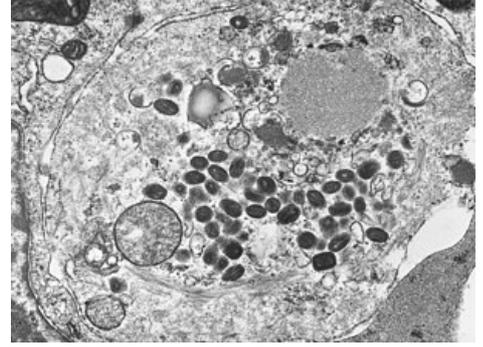


# Poxviridae

**Poxviruses** are **DNA viruses**. Their size is around 230-300 nm. These are **enveloped** viruses, oval or square with rounded corners. They contain extensive genetic and enzymatic equipment in the form of a **single linear strand of double-stranded DNA** and enzymes for RNA and DNA synthesis. They are very resistant to drying and disinfectants. They can be seen in the cytoplasm as inclusion-like particles. They also multiply in the cytoplasm of the host cells, so-called **Guarnieri bodies** are formed during their synthesis.

Poxviruses can be divided into two subfamilies:

- *Entomopoxvirinae* occurring in insects
- *Chordopoxvirinae*, which includes six genera. Of these, are medically interesting *Orthopoxviruses*, *Parapoxviruses* a *Molluscipoxviruses*, because they attack man.



Smallpox Tissue section containing variola orthopox viruses TEM PHIL 2291 lores

## Variola (smallpox)

The causative agents of this disease have an oval virion, a nucleoid encased in a protein ring. The disease is very serious but has been declared by the World Health Organization as eradicated since 1979. Infection occurs by droplet infection or direct contact. At first, the virus attacks the respiratory tract, where it is phagocytosed by cells. After the virus enters the cell, it associates with the lysosome, whose enzymes dissolve the envelope. Subsequently, the virus enzymes dissolve the capsid. DNA, which is now free in the cytoplasm, begins to be transcribed by the enzyme RNA polymerase - the viral DNA is transcribed into mRNA. Expression of the viral genome creates material for the assembly of new virions. The virus multiplied in this way enters the lymph nodes and further into the host organism. Fever develops.

After the virus multiplies in the endothelium of the subcutaneous tissue and skin, characteristic skin lesions develop. First, macules are seen, which gradually turn into papules and vesicles (small blisters) and finally into pustules (purulent blisters, smallpox).

The consequences of smallpox were often disfigurement, blindness and often death. Variola has two forms: *variola minor* and *major*. Variola minor is less important.

Vaccination against smallpox was given using vaccinia, one of the viruses that cause cowpox.

Smallpox is to some extent similar to the so-called chickenpox, which is caused by the varicella-zoster virus from the genus Herpesviruses. Unlike smallpox, fever occurs a little earlier in varicella (at the same time as the rash), the rash mainly affects the trunk; in smallpox, the rash occurs more slowly and mainly affects the head, limbs, but also the palms and soles.

## Molluscum contagiosum

It is a benign skin disease manifested by warts. They are transmissible by direct contact, they are also a sexually transmitted disease. Depending on the location or inflammation, the disease can be painful.

## Breaking the host's defence, the course of the infection

The host defends the viral infection with a superficial barrier, innate immunity and adaptive immunity. However, poxviruses inhibit innate immunity by neutralizing cytokines, receptor baits (IFN, IL-1, TNF, chemokines), cytokine blocking proteins, and inhibiting the IFN signalling pathway. It also protects against Tc cells by modulating MHC and protects against complement.

The virus enters the cell by surface fusion of the endosome or its lysis.

The infection begins with the virus entering the body, entering the cell and unwrapping it (for example with lysosomal enzymes). The synthesis of nonstructural proteins follows. Their function is DNA and RNA synthesis (DNA polymerase, topoisomerase, ribonucleotide reductase, ligase, thymidine kinase, RNA polymerase, viral RF VGF, etc.). There are also proteins that help inhibit apoptosis (the product of the F1L gene in the mitochondria binds the Bak cellular protein, prevents its oligomerization, and thus blocks the mitochondrial cascade). Subsequently, the genome replicates the synthesis of structural proteins, their assembly into particles and the release of newly formed virions. The course of infection is cytopathic, leading to morphological changes in the affected cell.

Two types of infectious particles are described in poxviruses. It is a **mature virion (MV)** and an **enveloped extracellular virion (EV)**. Each type of particle uses a different method of macropinocytosis and fusion. The MV-form has only one membrane, while the EV-form also has an outer membrane, which is disrupted before fusion.

Several viral proteins on the MV membrane simplify the attachment of glycosaminoglycans and host cell membrane laminins, thereby facilitating macropinocytosis. The fusion of both EV and MV is dependent on a complex of eleven to twelve transmembrane proteins.

Membrane fusion of a nucleoprotein and a host cell has three phases:

- closure of the apposition of the viral and cell membrane,
- mixing of the outer membrane lipids, joining of the outer leaves and formation of hemifusion,
- formation and expansion of pores.

The virion material then penetrates the cytoplasm of the host cell.

## Links

### Related articles

- smallpox

### Literature

- HORÁČEK, Jiří. Základy lékařské mikrobiologie. 1. vydání. Praha : Nakladatelství Karolinum, 2000. sv. 1. ISBN 80-246-0006-4.
- BEDNÁŘ, Marek. Lékařská mikrobiologie. 1. vydání. Marvil, 1999.

### Extern links

- <https://www.ncbi.nlm.nih.gov/pubmed/22440962>
- <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3386626/h> (<http://www.virology.net>)
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