VIROLOGIA – BMM400

Professores:

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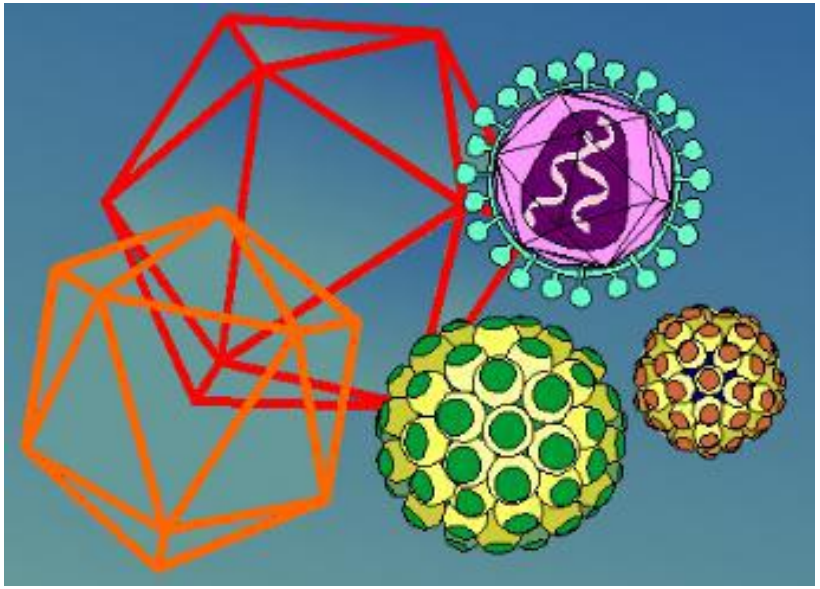
Apoio: Dra. Veridiana Munford

BIBLIOGRAFIA RECOMENDADA:

1. **Flint, SJ, Enquist, LW, Krug, RM, Racaniello, VR & Skalka, AM. Principles of Virology, ASM Press, 2015, 4th Edition.**

2. **Microbiologia 6ª edição (2015), Atheneu. Editores: Luiz R. Trabulsi e F. Alterthum Principais Capítulos: 73, 74. 75, 79, 80, 81 e 95***

Propriedade Gerais dos Vírus



Componentes:

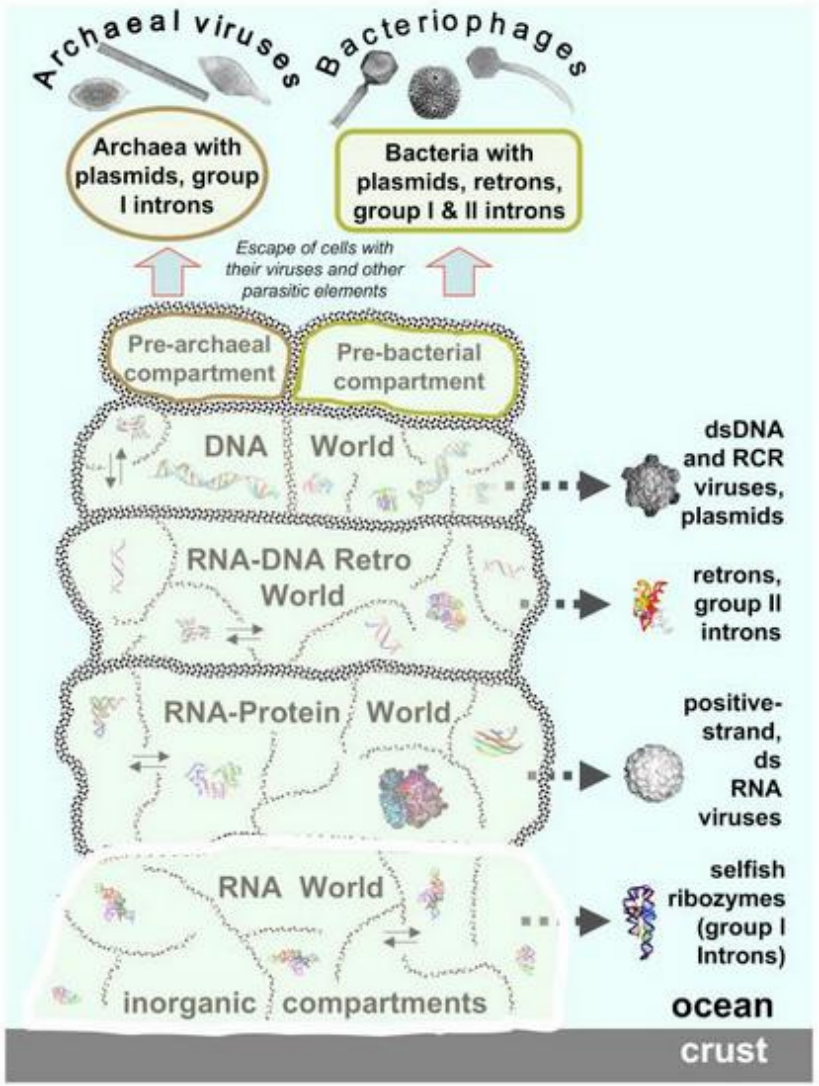
Genoma.
Capsídeo
Envelope.

VIROMA NO PLANETA TERRA

Fitoplancton

(o viroplancton)

VÍRUS E O MUNDO DE RNA.



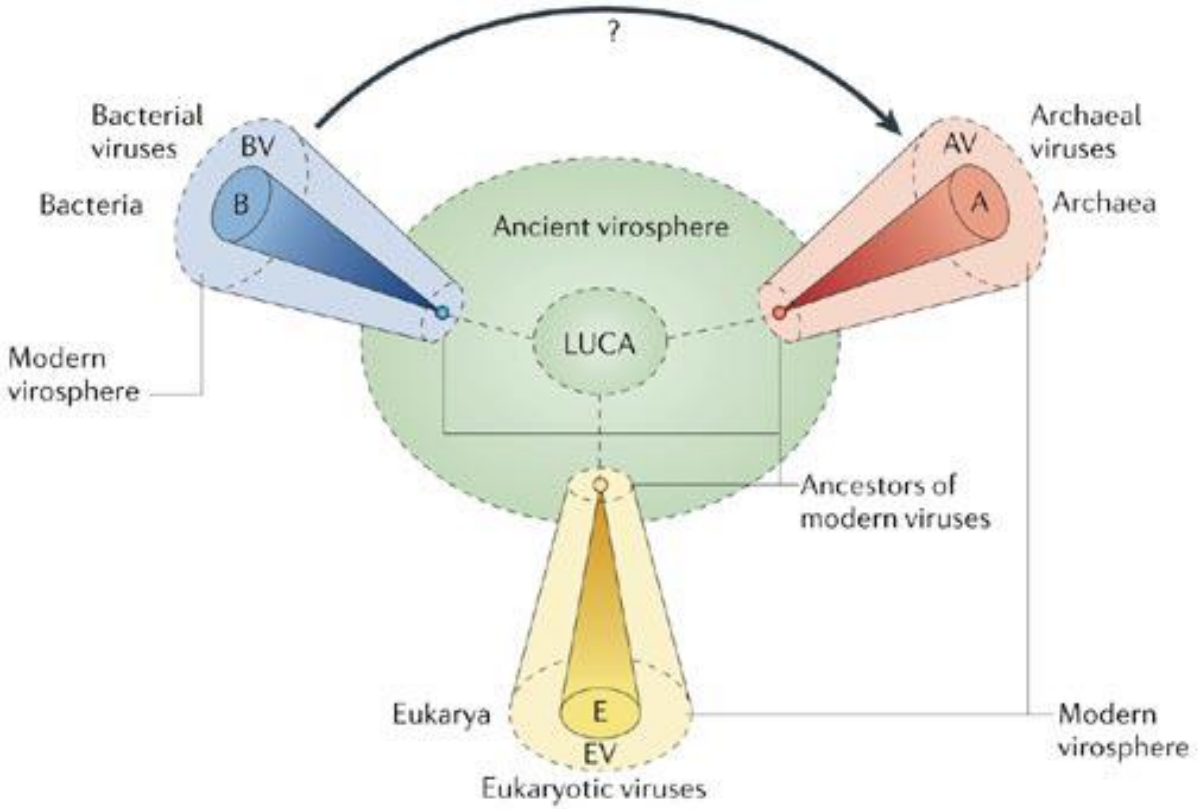
The ancient Virus World and evolution of cells
Koonin et al, 2006, Biol Direct

Viruses prior to last universal cellular ancestor (LUCA) ?

(a) they originated in a pre-cellular world (the 'virus first' hypothesis);

(b) they originated by a reduction from parasitic cells; or

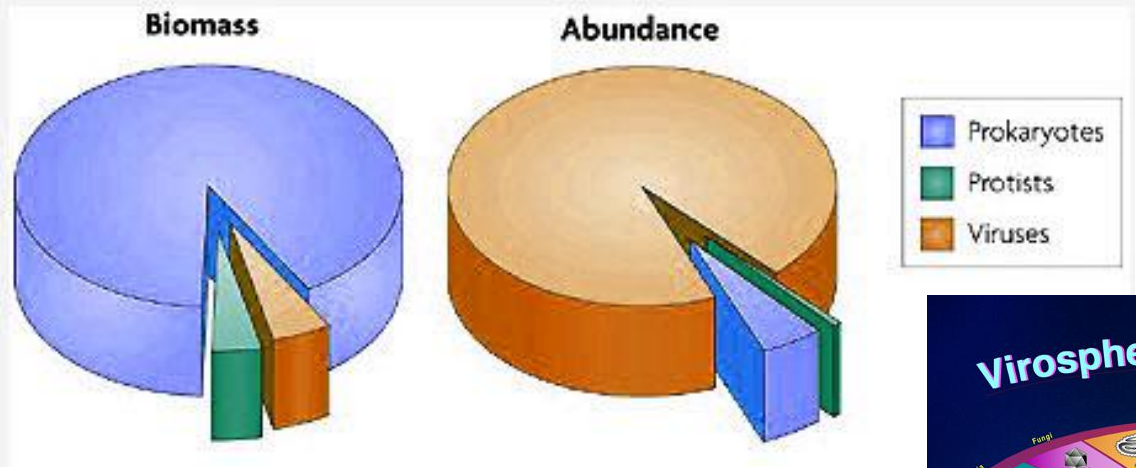
(c) they originated from fragments of cellular genetic material that escaped from cellular control and became parasites (the escape hypothesis).

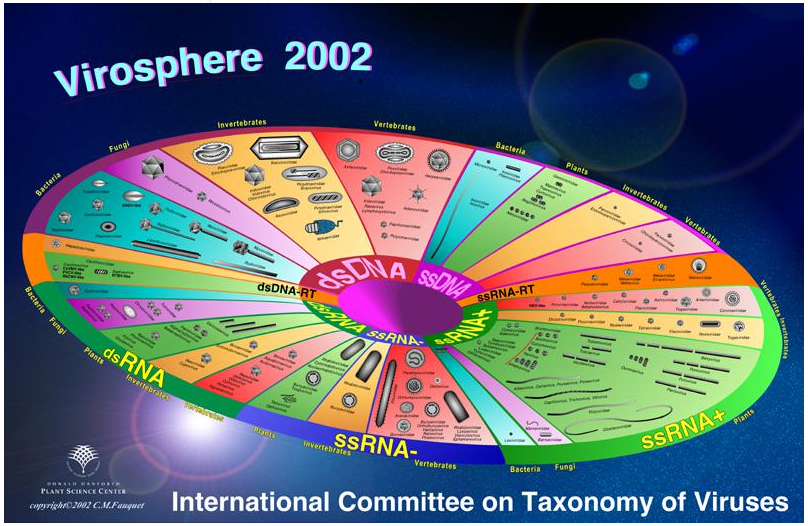


Viruses: Earth's most diverse life forms

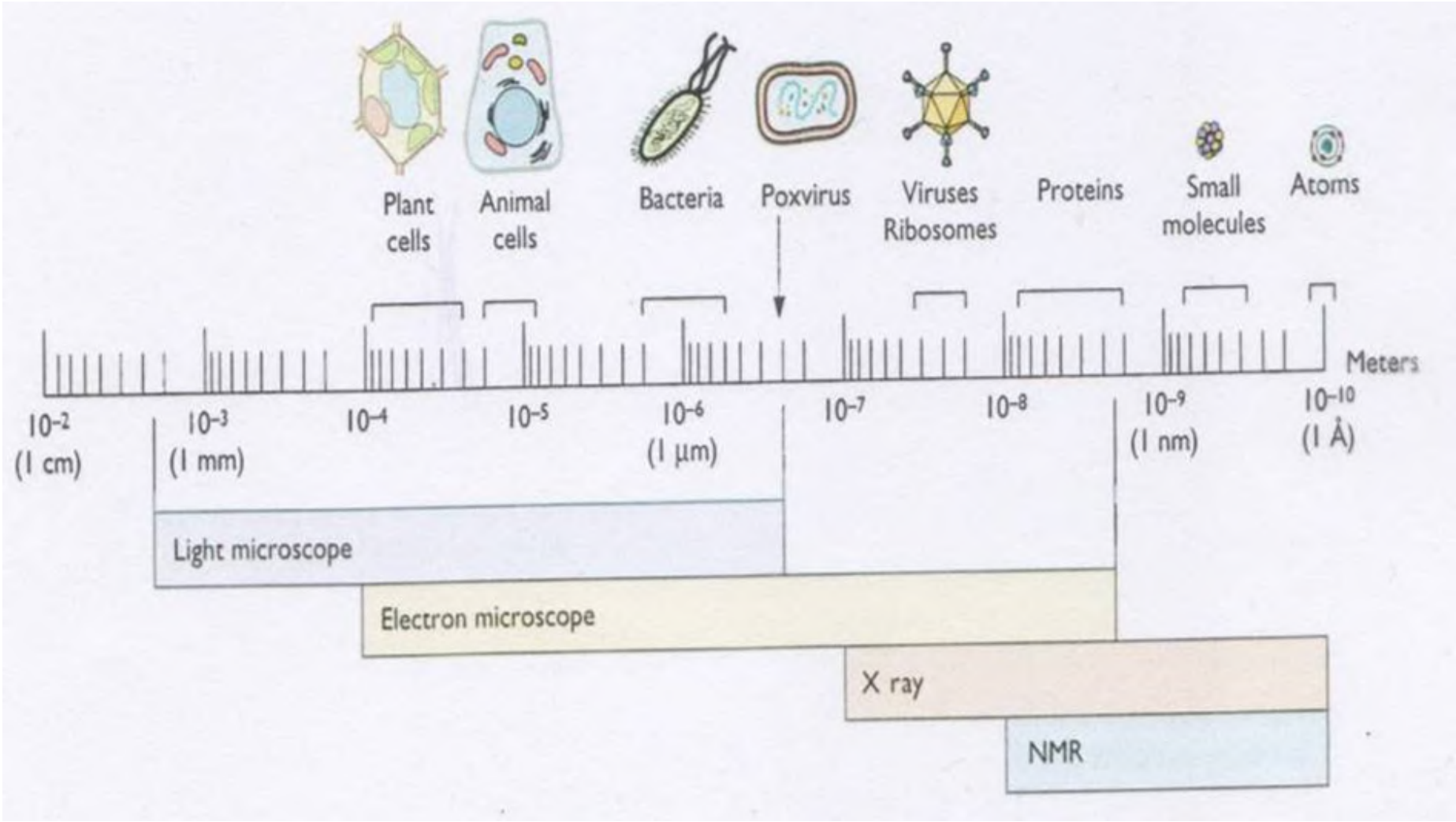
- There are fifteen times as many viruses in the oceans as there are bacteria and *archaea*. (account for 56 million blue wales in C mass)

- They infect every branch of the tree of life and hence suggesting a very early origin (as does their diversity).

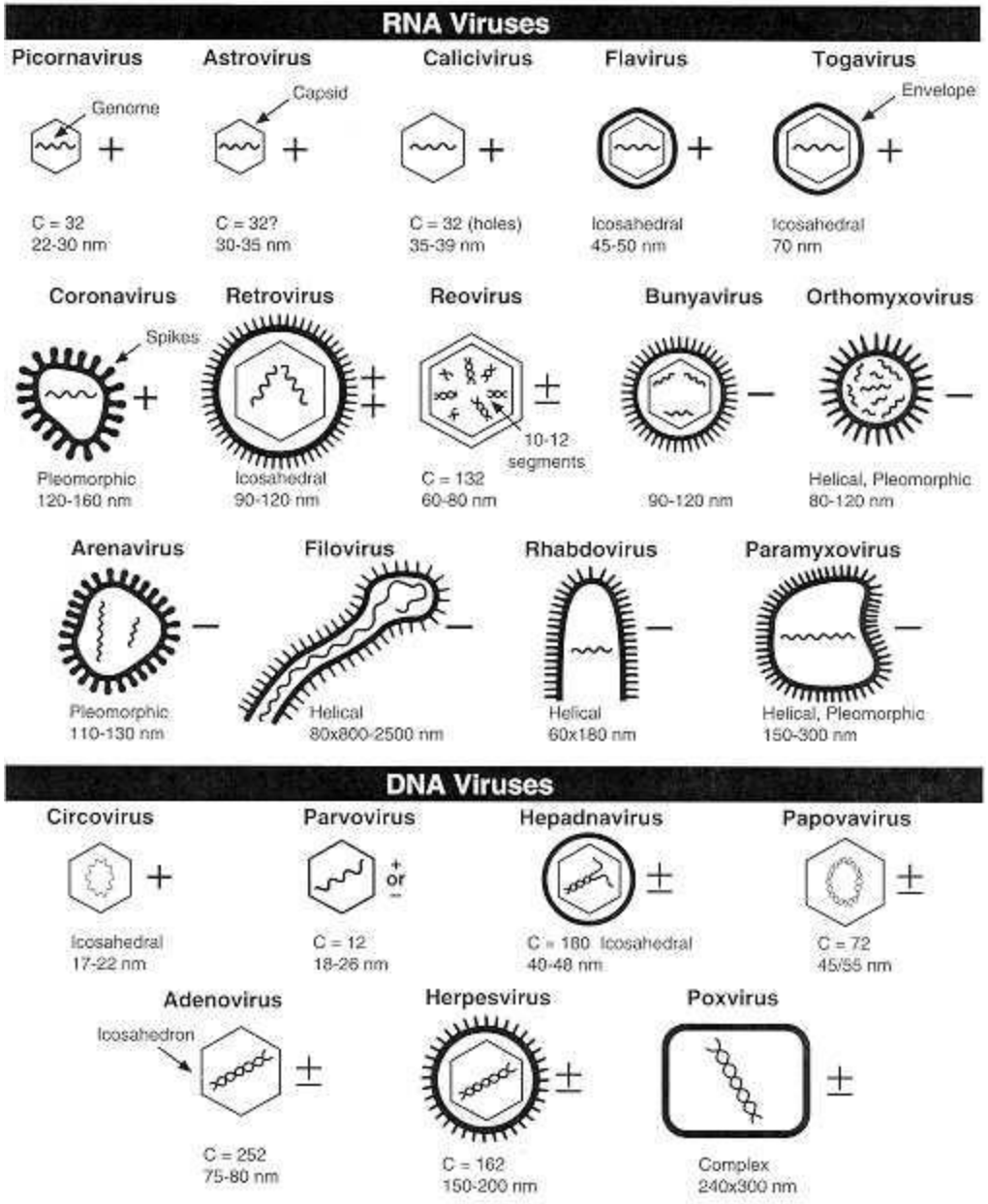


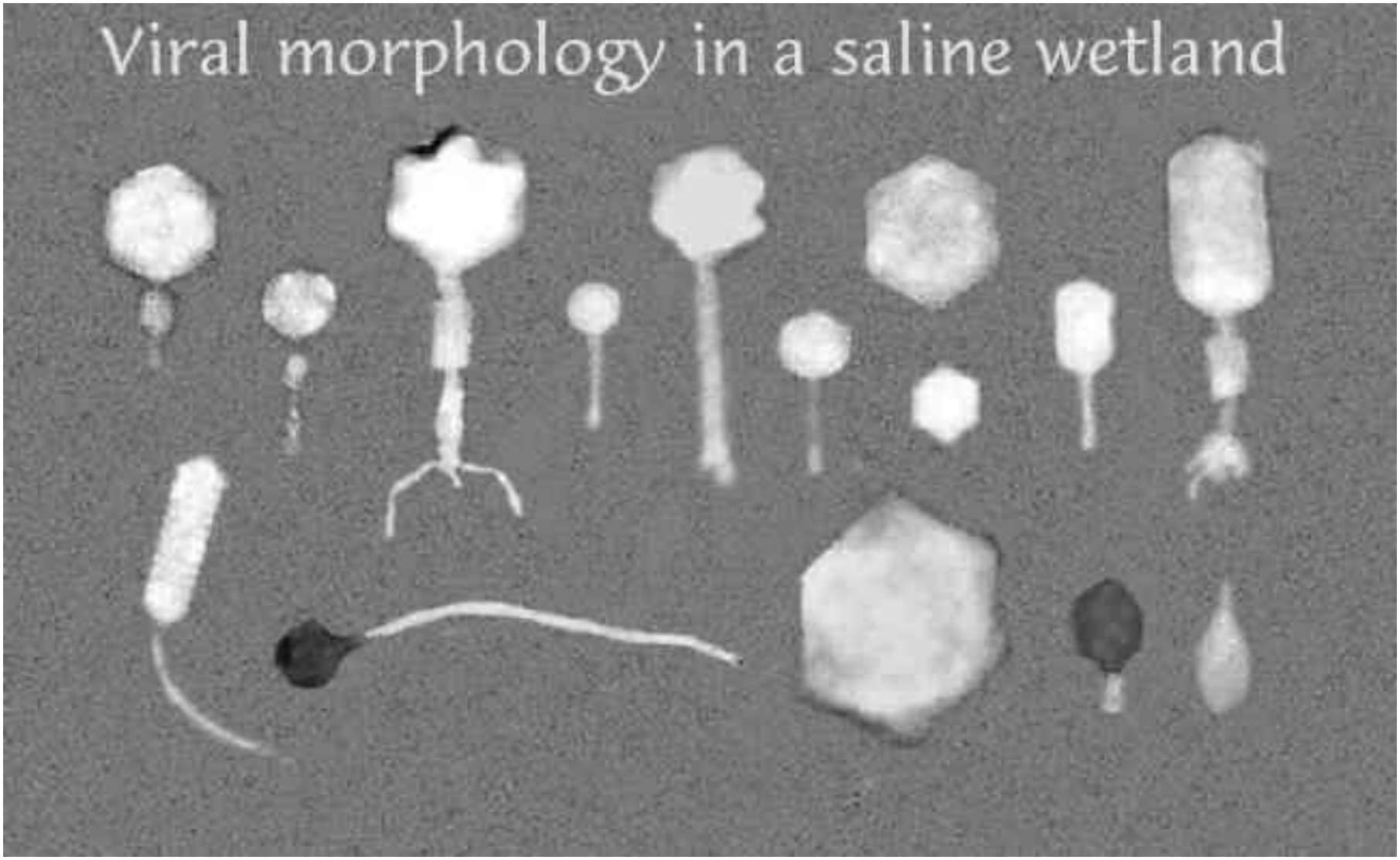


Características virais: pequeno tamanho!

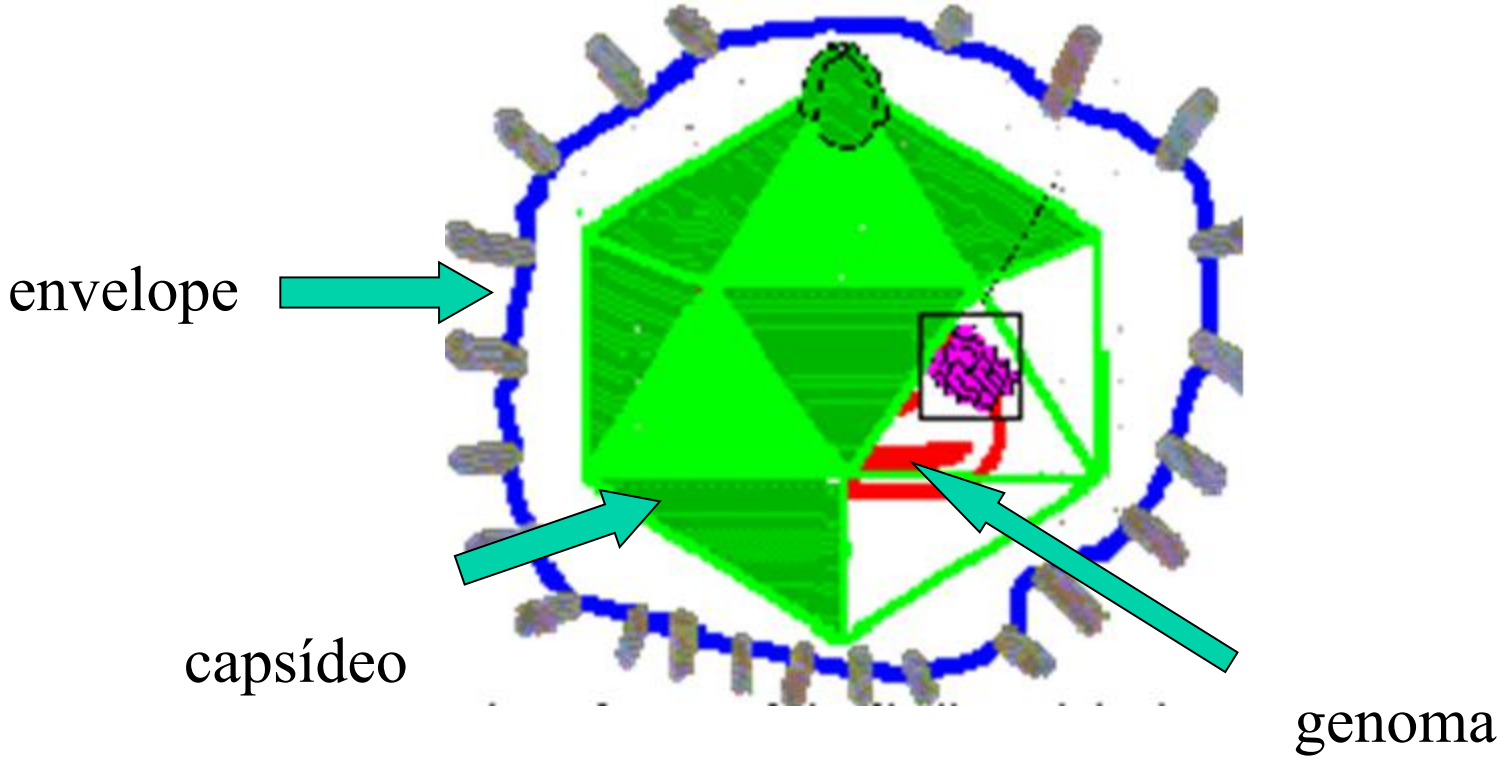


Diversidade viral: forma e genoma (RNAe DNA)



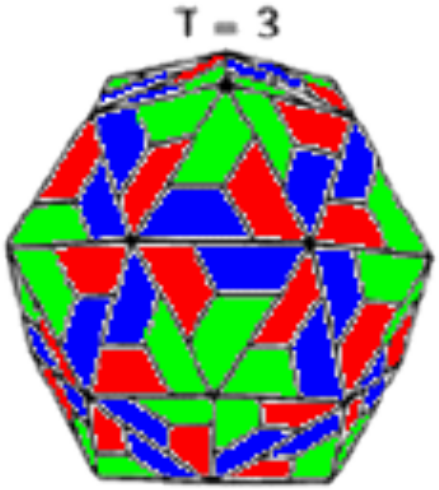

Viral morphology in a saline wetland

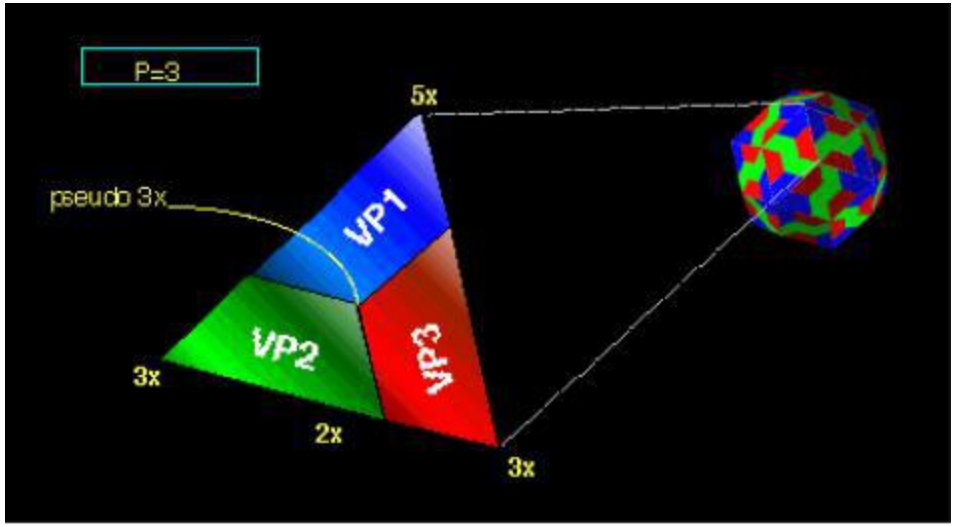
COMPOSIÇÃO VIRAL

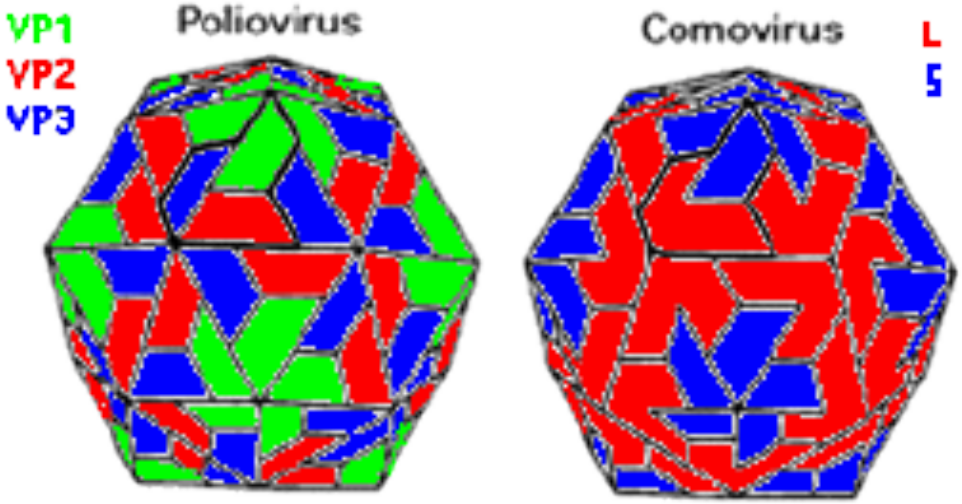


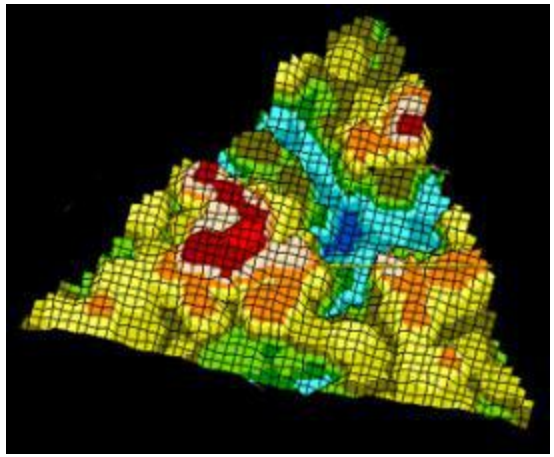
COMPOSIÇÃO DO CAPSÍDEO

Proteínas: Protômeros e capsômeros

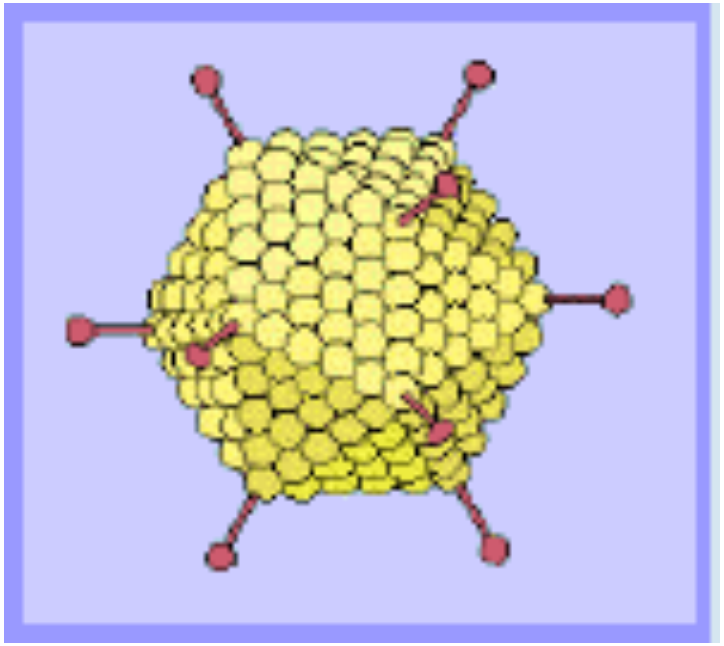


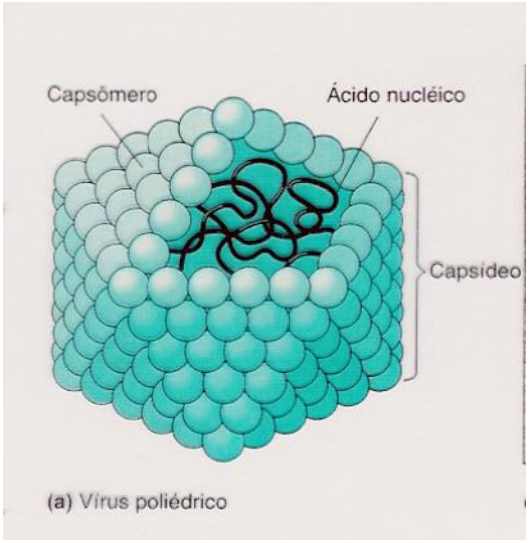




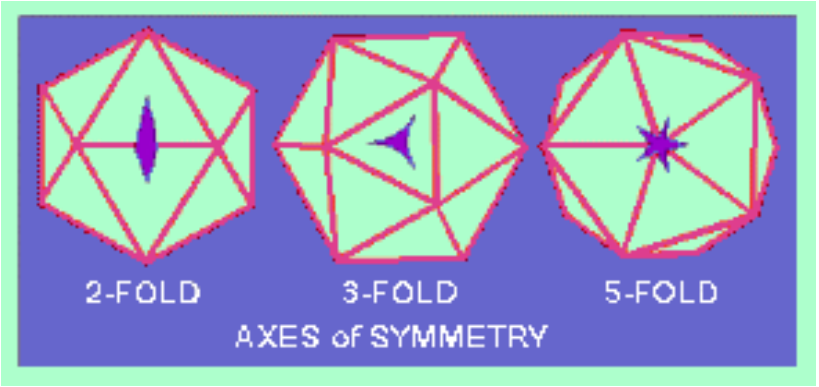


Simetria do capsídeo: icosaedro

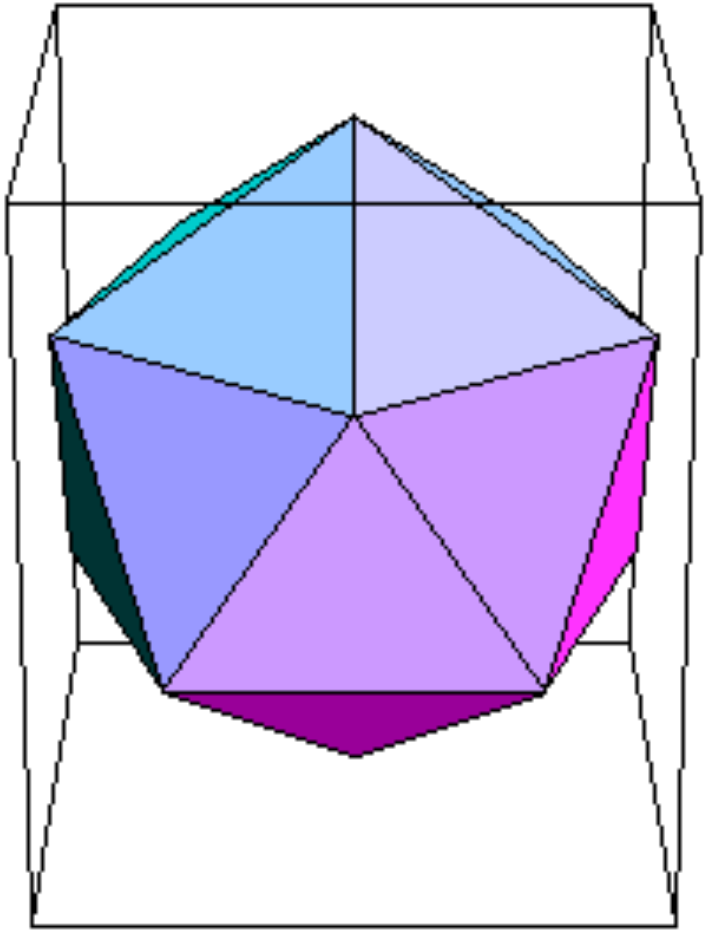




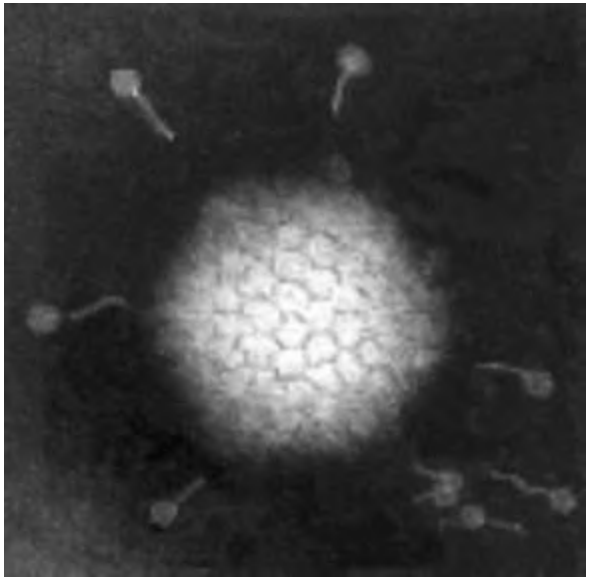
Eixos de simetria:



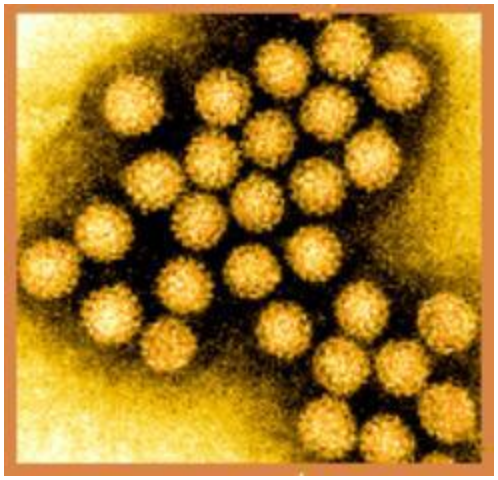
Simetria do capsídeo: icosaedro



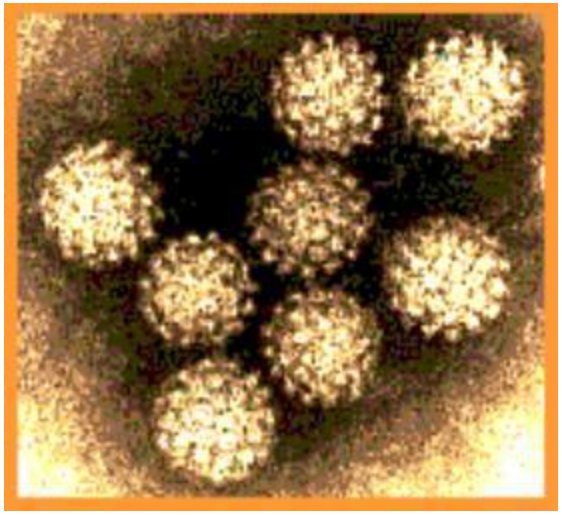
EXEMPLOS:



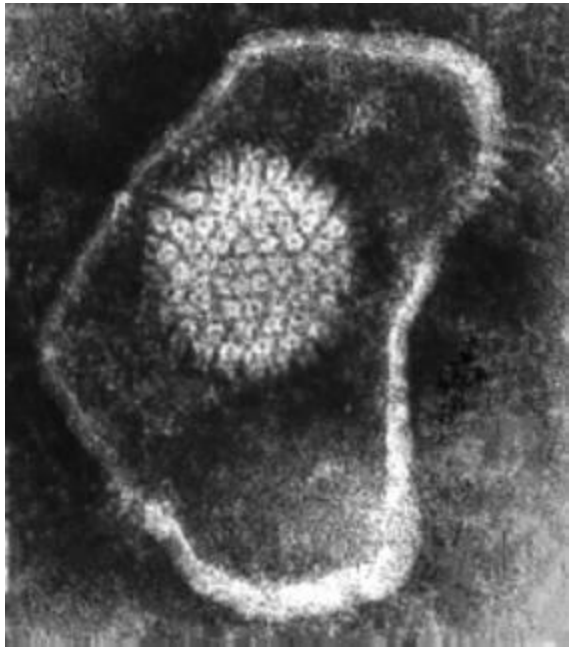
adenovírus



papilomavírus

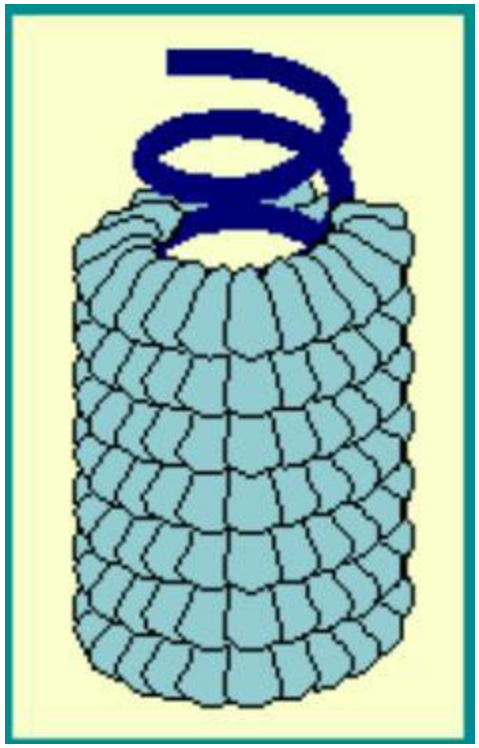


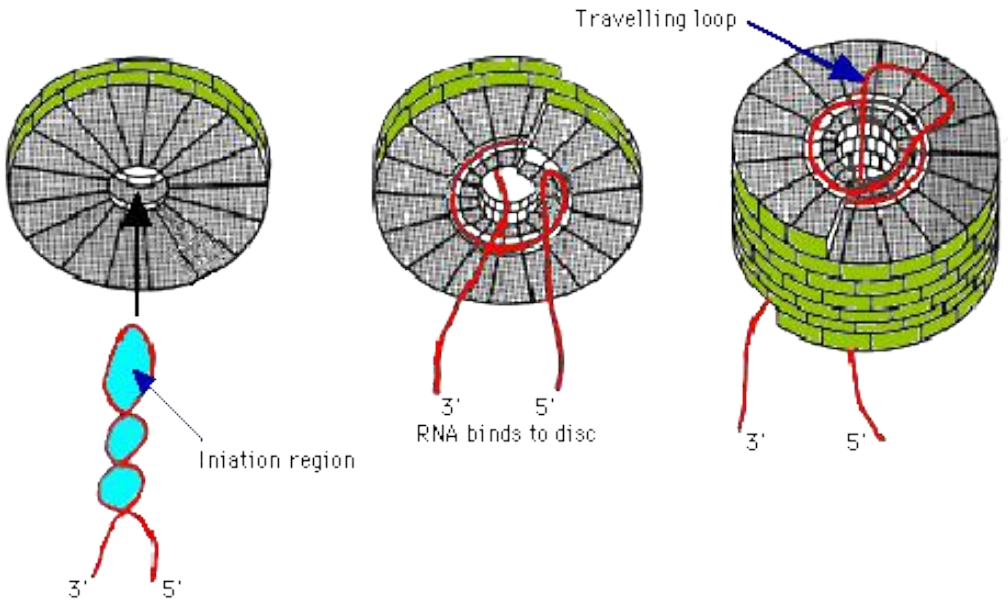
rotavírus



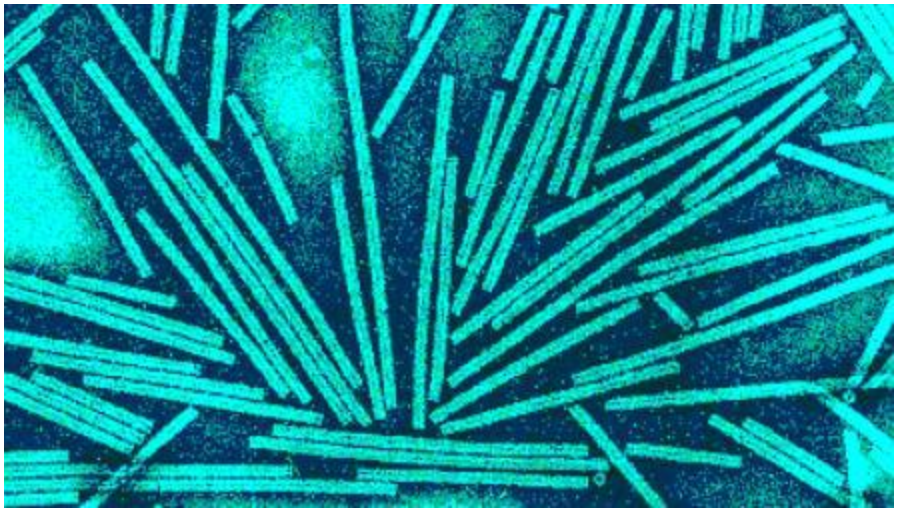
herpesvírus

Simetria do capsídeo: HELICOIDAL!

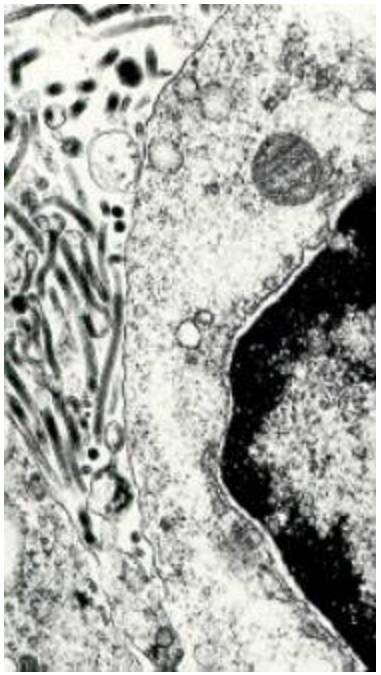




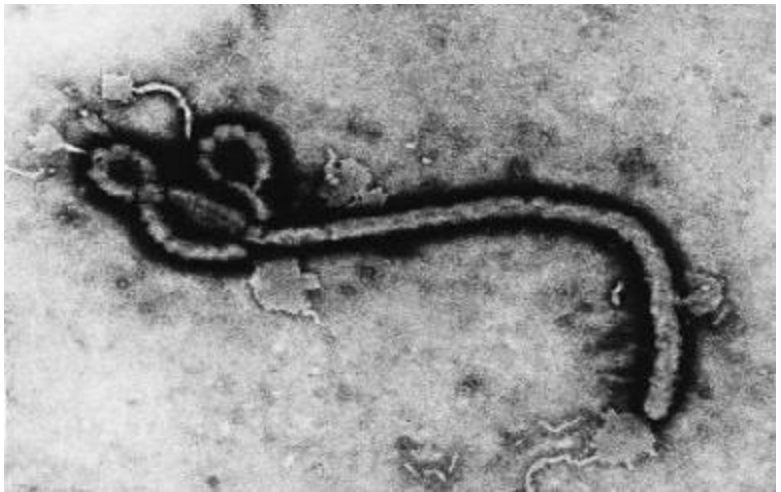
Exemplos:



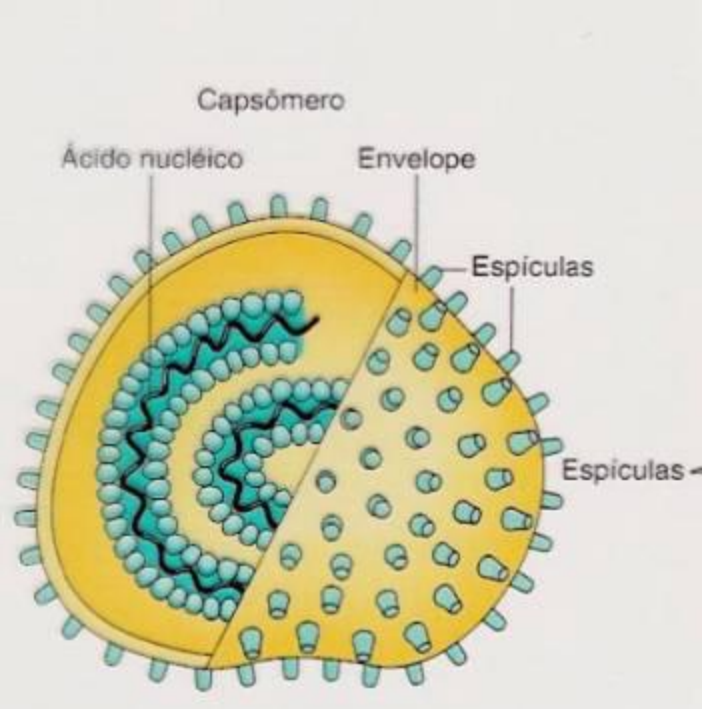
Vírus do mosaico de tabaco

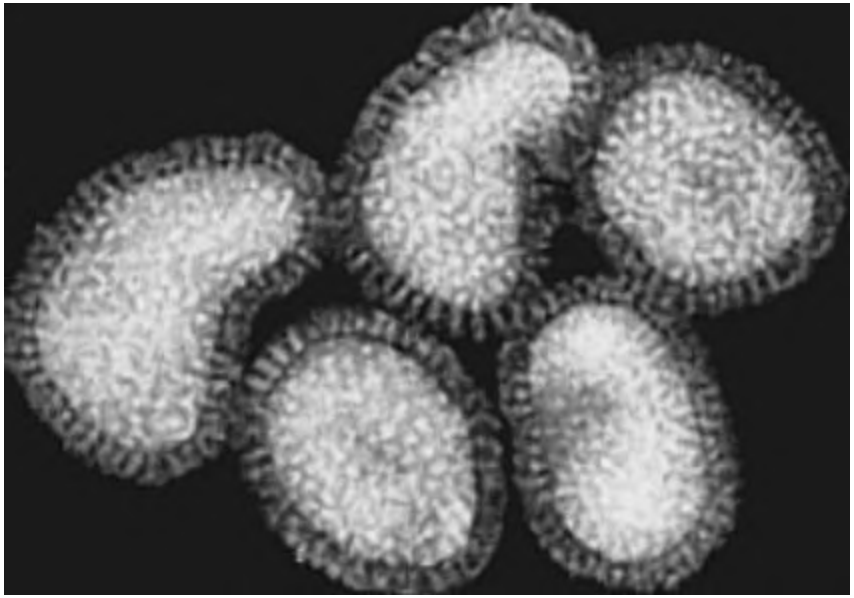


ebola



Exemplo de helicoidal envelopado.

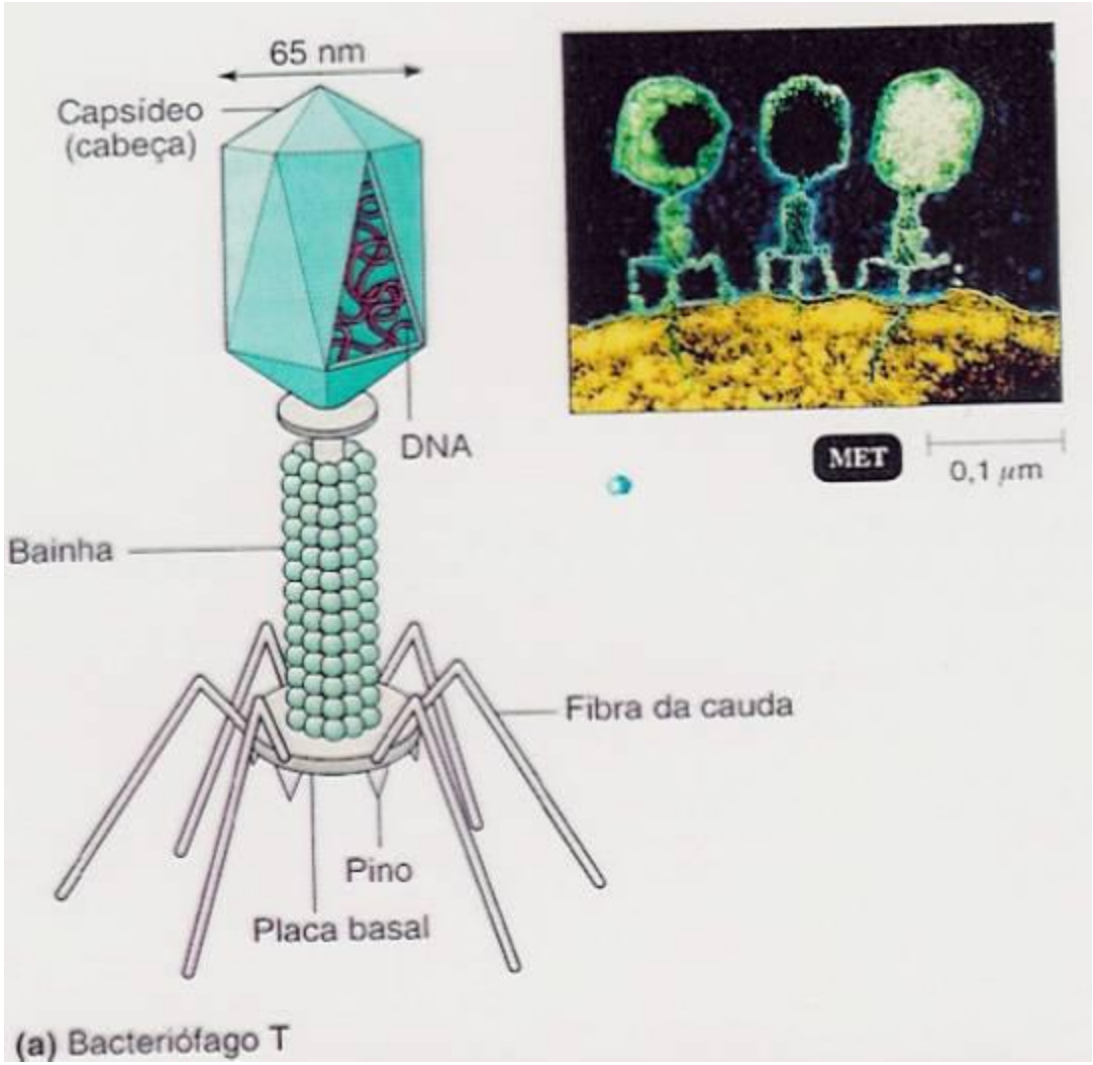




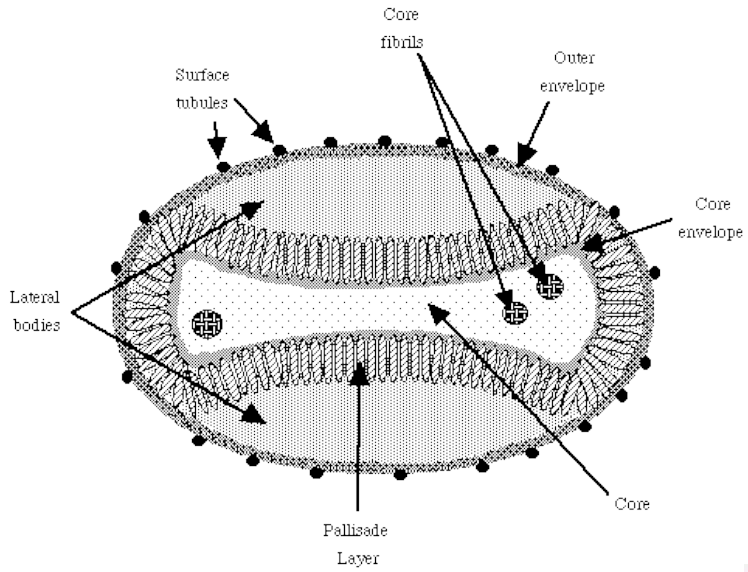
Vírus influenza

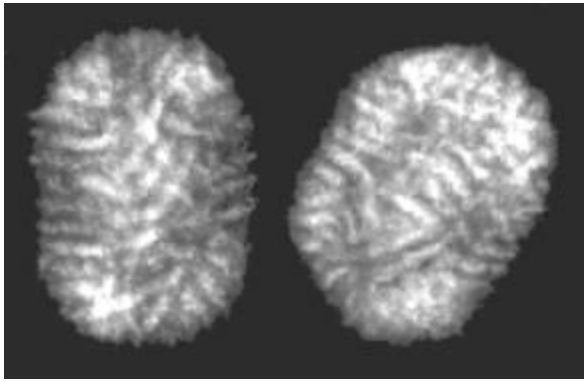
Simetria do capsídeo: complexa

Bacteriófagos:



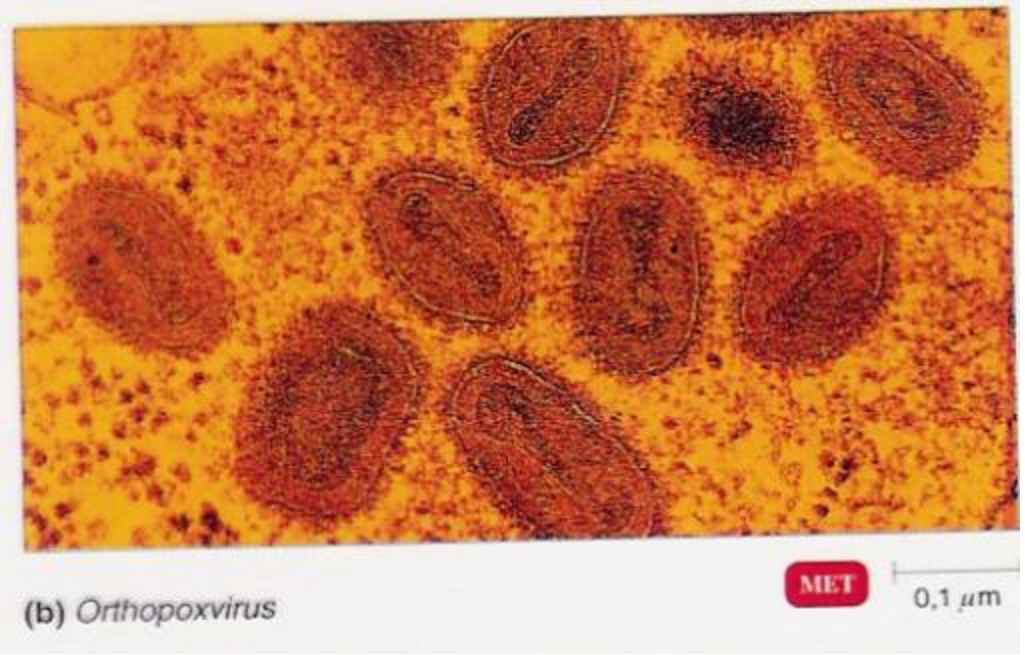
Simetria do capsídeo: complexa





Poxvírus:

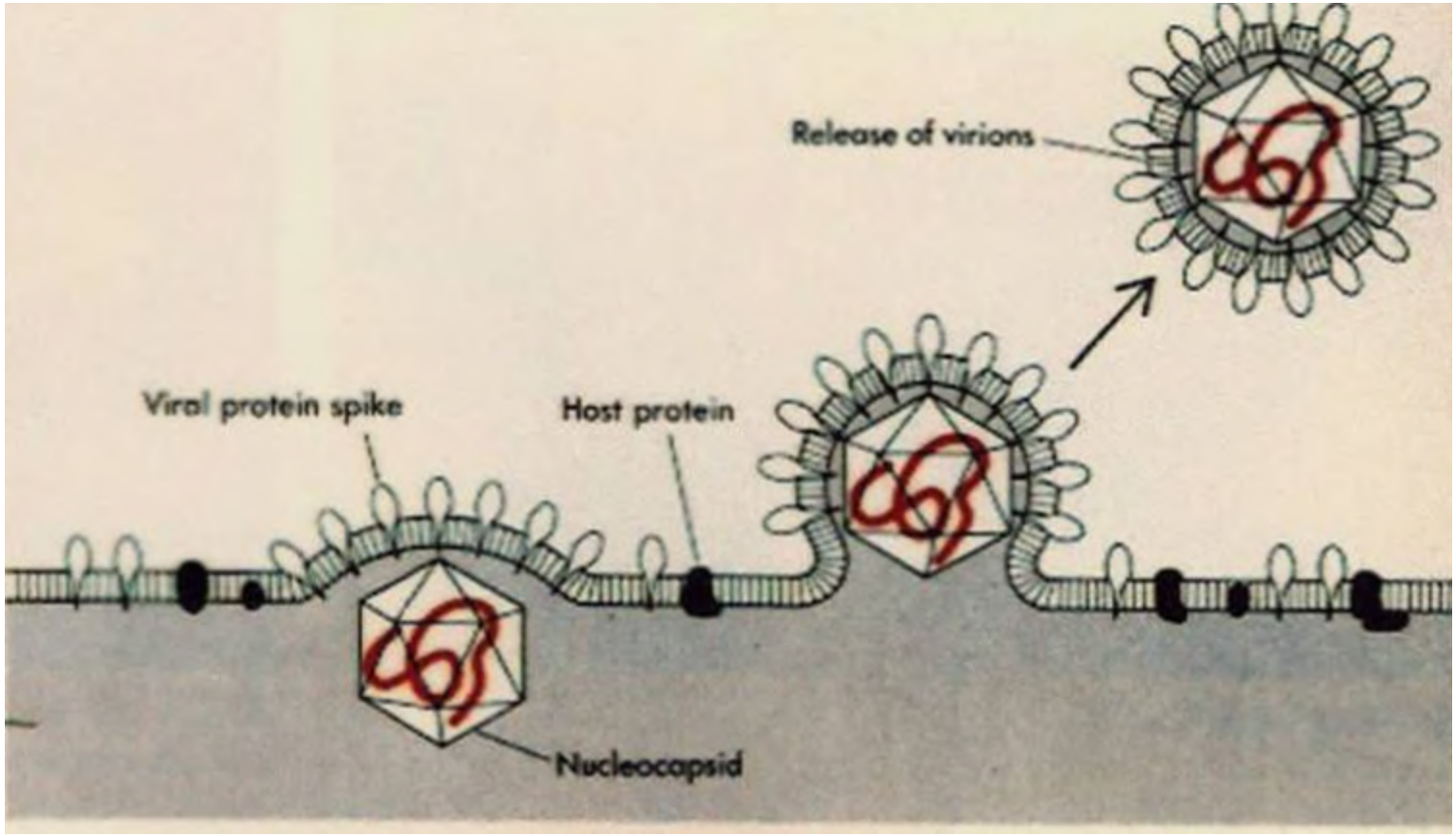
Vírus vaccinia.



COMPOSIÇÃO DO ENVELOPE

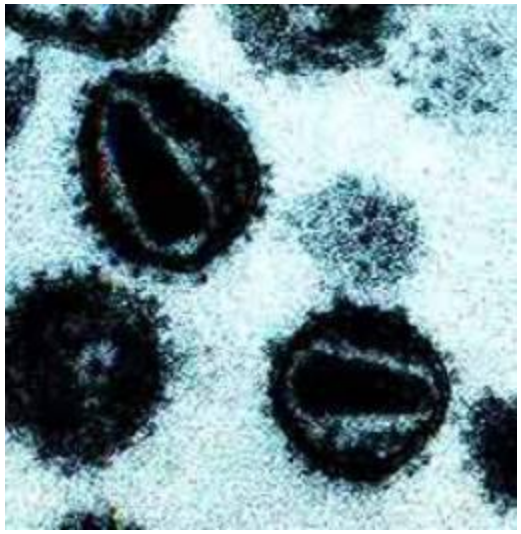
Lipídeos e proteínas:

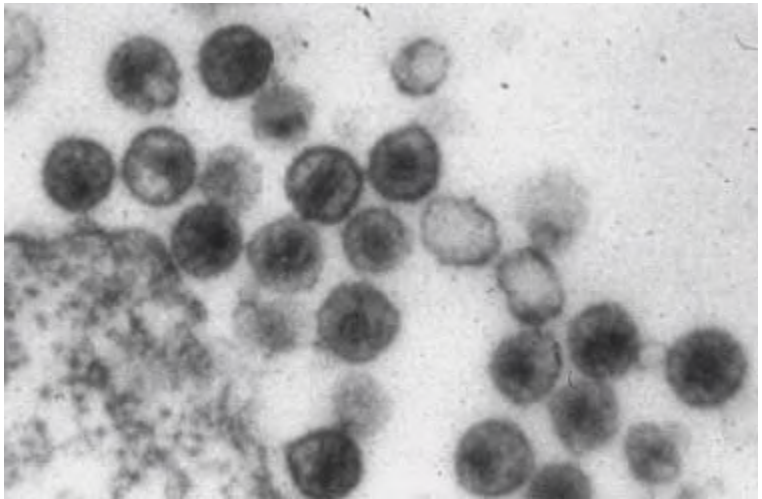
Qual sua origem?



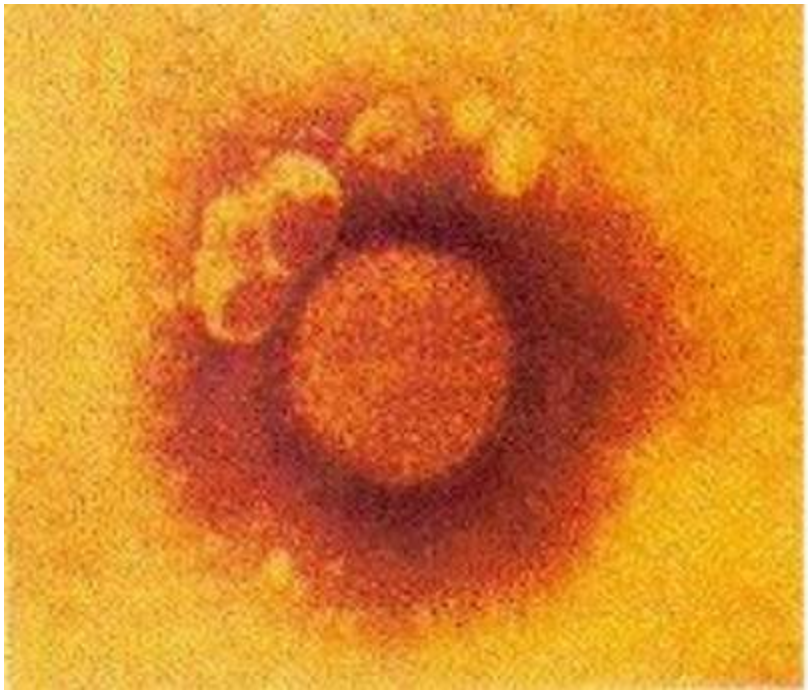
OUTROS EXEMPLOS INTERESSANTES

HIV





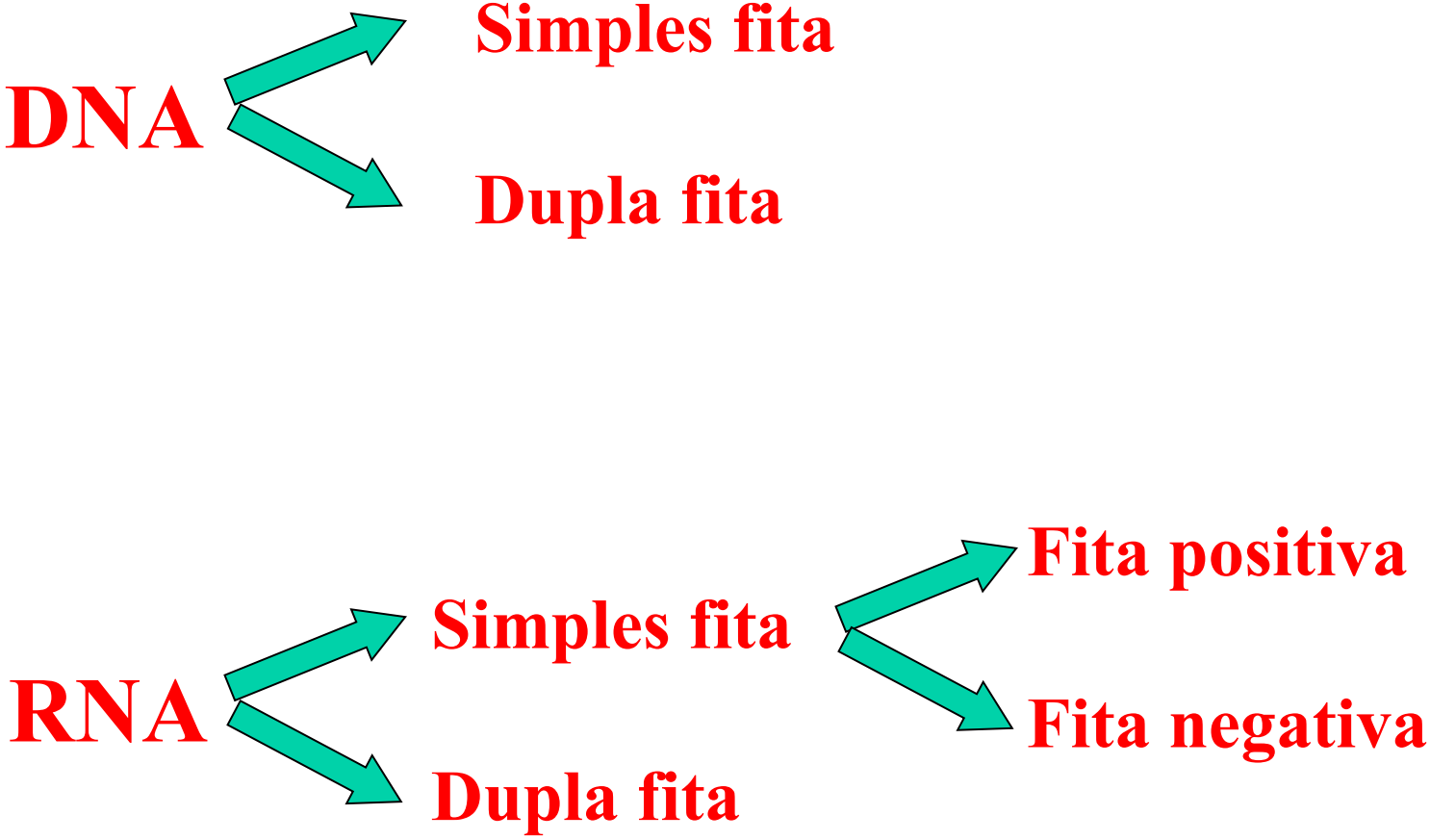
Arenavírus



Classificação dos vírus.

- Sec XX Sorologia
- Sec XX fim Tipo de ácido nucléico e homologia
- Morfologia
- Presença de enzimas no vírion
- Suscetibilidade a agentes físicos e químicos
- Propriedades imunológicas
- Vias de transmissão
- Tropismo
- Patologia ao nível tecidual
- Sintomatologia

VÍRUS E SEUS TIPOS DE GENOMA.



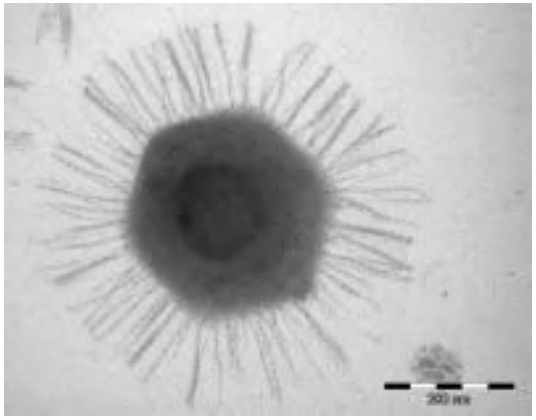
TIPOS DE GENOMA VIRAL

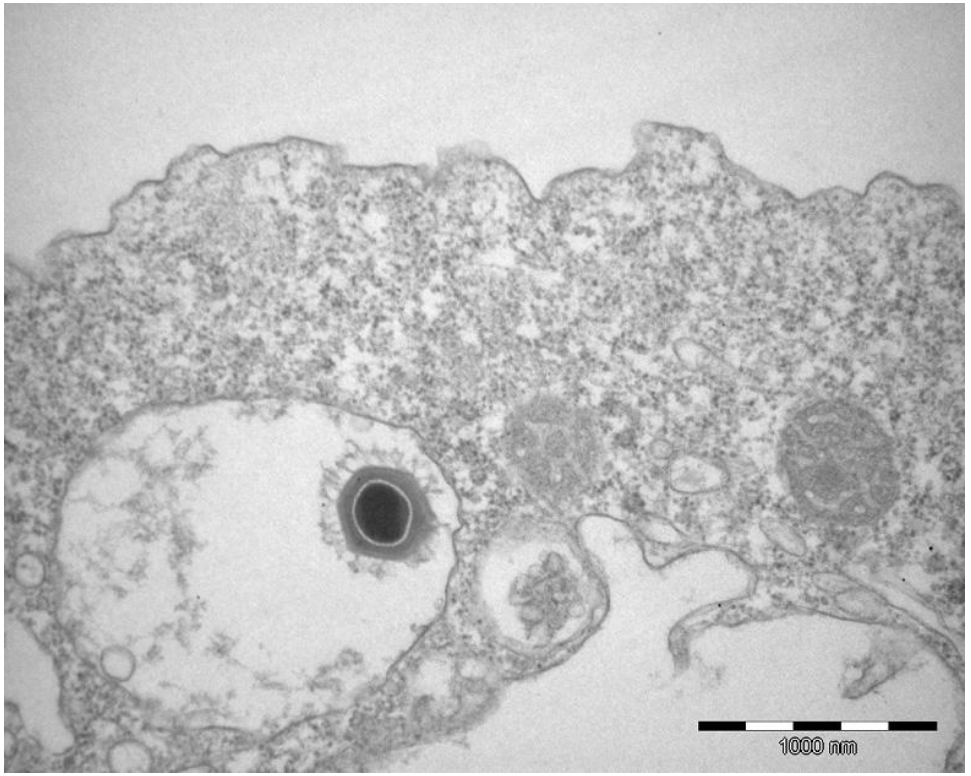
VÍRUS	genoma	estrutura	No de moléculas	tamanho
Parvovirus	DNA sf	linear	1	5,2 Kb
SV40	DNA df	circular	1	5,2 Kbp
Adenovírus	DNA df	linear	1	36 Kbp
Herpes simplex	DNA df	linear	1	152,3 Kbp
Poliovírus	RNA sf+	linear	1	7,4 Kb
Reovírus	RNA df	linear	10	23,5 Kbp
Influenza	RNA sf-	linear	8	~10 Kb
HIV	RNA sf+	linear	2(idênticas)	8,0 Kb

Hepatite B	DNA gapped	circular	1	3,4 Kb
Bromovíridea (Alfafa mosaic virus)	RNA sf	genoma segmentado em 3 capsídeos.		
Viróide	RNA sf	linear	1	0,3 Kb
Prion	não tem genoma próprio!!!!!			

VÍRUS EM GERAL SÃO PEQUENOS

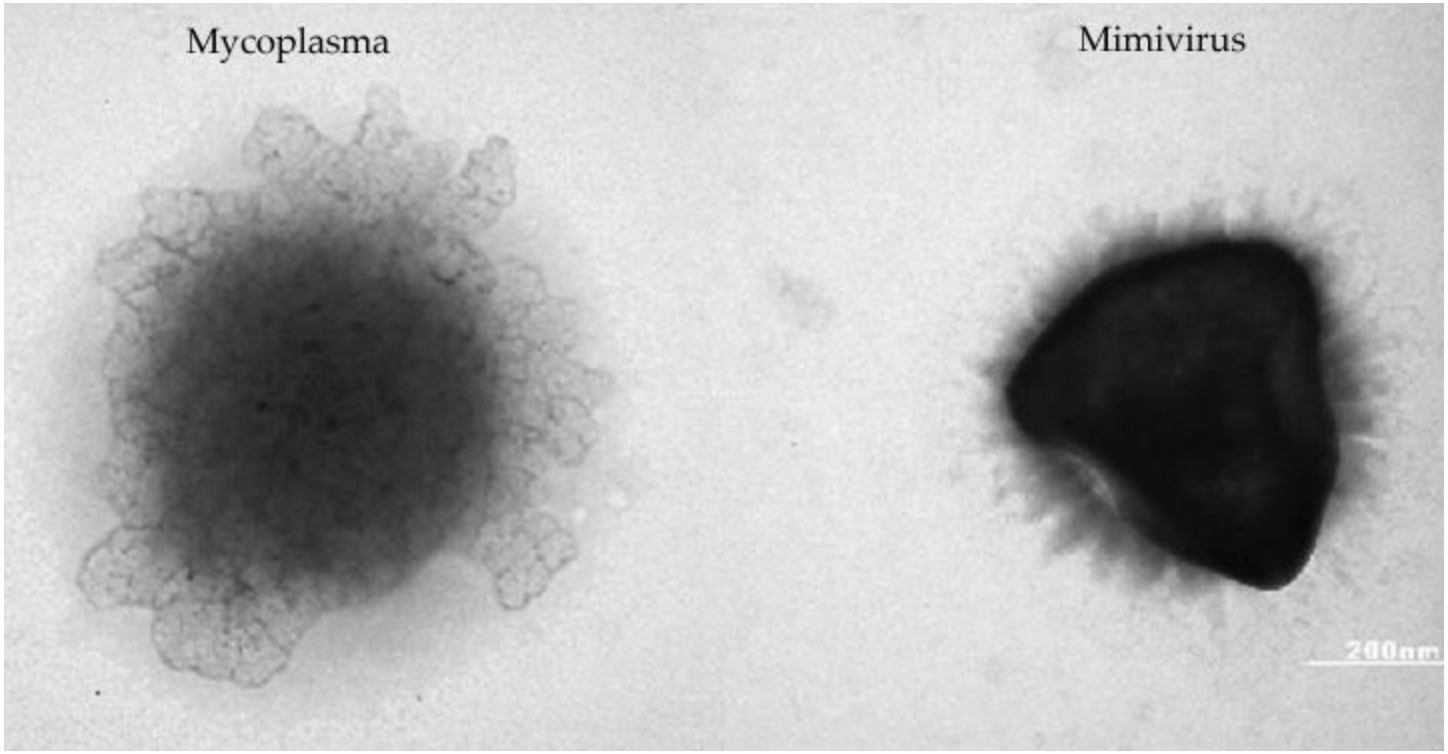
MIMIVÍRUS: O VÍRUS GIGANTE



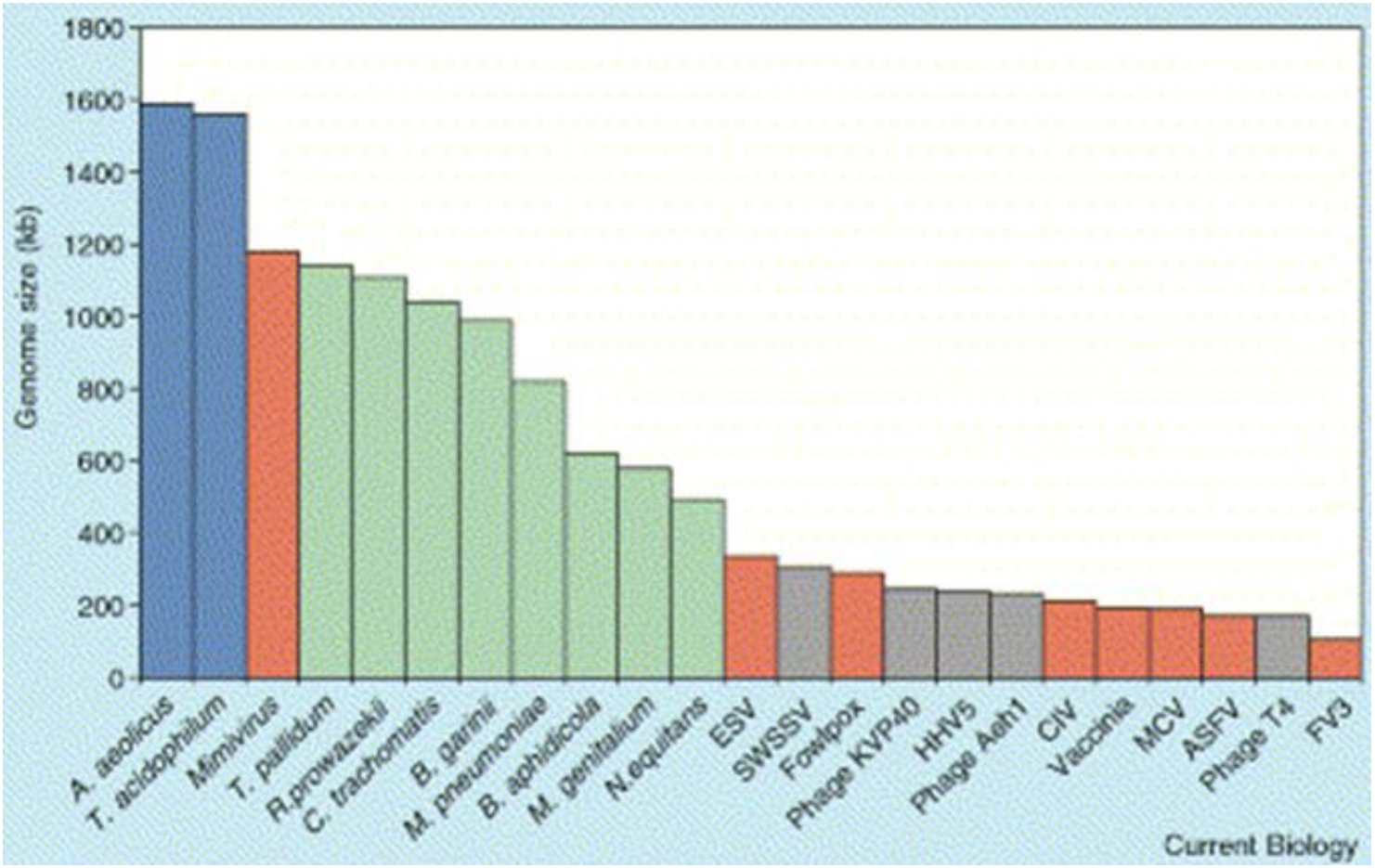


MIMIVÍRUS- INFECTA AMEBA

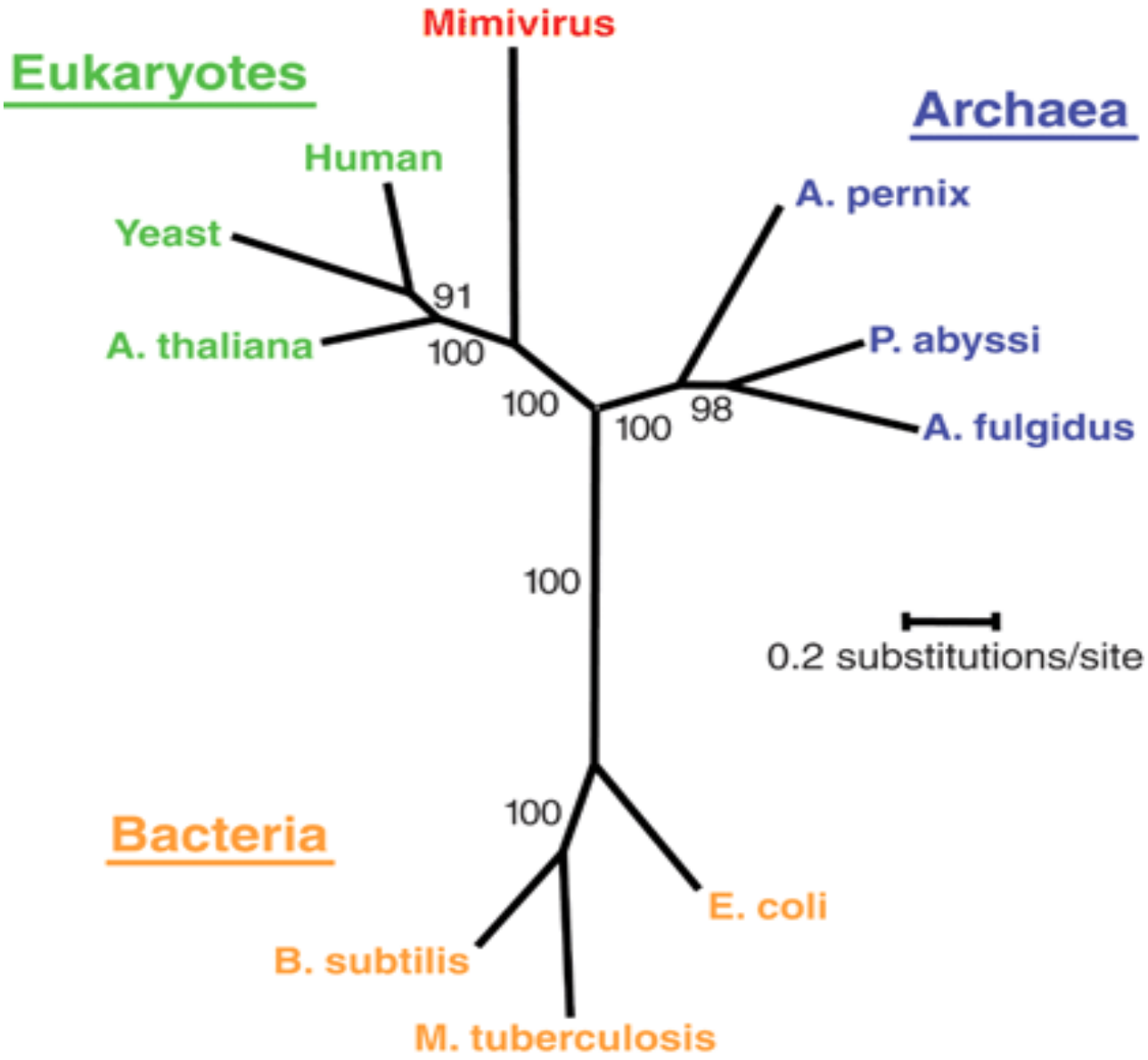
VÍRUS EM GERAL SÃO PEQUENOS



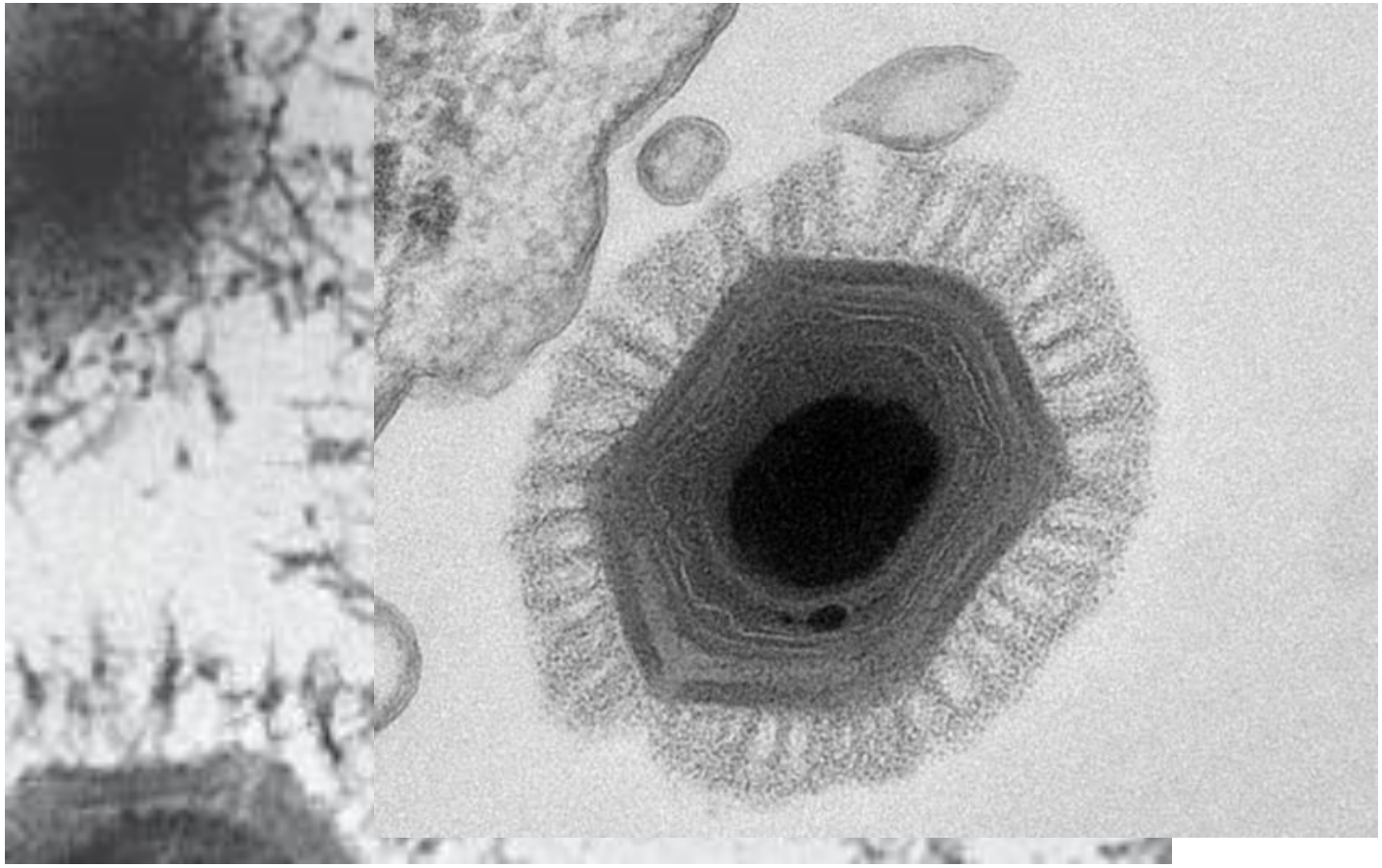
VÍRUS EM GERAL TEM GENOMA PEQUENOS



POSIÇÃO FILOGENÉTICA DOS MIMIVIRUS

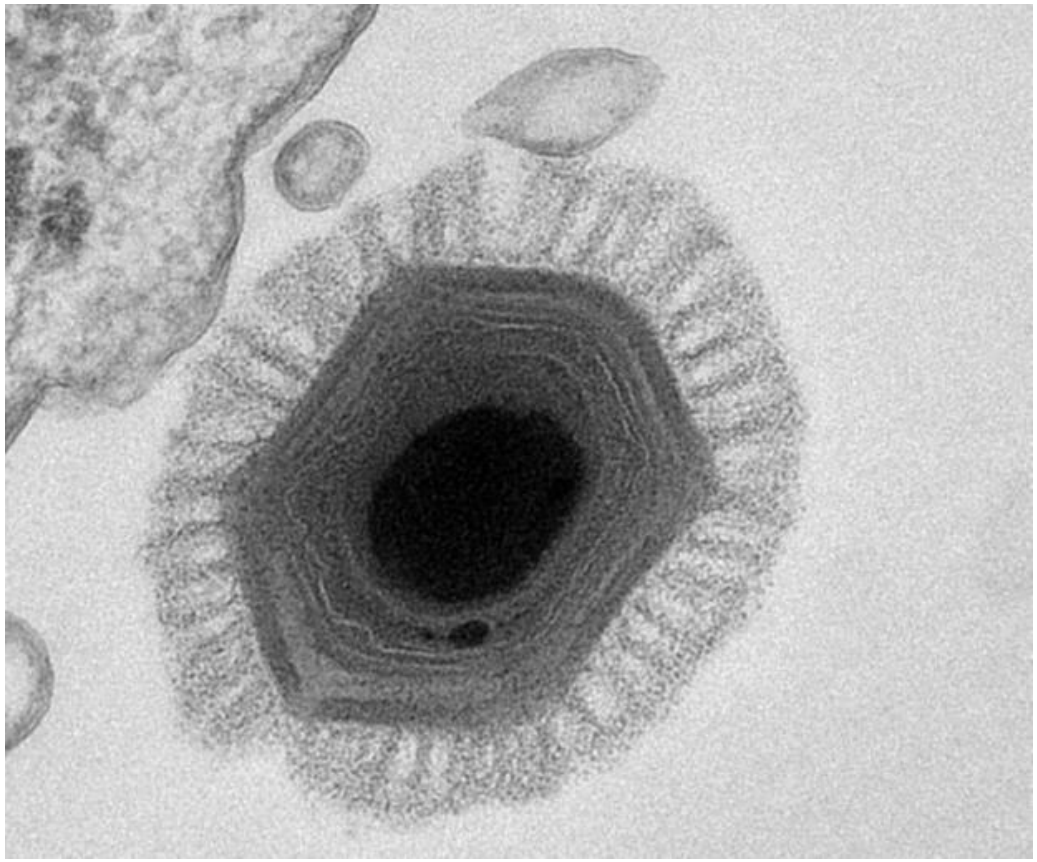


Sputnik virus (18 KBP) infecta mamavirus, um tipo de mimivírus!!!!!



21 genes similar a vírus de eucária, bactéria e arquéia!!!

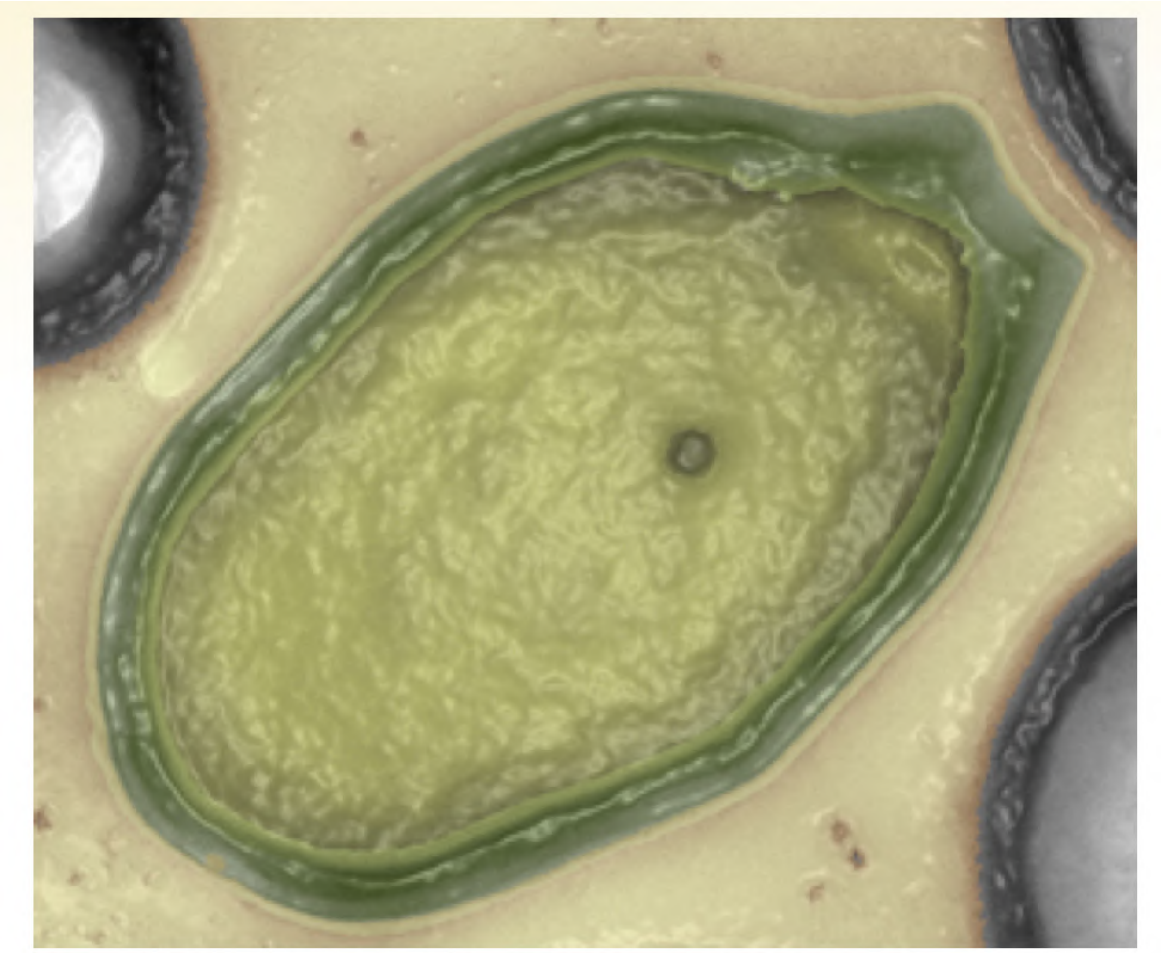
Megavirus chilensis!!!!!
Encontrado nas águas do mar do Chile, 6,5% maior que o mimivirus



PANDORAVIRUS!!!!

Ainda maior! 2.5 mega pares de base!!!!

Genes muito distintos: 4o domínio da vida???



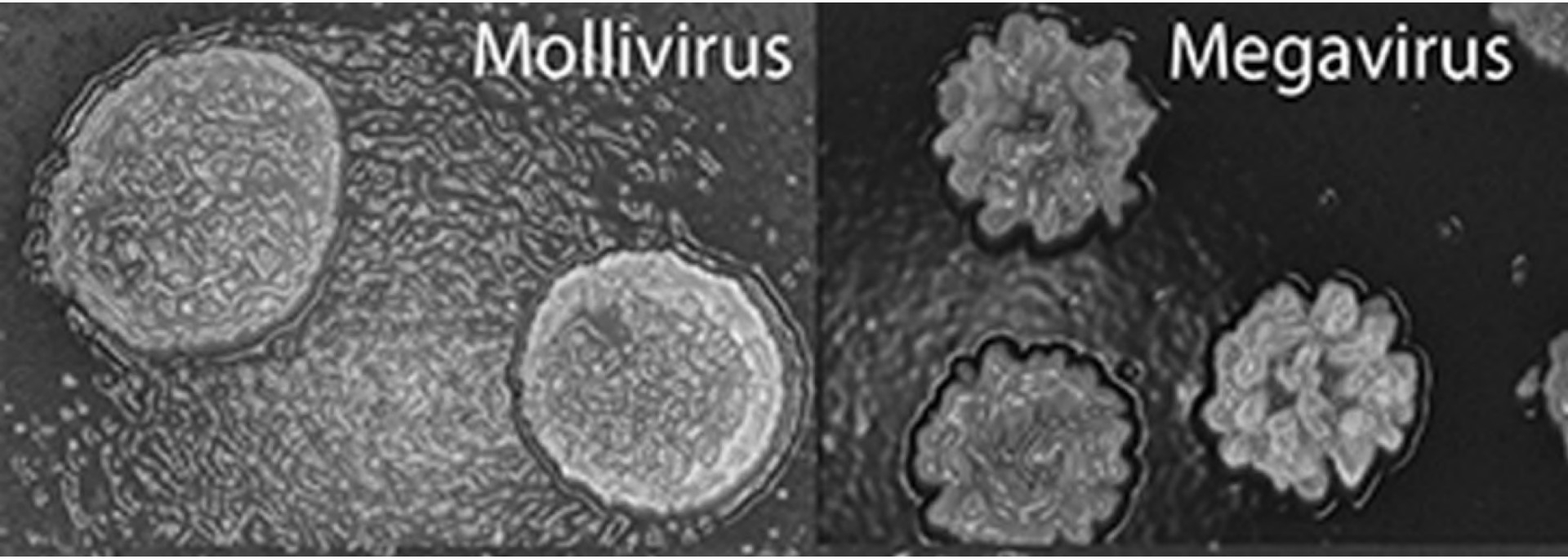
Pandoraviruses were discovered lurking in the mud of Chile and Australia, half a world apart.

MOLLIVIRUS!!!!= 2015

Encontrado na permafrost da Sibéria!

Congelado por 30.000 anos.

Será que pode ser recuperado?



Histórico

Evidências históricas de doenças ligadas a vírus:

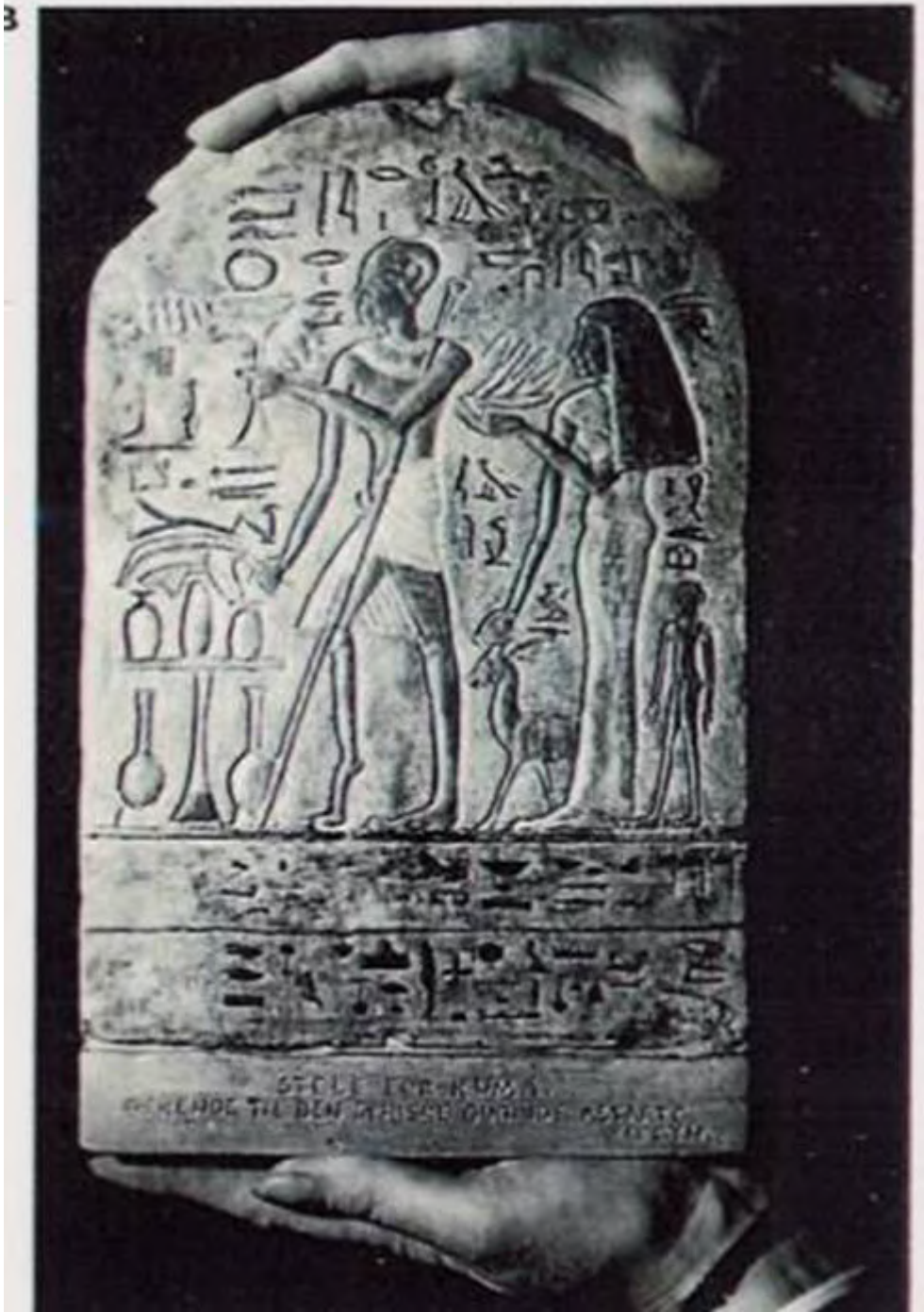
Múmias Rampses V morreu provavelmente de varíola!!!

Maldição das múmias

“o Faraó virá chamar aquele que violar seu túmulo”

Vírus X fungos

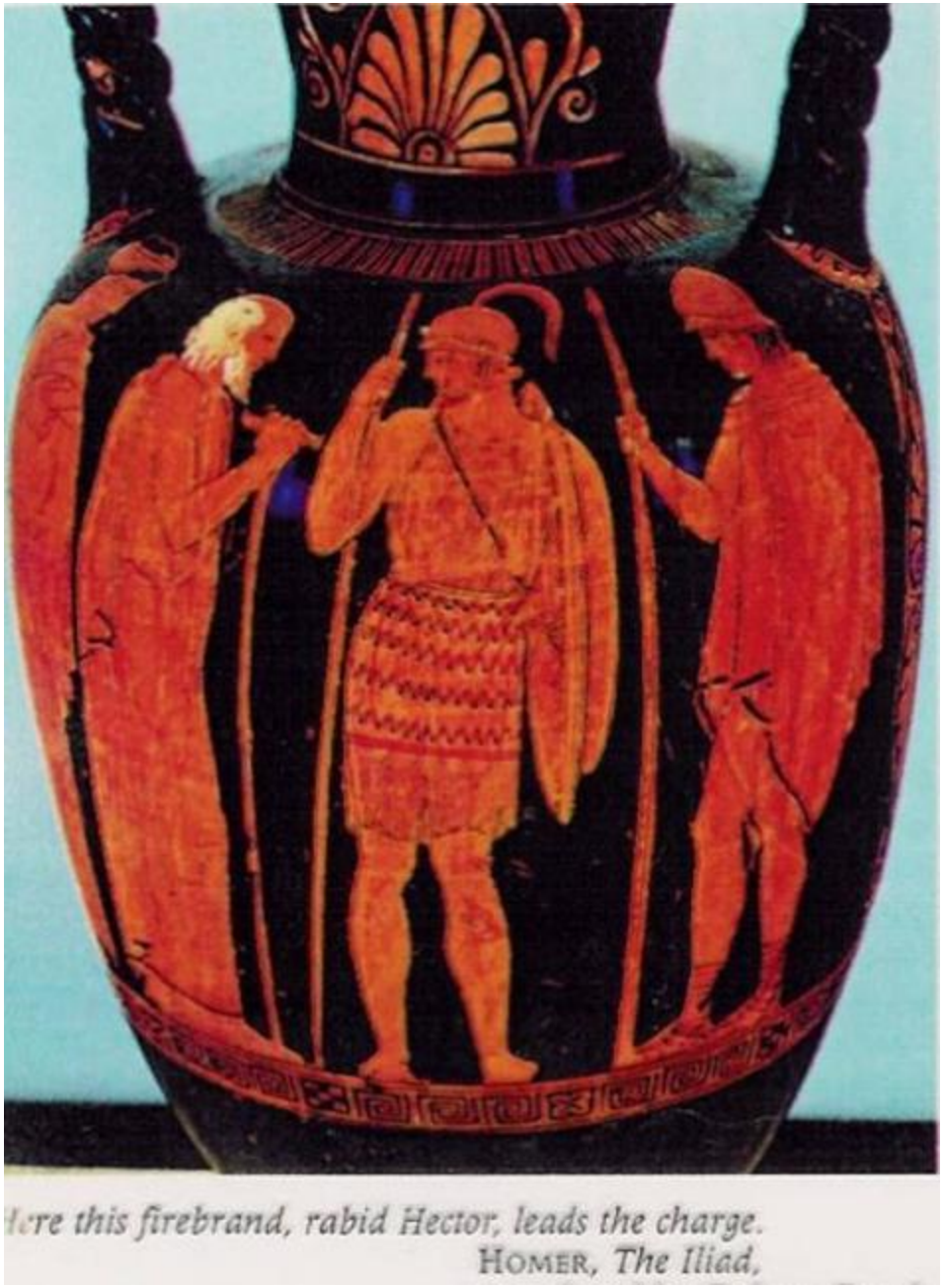
Figuras de pessoas com sequelas de Poliomielite no Egito Antigo.



Múmia do Faraó Sipta com 20 anos

Raiva citada no livro
As Ilíadas

e na Mesopotâmia:
Lei sobre responsabilidade por cães com raiva.



ere this firebrand, rabid Hector, leads the charge.
HOMER, *The Iliad,*

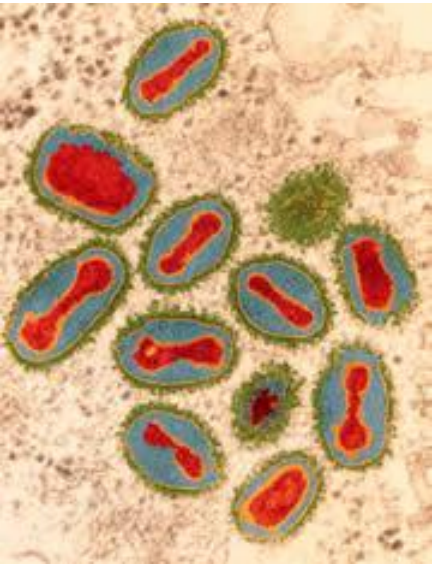
Histórico

"Miss Chile" Mummy

Múmia miss Chile, contaminada com HTLV (relacionado com leucemia, e comum entre os japoneses)!!!

Museu de San Pedro, no Atacama.

Varíola: uma epopéia humana:



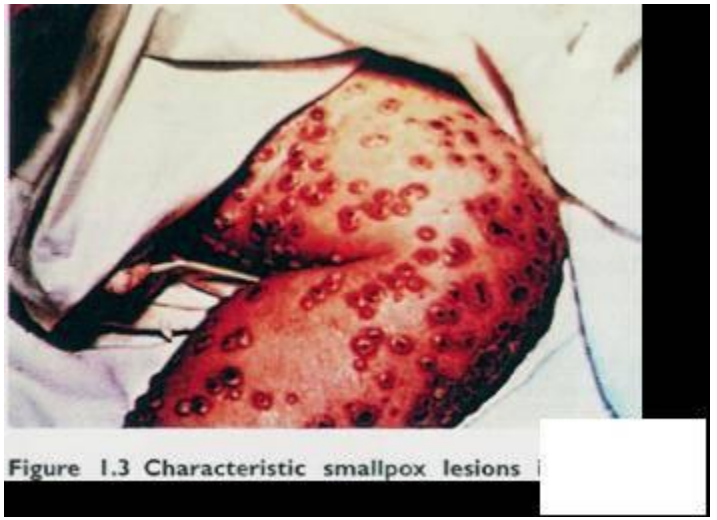


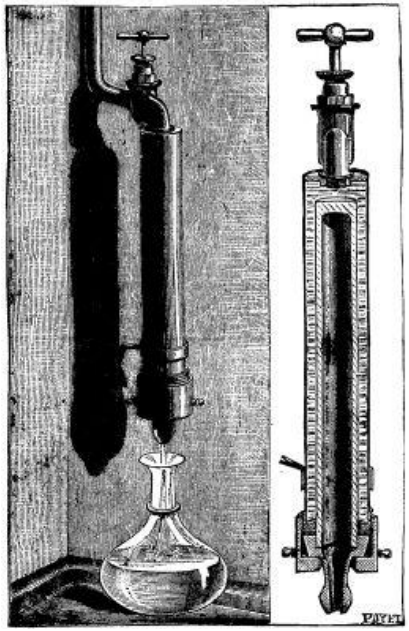
Figure 1.3 Characteristic smallpox lesions

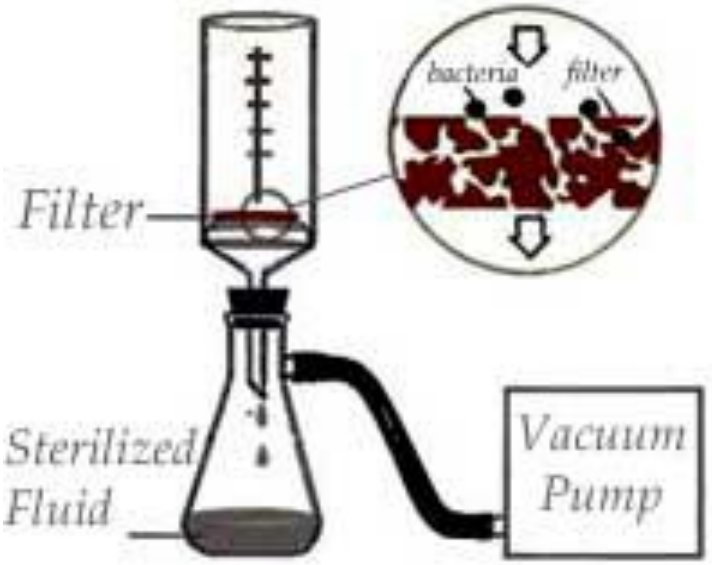
- Originária provavelmente na Ásia!
- Ásia para a Europa

- **Guerra Biológica: importância na invasão das Américas (espanhóis –Hernando Cortez "doavam" cobertores contaminados aos índios como resultado 3,5 milhões de Astecas morreram entre 1520-22).**

MORTAL SICKNESS AMONG THE INDIANS.

Descoberta dos vírus





Filtro de Chamberlain, usado Beijerink para filtrar TMV em 1898

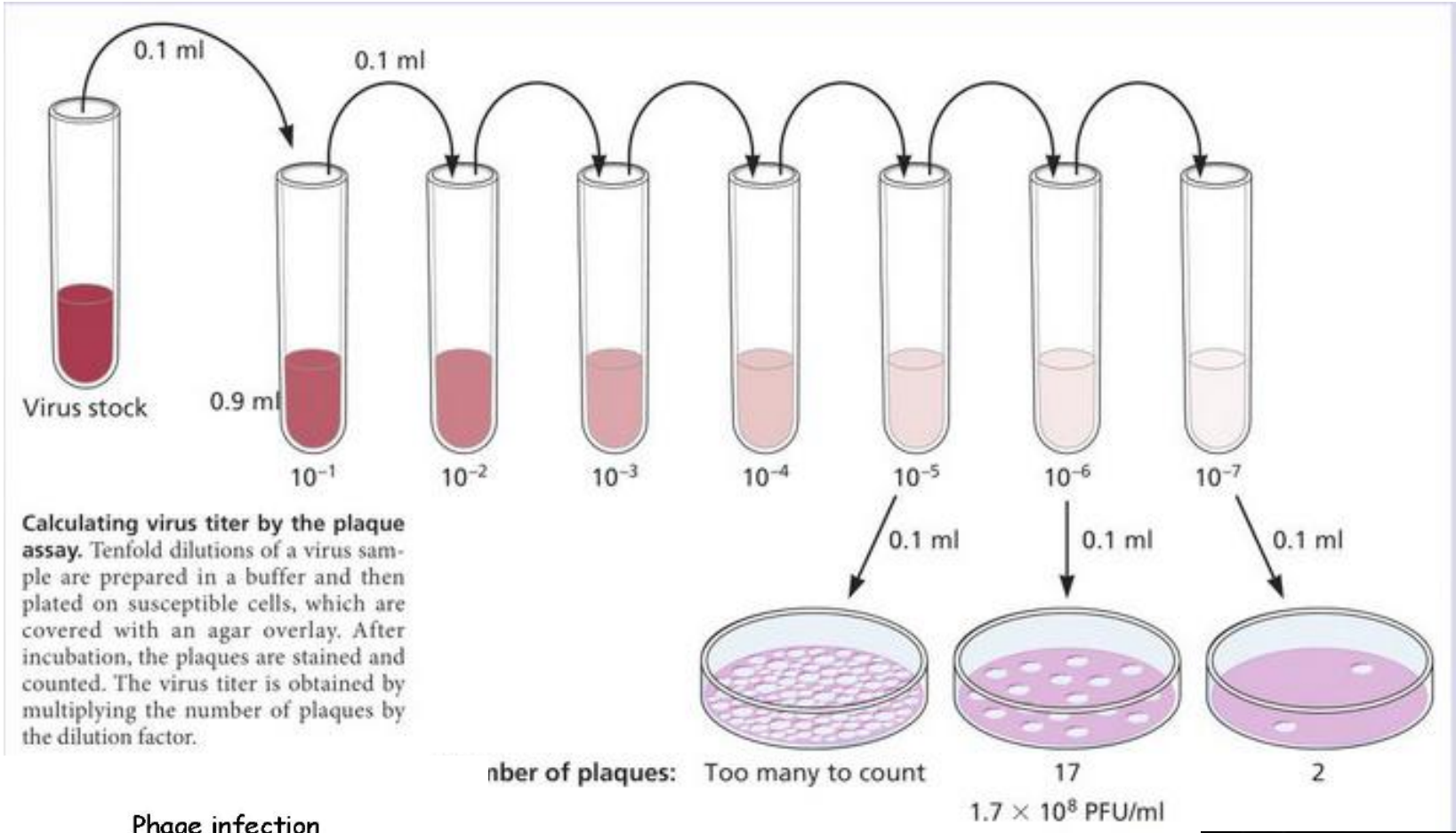
Século XX: Algumas doenças eram causadas por elemento tóxico filtrável.

Mas com capacidade de reprodução: "contagium vivum fluidum"!!

Por isso foi chamado de vírus (veneno) filtrável...

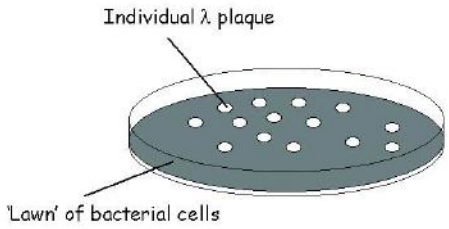
Com o tempo ficou apenas vírus!

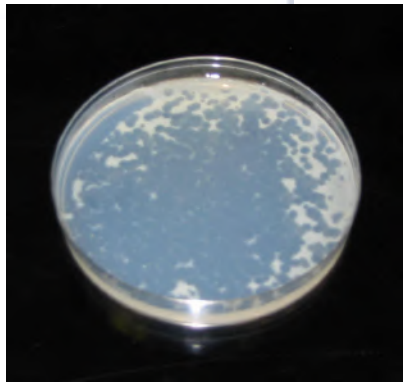
Bacteriófagos: comedores de bactérias-> fagos.



Calculating virus titer by the plaque assay. Tenfold dilutions of a virus sample are prepared in a buffer and then plated on susceptible cells, which are covered with an agar overlay. After incubation, the plaques are stained and counted. The virus titer is obtained by multiplying the number of plaques by the dilution factor.

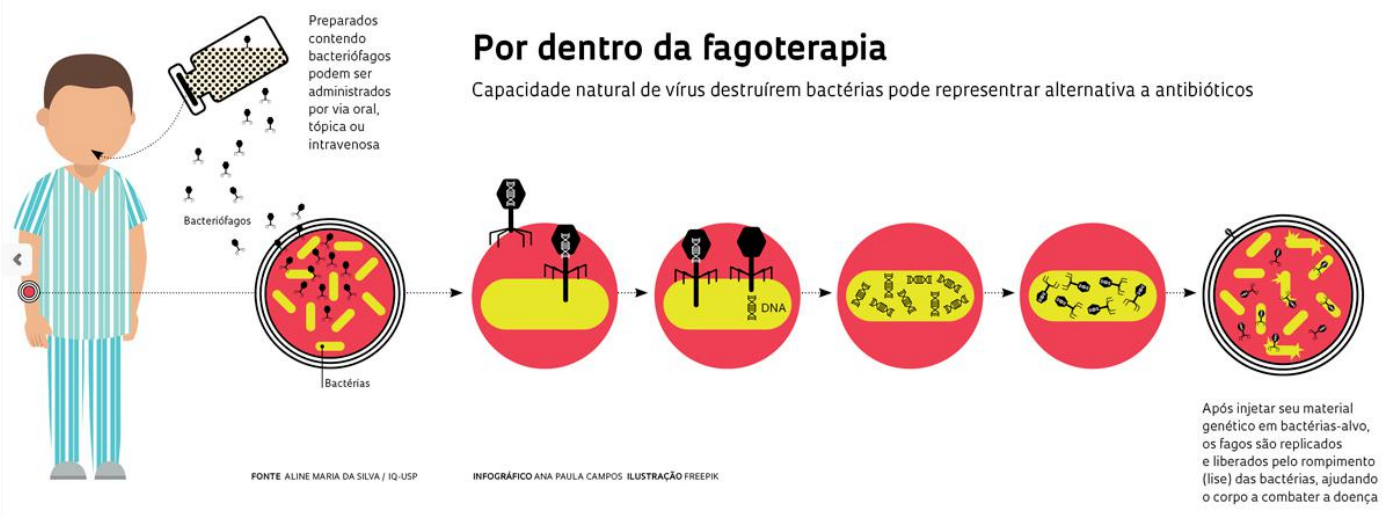
Phage infection





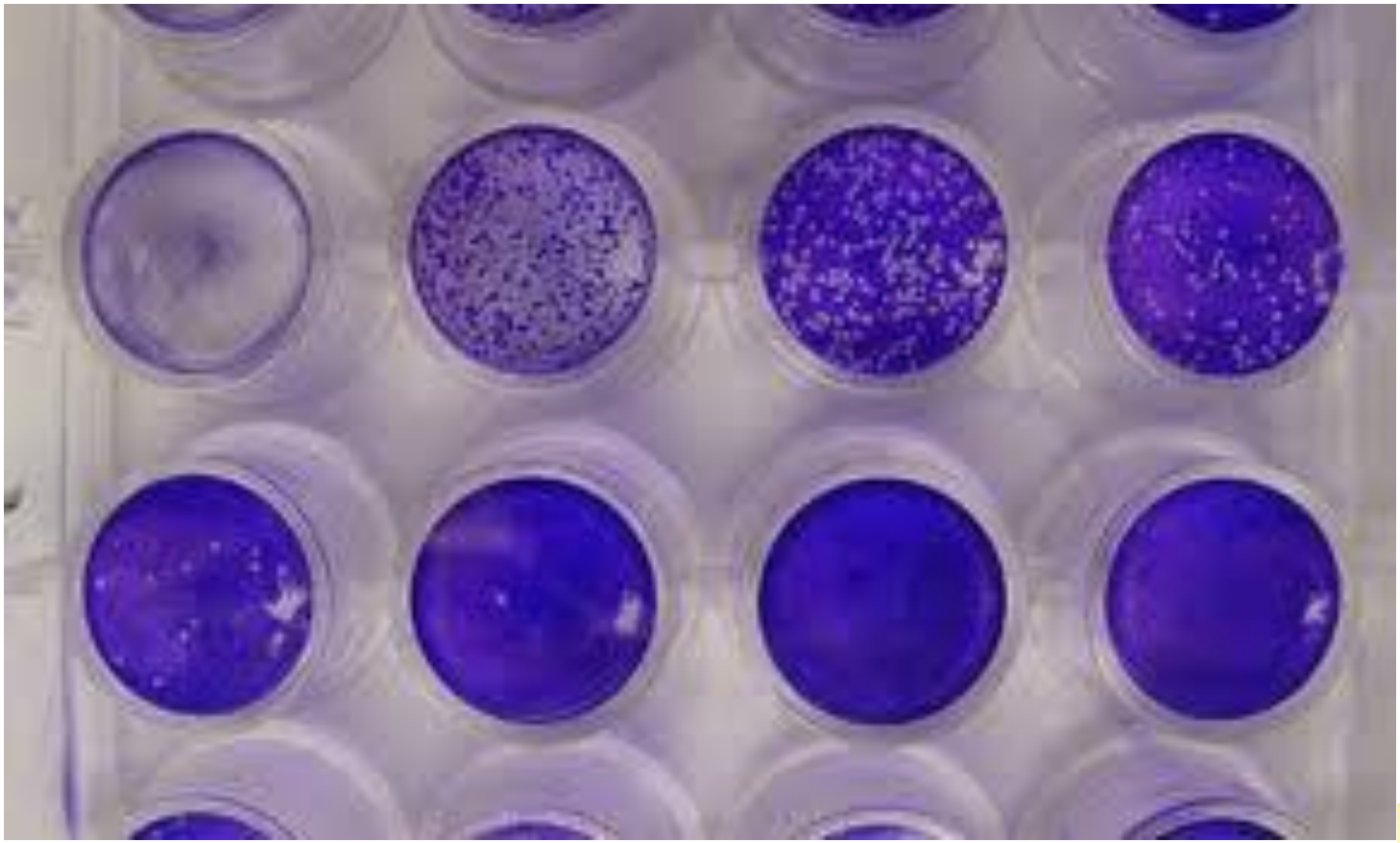
Bacteriófagos: comedores de bactérias-> fagos.

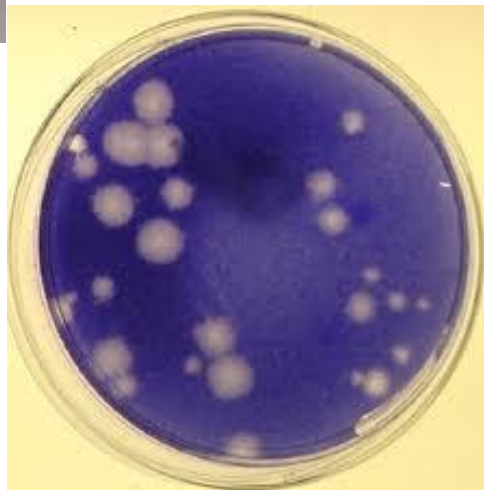
Felix d'Herelle (1873-1949) e o britânico Frederick Twort (1877-1950) descobriram os fagos e dHerelle propôs a terapia de infecções bacterianas com fagos!!!



Ver Revista FAPESP 257, Julho 2017!!!

E os vírus de células animais também podem ser quantificados!!





1952: Hershey e Chase: DNA é o material genético!

Marcação diferencial entre proteínas (S35) e DNA (P32).

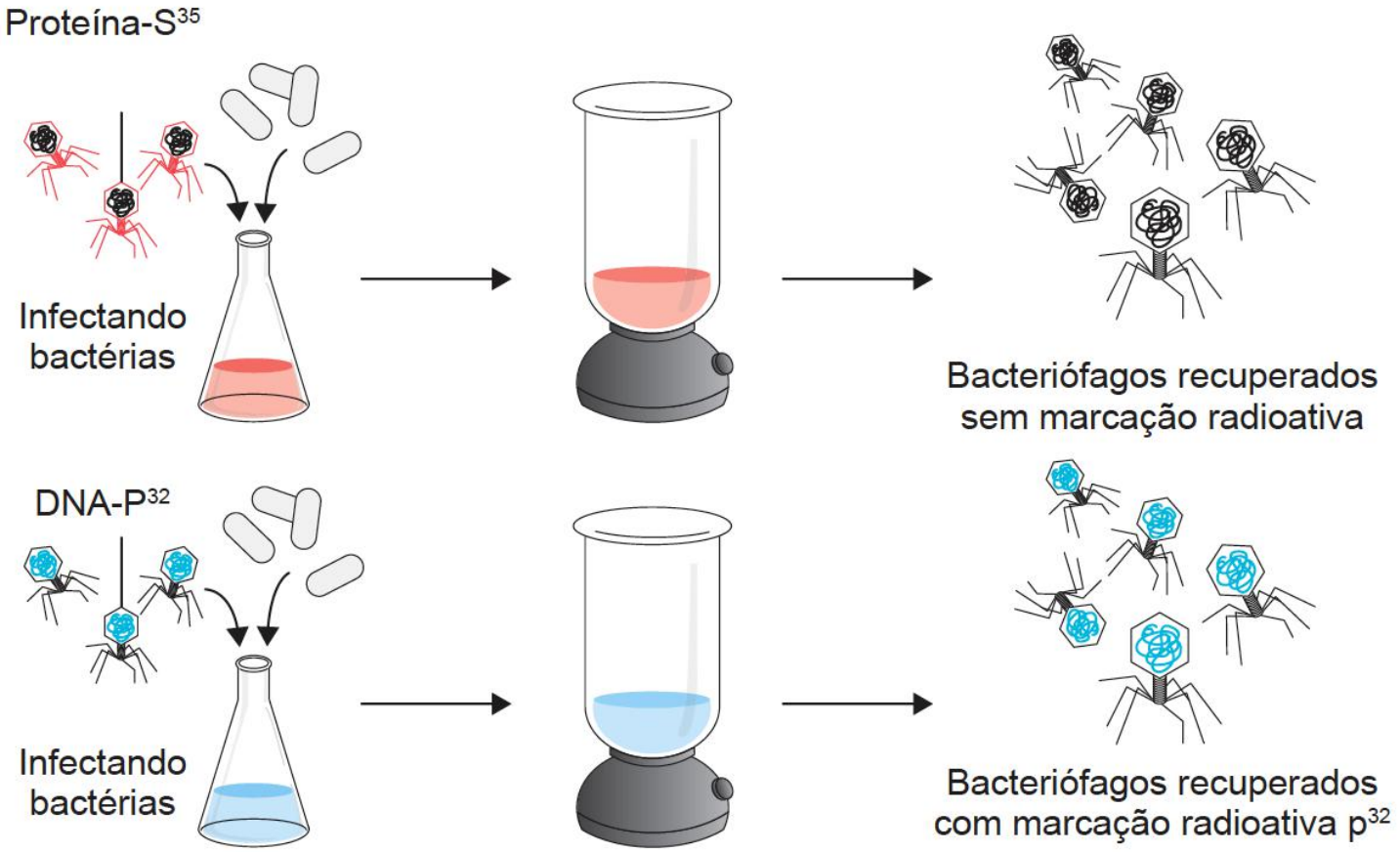
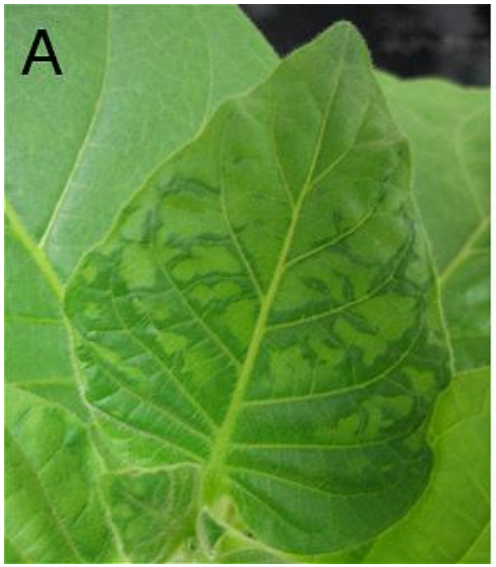
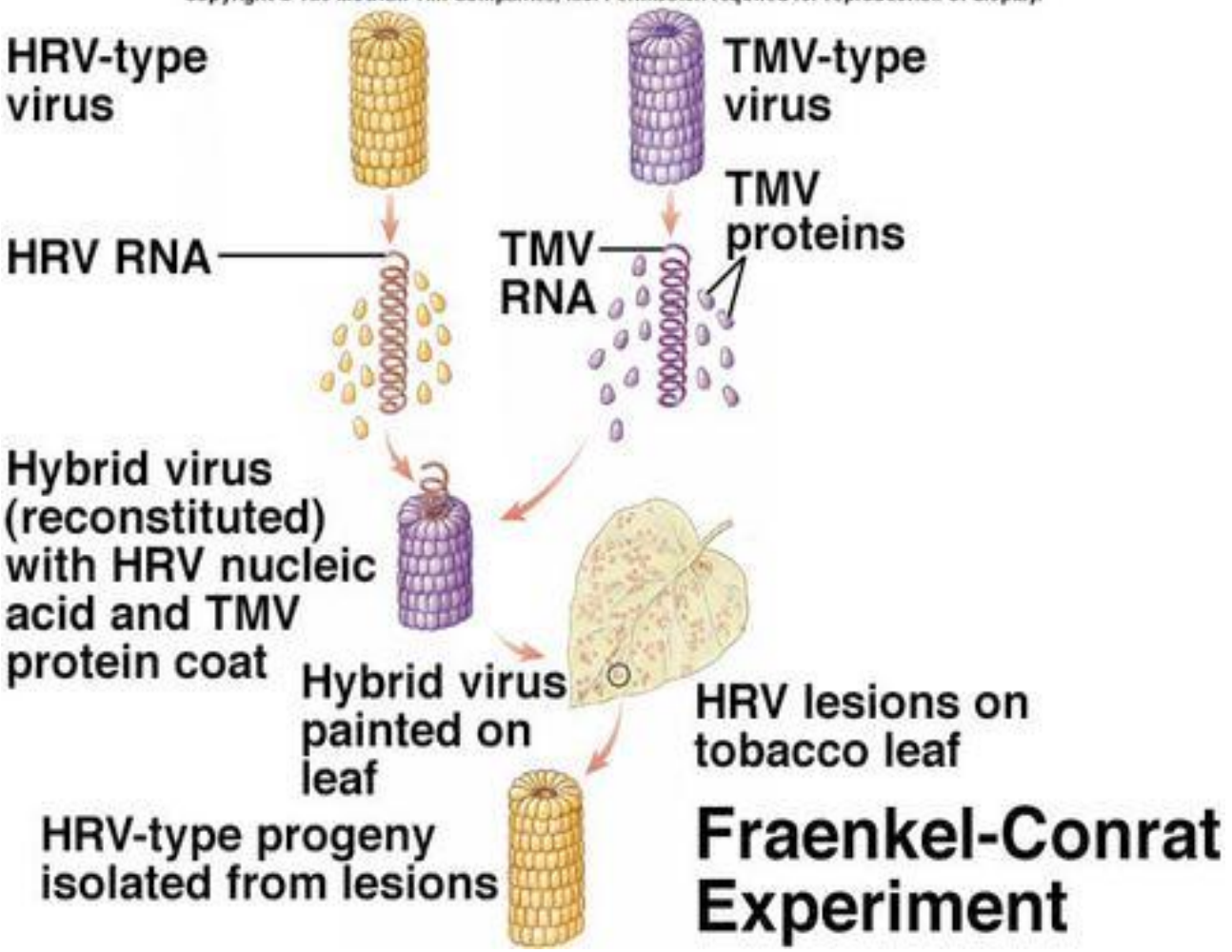


Figura do "Genética Molecular Básica: dos Genes aos Genomas", 2017



1956: vírus do mosaico do tabaco (TMV) – genoma de vírus é RNA!

Heinz Ludwig Fraenkel-Conrat alemão-americano.



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