

Influenza: acute immune strategies

INFLUENZA

(commonly known as “the flu”) is a highly contagious and potentially deadly disease¹



Each year in Australia, influenza on average causes
3,500 DEATHS
18,000 HOSPITALISATIONS
300,000 GP CONSULTATIONS^{1,2}

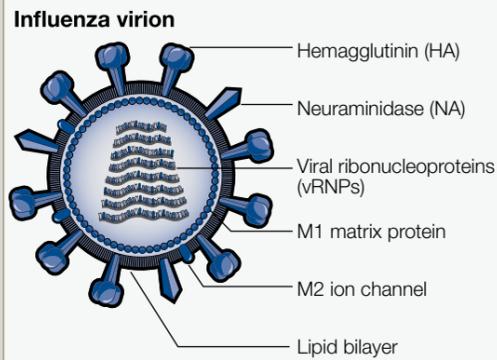


INFLUENZA IS NOT THE SAME AS THE COMMON COLD³

Although symptoms of a cold and influenza can be similar, **INFLUENZA** comes on **SUDDENLY** and symptoms tend to be **MORE SEVERE**³



NATURAL INTERVENTIONS FOR INFLUENZA⁴⁻¹⁵



1 VIRUS INVADES THE HOST

- Influenza virus inhaled into the nasal passage and invades epithelial cells of the upper respiratory tract.

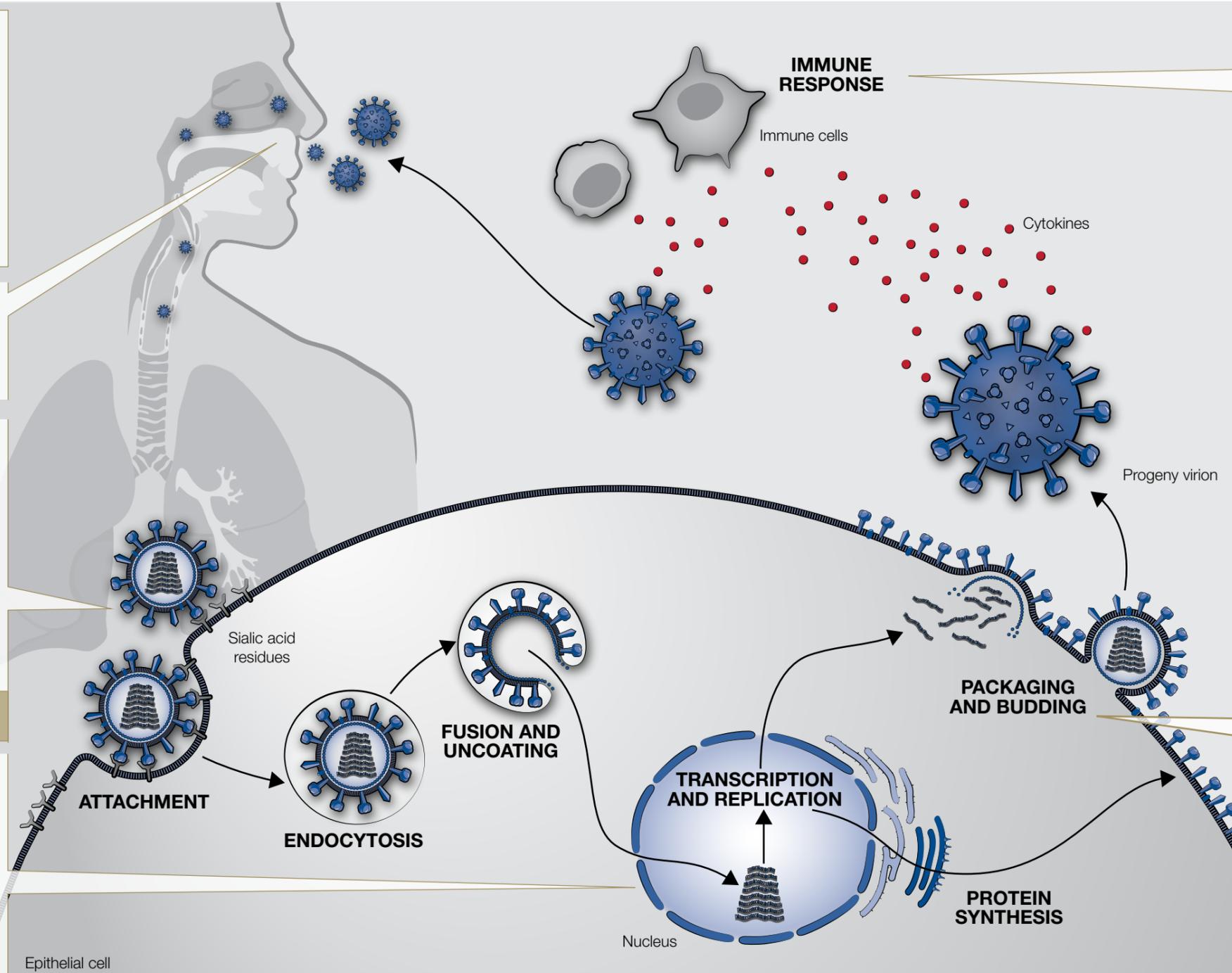
2 VIRUS ENTERS HOST CELL

- Viral HA binds to sialic acid residues on host cell plasma membrane.
- Upon **attachment**, virus enters cells via receptor-mediated **endocytosis**.
- Low pH in endosome triggers **fusion** of viral and endosomal membrane.
- At the same time, acidic environment of endosome opens up M2 ion channels **uncoating** virion interior.
- vRNPs are released into the cytoplasm and migrate to nucleus.

ANDROGRAPHIS interferes with viral HA and inhibits attachment.

3 TRANSCRIPTION AND REPLICATION OF VIRUS

- Influenza viral **transcription and replication** occurs in the nucleus.
- Influenza virus hijacks host transcription machinery.
- vRNPs serve as a template and are transcribed, replicated and exported from the nucleus.
- mRNA translation occurs in cellular ribosomes stimulating synthesis of viral proteins.



5 ACTIVATION OF IMMUNE RESPONSES

- Immune cells are recruited to the site of infection.
- Immune cells release cytokines that initiate and maintain inflammation.
- Inflammation causes characteristic flu symptoms: redness, soreness and swelling in the back of the throat, fever, headache, fatigue, mucus secretion and coughing.
- As the concentration of virus increases in the body, symptoms intensify.

ANDROGRAPHIS reduces symptoms, severity and duration of infection due to anti-inflammatory, analgesic, antipyretic and expectorant actions.

ELECAMPANE relieves respiratory difficulties. It has anti-inflammatory and cytotoxic activities.

BERBERINE reduces symptoms, severity and duration by stimulating immune responses as well as having anti-inflammatory actions.

THYME relieves symptoms of cough and mucus congestion. It is anti-inflammatory, analgesic, antitussive, antispasmodic and is an expectorant.

ZINC is essential for normal development and function of immune cells such as neutrophils, monocytes, natural killer cells and T cells. Zinc helps to control the body's inflammatory response due to its influence on cytokine production.

4 VIRUS PACKAGING AND BUDDING

- Newly formed vRNPs are exported from nucleus and form new viral particles using host cell plasma membrane.
- Viral NA must cleave sialic acid residues from glycoproteins and glycolipids in order for progeny virion to leave the plasma membrane.
- New viral particles are released and can go on to infect surrounding cells.

BERBERINE interferes with release of progeny virion by inhibiting NA activity.