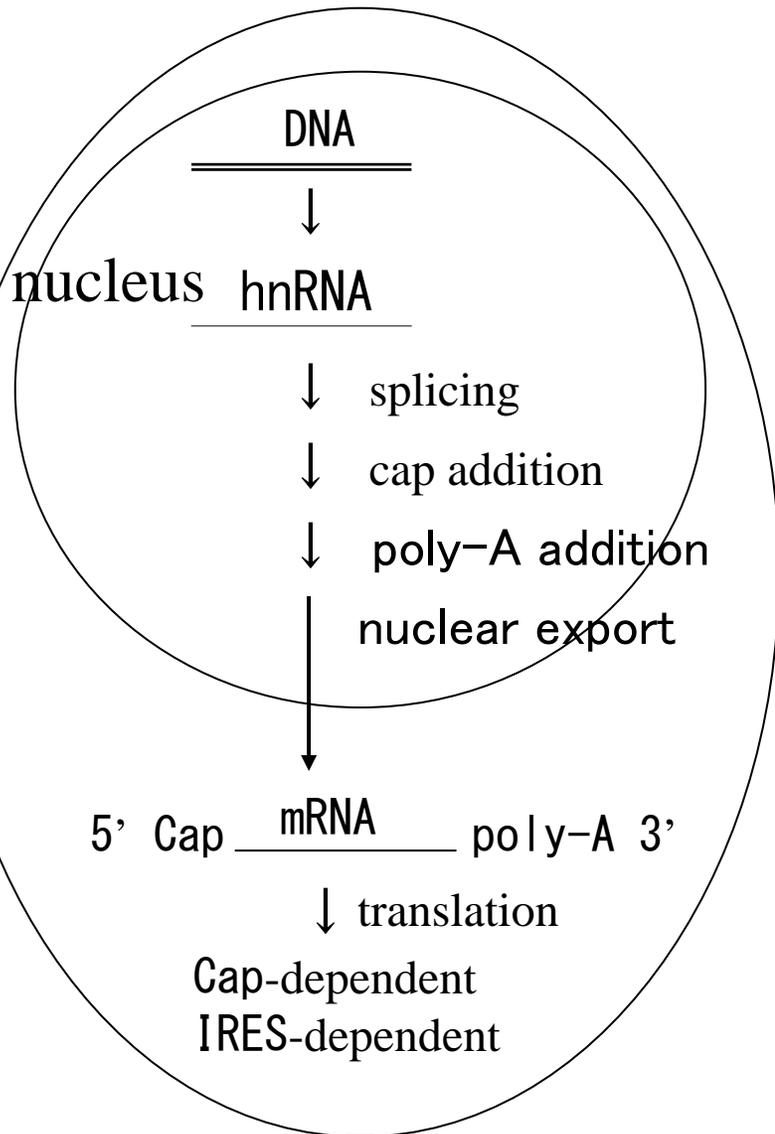

microbes	self-reproducing		genome
prion	non-living	×	×
virus	non-living	×	○
rickettsia	prokaryote	×	○
chlamydia	prokaryote	×	○
bacteria	prokaryote	○	○
fungus	eukaryote	○	○
parasite	eukaryote	○	○

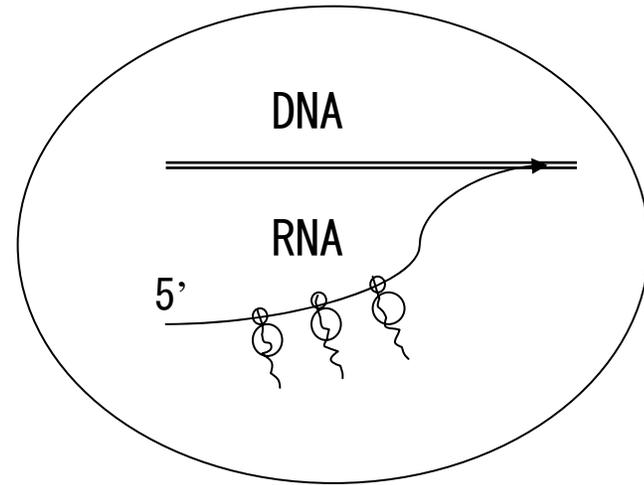
Why viruses are neither living organisms nor self-reproducing

- They have no ability to take in nutrients.
- They cannot yield energy (ATP).
- They have no system for protein biosynthesis.

eukaryotes

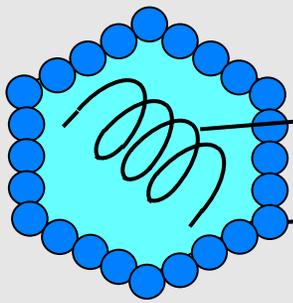


prokaryotes



	eukaryote	prokaryote
RNA polymerase	3	1
mRNA	monocistronic	polycistronic

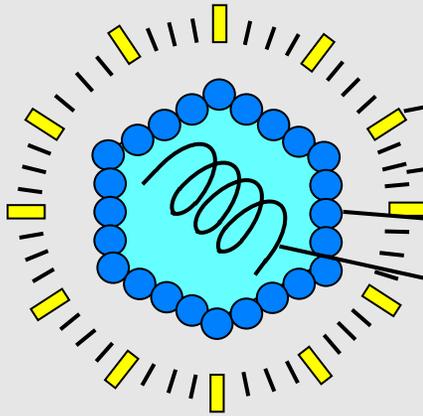
A



virus nucleic acid

capsomere made of capsid protein

B



envelope protein

lipid bilayer

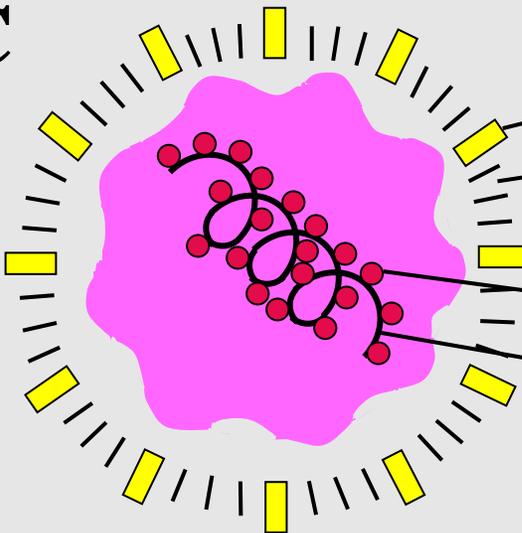
capsomere

virus nucleic acid

} envelope

} nucleocapsid

C



envelope protein

lipid bilayer

capsid protein

virus nucleic acid

} envelope

} nucleocapsid

Discovery of pathogenic virus

1892 Iwanowski

“Pathogen of tobacco mosaic disease passed through bacteria-retaining filter. “

1899 Iwanowski

“Iwanowski explained that his result was caused by toxin incorporation.”

1898 Loeffler & Frosch

“The filterable agent of the disease which cannot be incubated exists in the vesicle fluids of cattle.”

FMDV : foot and mouth disease virus

1898 Beijerinck

“Tobacco mosaic disease is caused by a virus.”

Idea of virus particles

1929

Holmes

Local lesion of TMV (**necrotic local lesion**) ⇒ purifiable

(note) 1949 Enders “isolated the polio virus by cultivating it in vitro”

1952 Dulbecco “developed the plaque assay to measure polio viruses”

1935

Stanley

“crystallization of TMV” ⇒ Physicists and chemists participated in the field of biology.

biophysics

biochemistry

molecular biology started

1936

Bowen & Pirrie

“TMV has RNA”

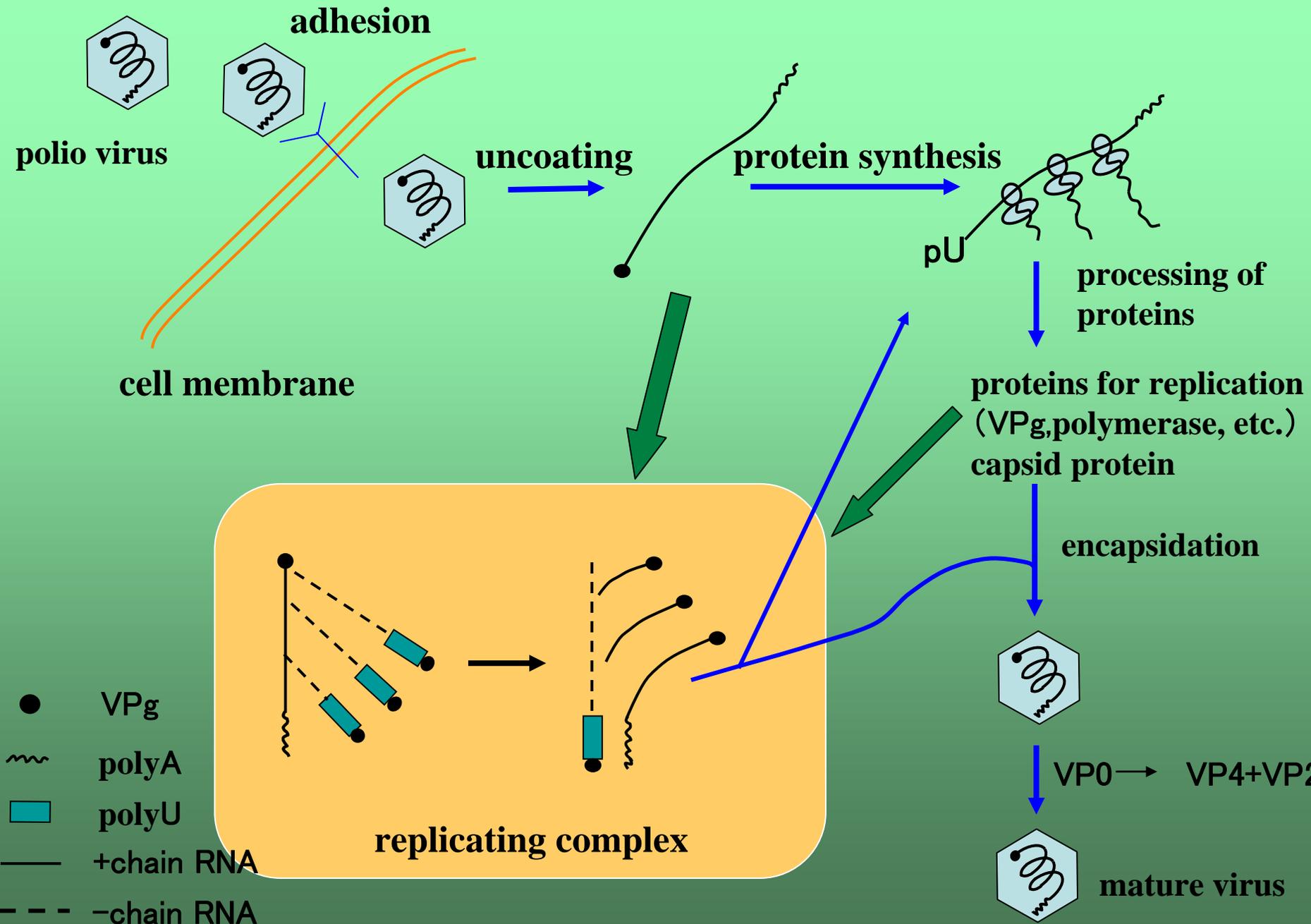
Virus (1)

An aggregate of chemical substances
(a non-living organism)

(ex) structure of polio virus



not including poly(A) and cations



Virus (2)

Life cycle formed by interactions
between hosts (organisms ?)

Chemicals with a life cycle

Research using viruses

Replication mechanism

Information expression

Morphogenesis

Evolution mechanism

Genetic structure

Gene engineering

Research on viruses instead of cells can lead the development of life science.

Important discoveries in biology from research on virus replication

reverse transcriptase, gene transformation
(retrovirus)

cap structure (CPV)

RNA splicing (adenovirus)

IRES (poliovirus)

Virology

- The field of biology studies both the virus and the living body, and the interactions between them.
- The field covers a wide range (cutting-edge life science, epidemiology, clinics, international medical aid, etc.)
- Advanced research requires a comparatively long time to master.

Research on virus pathogenicity

Identification of host molecules in each stage of replication and infection

Virus-specific genes causing:

cell-altering effects

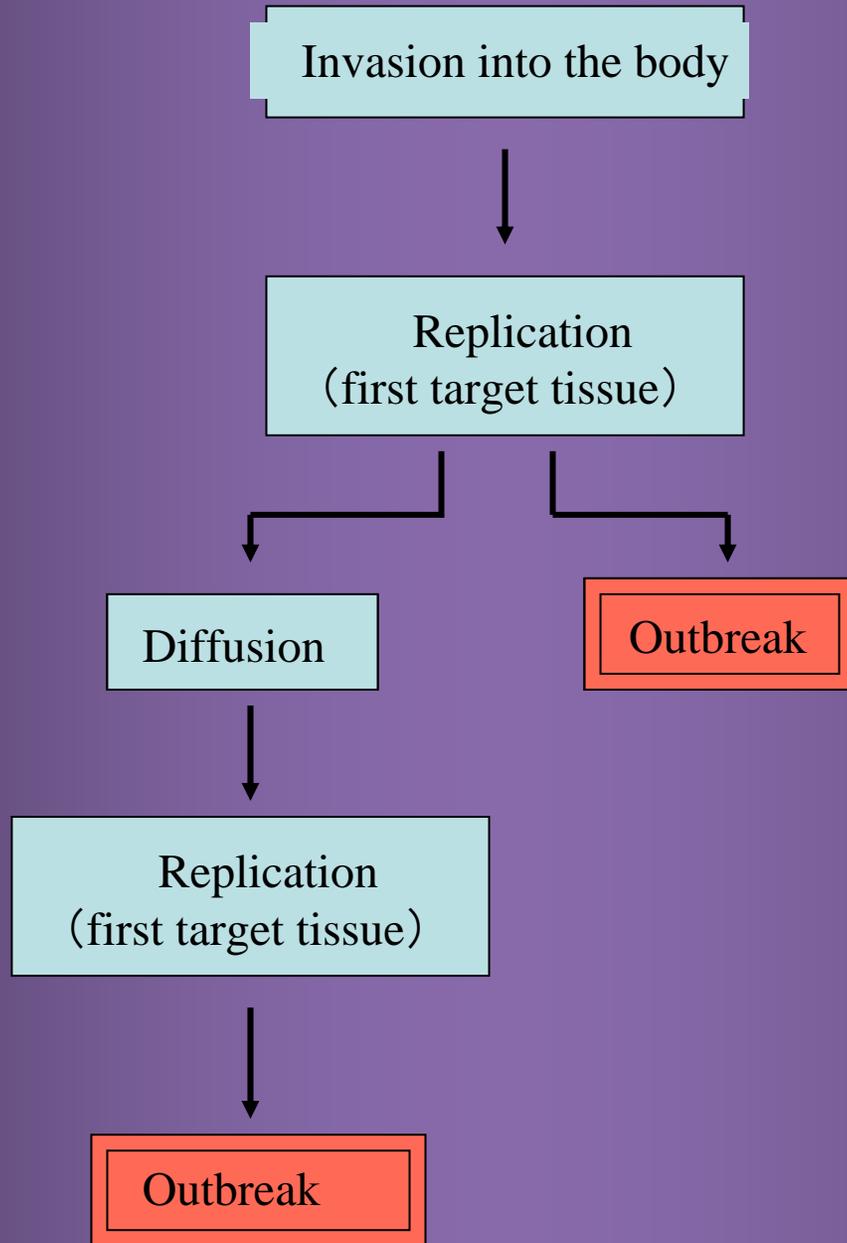
inhibition of apoptosis → immortalization

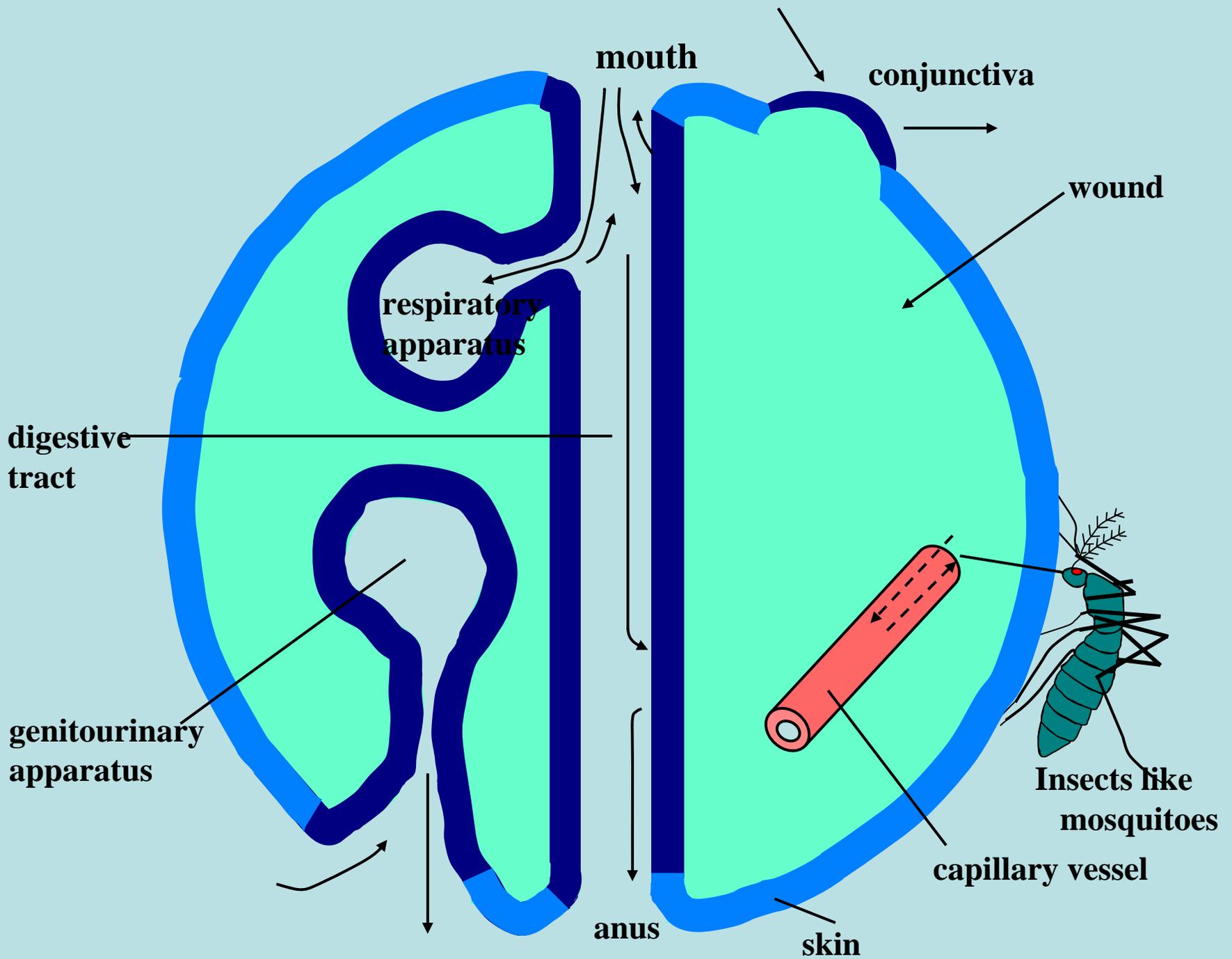
escape from host defense system

Research on the biosystem formed between viruses and host (infection analysis)

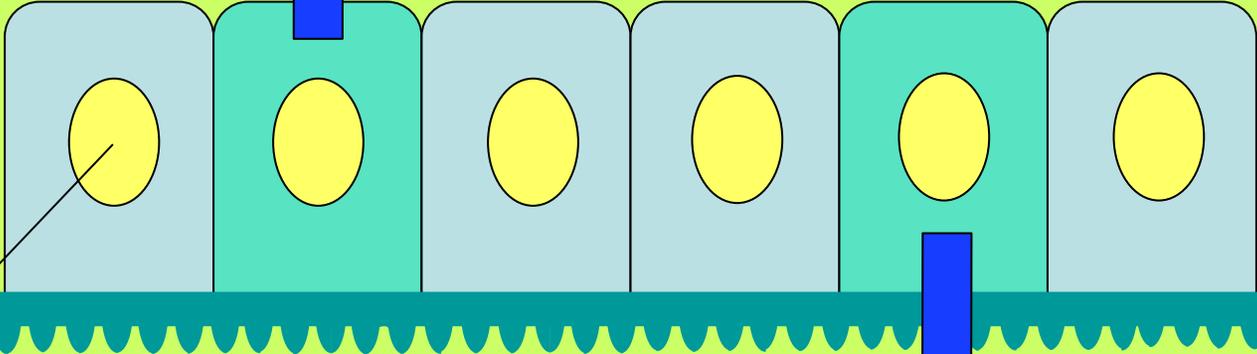
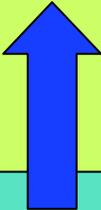
4 postulates of Henle-Koch

- 1 . The organism must be found in all animals suffering from the disease, but not in healthy animals.**
- 2 . The organism must be isolated from a diseased animal and grown in a pure culture.**
- 3 . The cultured organism should cause disease when introduced into a healthy animal.**
- 4 . The organism must be reisolated from the experimentally infected animal.**





budding from apical surface



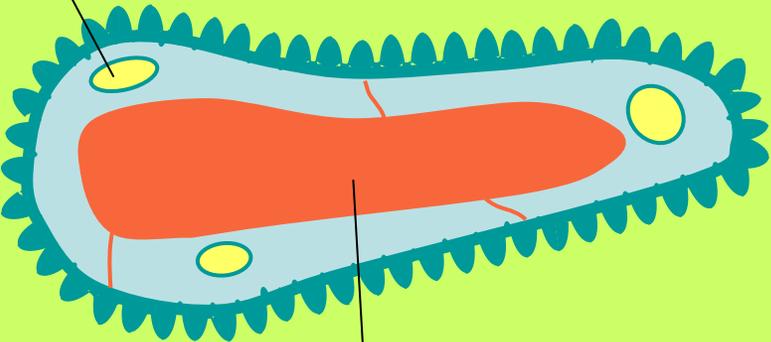
epithelial cell

basal lamina

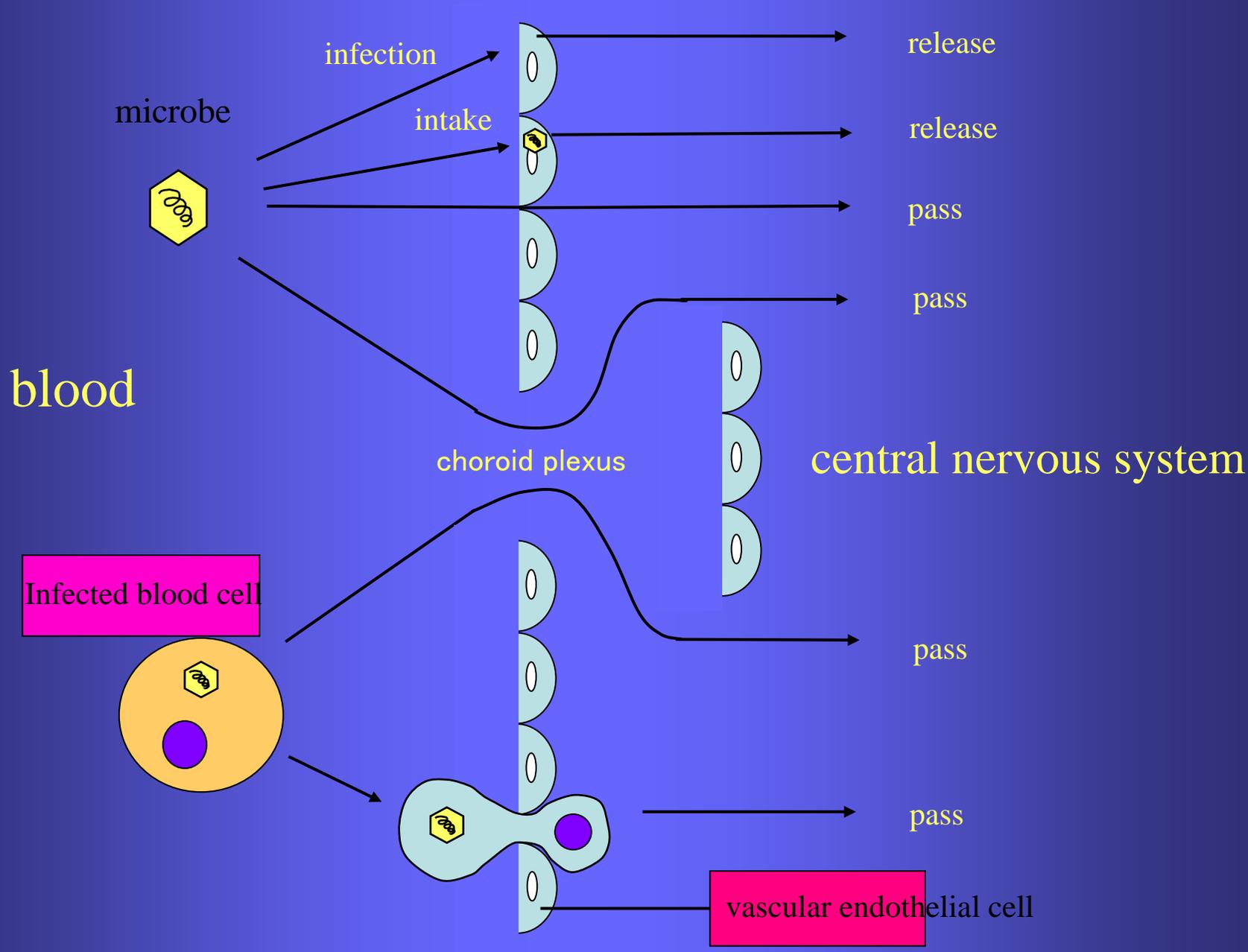
connective tissue

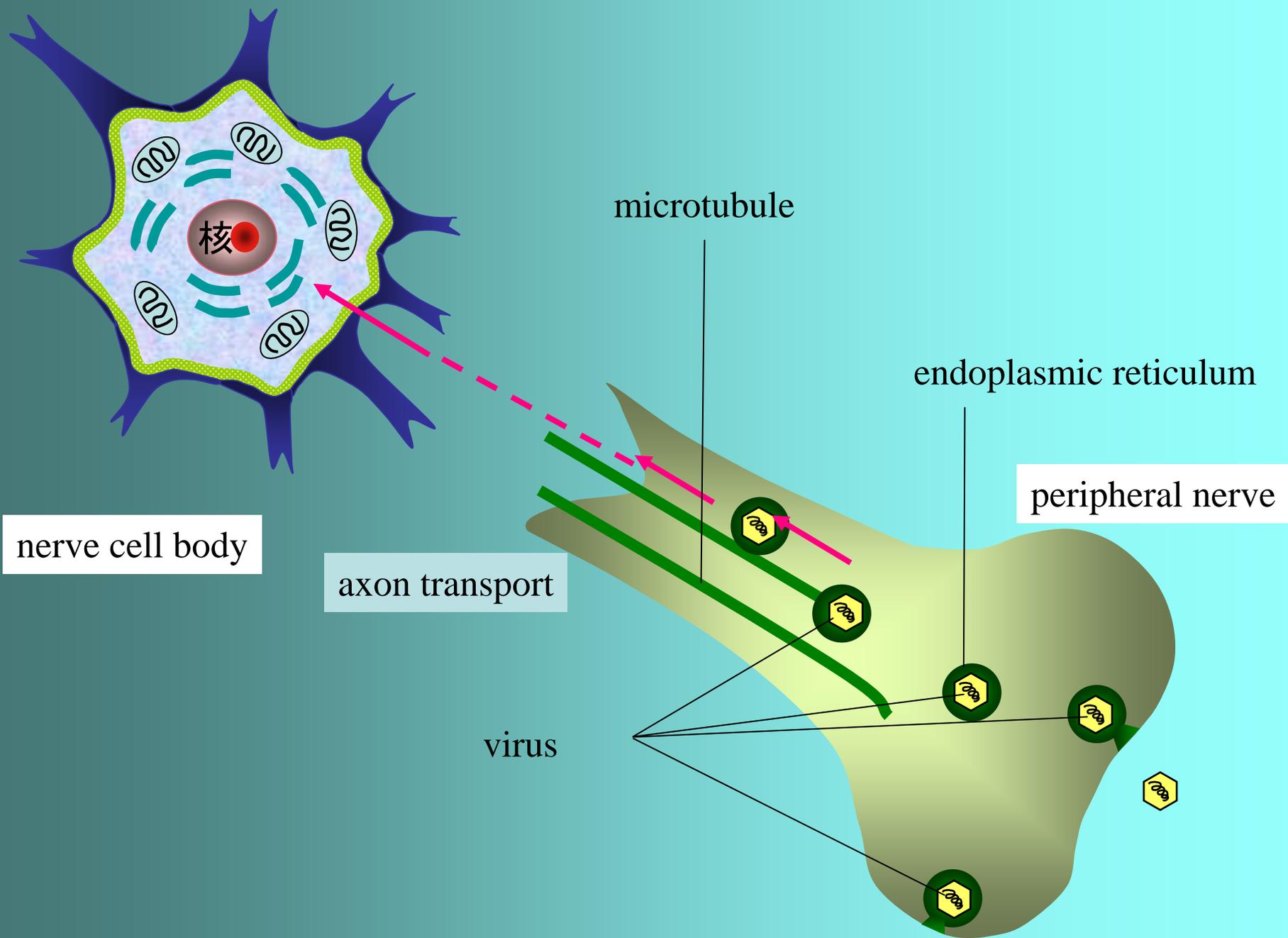
nucleus

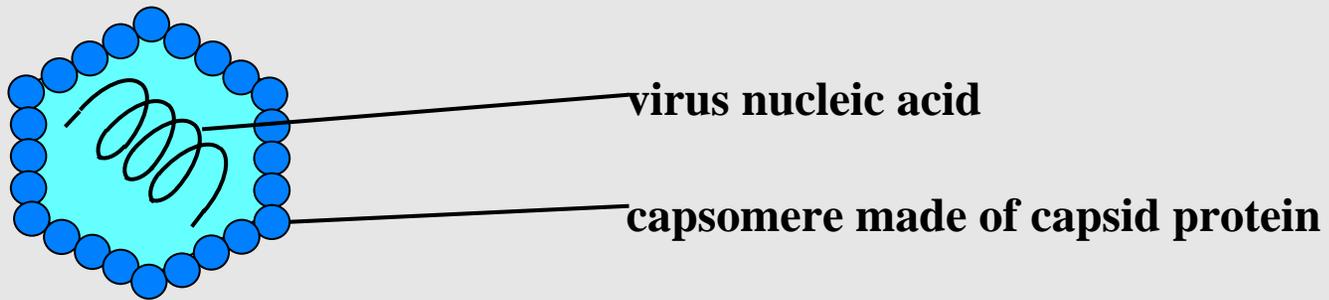
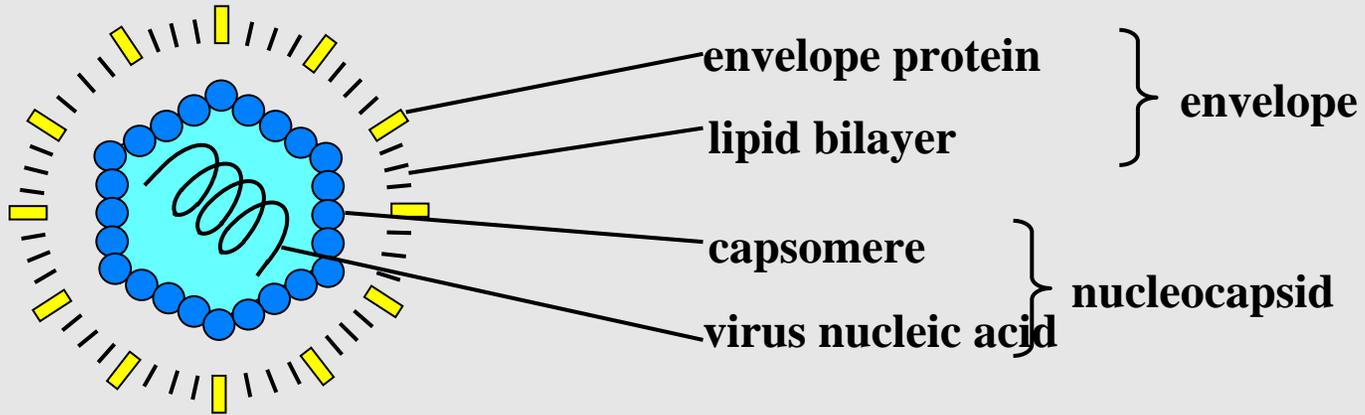
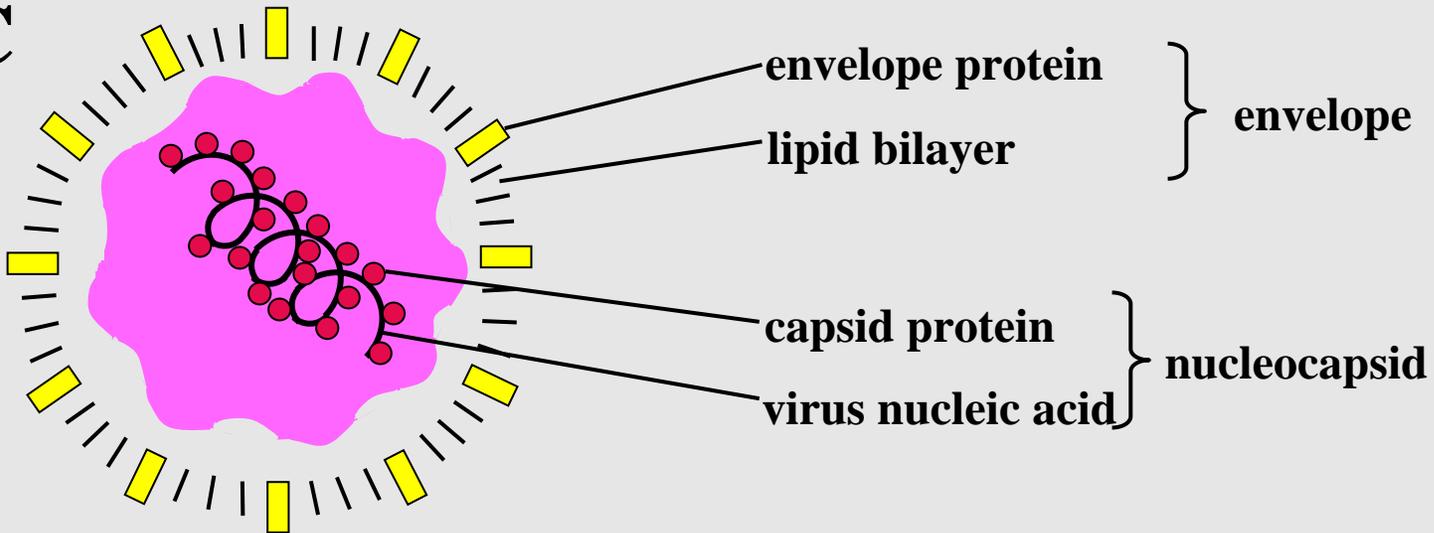
budding from basal surface



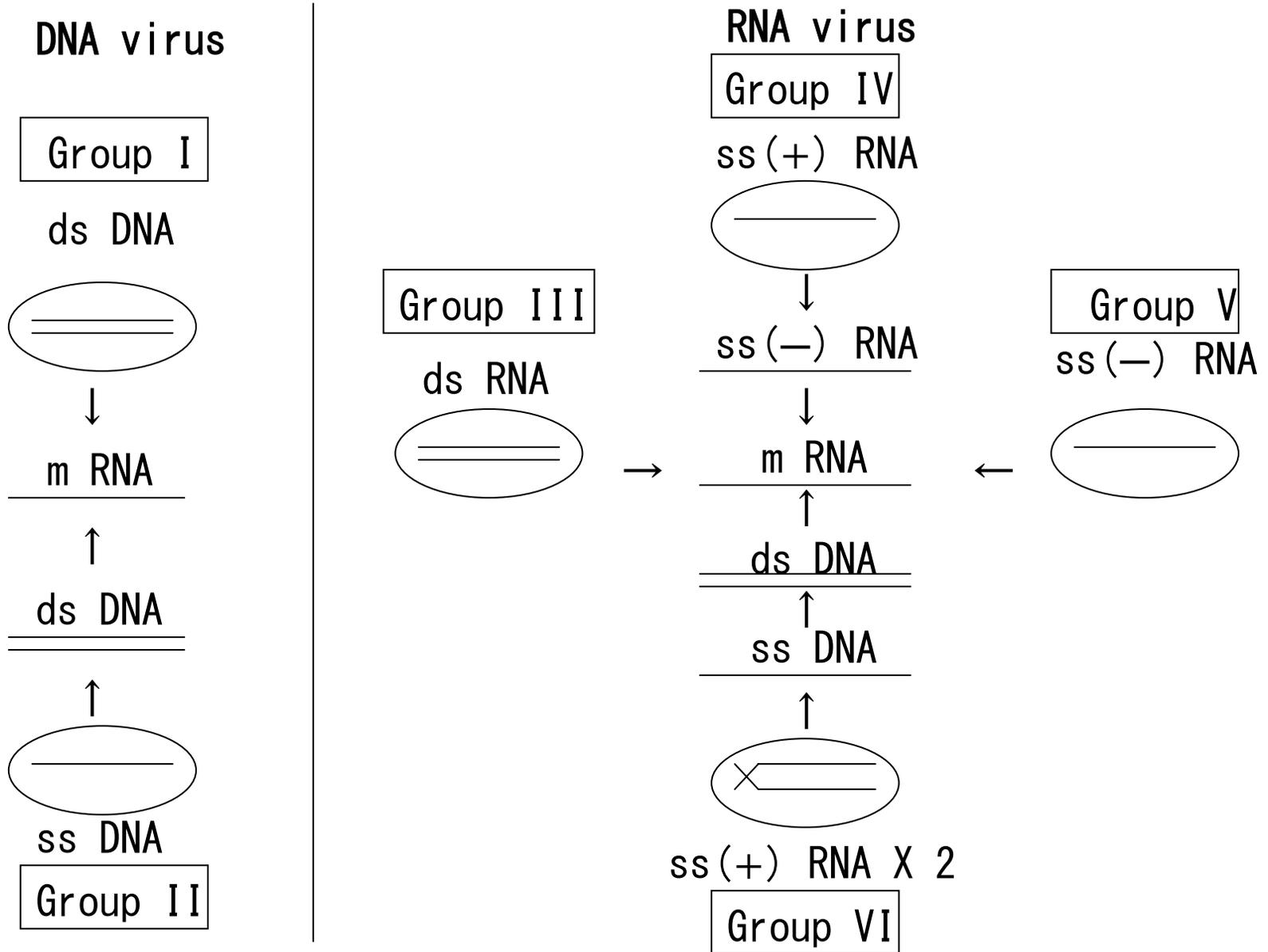
capillary vessel

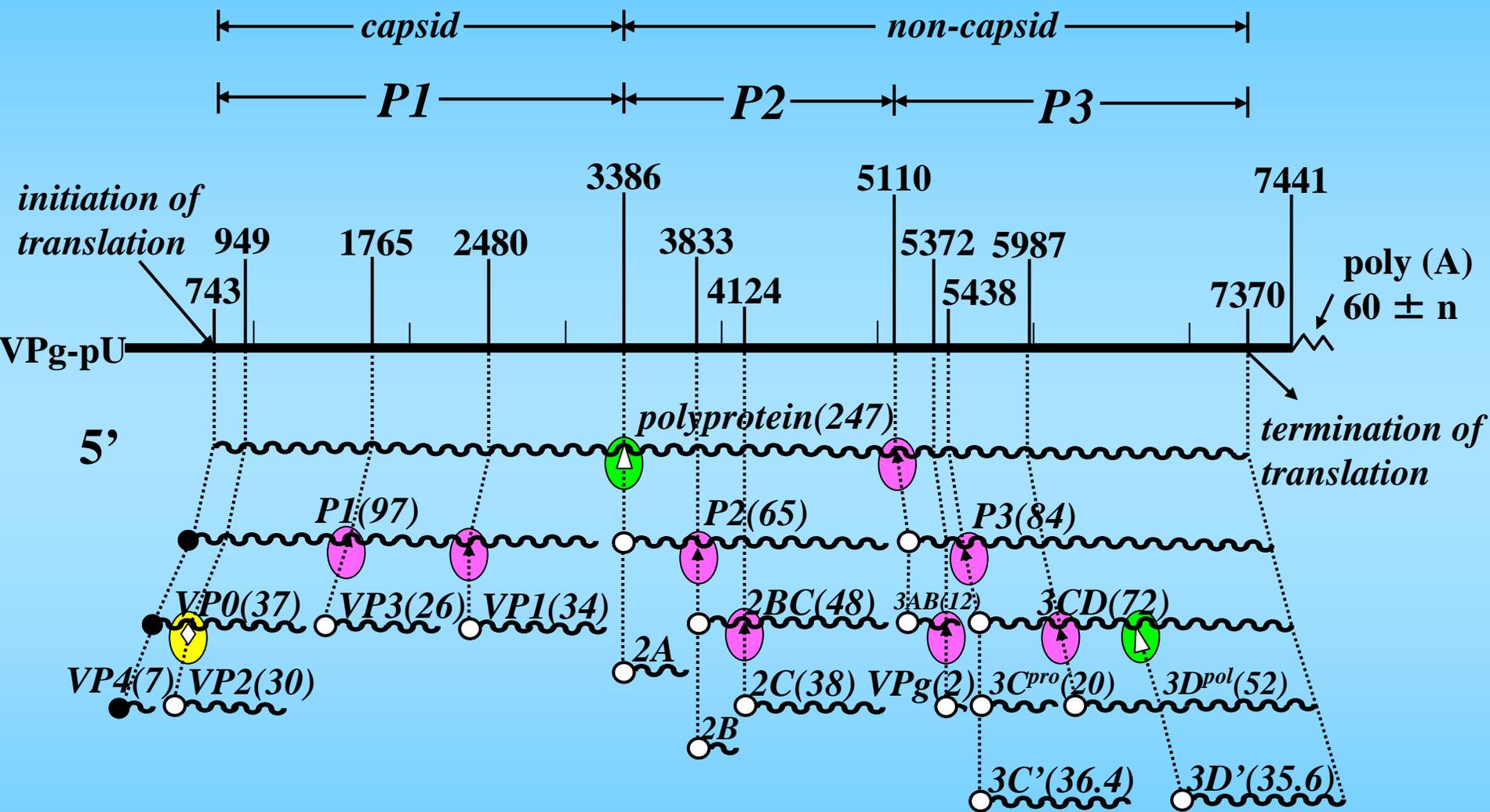


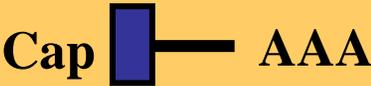
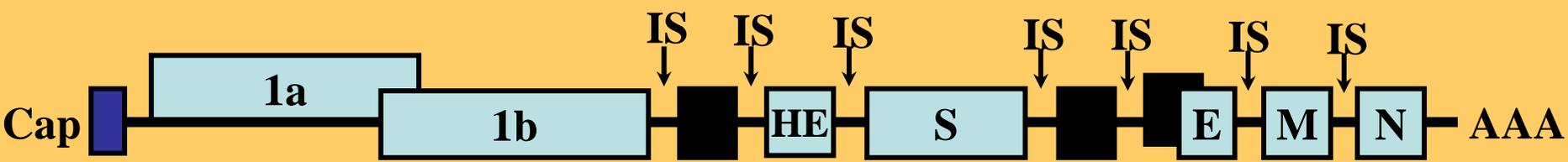


A**B****C**

Structure of virus genome and classification based on genetic code expression

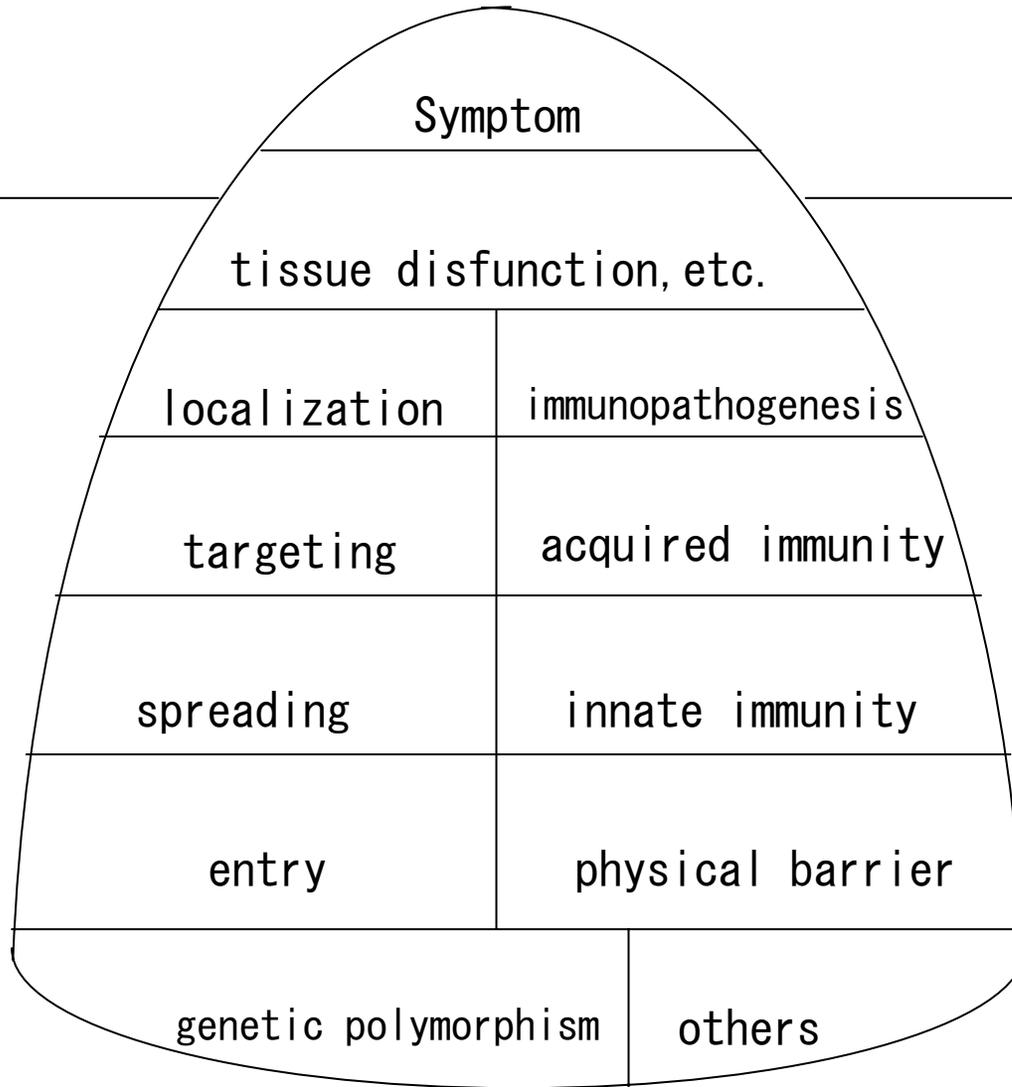






■ : putative nonstructural protein
 IS : conserved intergenic sequence

From infection to outbreak (Koriyama theory)



Virus pathogenicity and bio-defense

