transmit viruses in potatoes in the persistent and the non-persistent manner.

Non-persistent transmission

In non-persistent transmission, the aphid can transmit the virus directly to healthy plants after it has fed on a diseased plant. For the uptake of the virus (acquisition) the aphid has to feed on the infected plant (a short probing by the aphid is sufficient for virus uptake). The acquisition time for the non-persistent viruses PVA and PVY is a few seconds. After uptake of the virus an aphid can directly transmit the virus to a healthy plant, but loses the virus a few hours (1-2) after feeding on the diseased plant. This means that non-persistent transmitted viruses are only transmitted over a short distance (e.g. 20-100m)

Modes of virus transmission

Vertical and horizontal

The most crucial stage in the dynamics of virus infections is the mode of virus transmission.

In general, transmission of viruses can occur through two pathways:

- Horizontal transmission
- Vertical transmission.

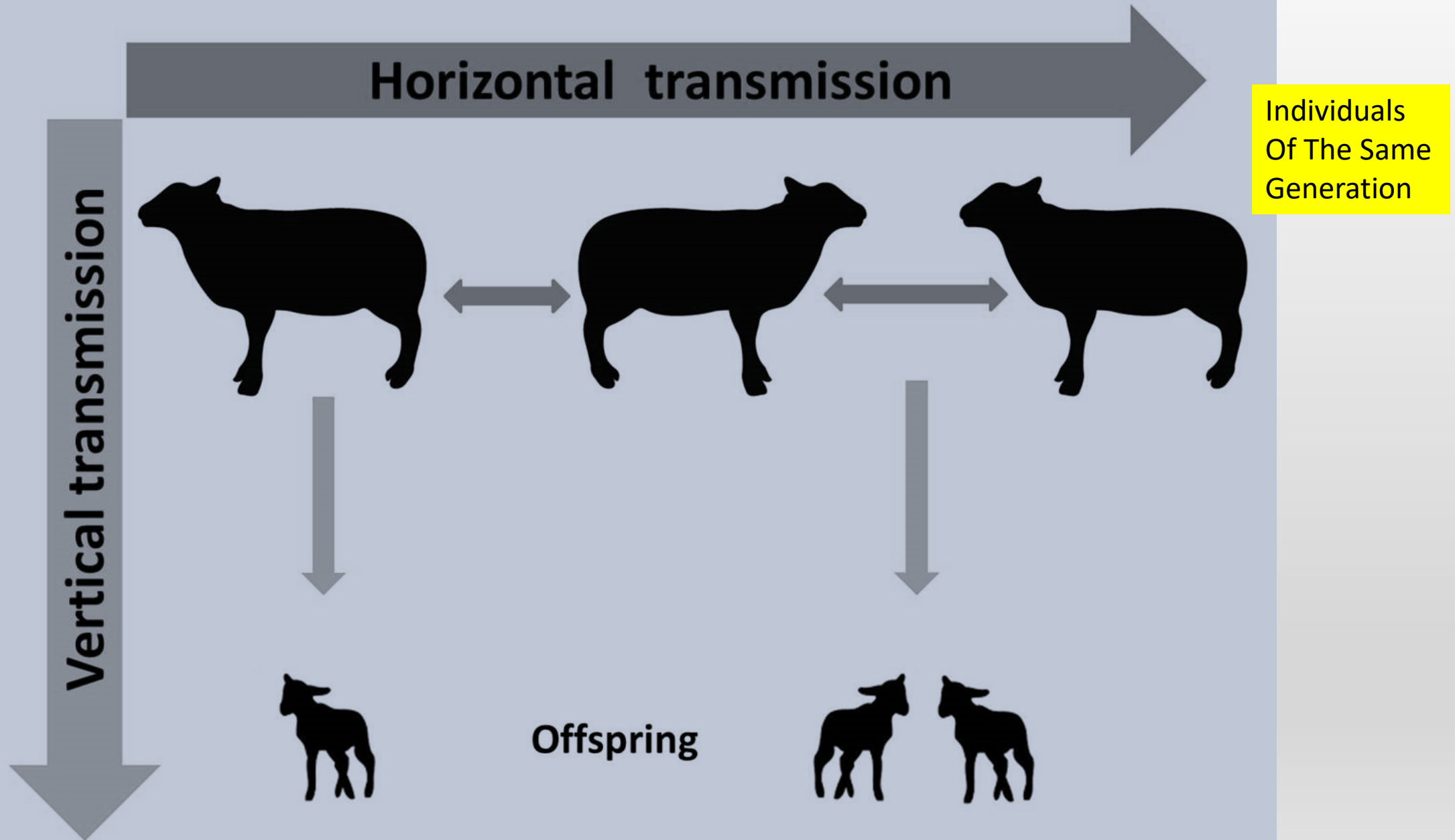
In horizontal transmission, viruses are transmitted among individuals of the same generation

vertical transmission occurs from mothers to their offspring.

Transmission types

- **Horizontal transmission**
- In Horizontal transmission virus travels from one host to another between two individuals, generally in the same generation
 - Direct contact can occur due to touching, biting or licking or sexual intercourse (HIV, HCV, Influenza)
 - Indirect contact can occur through vectors (Dengue Virus, CLCV)
- **Vertical transmission**
- Viruses that can be transmitted directly from a parent to members of the next generation (HIV, Rubella Virus)

Disease transmission



In case of Plant cells : Plant cells, however, have a cell wall that is nearly impossible for viruses to breach in order to cause infection. As a result, plant viruses are typically spread by two common mechanisms:

horizontal transmission and vertical transmission.

Horizontal Transmission

In this type of transmission, the plant virus is transmitted as a result of an external source. In order to "invade" the plant, the virus must penetrate the plant's outer protective layer.

- Plants that have been damaged by weather, pruning, or plant vectors (bacteria, fungi, nematodes, and insects) are typically more susceptible to a virus.
- Horizontal transmission also occurs by certain artificial methods of vegetative reproduction typically employed by horticulturists and farmers.
- Plant cutting and grafting are common modes by which plant viruses may be transmitted.

Vertical Transmission

In vertical transmission, the virus is inherited from a parent.

- This type of transmission occurs in both asexual and sexual reproduction.
- In asexual reproductive methods such as vegetative propagation, the offspring develop from and are genetically identical to a single plant.
- When the new plants develop from the stems, roots, bulbs, etc. of the parent plant, the virus is passed along to the developing plant.
- In sexual reproduction, viral transmission occurs as a result of seed infection.

