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## Programme: M.Sc., Biomedical Science

## Course Title : Clinical Microbiology

## Course Code: BM36C9

## Unit-IV

## Pox virus


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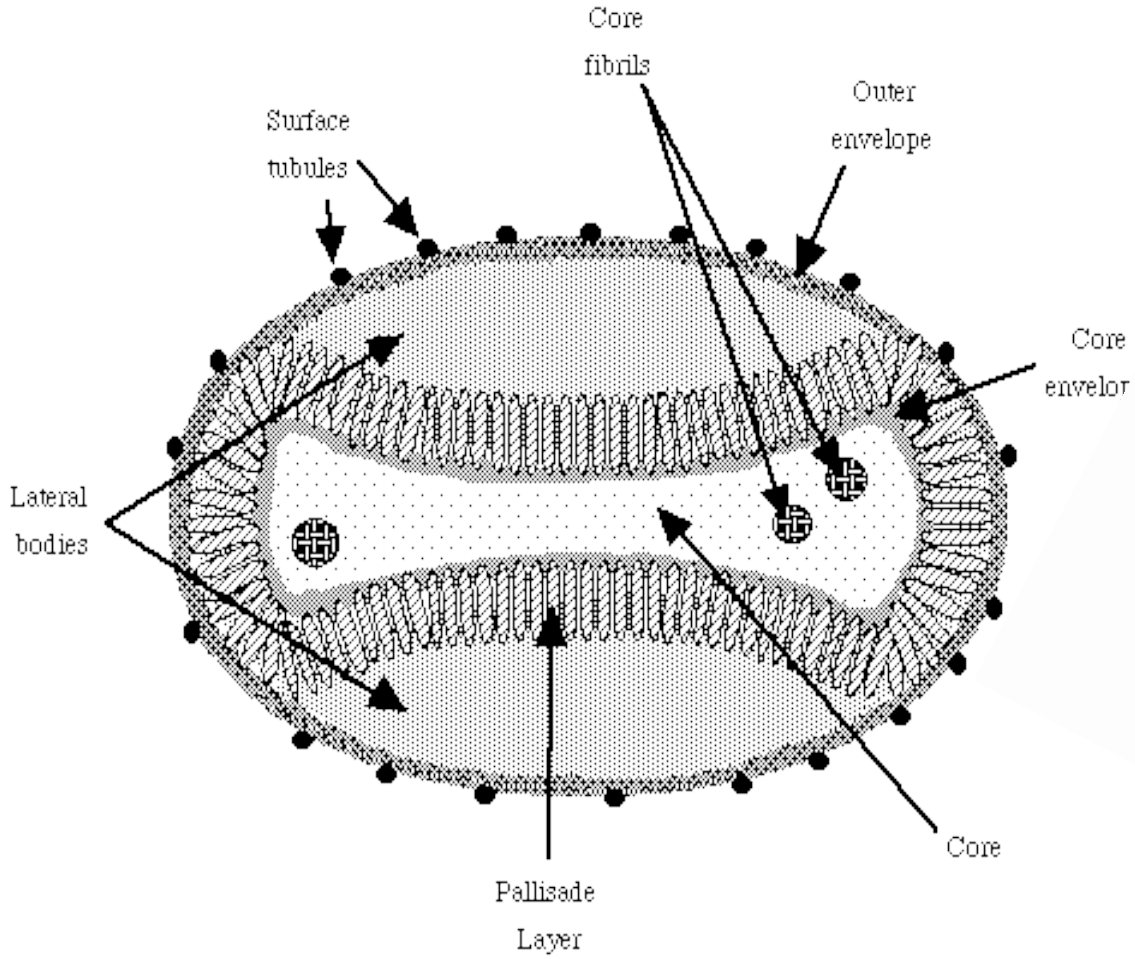
# POX VIRUS :

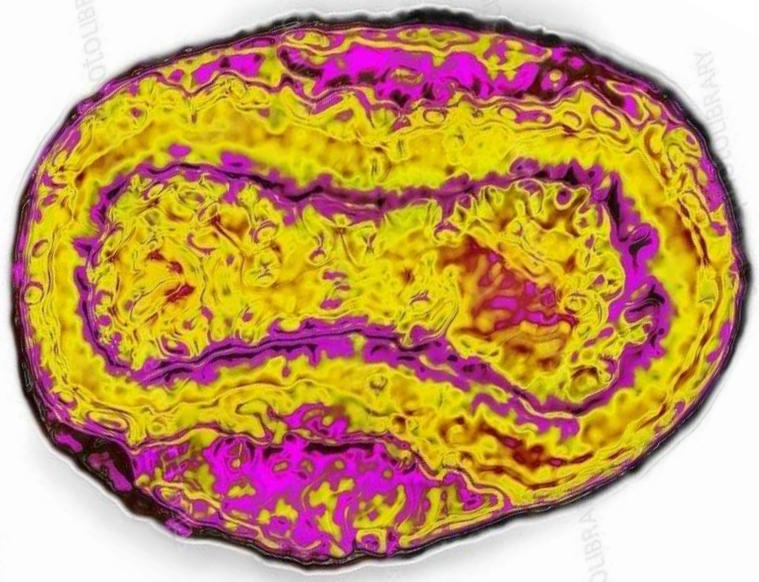
- Poxviruses are brick or oval-shaped viruses with large double-stranded DNA genomes.
- Poxviruses exist throughout the world and cause disease in humans and many other types of animals.
- Poxvirus infections typically result in the formation of lesions, skin nodules, or disseminated rash.
- Infection in humans usually occurs due to contact with contaminated animals, people, or materials.
- While some poxviruses, such as smallpox (variola virus), no longer exist in nature, other poxviruses can still cause disease. These include monkeypox virus, orf virus, molluscum contagiosum, and others.

# STRUCTURE OF POX VIRUS:

- Oval or brick-shaped 200-400 nm long particles can be visualized by the best light microscopes.
- The external surface is ridged in parallel rows, sometimes arranged helically.
- Viral particles (virions) are generally enveloped (external enveloped virion-EEV).
- The intracellular mature virion (IMV) form of the virus contains different envelope and is also infectious.
- On the basis of their species they vary in their shape but generally appear brick like or as an oval form similar to a rounded brick.
- The virion size is around 200 nm in diameter and 300 nm in length and carries its genome in a single, linear, double-stranded segment of DNA. The external surface of the virion is ridged in parallel rows, sometimes arranged helically.
- The particles are extremely complex and contain more than 100 different proteins. Antigenically, poxviruses are very complex inducing both specific and cross-reacting antibodies.

# STRUCTURE OF POX VIRUS:



# Classification
## Family *Poxviridae*

| Subfamilies | Genera | Members |
|---|---|---|
| *Chordopoxvirinae* | *Orthopoxvirus* | Variola, vaccinia, cowpox, monkeypox, camelpox |
| (vertebrates) | *Parapoxvirus* | Sealpox, parapox of deer, pseudocowpox |
| | *Avipoxvirus* | Canarypox, fowlpox, pigeonpox, turkeypox, penguinpox |
| | *Capripoxvirus* | Goatpox, sheeppox |
| | *Leporipoxvirus* | Hare fibroma, myoma, rabbit fibroma, squirrel fibroma |
| | *Suipoxvirus* | Swinepox |
| | *Molluscipoxvirus* | Molluscum contagium |
| | *Yatapoxvirus* | Tanapox, Yaba monkey tumor |
| Entomopoxvirinae | *Capripoxvirus A* | |
| (insects) | *Capripoxvirus B* | |
| | *Capripoxvirus C* | |

# REPLICATION OF POX VIRUS:

- Viral genome is a linear 130-300 kb long (ds) DNA molecule. Ends of genome consist of a terminal hairpin loop (no free ends) with several tandem repeat sequences.
- This arrangement is found at the ends of chromosomes from a number of different organisms.
- The ends of the genome form repeats called ‘inverted terminal repeats’ (ITRs). Several poxvirus genomes have been sequenced.
- Most of the essential genes are located in the central part of the genome, whereas non-essential (in tissue culture) genes are located at the ends. There are about 250 genes in the genome of poxviruses.
- Replication of the poxvirus is accomplished in several stages. Initially, the virus binds to a receptor present on the surface of host cell. So far the receptors for the poxvirus are not known.

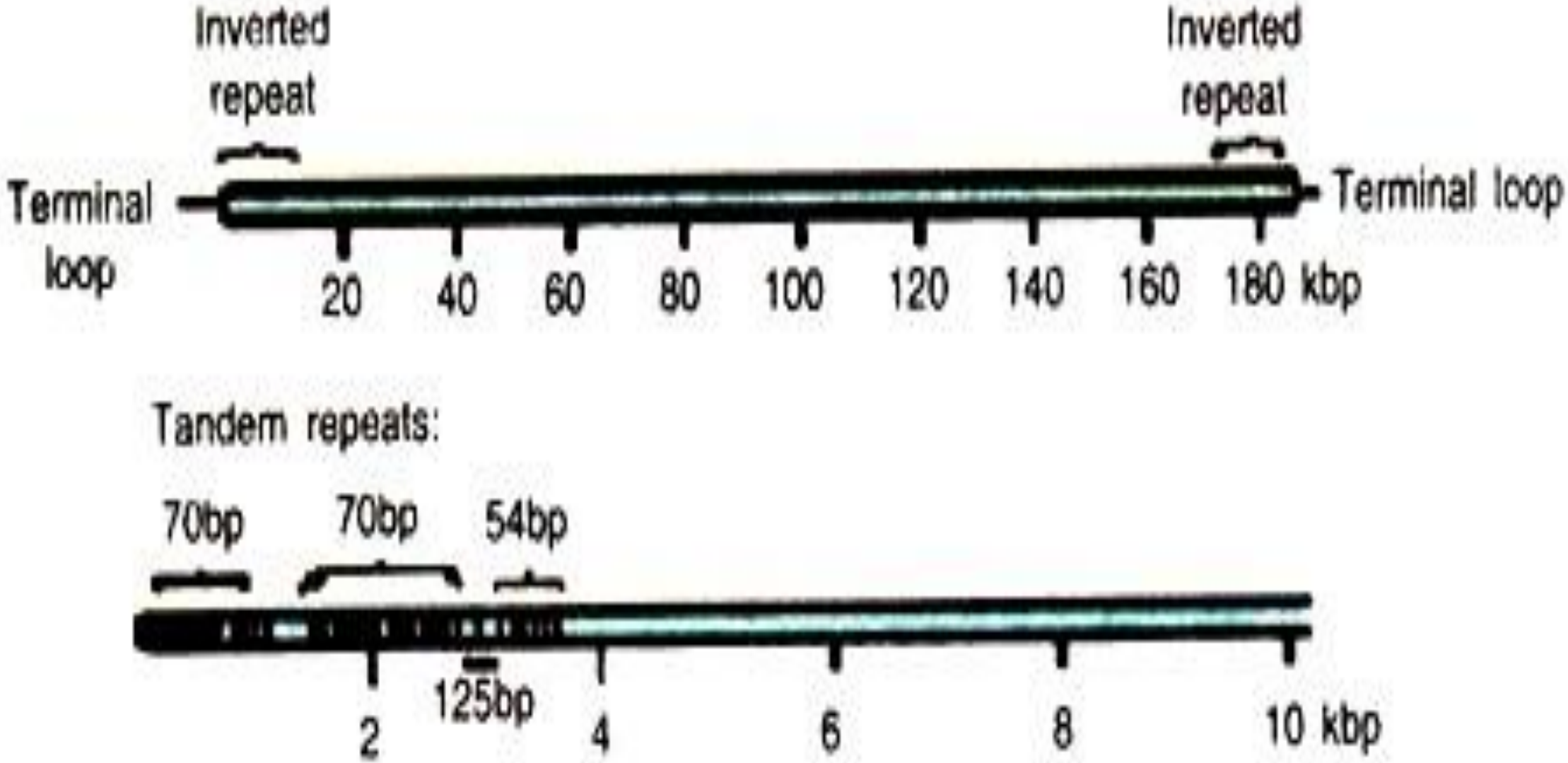



**Fig. 17.18** : Genome structure of poxvirus.

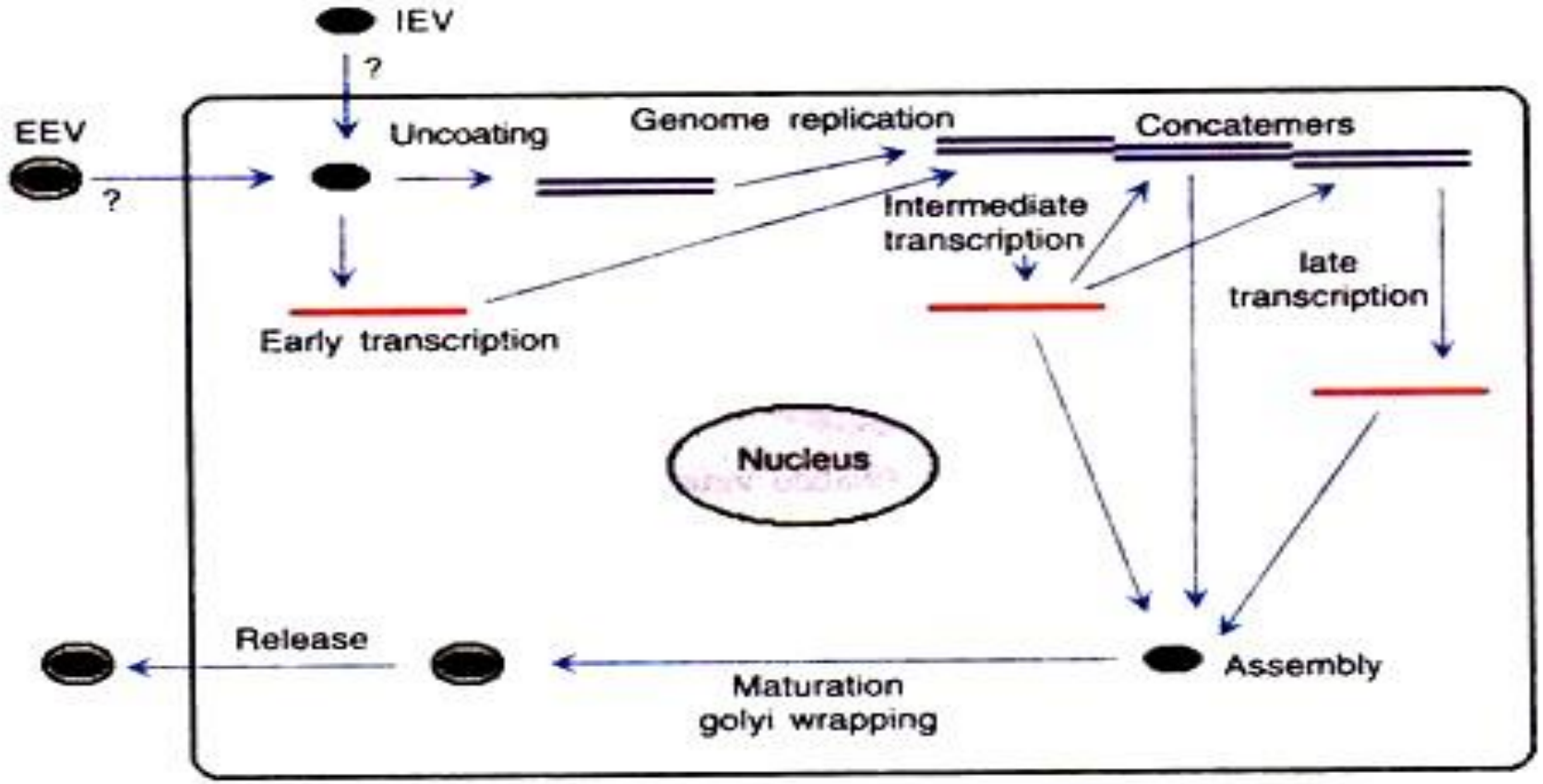



**Fig. 17.19 :** Replication of poxvirus (diagrammatic); IEV-intracellular enveloped virus; EEV-extracellular enveloped virus.

**Thereafter, the virus enters inside the cell where its uncoating is done in two steps:**

Firstly, the outer membrane is removed as the particle enters the cell.

Secondly, the virus particle is further uncoated to release the core into the cytoplasm (without the outer membrane).

The genes of pox virus are expressed in two phases; the early genes are expressed first.

These genes encode the nonstructural protein including proteins necessary for replication of the viral genome and are expressed before replication of genome.

The late genes are expressed after genome replication. The structural proteins of the genome make the virus particle.

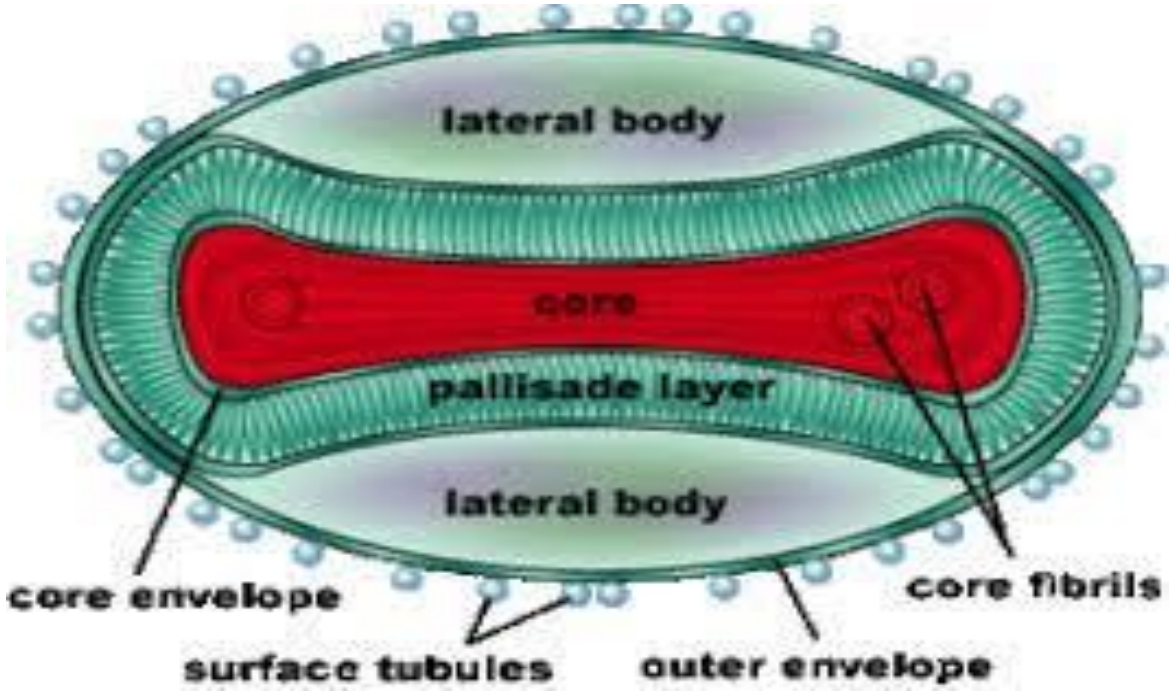
Assembly of the virus particle is a complex process which is poorly understood. It occurs in cytoskeleton of the cell.

This virus is large and complex; its replication is relatively quick which is completed in about 12 hours.

# SMALL POX:

- Smallpox is an extremely contagious disease, which is caused by the deadly virus called Variola. This contagious disease came into existence since 10,000 BC.
- In 1980, this syndrome was declared as completely eradicated after the global immunization campaign led by the World Health Organization (WHO) with the help of the smallpox vaccine.
- The first effective vaccine to be discovered was the smallpox one as it was developed in 1796 by Edward Jenner. The last symptoms of this infectious disease were found in the year 1977.
- Smallpox is a contagious disease, which transmits from one person to another by infective droplets of an infected person.
- There is no treatment found for this contagious disease but could be prevented through the vaccinations.

# STRUCTURE OF SMALL POX :



# VARIOLA VIRUS:

- The variola virus has two forms namely the  Variola minor and Variola major.  Variola virus, is a deadly virus, being a member of the orthopoxvirus family.
- The structure of this virus resembles that of brick ones and the core of the virus is made up of a genetic material DNA which resembles a dumbbell in shape.
- The DNA in the core comprises necessary proteins, which are required to replicate the host's cell.
- The incubation period for this disease is about 17 days, which later results in severe fever with the appearance of rashes on the face, legs, hands, arms, etc.

# CAUSES OF SMALL POX:

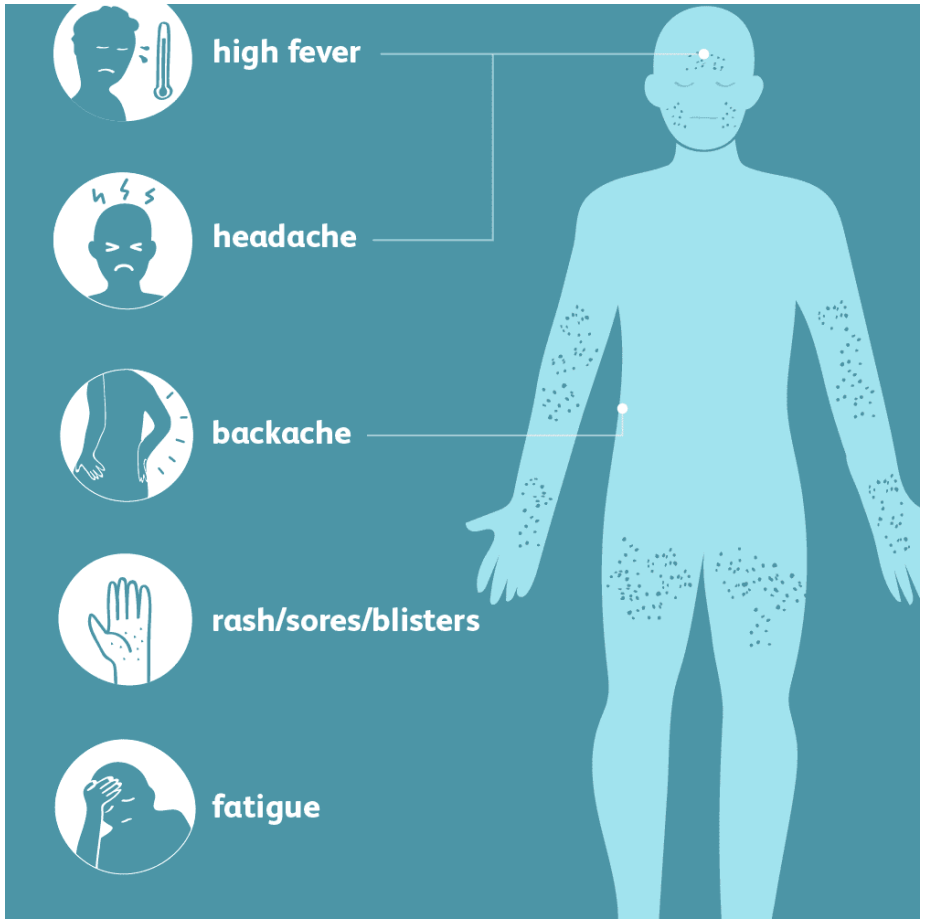
- Smallpox is an airborne disease that spreads at a faster rate and is mainly caused by an infection of a deadly type of virus variola.

1. It transmits through the droplets released from coughing, sneezing, and face to face contact with an infected person.
2. This infection is also transmitted by sharing drinks, exchange of body fluids like blood transfusion and etc.
3. Caused by even touching any contaminated area.
4. By using unclean syringes or the used ones.

# SYMPTOMS OF SMALL POX:

- Usually, after the infection of the variola virus, the symptoms occur after 17 days. Below Listed general symptoms are seen after the incubation period

1. High fever followed with chills.
2. Vomiting or nausea.
3. A severe headache, followed by other body pains.
4. Development of rashes, filled with pus or fluid on the face, legs, hands, arms, etc.



# TREATMENT FOR SMALL POX:

- Since it is a deadly disease, there is no such cure available for this syndrome.
- It could be still prevented by vaccinating with the smallpox vaccine.
- This vaccine helps in preventing the disease from illness and causing fatal conditions to humans.
- The antibodies present in this vaccine protects the body from invading and to destroy the virus.

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# THANK YOU