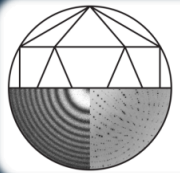


# Structure and replication cycle of a virus infecting climate-modulating alga *Emiliana huxleyi*

Miroslav Homola



Plevka Lab  
Structural virology

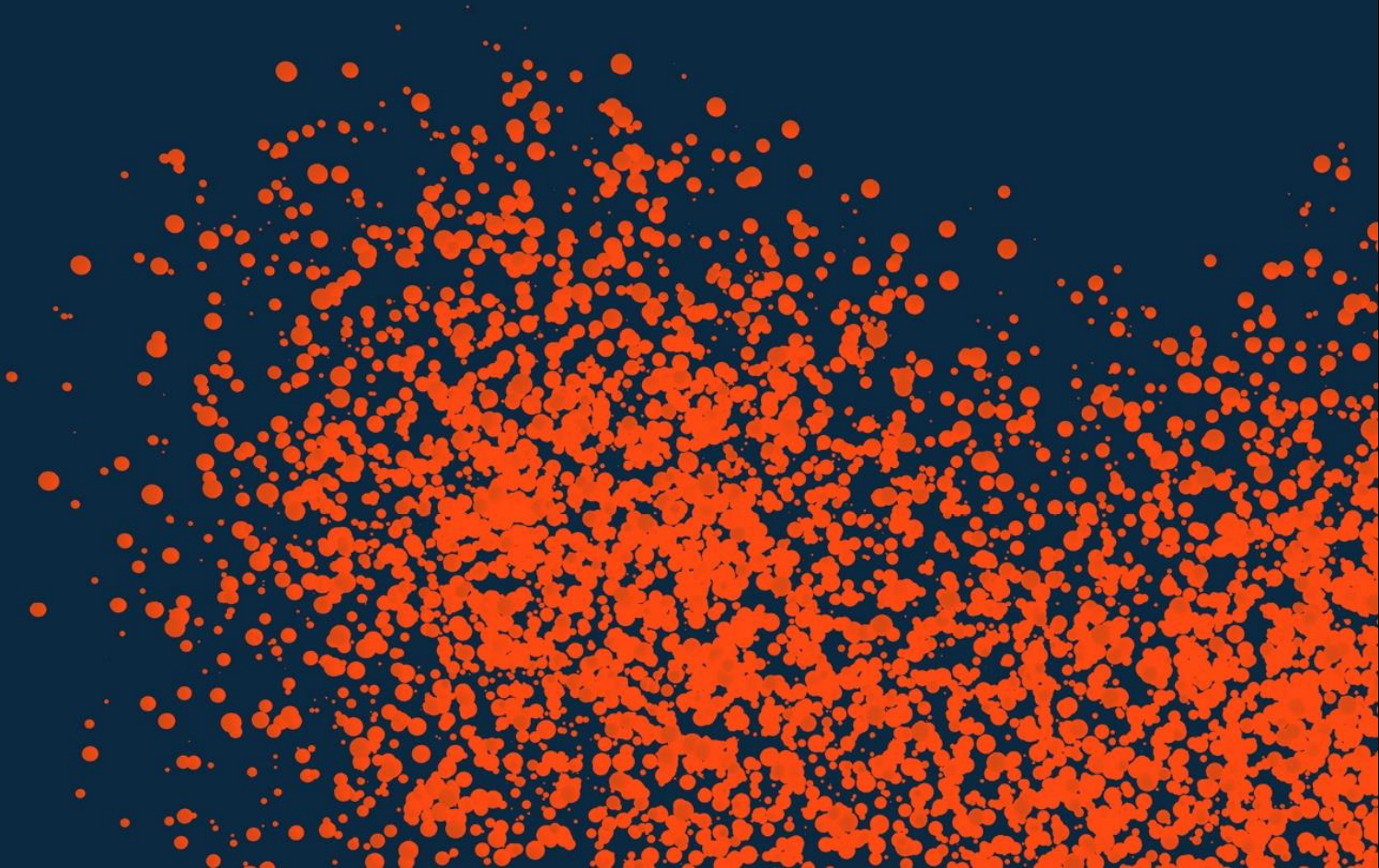


CEITEC  
MASARYK UNIVERSITY



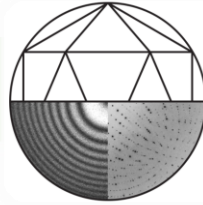
NIVB

National Institute  
of Virology and Bacteriology

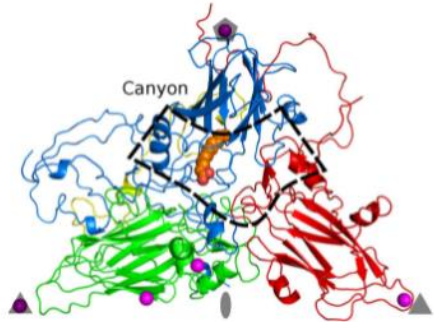


# Structural virology lab

CEITEC  
PLEVKA LAB



Plevka Lab  
Structural virology

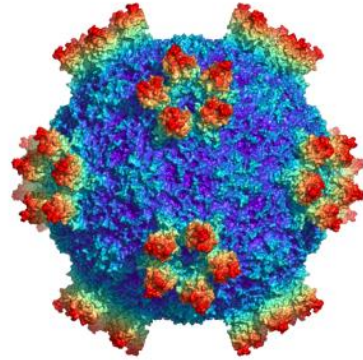


## Human Viruses

We study human viruses from families *Flaviviridae*, *Togaviridae*, tick-borne encephalitis virus, *Herpesviridae*, Plevka viruses and *Picornaviridae*, including rhinoviruses and coronaviruses. We aim to structure and characterize replication cycles of these viruses and their interactions with the immune system.

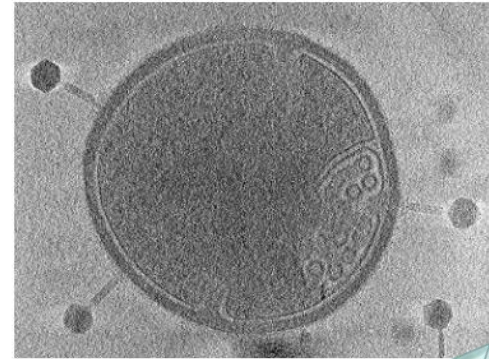


picoRNAviruses



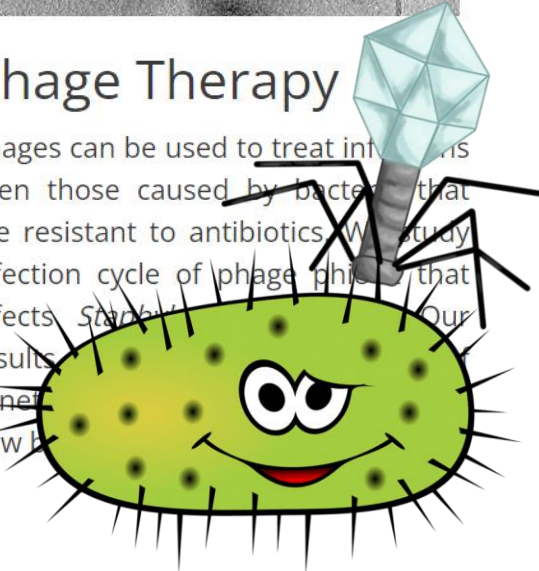
## Honeybee Viruses

Honeybees (*Apis mellifera*) are vital for agricultural industry by providing pollination for many food crops. However, the beekeeper suffers from virus infections that cause colony losses. We study honeybee viruses and their replication cycles in order to develop antiviral compounds.



## Phage Therapy

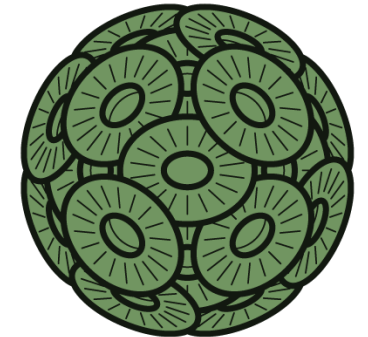
Phages can be used to treat infections, even those caused by bacteria that are resistant to antibiotics. We study the infection cycle of phage phiC31 that infects *Sarcoma*. Our results show that phage phiC31 generally does not cause new infections.



bacteriophages



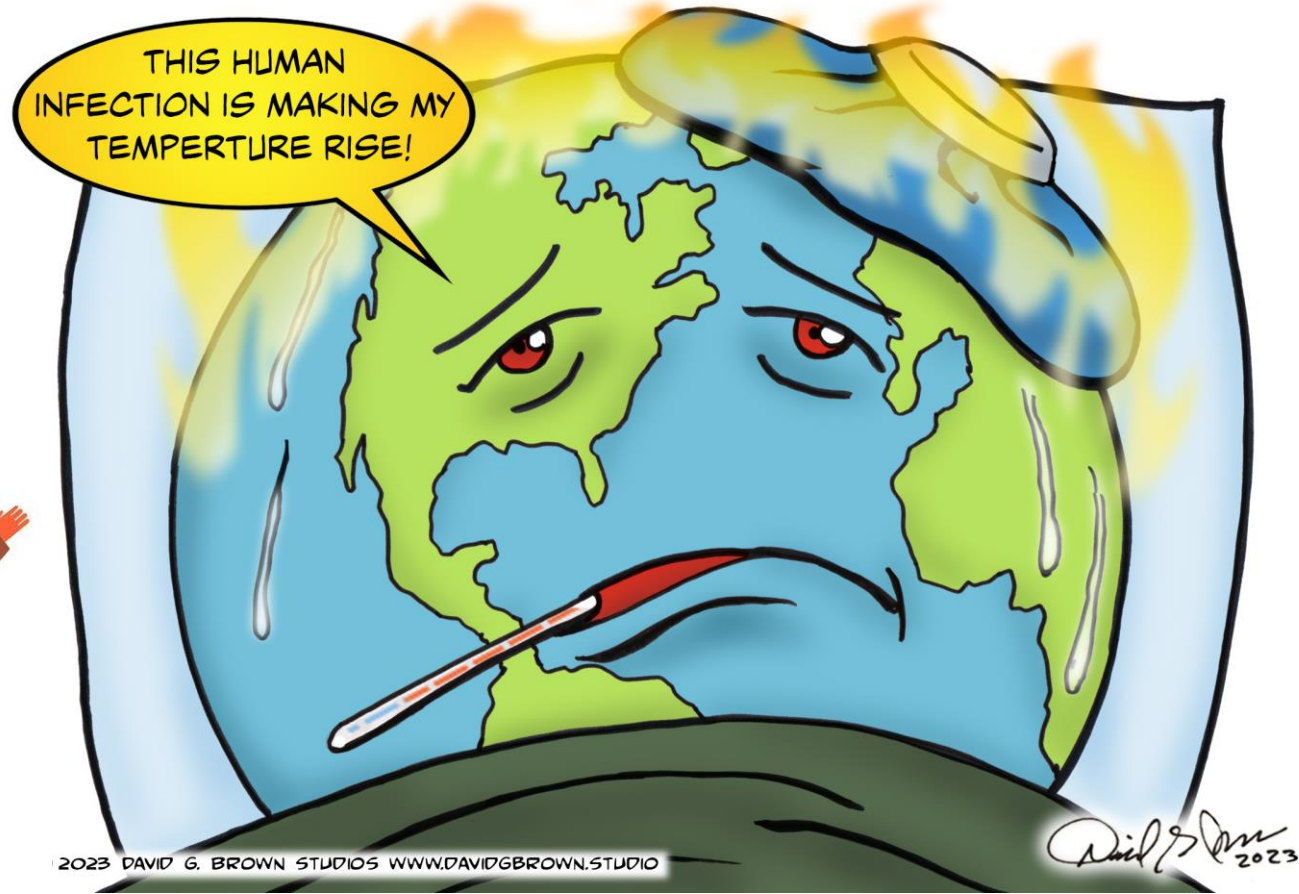
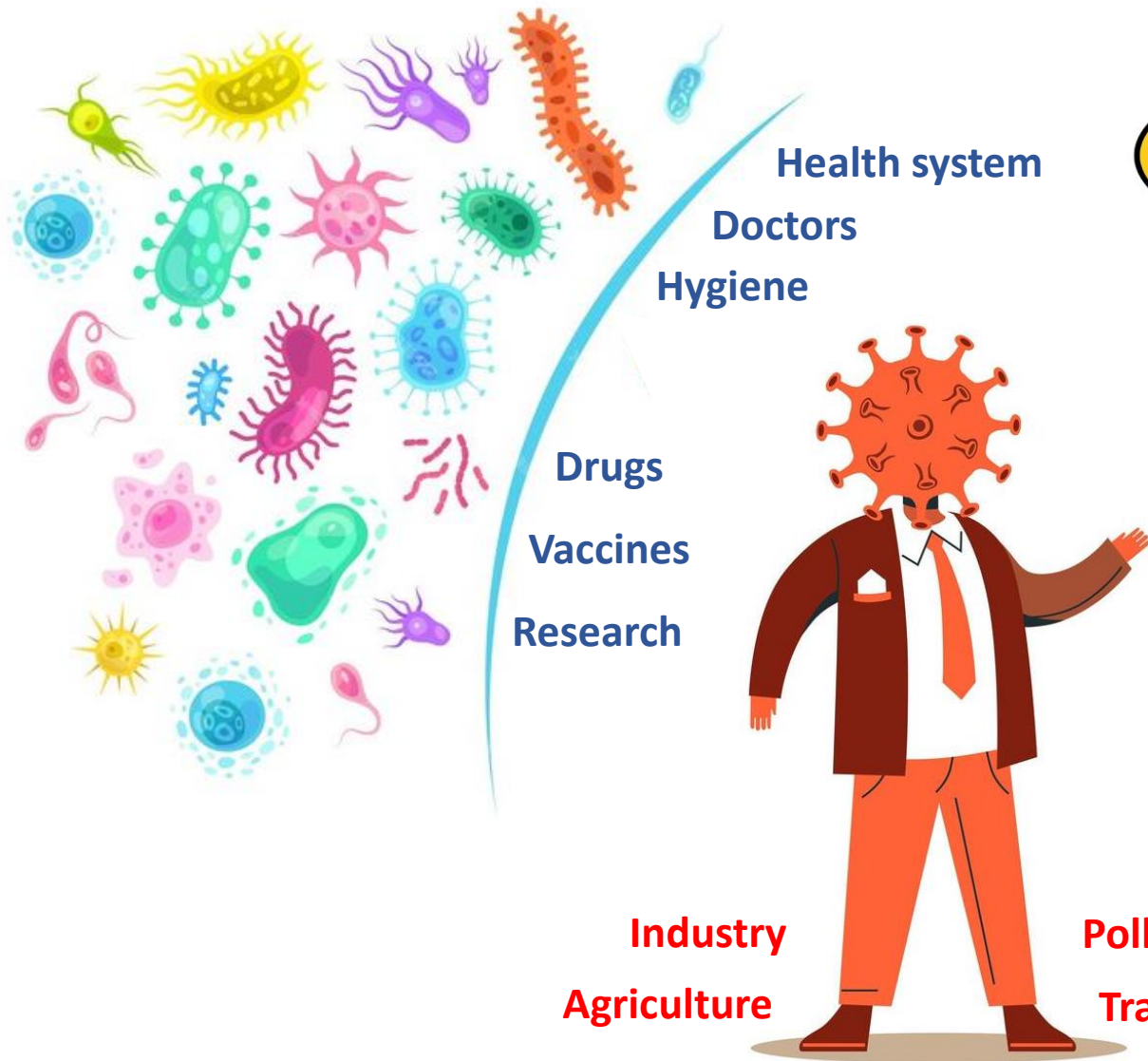
## Marine algae viruses



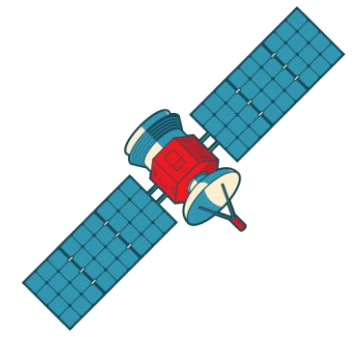
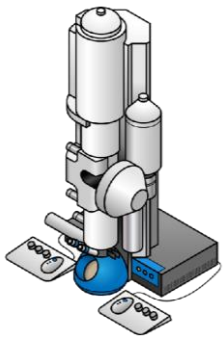
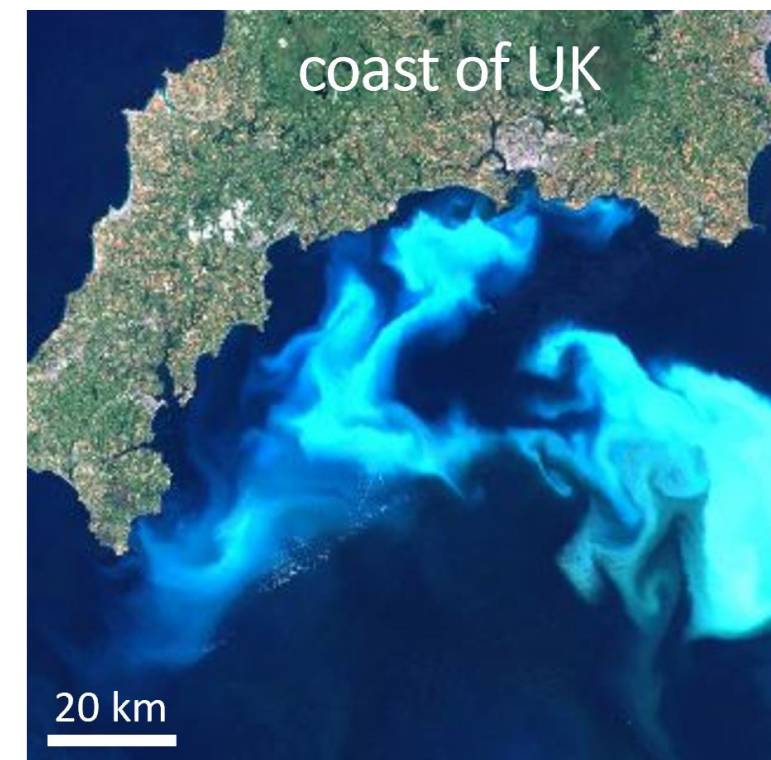
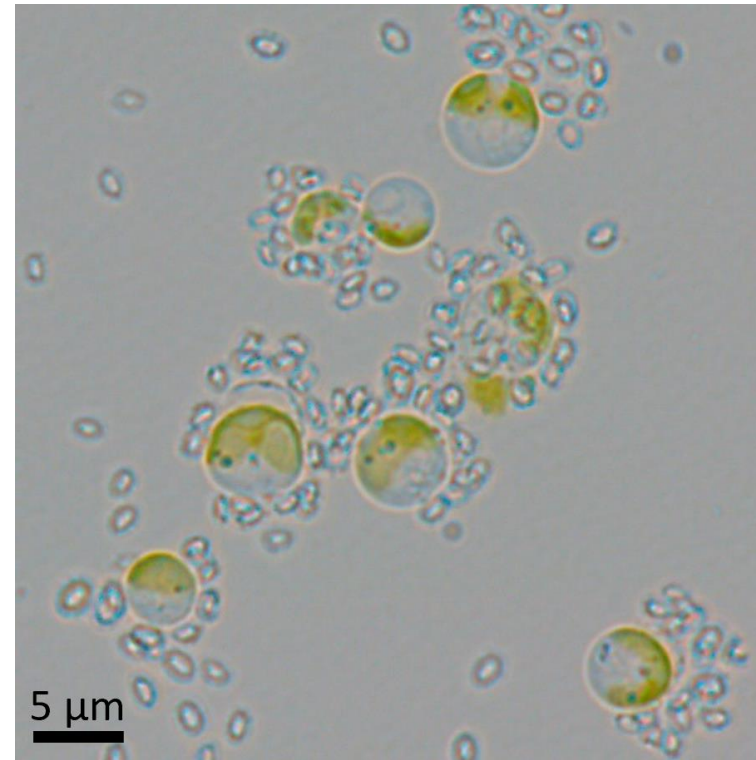
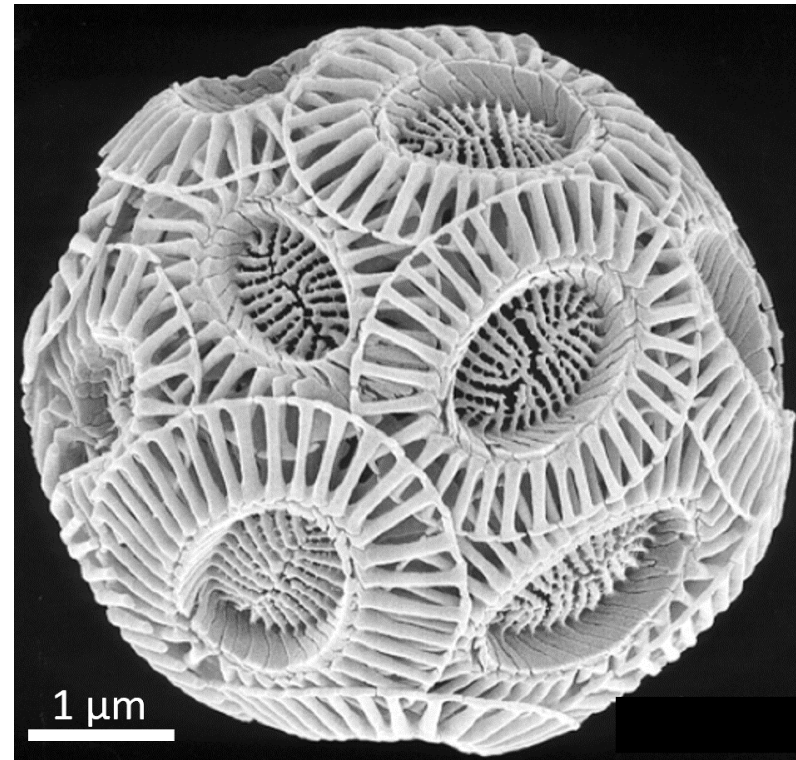
NCLDV's



# Human pathogen vs. human as a pathogen

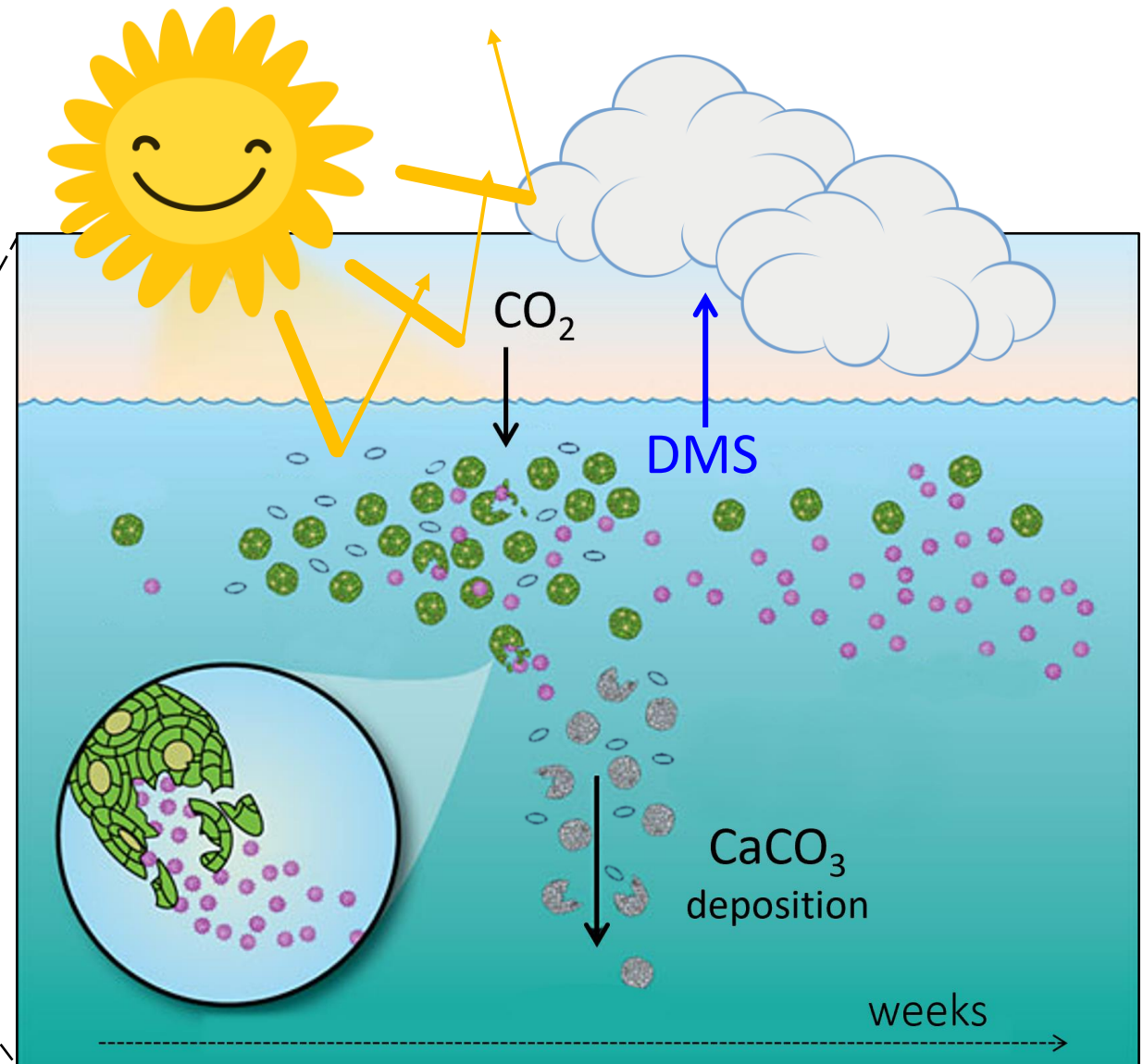
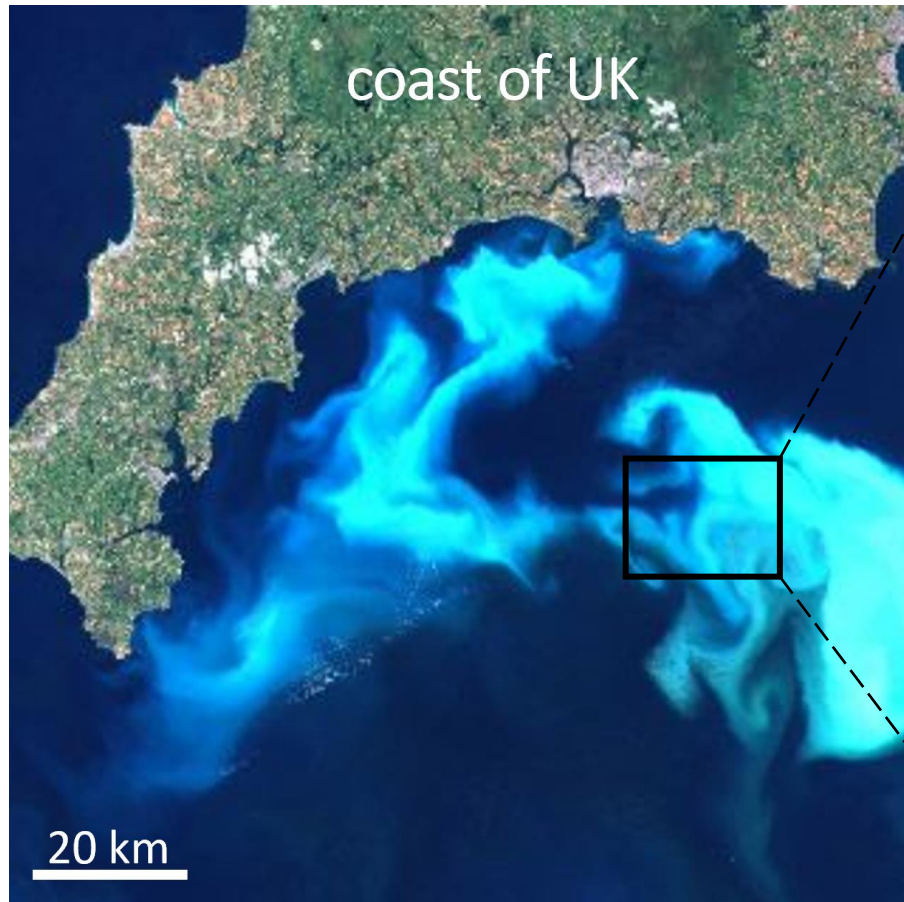


# Marine alga *Emiliana huxleyi*

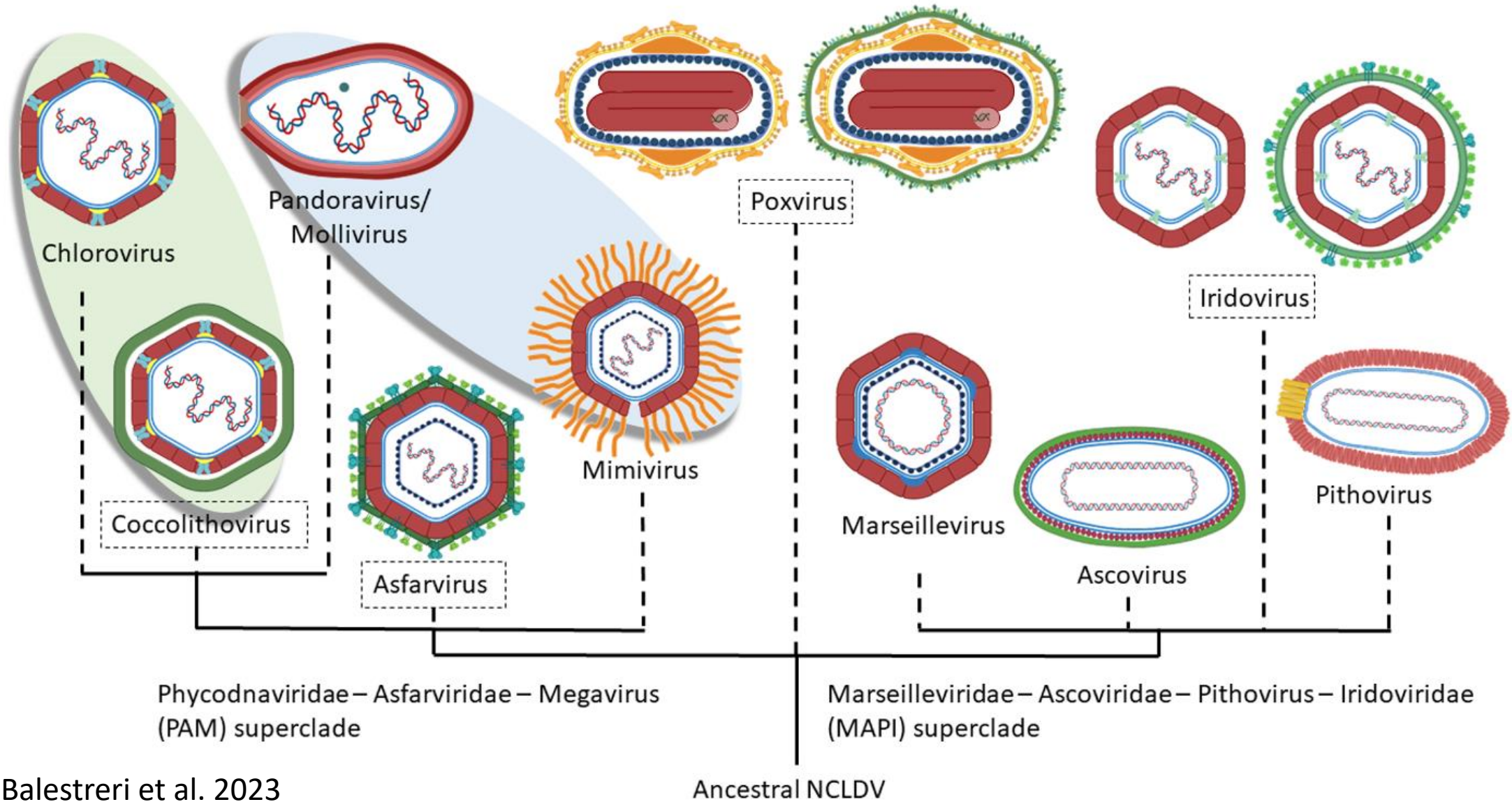




# Blooms of the *Emiliana huxleyi* alga



# *Emiliana huxleyi* virus 201 (EhV-201)

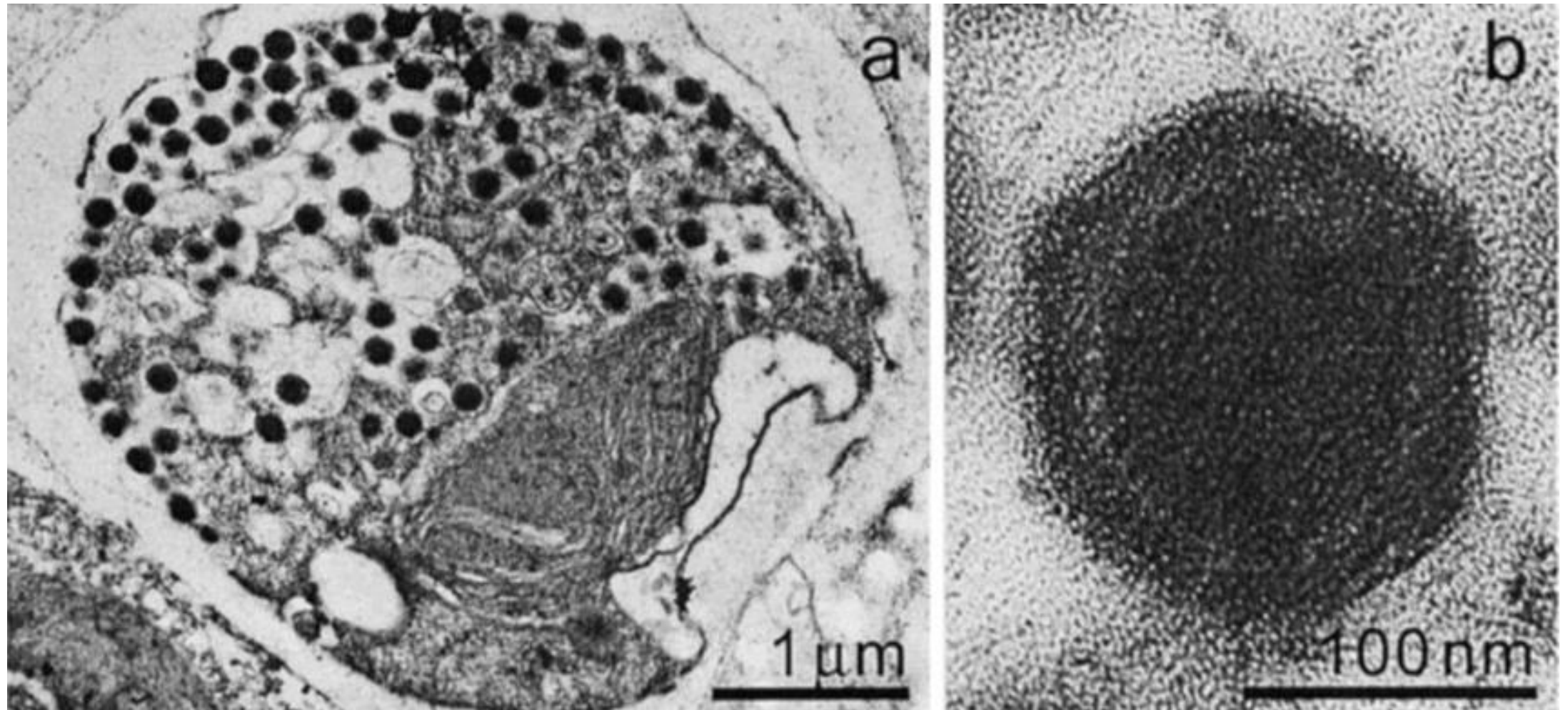


Balestreri et al. 2023

Ancestral NCLDV



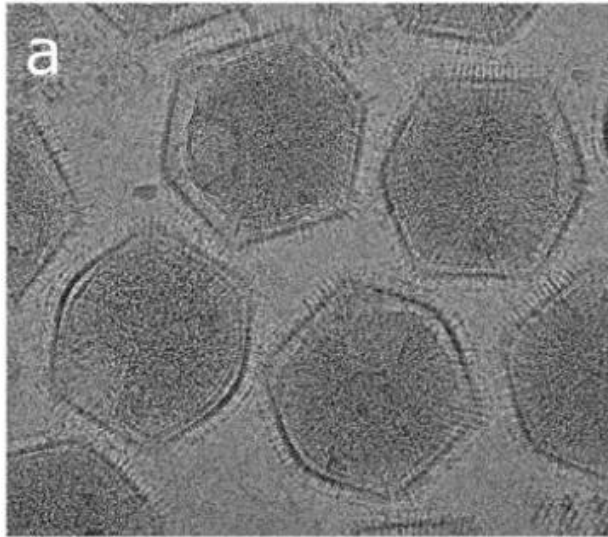
# *Emiliana huxleyi* virus 201 (EhV-201)



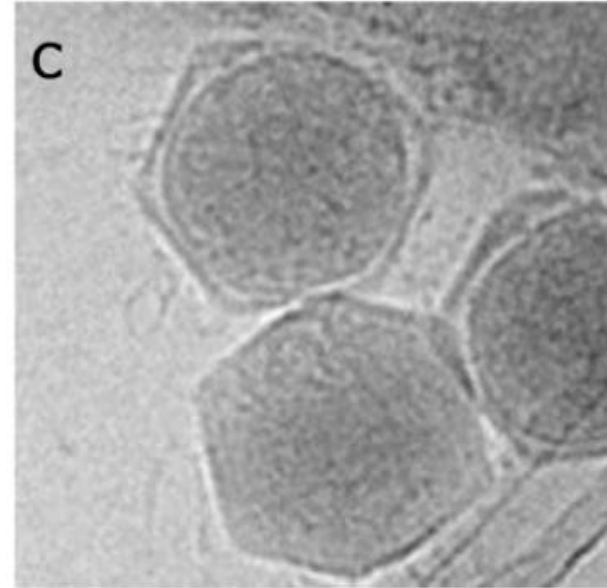
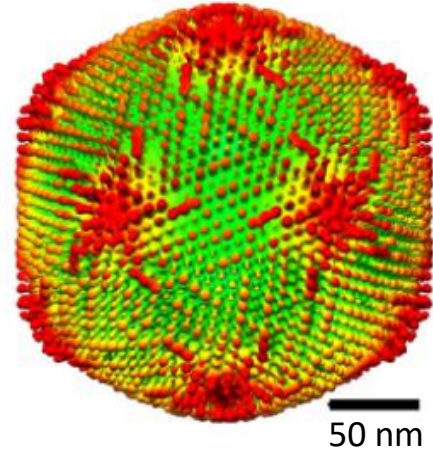
Castberg et al. 2001



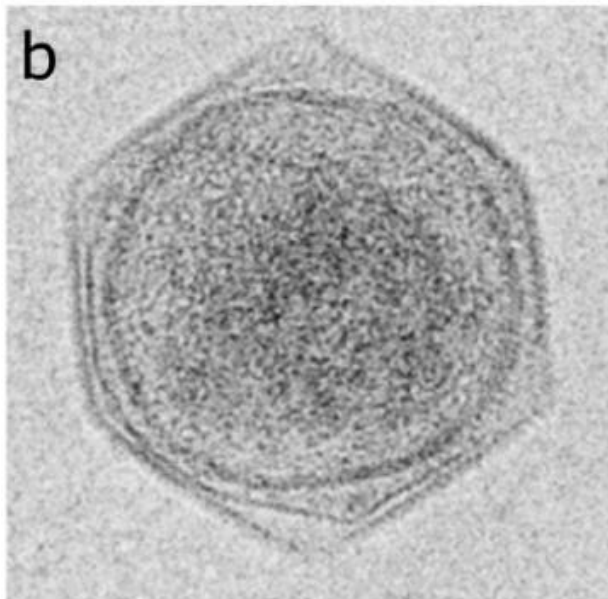
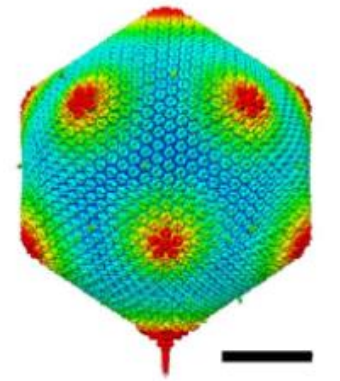
# Related viruses



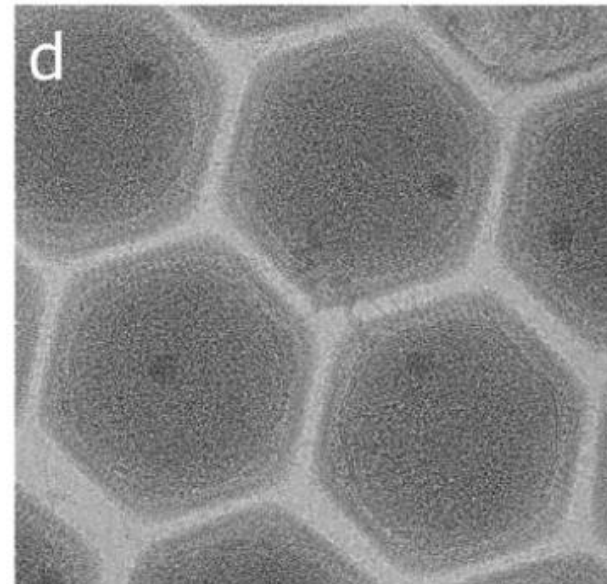
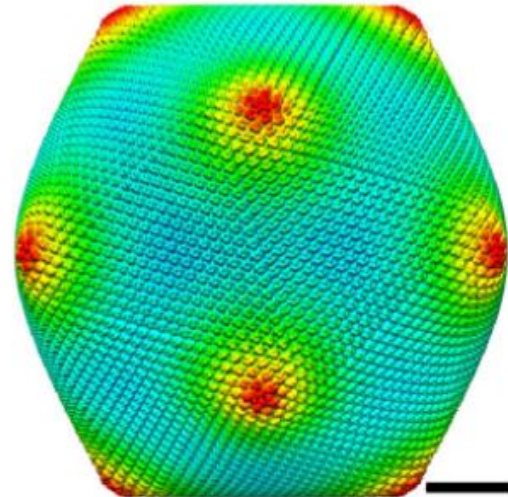
Medusavirus T=277



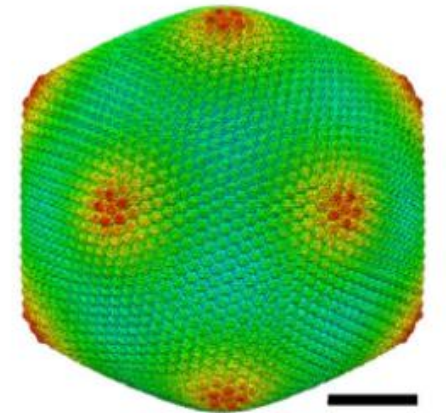
PBCV-1 T=169



CroV T=499



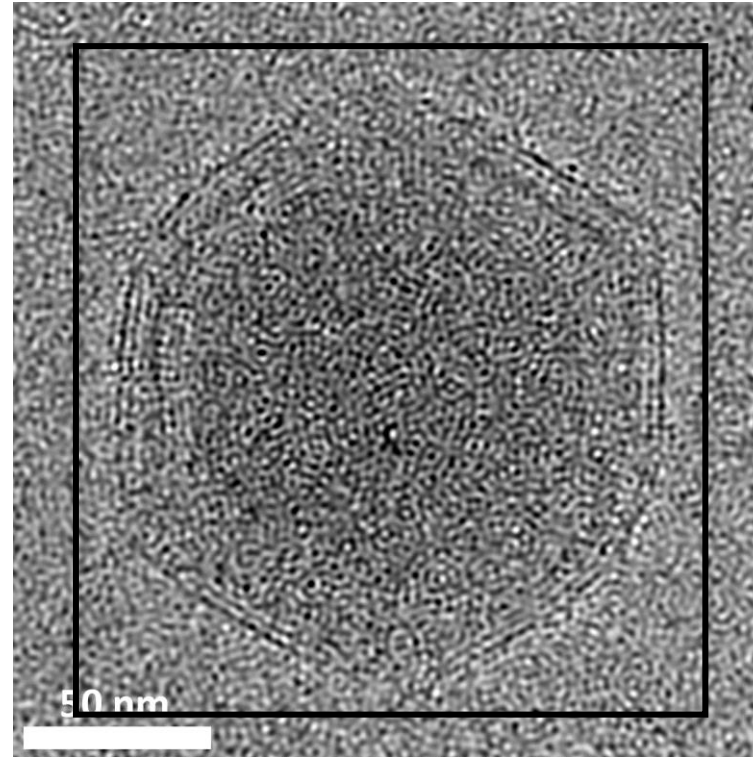
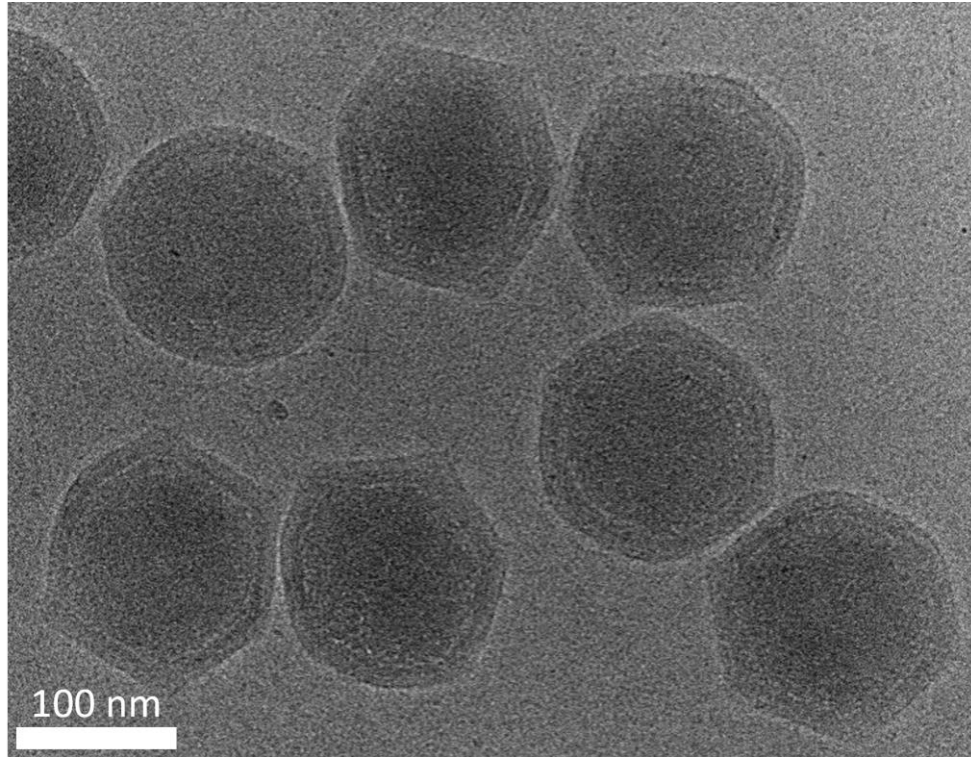
Melbournevirus T=309





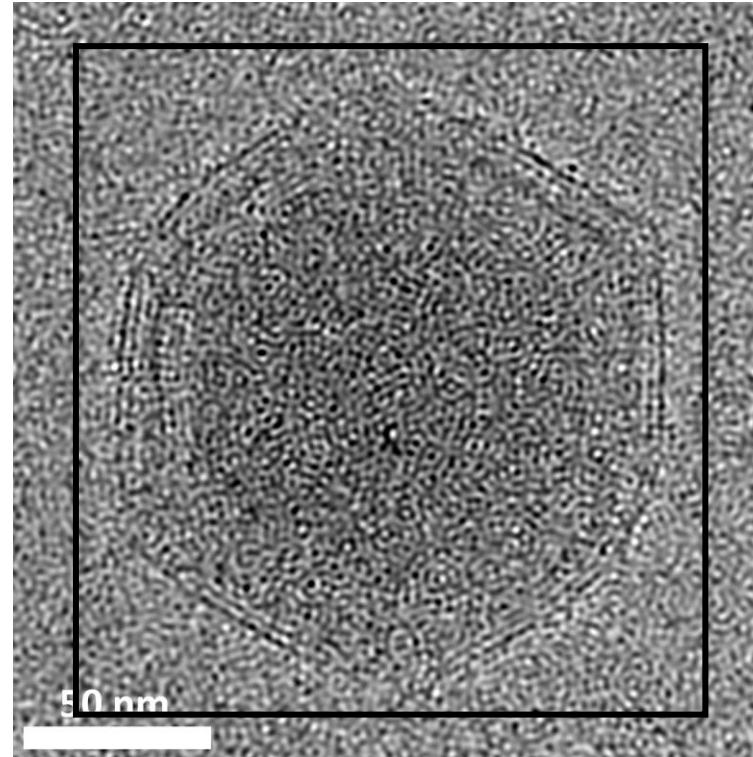
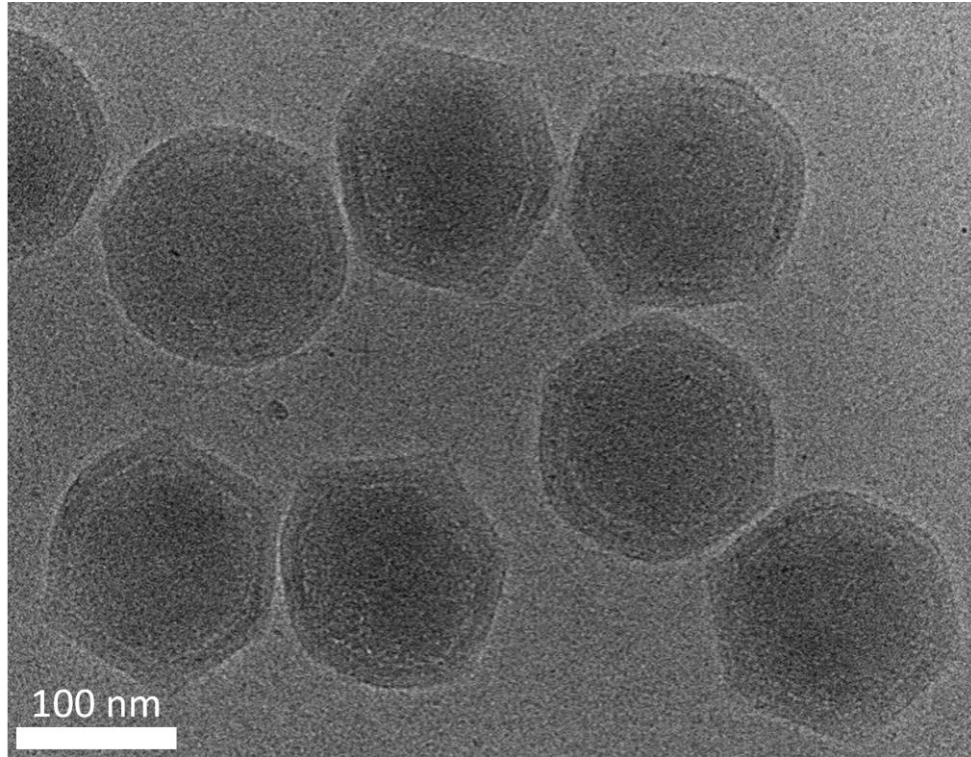
# Single-particle analysis of EhV-201 cryo-EM data

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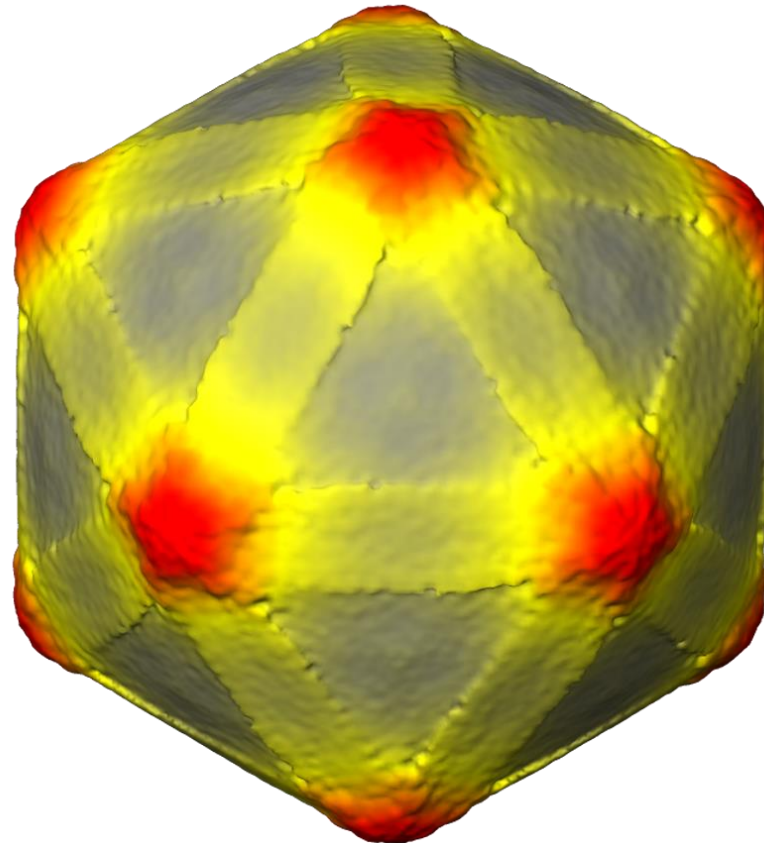
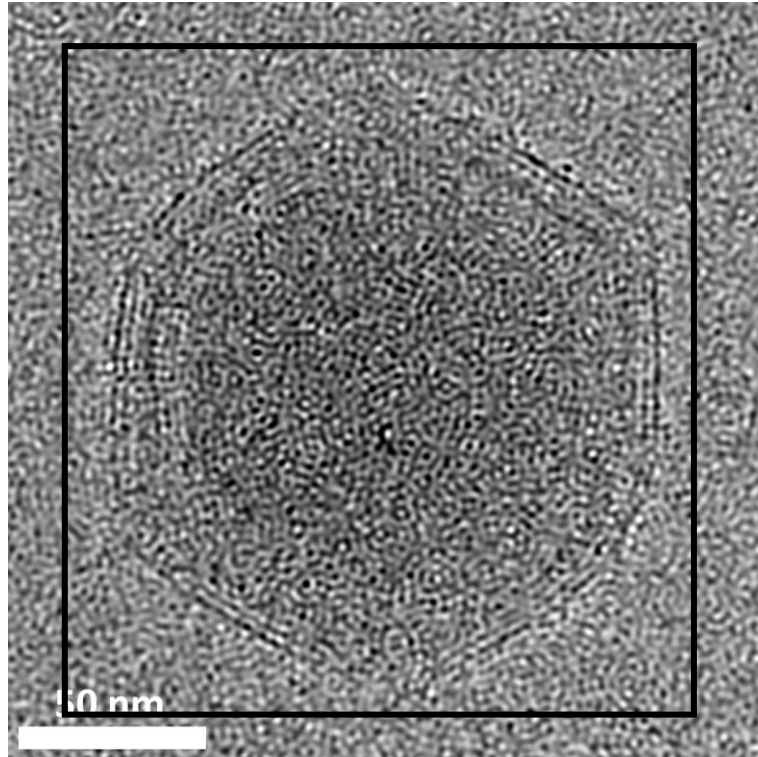
# Single-particle analysis of EhV-201 cryo-EM data

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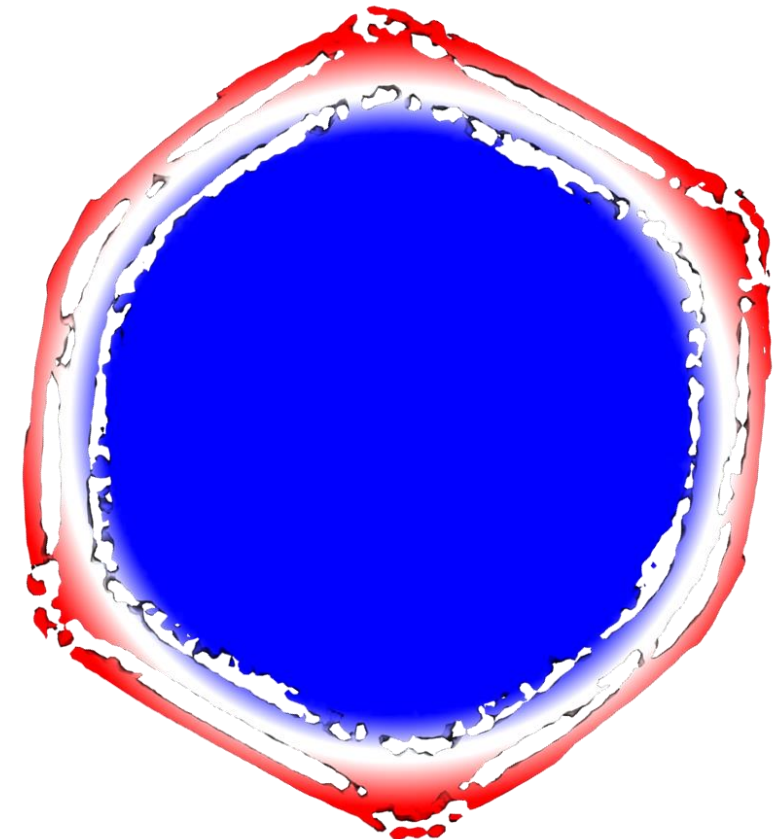
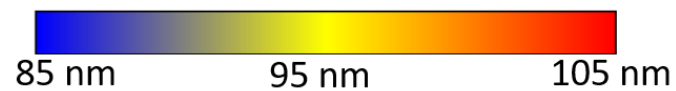




# Single-particle analysis of EhV-201 cryo-EM data

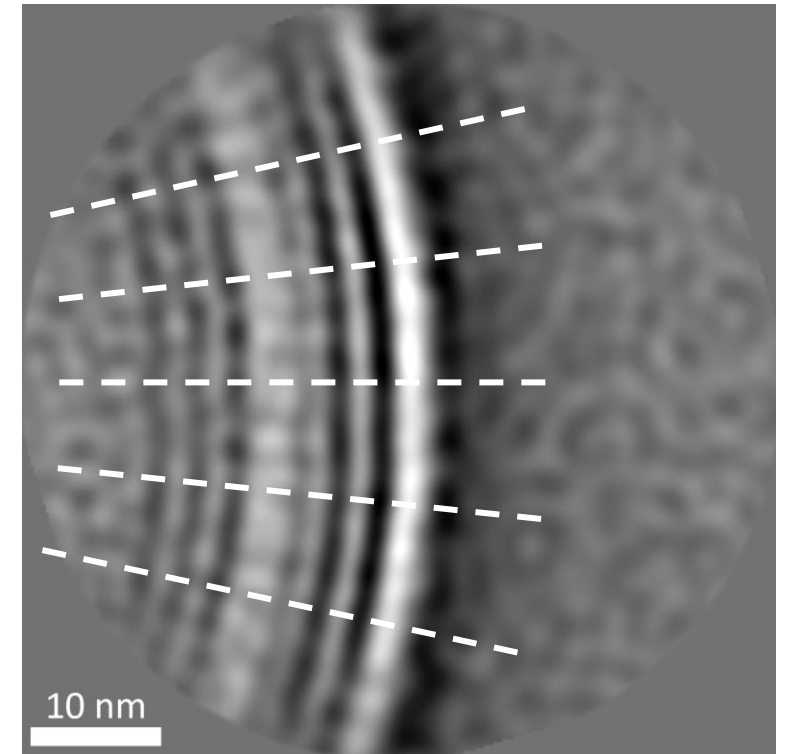
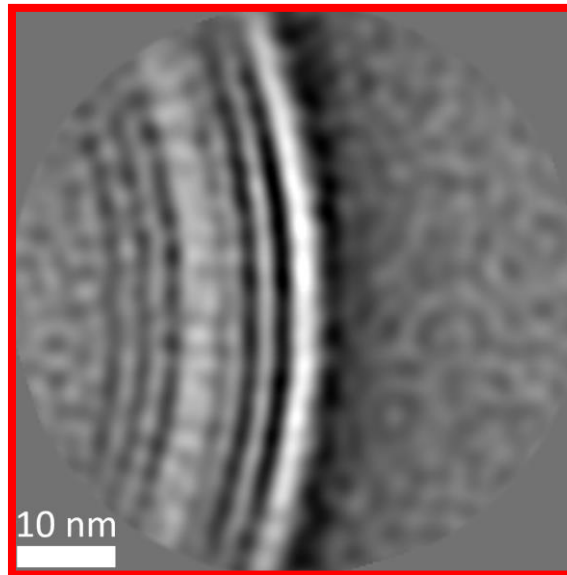
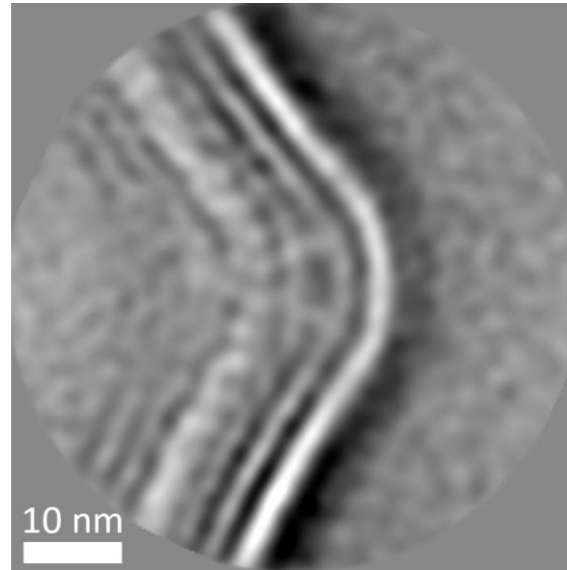
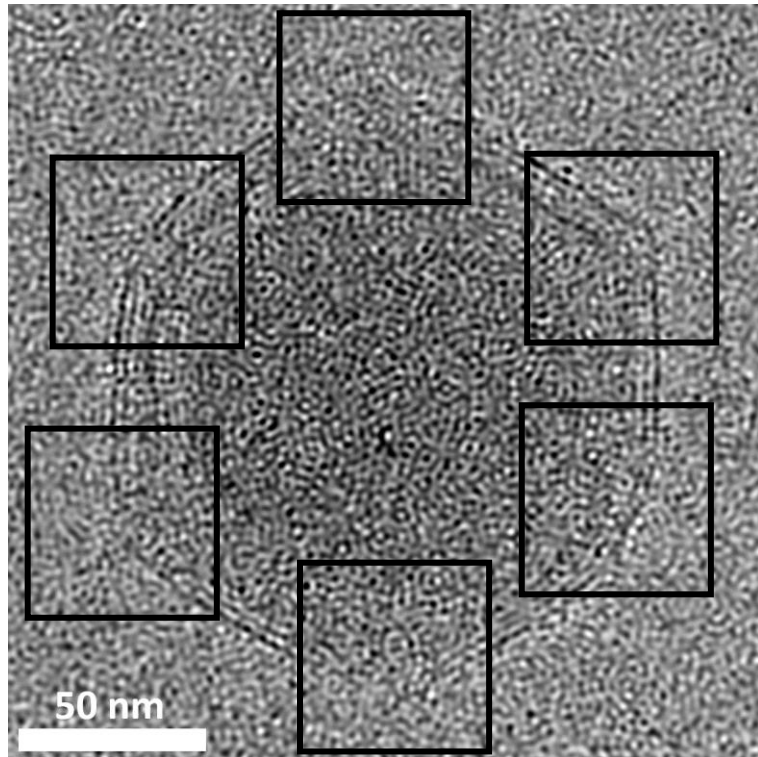


distance from particle center



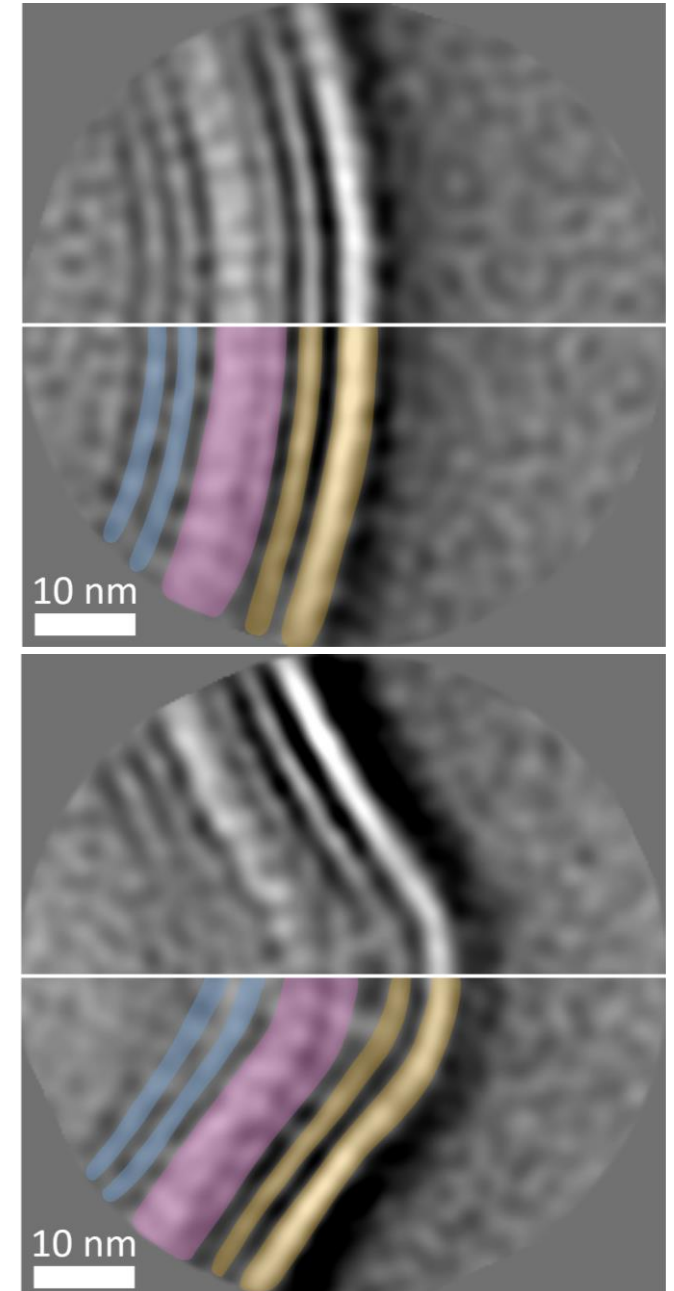
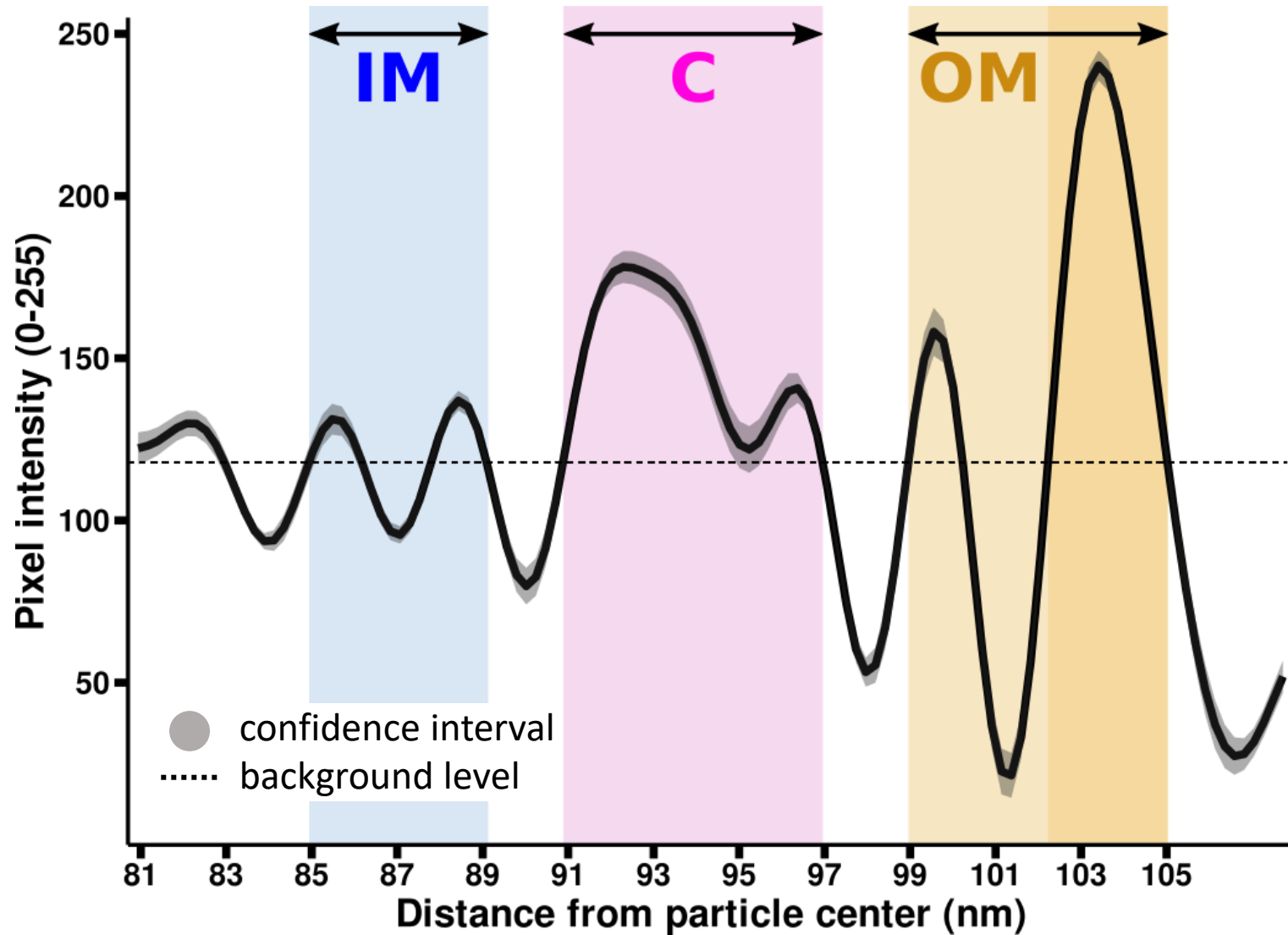
● membrane ○ capsid ● genome

# Localized single-particle analysis of EhV-201 cryo-EM data

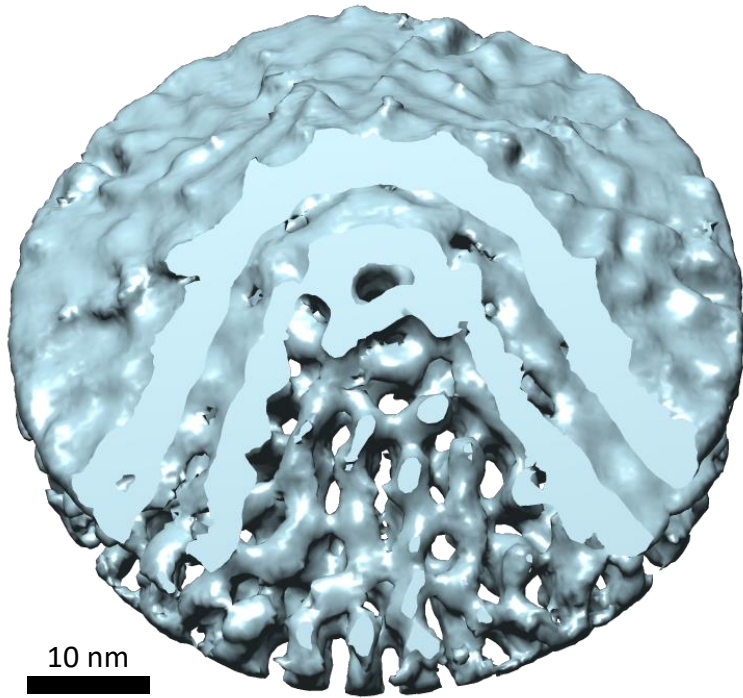




# Analysis of EhV-201 virion surface layers

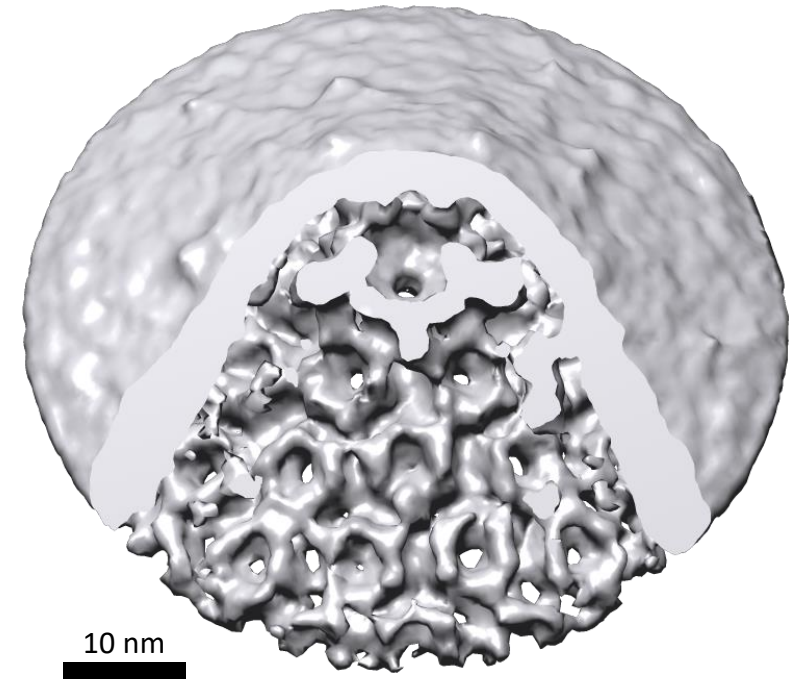
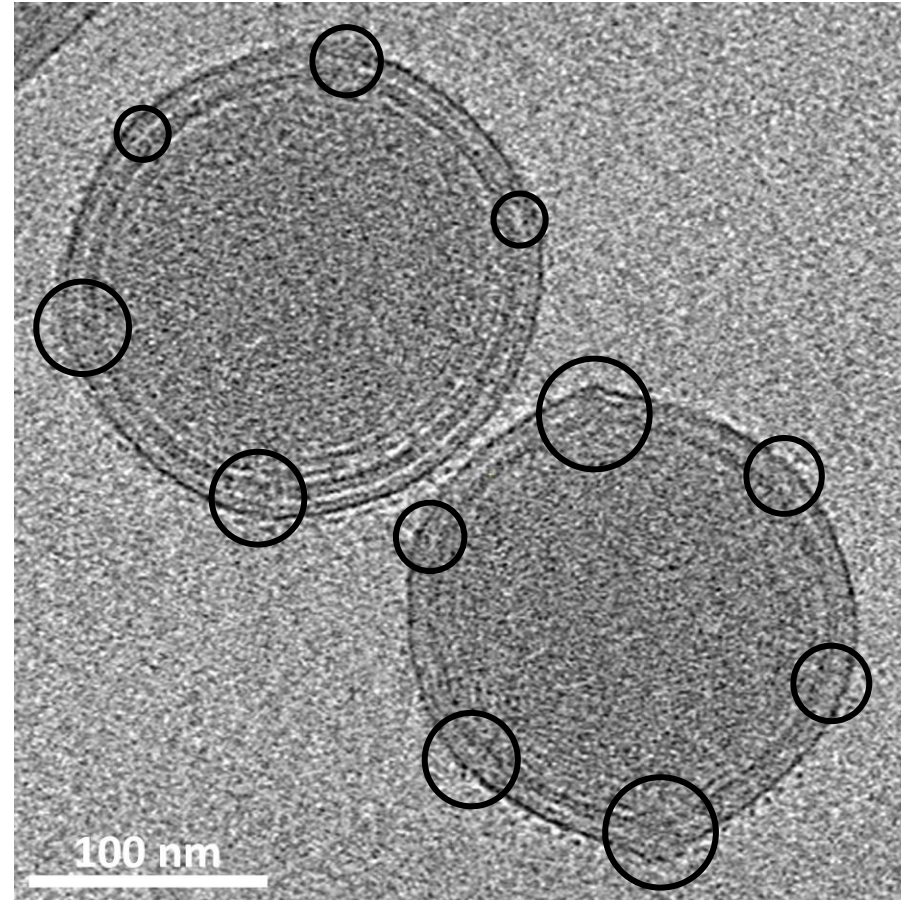


# Sub-tomogram averaging of EhV-201



## Single particle analysis

2.27 apix  
24 Å res.  
3 000 particles

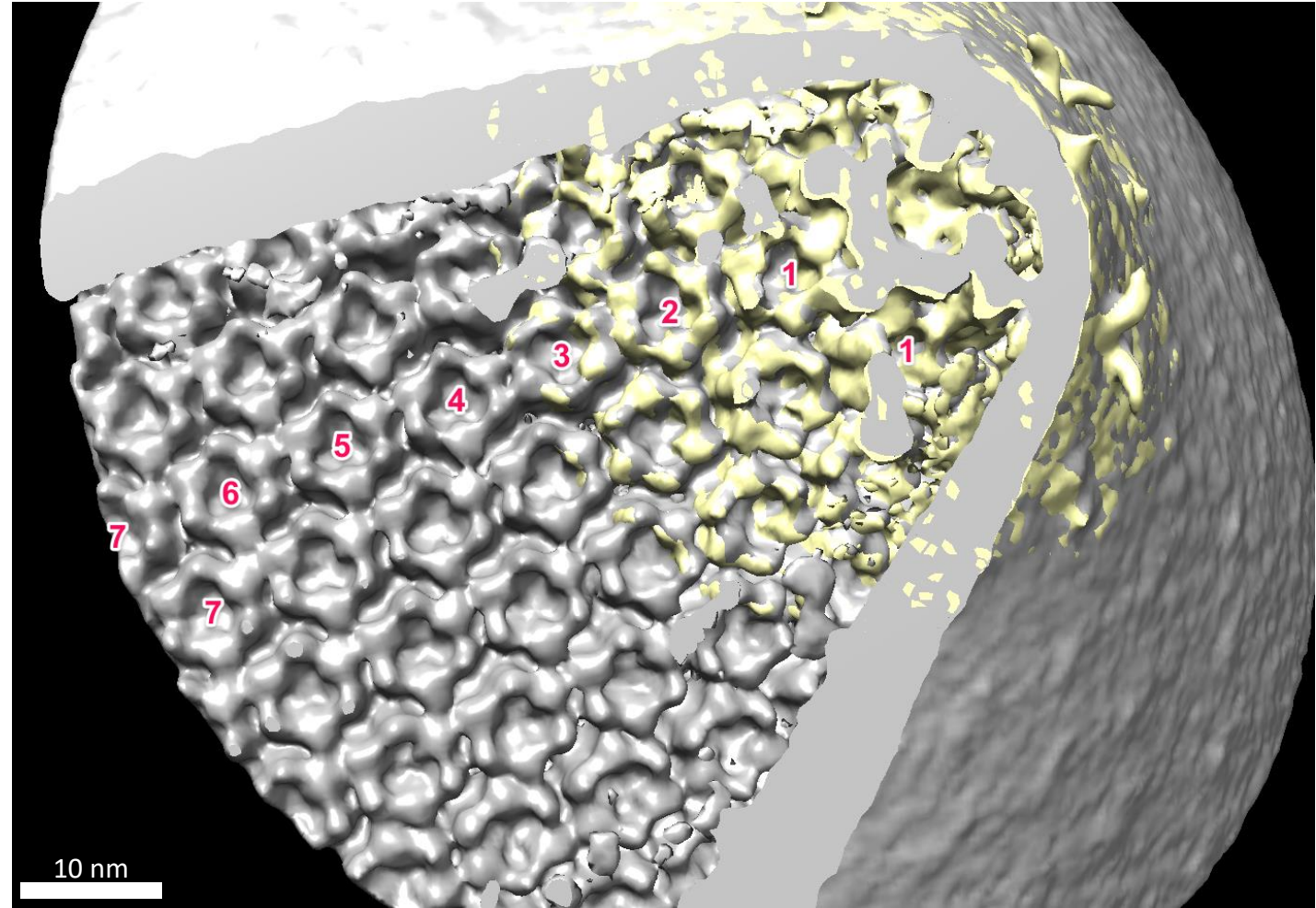
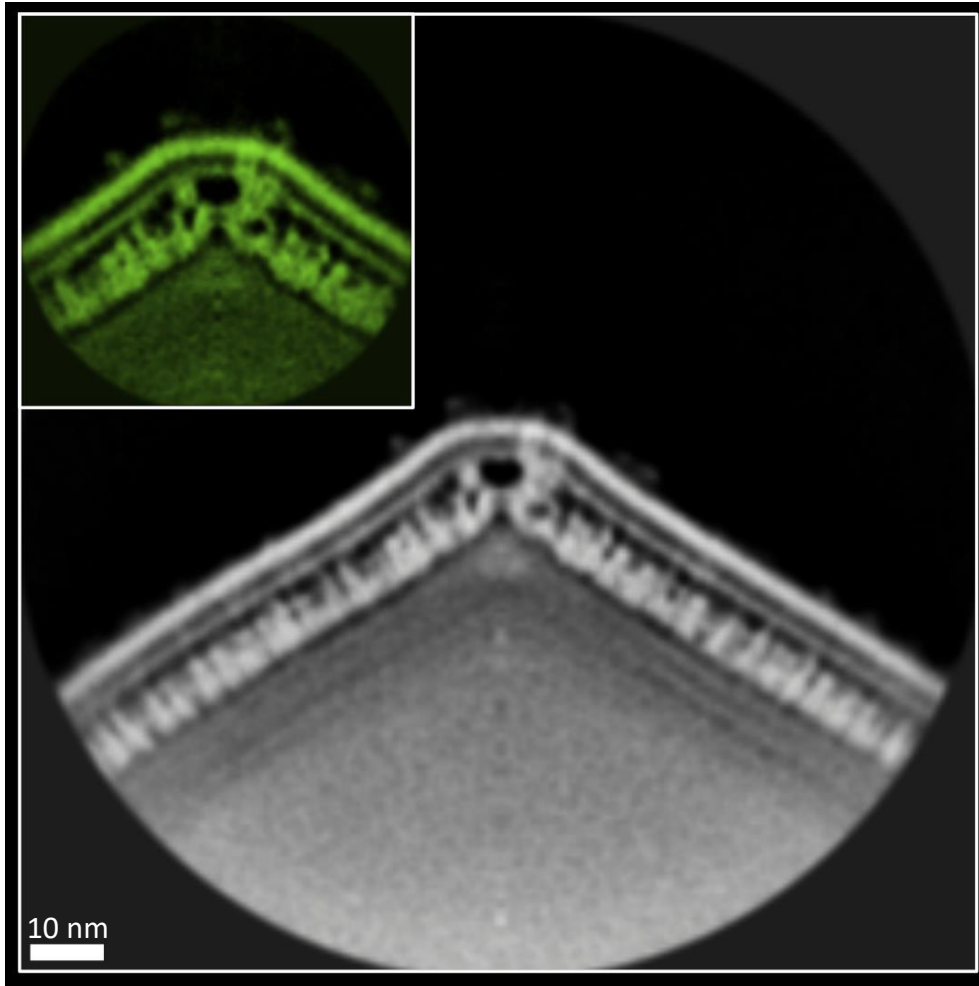


## Sub-tomogram averaging

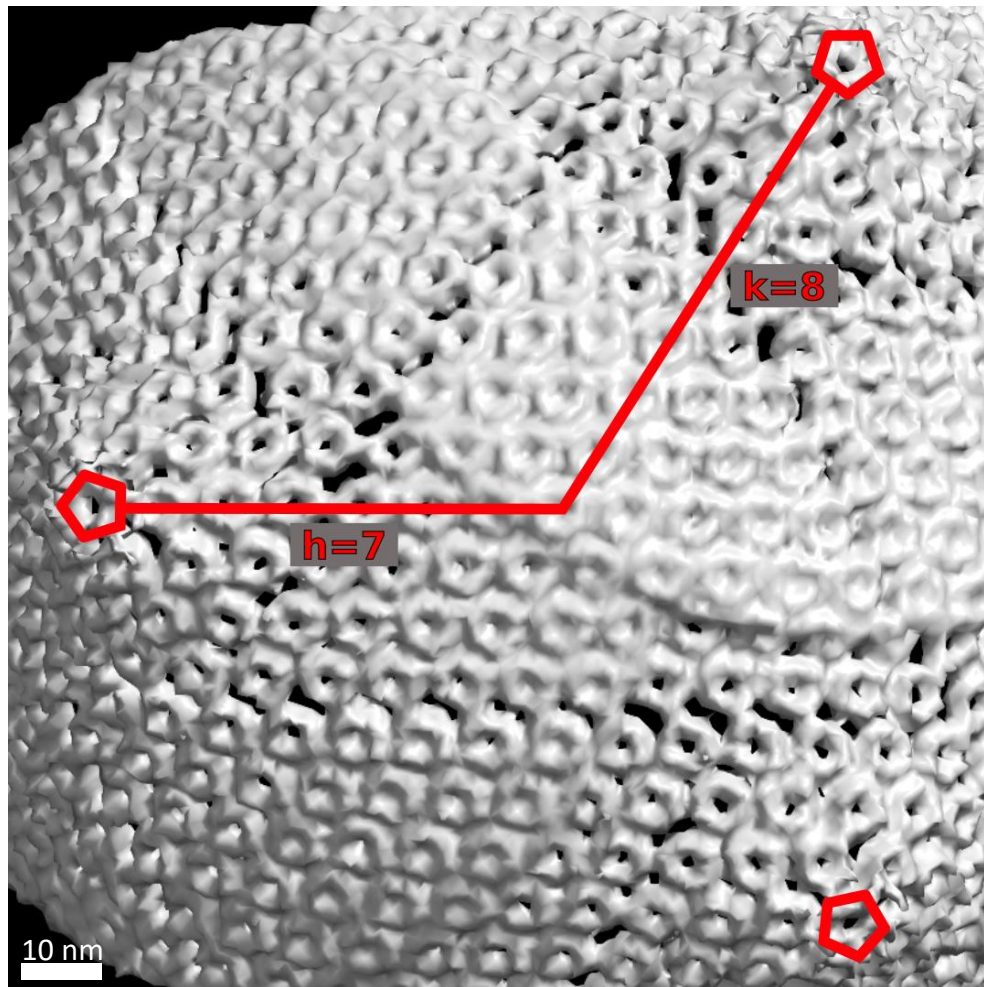
5.36 apix  
22 Å res.  
800 particles



# Bigger piece of capsid around virion vertex

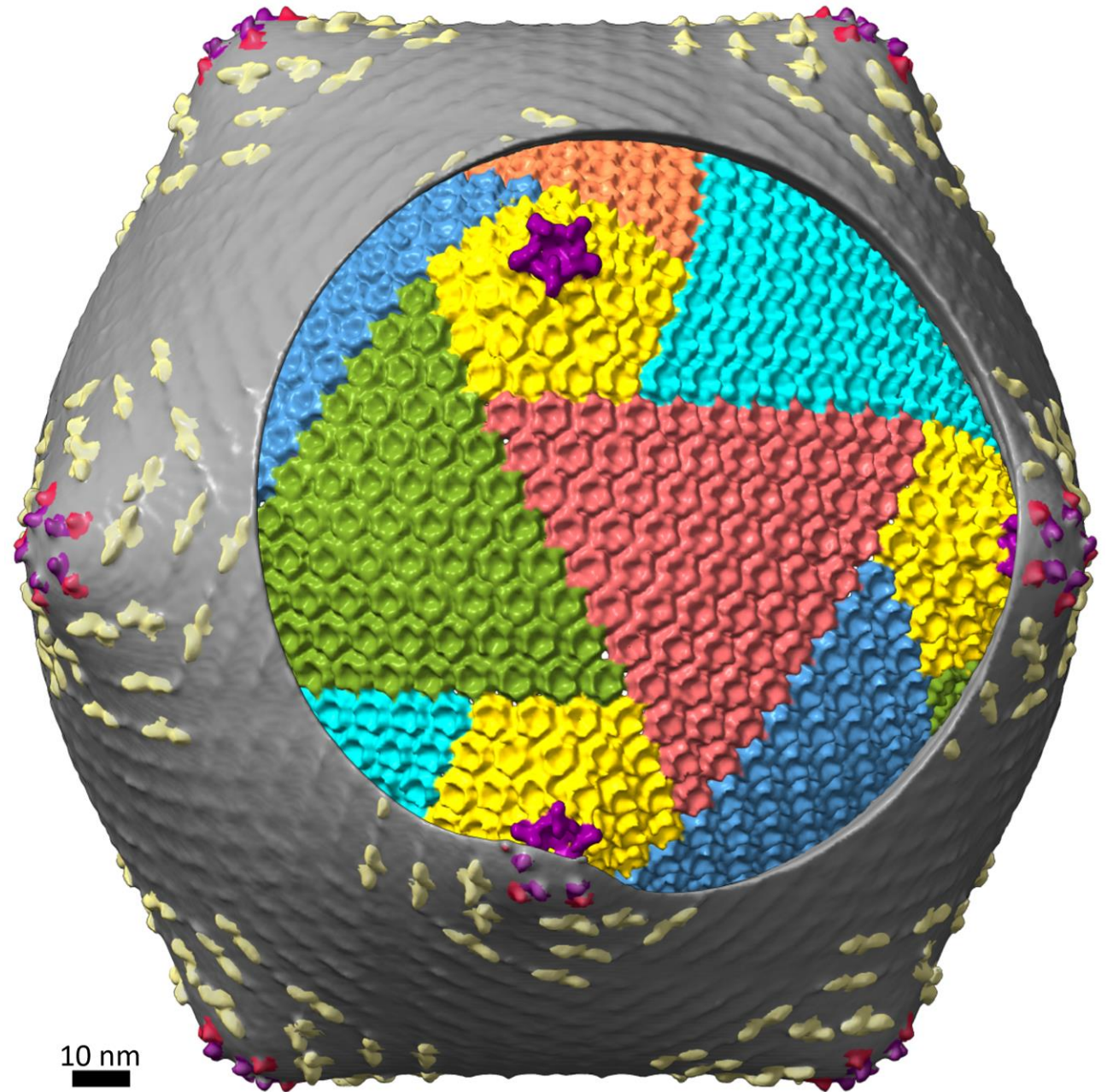
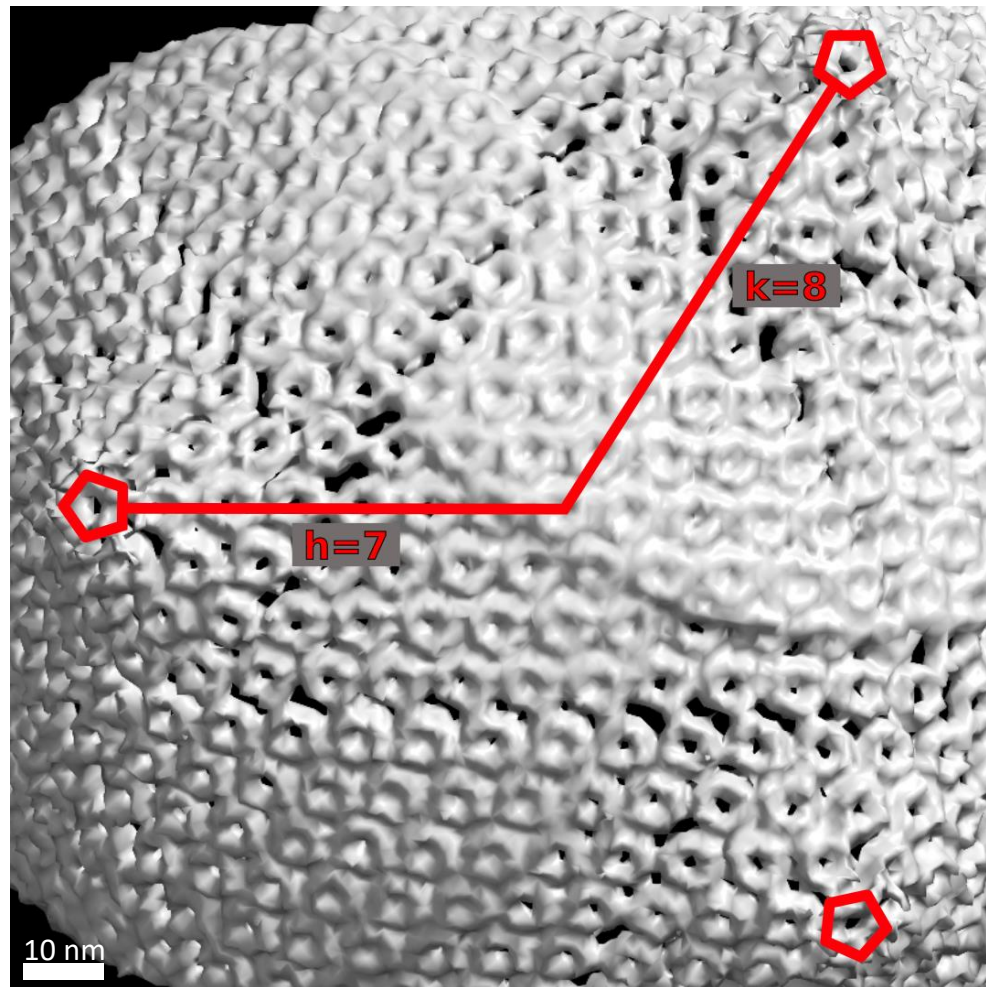


# *T* number and composite map of EhV-201 virion



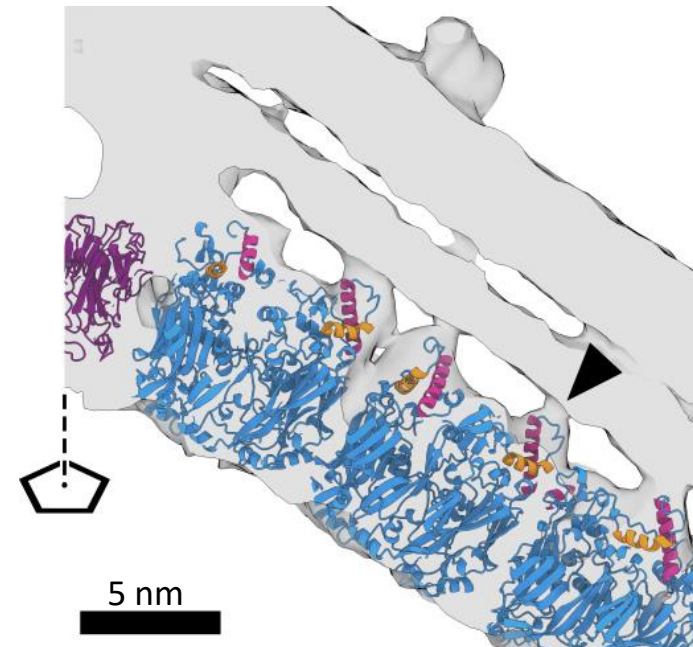
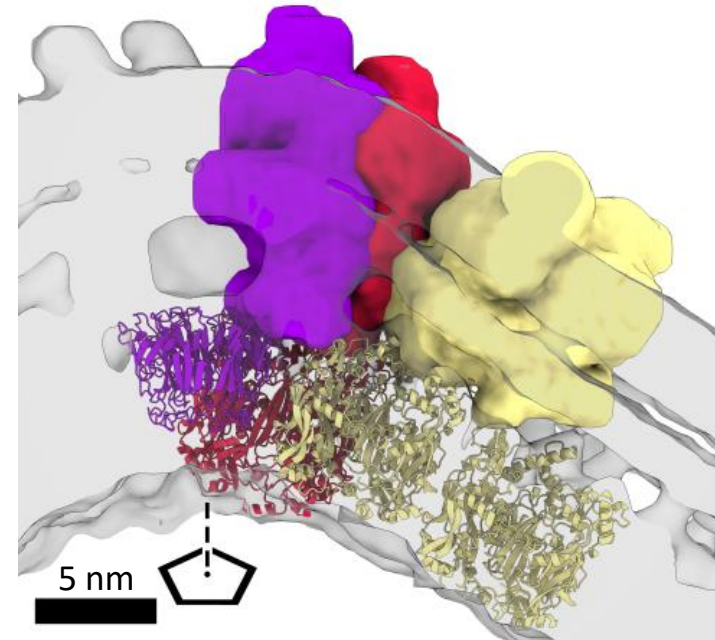
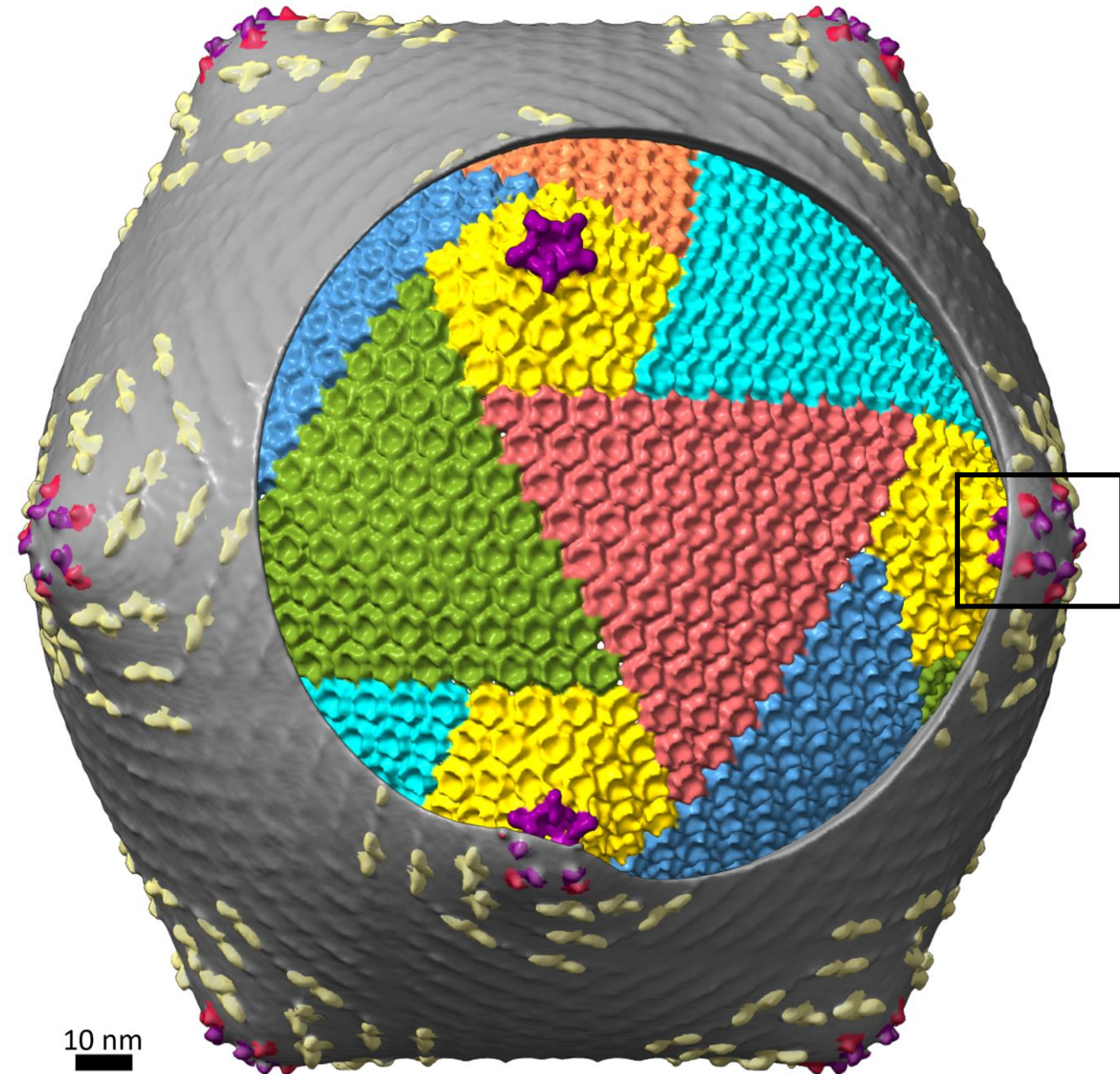


# $T$ number and composite map of EhV-201 virion



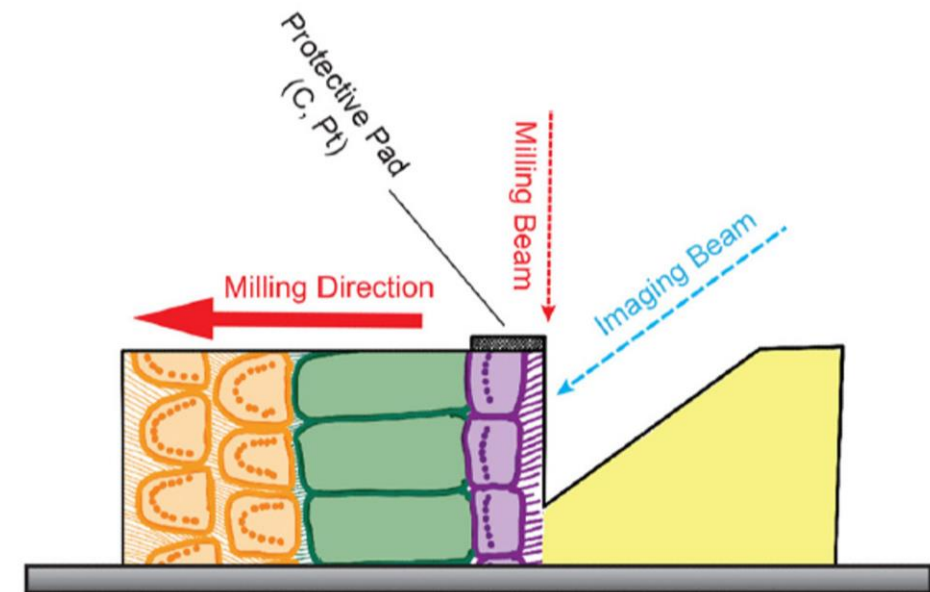
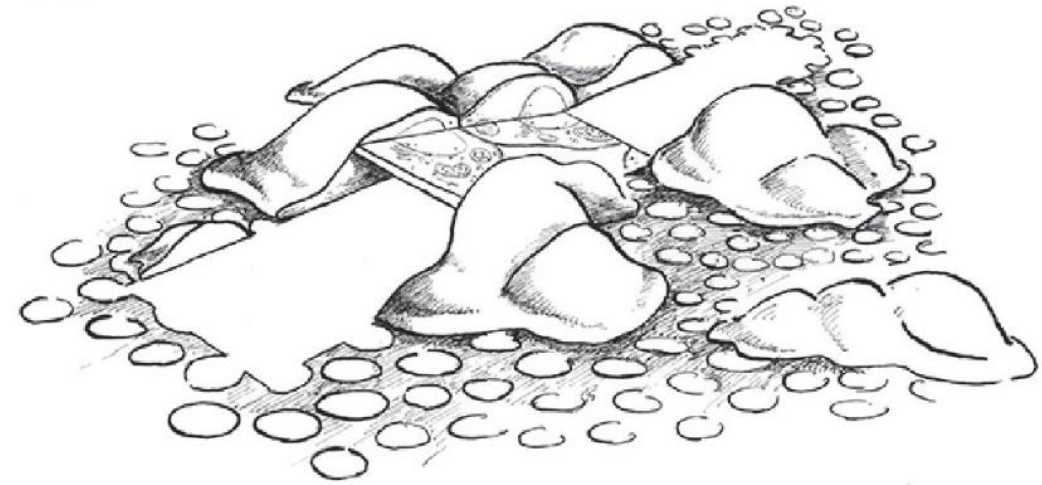
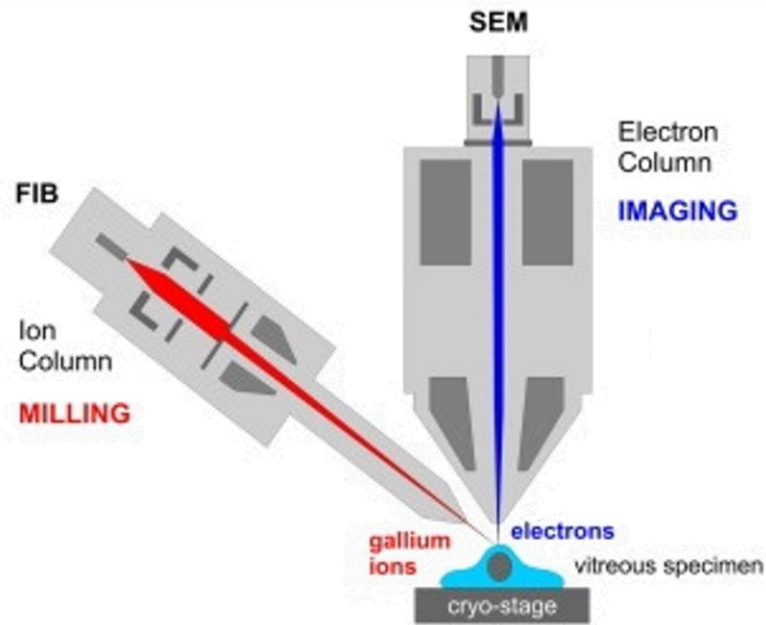


# Composite map of EhV-201 virion



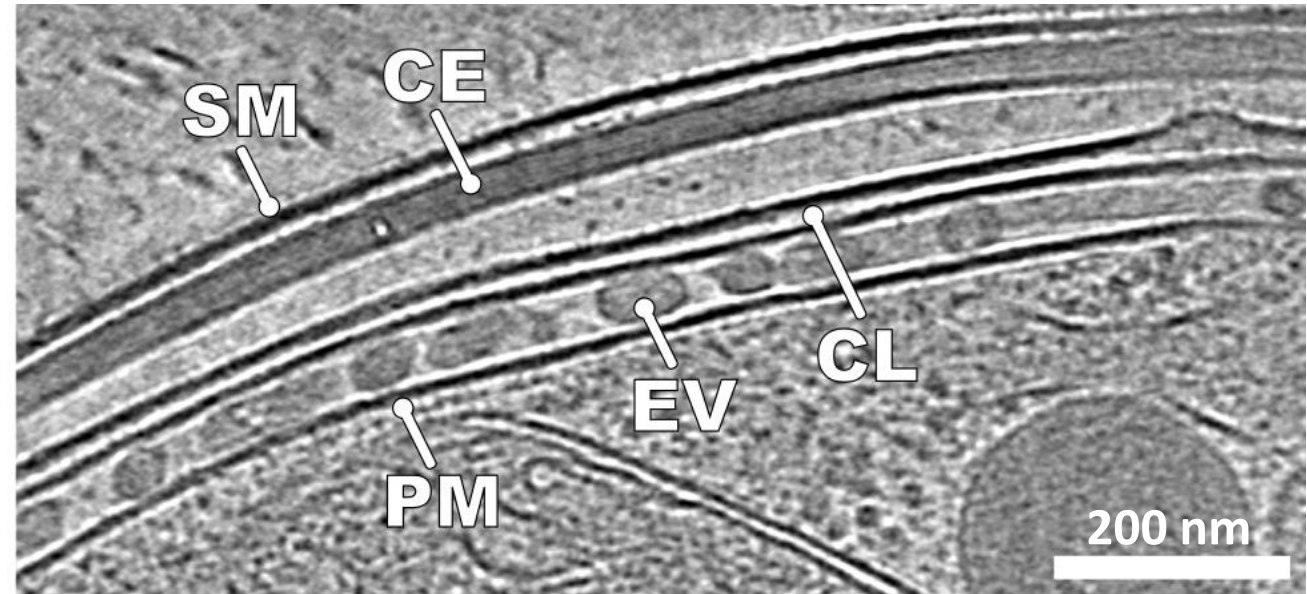
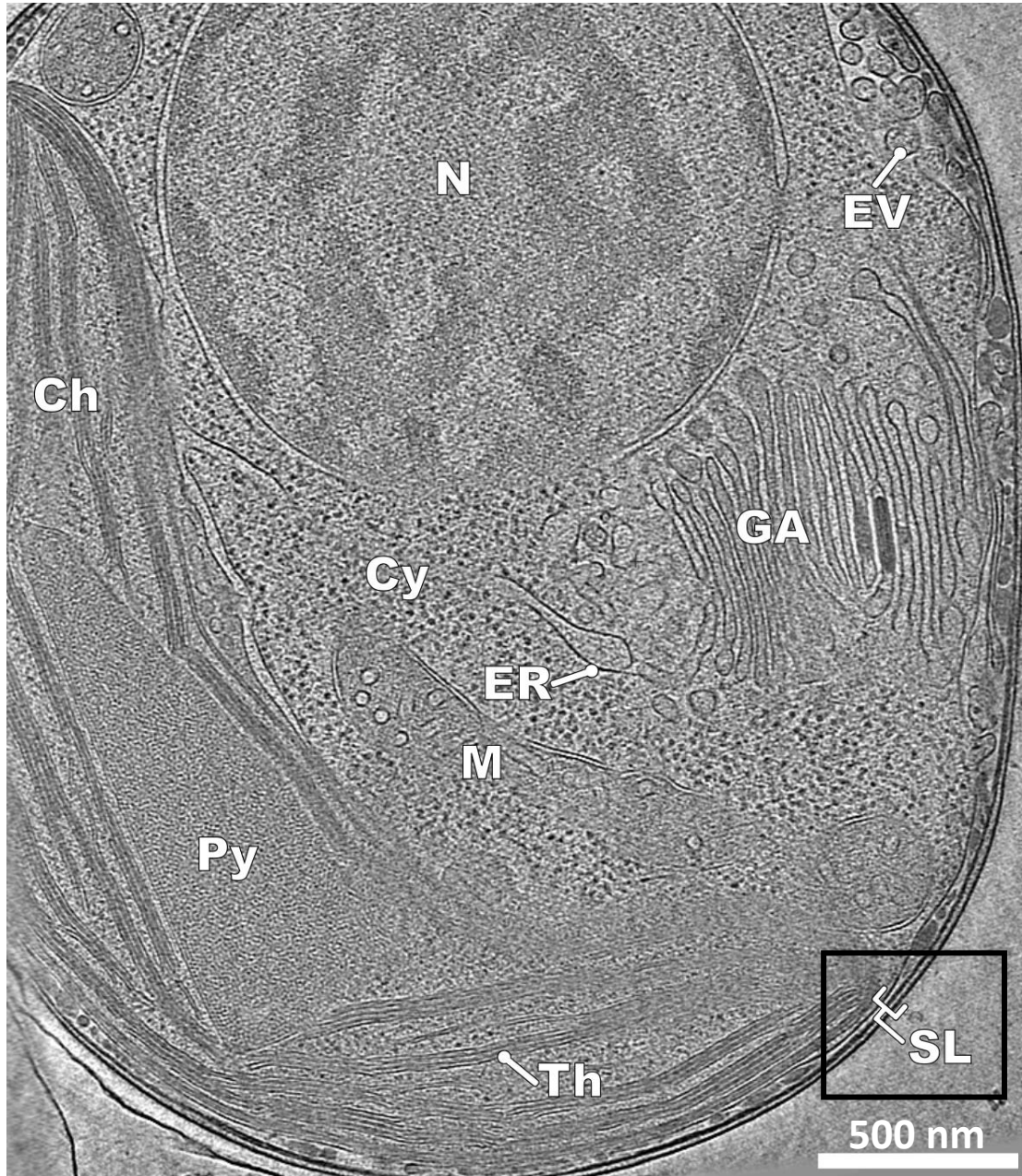


# *In situ* EhV-201 life cycle - sample preparation



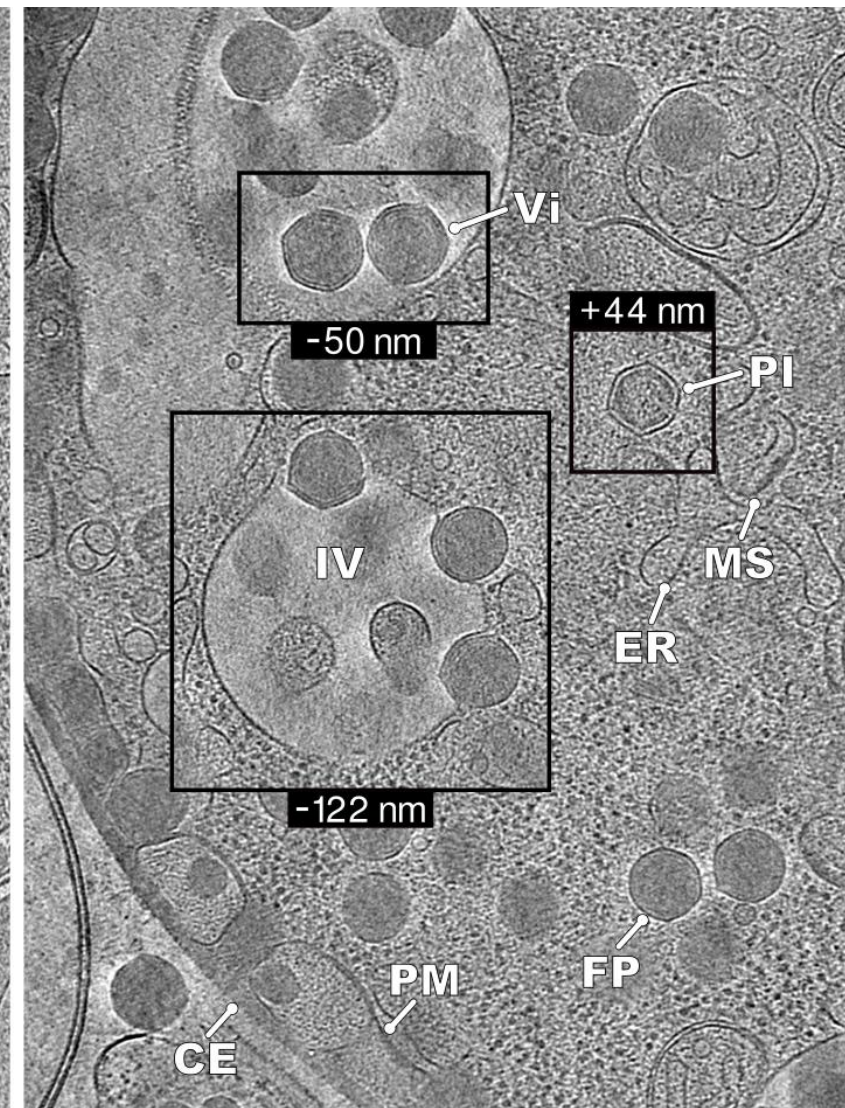
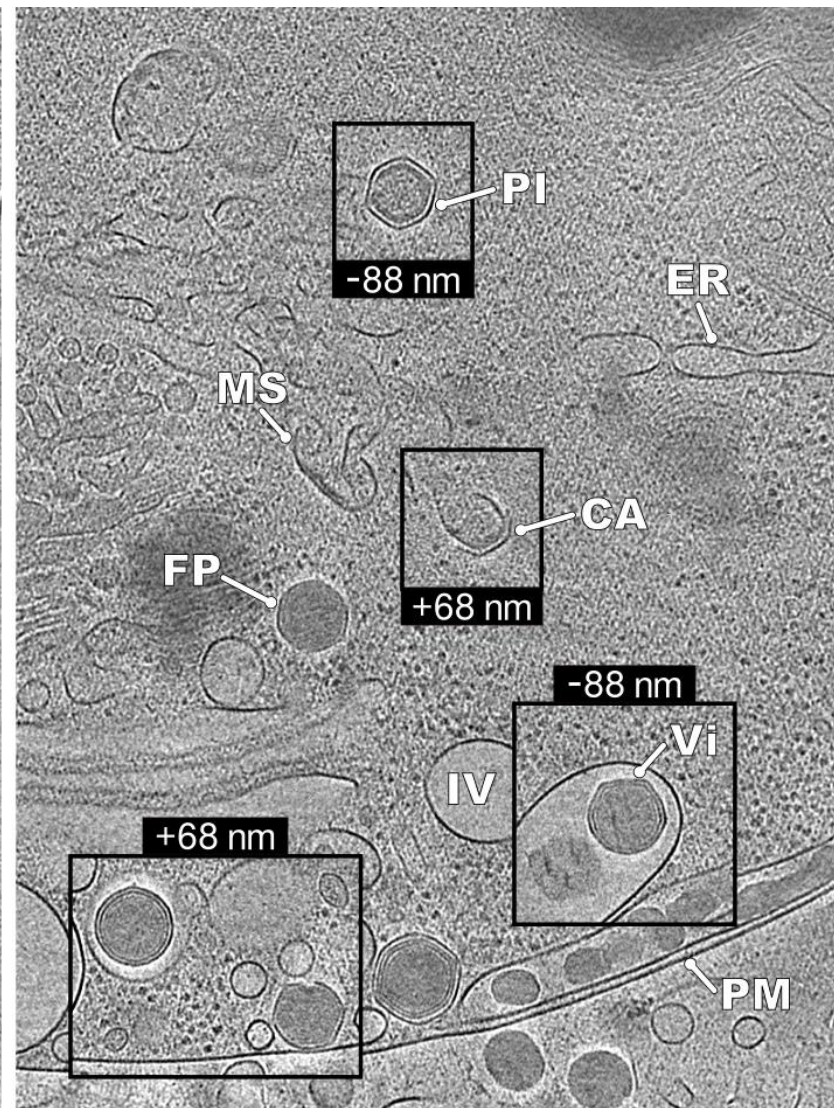
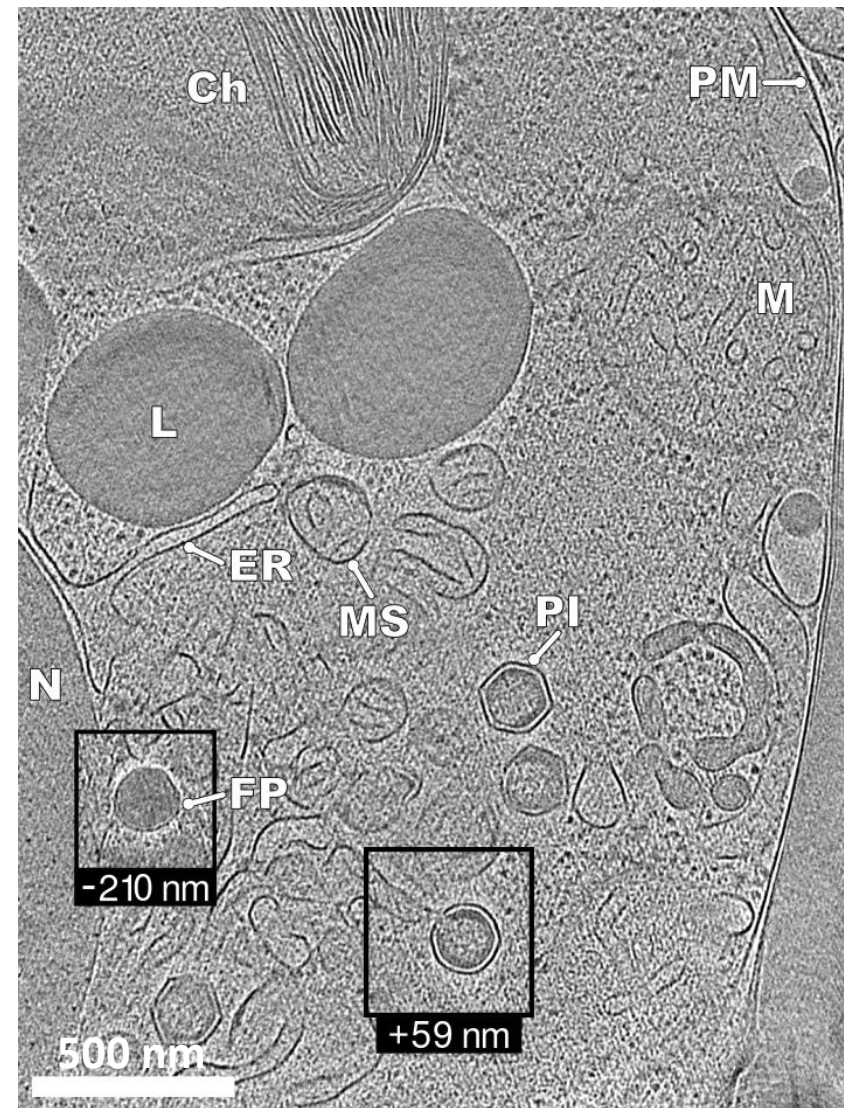


# Tomography of healthy alga cell





# Tomography of EhV-201 viral factories





*E. huxleyi* infected cell

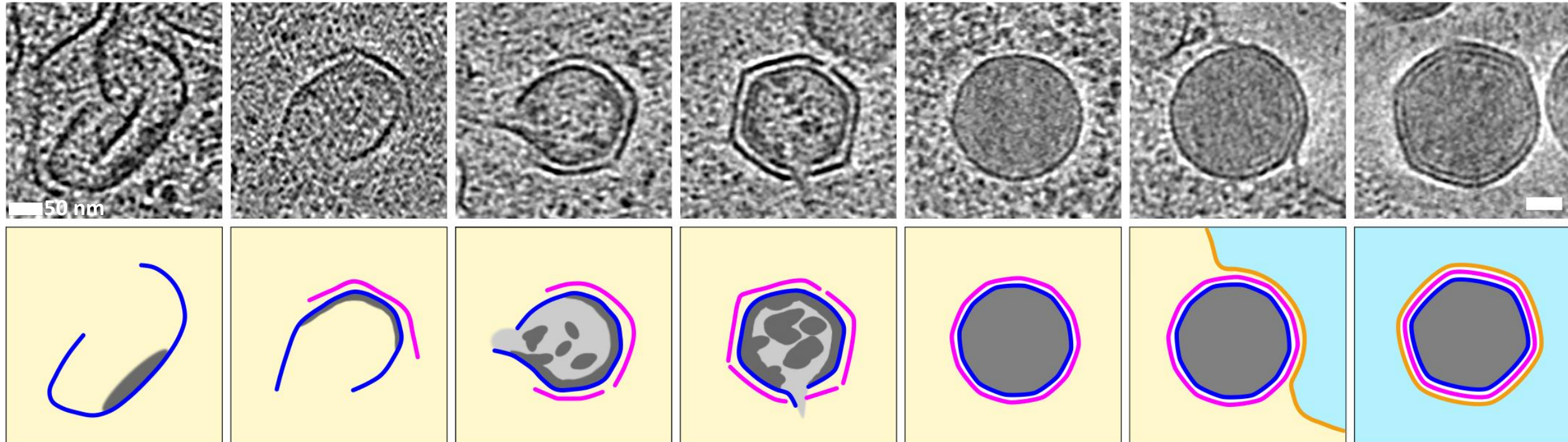
Late stage of infection with EhV-201

Cryo-lamella sample

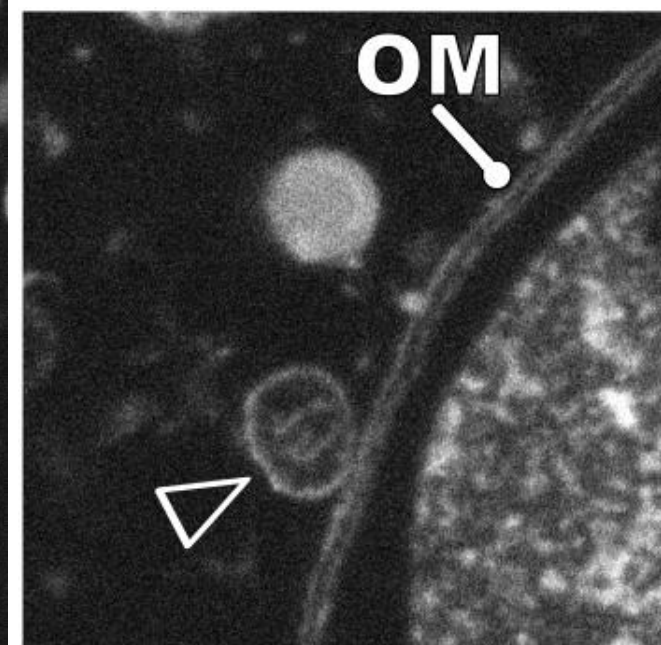
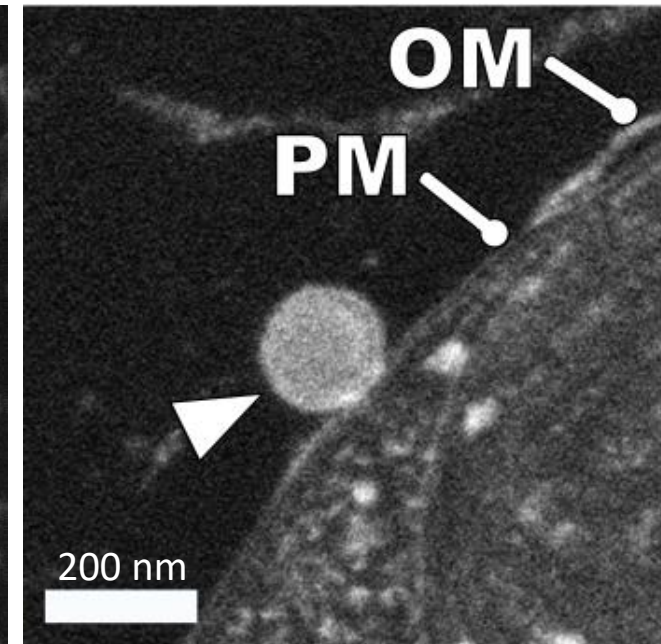
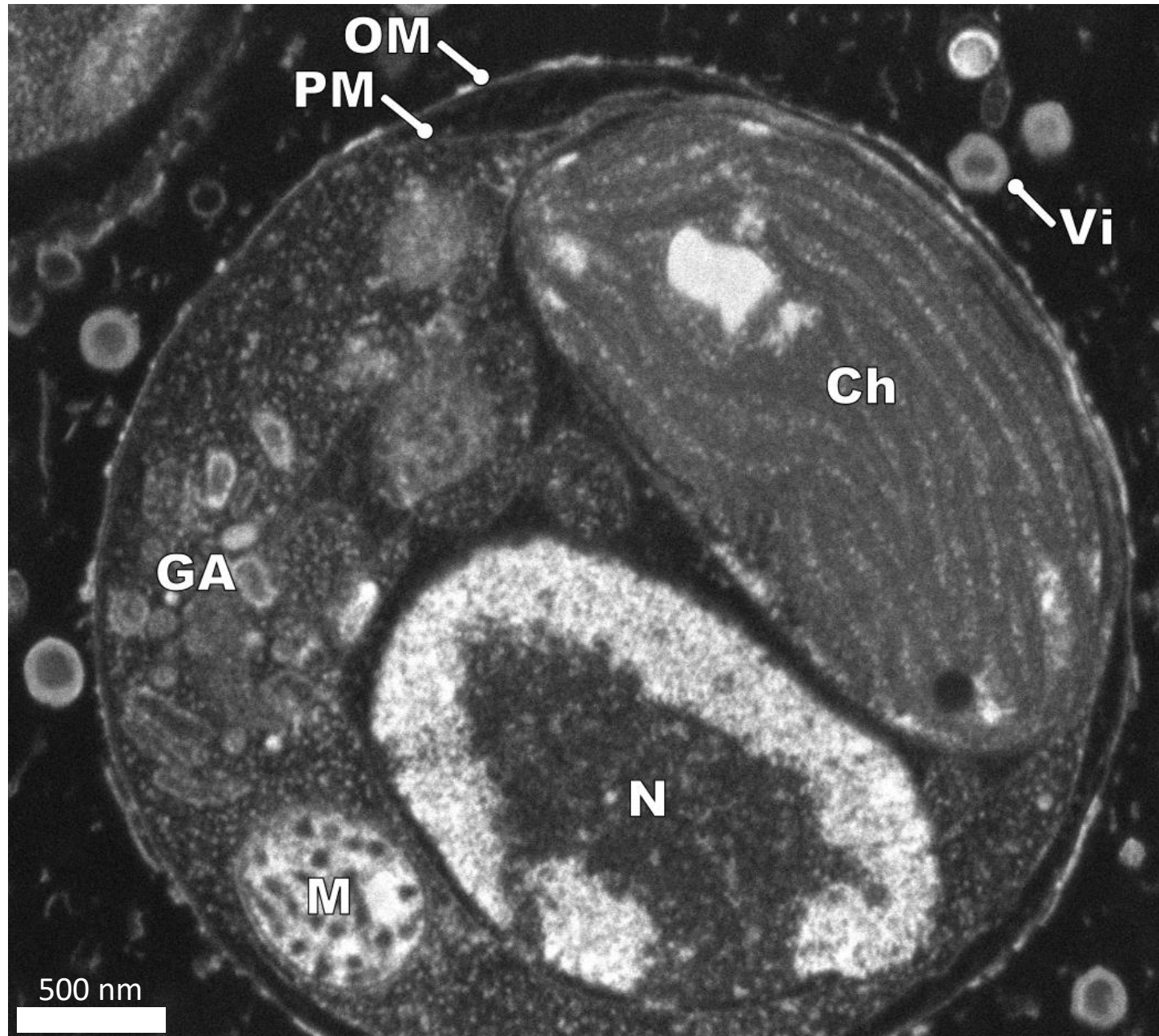
Segmentation of a tomographic volume



# EhV-201 virion assembly stages



# EhV-201 attachment and genome delivery





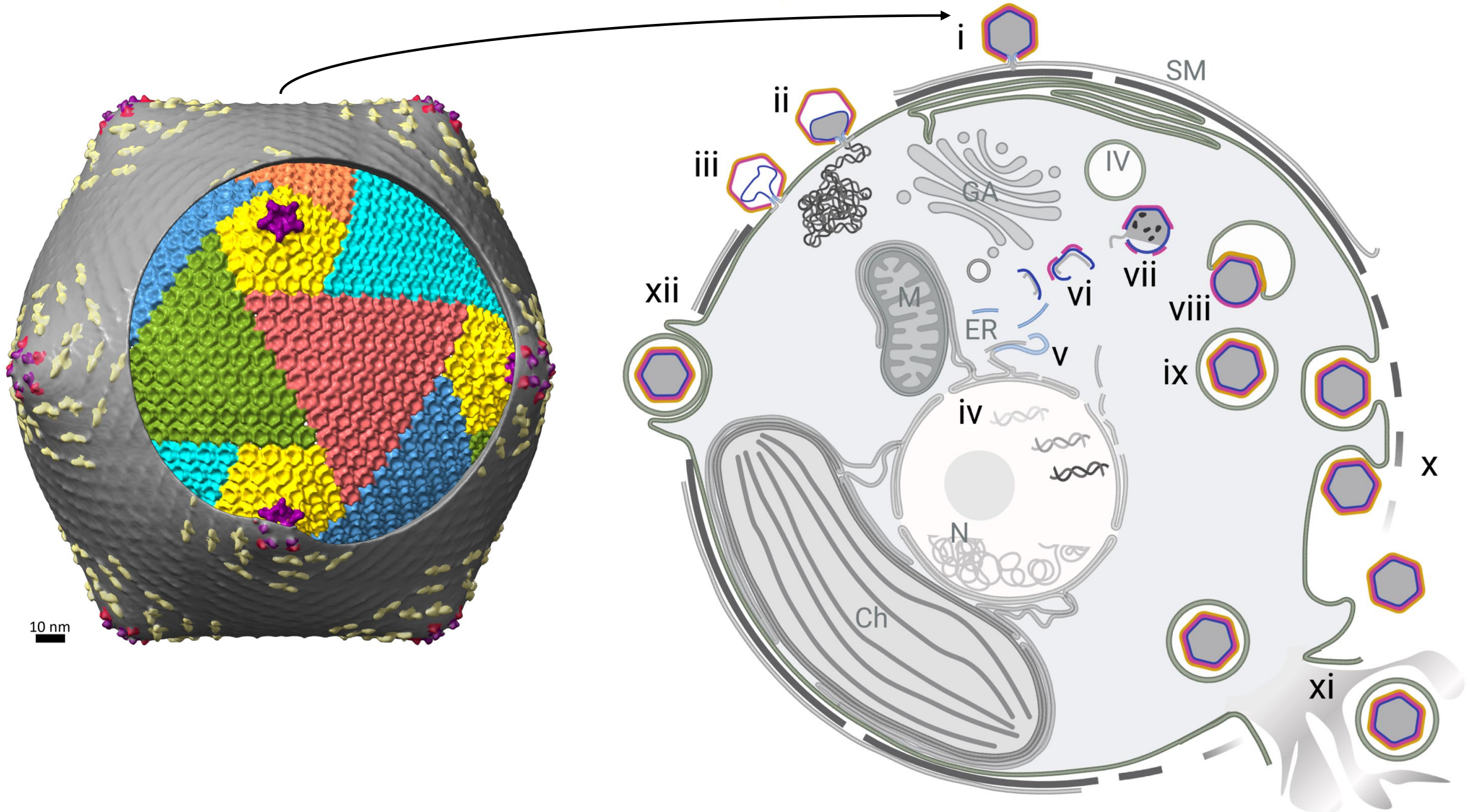
## *E. huxleyi* infected cell

Early stage of infection with EhV-201 (30 min)

High-pressure frozen/freeze-substituted/resin-embedded sample

Serial block-face imaging

# Conclusions





# Acknowledgement



Pavel Plevka



Carina Büttner



Tibor Füzik



Jiří Nováček



Willie Wilson



Declan Schröder



Marten Chaillet



Friedrich Förster

