ウイルスとは?

1）遺伝物質がDNAかRNAのいずれか
2）成長・分裂しない
3）エネルギー産生系・リボソームをもたない
4）ウイルスの複製には宿主細胞の素材を利用する

ウイルス粒子（Virion）ー核酸と蛋白性外被（CapsidProtein）
核酸を包むタンパク性外被
（nucleocapsid）

これら全部を包むエンベロープ
（envelope）

昆虫病原性ウイルス

科　　名	属　　名	和　　名	核酸の種類
Baculoviridae	*Baculovirus*	核多角体病ウイルス 顆粒病ウイルス	複鎖DNA
Reoviridae	*Cypovirus*	細胞質多角体病ウイルス	複鎖RNA
Poxviridae	*Entomopoxvirus*	昆虫ポックスウイルス	複鎖DNA
Iridovirus	*Iridovirus*	虹色ウイルス	複鎖DNA
Parvoviridae	*Densovirus*	濃核病ウイルス	単鎖DNA
Rhabdoviridae	*Sigmavirus*	σウイルス	単鎖RNA
Picornaviridae	*Enterovirus*	急性麻痺病ウイルス	単鎖RNA

「昆虫病理学」：福原敏彦編から転載

http://hashi.agr.hokudai.ac.jp/IP/IP.html

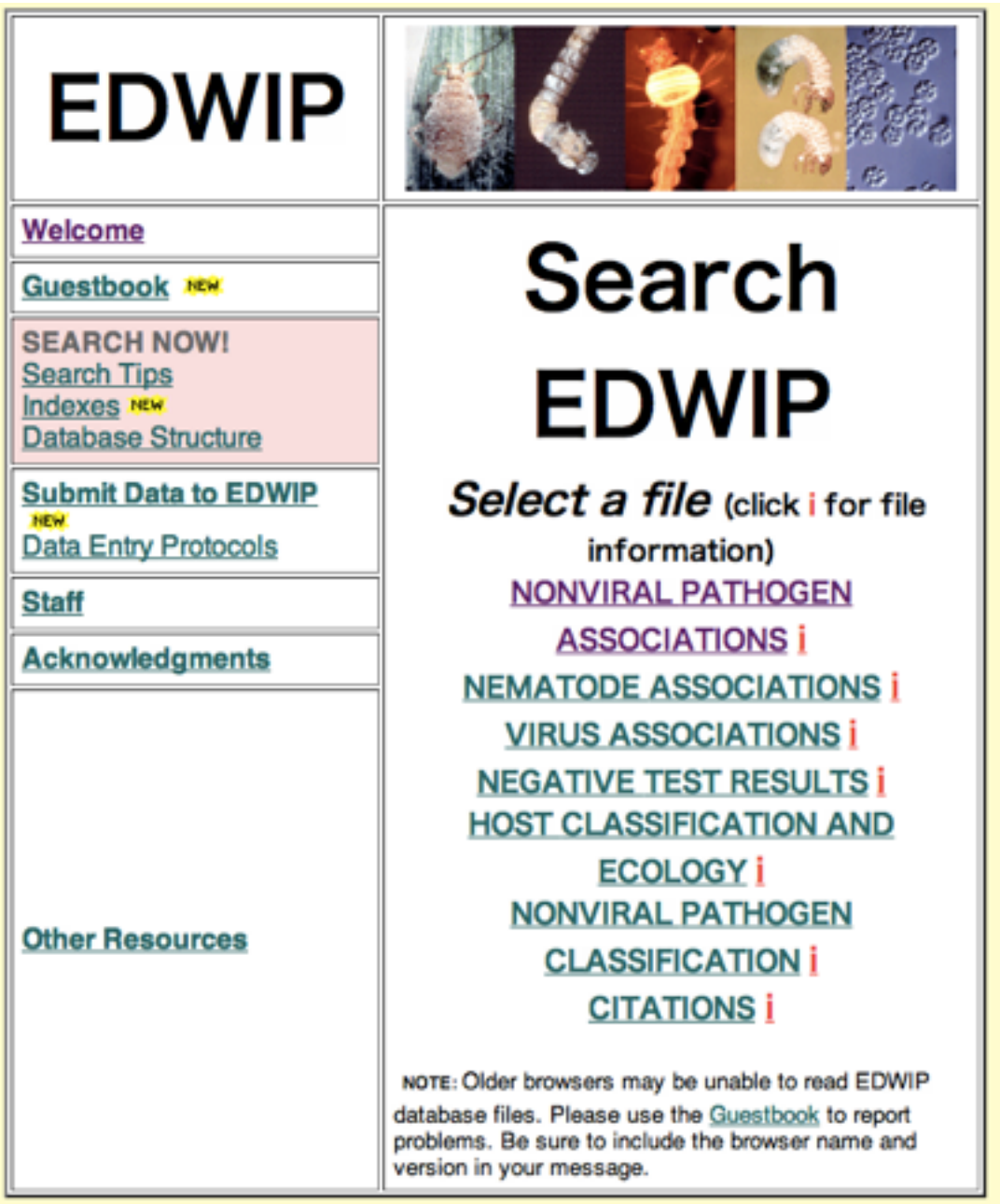
Viral Diseases of Insects in the Literature (VIDIL)
Literature, species, and subjects to 1985
Developed by Mauro E. Martignoni

Text Last Updated: June 13, 2001
Database Last Updated: March 12, 1999

http://insectweb.inhs.uiuc.edu/Pathogens/VIDIL/

The Illinois Agricultural Experiment Station, University of Illinois
The Center for Economic Entomology, Illinois Natural History Survey

Search the Ecological Database of the World's Insect Pathogens (EDWIP)



Families and Groups of Viruses Associated with Insect

DNA VIRUSES

Double-stranded DNA, enveloped

- **POXVIRIDAE, Poxviruses**
  - **ENTOMOPOXVIRINAE, Poxviruses of insects**
    - **Three probable genera (poxvirus α, β, γ)**
  - **BACULOVIRIDAE**
    - **Baculovirus**
      - **Subgroup A, nuclearpolyhedrovirus**
      - **Subgroup B, granulosis virus**
      - **Subgroup C, enveloped nonoccluded rod-shaped nuclear virus**
  - **POLYDNAVIRIDAE**
    - **Polydnavirus**
      - **Subgroup A, polydnavirus with fusiform nucleocapsids**
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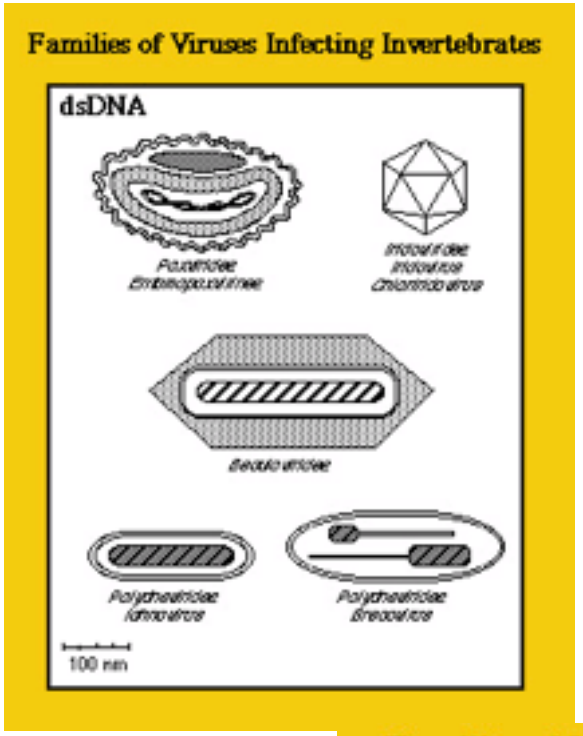
Double-stranded DNA, nonenveloped

- **IRIDOVIRIDAE, icosahedral cytoplasmic deoxyriboviruses**
  - **Iridovirus, small iridescent insect virus**
  - **Chloriridovirus, large iridescent insect virus**

Single-stranded DNA, nonenveloped

- **PARVOVIRIDAE, parvoviruses**
  - **Densovirus, densonucleosis virus**



ポックスウイルス科　Poxviridae　（Pox（痘症、天然痘）に由来する。）

コードポックスウイルス亜科　Chordopoxvirinae（脊椎動物に感染する）

オルトポックスウイルス属　Genus: Orthopoxvirus
主なウイルス：　痘瘡ウイルス　Variola virus
牛痘ウイルス　Cowpox virus
ワークシニアウイルス　Vaccinia virusem_poxvi.htm

パラポックスウイルス属　Genus: Parapoxvirus
主なウイルス：　オーフウイルス　Orf virus

アヴィポックスウイルス属　Genus: Avipoxvirus
主なウイルス：　鶏痘ポックスウイルス　Fowlpox virus

カプリポックスウイルス属　Genus: Capripoxvirusem_poxvi.htm
主なウイルス：　ヒツジポックスウイルス　Sheeppox virus

レポリポックスウイルス属　Genus: Leporipoxvirus
主なウイルス：　粘液腫ウイルス　Myxoma virus

モラシポックスウイルス属　Genus: Molluscipoxvirus
主なウイルス：　Molluscum contagiosum virus

ヤタポックスウイルス属　Genus: Yatapoxvirus
主なウイルス：　ヤバサル腫瘍ウイルス　Yaba monkey tumor virus

痘瘡ウイルス[Variola virus]

古代エジプトのミイラにも痘瘡の痕跡が見つかり、天然痘は古い病気であること、人類にとって死亡率の高い伝染病であった。種痘よるWHOの全世界痘瘡根絶計画が奏を功し、1977年10月東アフリカのソマリアにおける患者発生が最後だったことから、WHOは1979年この地球上から天然痘が撲滅されたと宣言しました。英国のエドワード・ジェンナーが生ワクチンを開発した。

エントモ(昆虫）ポックスウイルス亜科 Entomopoxvirinae（昆虫に感染する）

昆虫ポックスウイルス Alpha属　Genus: Alphaentomopoxvirus (鞘翅目昆虫）
主なウイルス：　*Melolontha melolontha* entomopoxvirus

昆虫ポックスウイルス Beta属　Genus: Betaentomopoxvirus　（直翅目、鱗翅目昆虫）
主なウイルス：　*Amsacta moorei* entomovirus

昆虫ポックスウイルス Gamma 属 Genus: Gammaentomopoxvirus　（双翅目昆虫）
主なウイルス：　*Chironomus luridus* entomopoxvirus

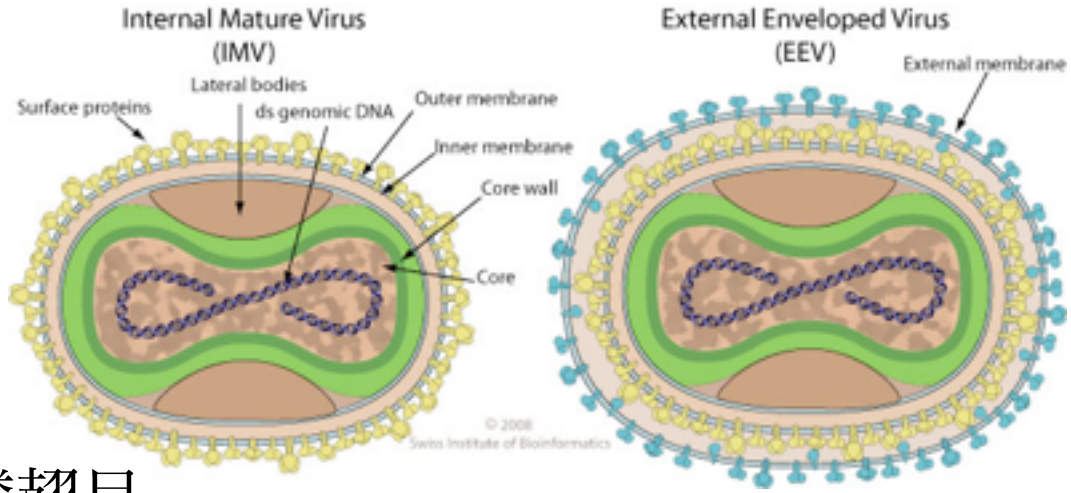
・感染と病気　　脊椎動物、昆虫に感染。痘瘡ウイルスは、天然痘を引き起こす。
・粒子構造　　レンガ状の大型ウイルス
・遺伝子　　直鎖二本鎖DNA

Alpha：鞘翅目

***Melolontha melolontha entomopoxvirus* (MMEV)**

Anomala cuprea entomopoxvirus [AB005053] (ACEV)

Complete nucleotide sequence of spheroidin gene of *Anomala cuprea* entomopoxvirus Virus Res. 55 (1), 61-69 (1998)



Beta：鳞翅目

Amsacta moorei entomopoxvirus 'L' (AMEV)

Complete genomic sequence of the *Amsacta moorei* entomopoxvirus: analysis and comparison with other poxviruses

Virology 274 (1), 120-139 (2000)

Arphia conspersa entomopoxvirus 'O' (ACOEV)

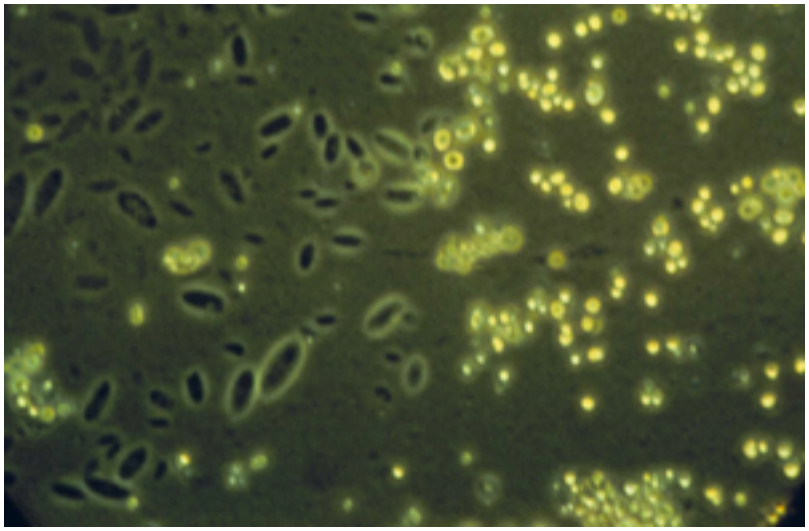
Gamma：双翅目

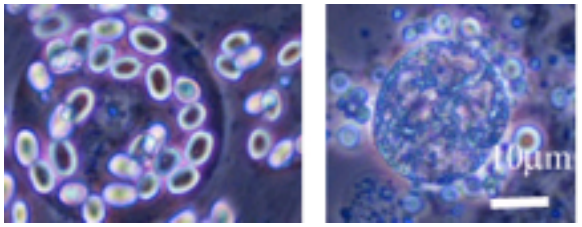
Chironomus luridus entomopoxvirus (CLEV)

Aedes aegypti entomopoxvirus (AAEV)

昆虫ポックスウイルス　（Entomopoxvirus）

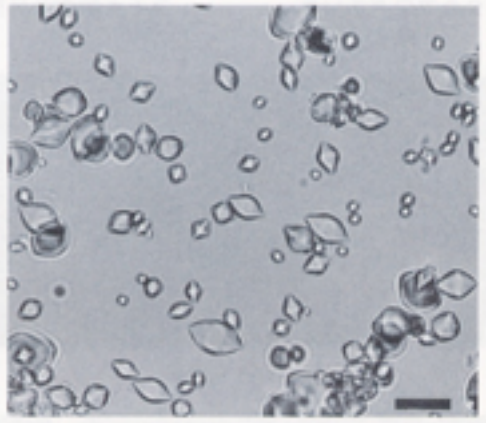
ポックスウイルス科に属する二本鎖DNAウイルス



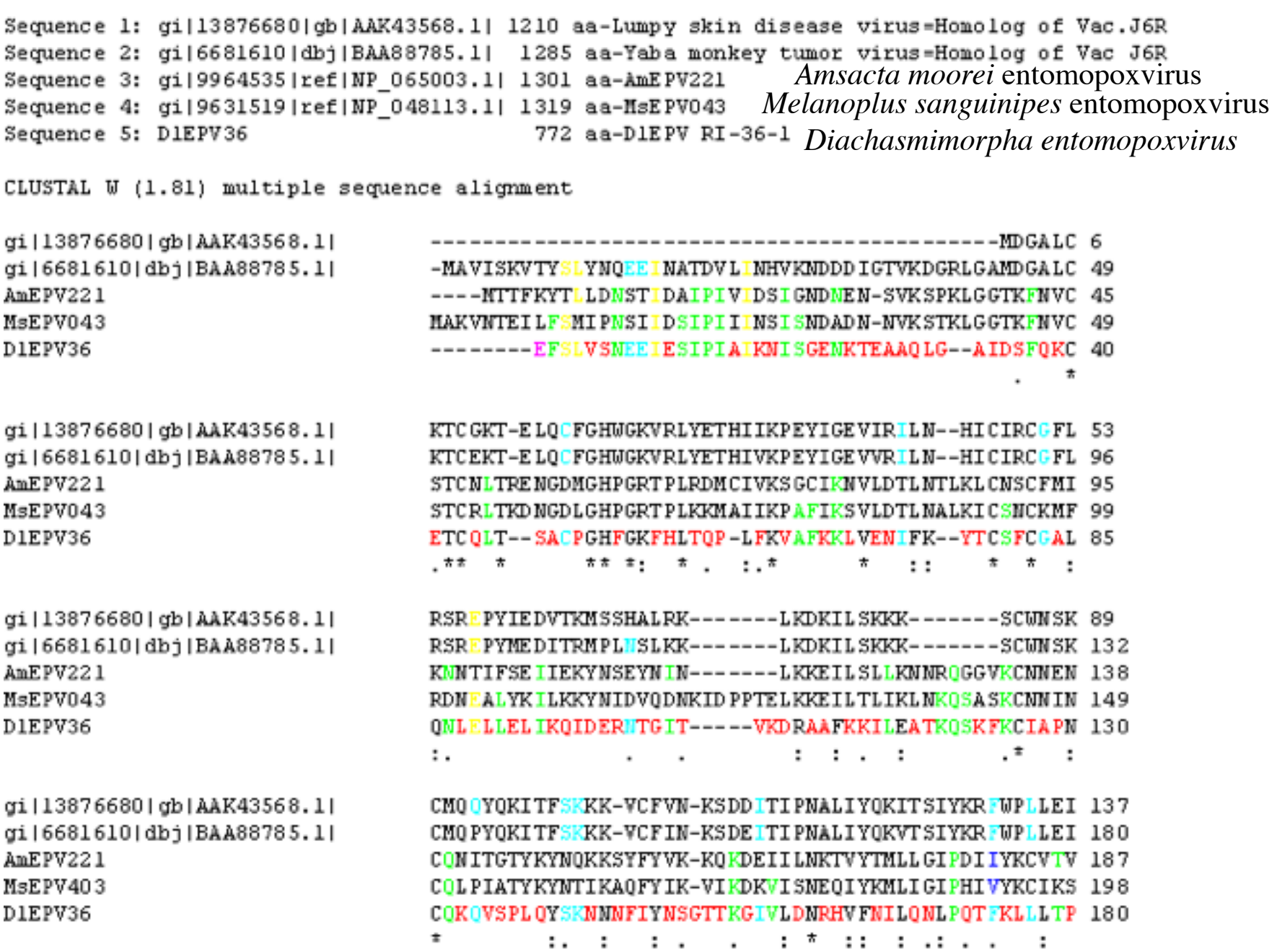


昆虫ポックス感染虫の脂肪体細胞（左）。細胞質で包埋体が産生されている。右は、正常な脂肪体細胞。

種々の核多角体病ウイルスの感染力を大きく増強する
昆虫ポックスウイルスのスピンドル



精製したドウガネブイブイのEPVのスピンドル。バーは10μmを示す。



a large gene that encodes a homolog of a DNA-directed RNA polymerase.

Families and Groups of Viruses Associated with Insect

DNA VIRUSES

Double-stranded DNA, enveloped

- **POXVIRIDAE, Poxviruses**
  - **ENTOMOPOXVIRINAE, Poxviruses of insects**
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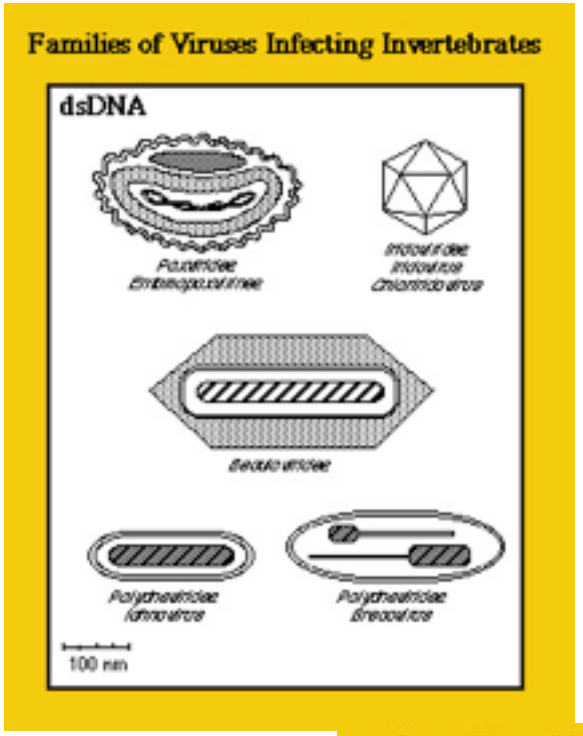
Double-stranded DNA, nonenveloped

- **IRIDOVIRIDAE, icosahedral cytoplasmic deoxyriboviruses**
  - **Iridovirus, small iridescent insect virus**
  - **Chloriridovirus, large iridescent insect virus**

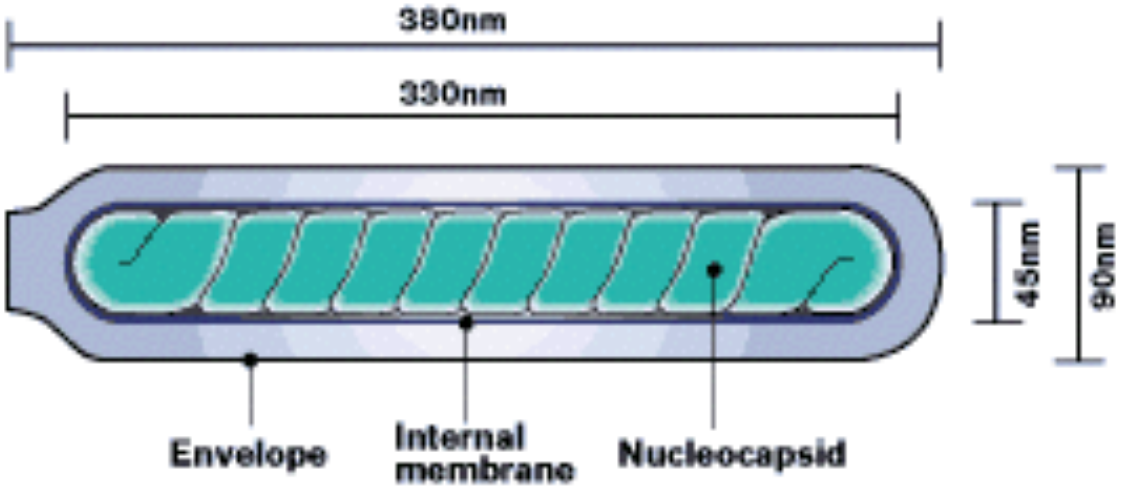
Single-stranded DNA, nonenveloped

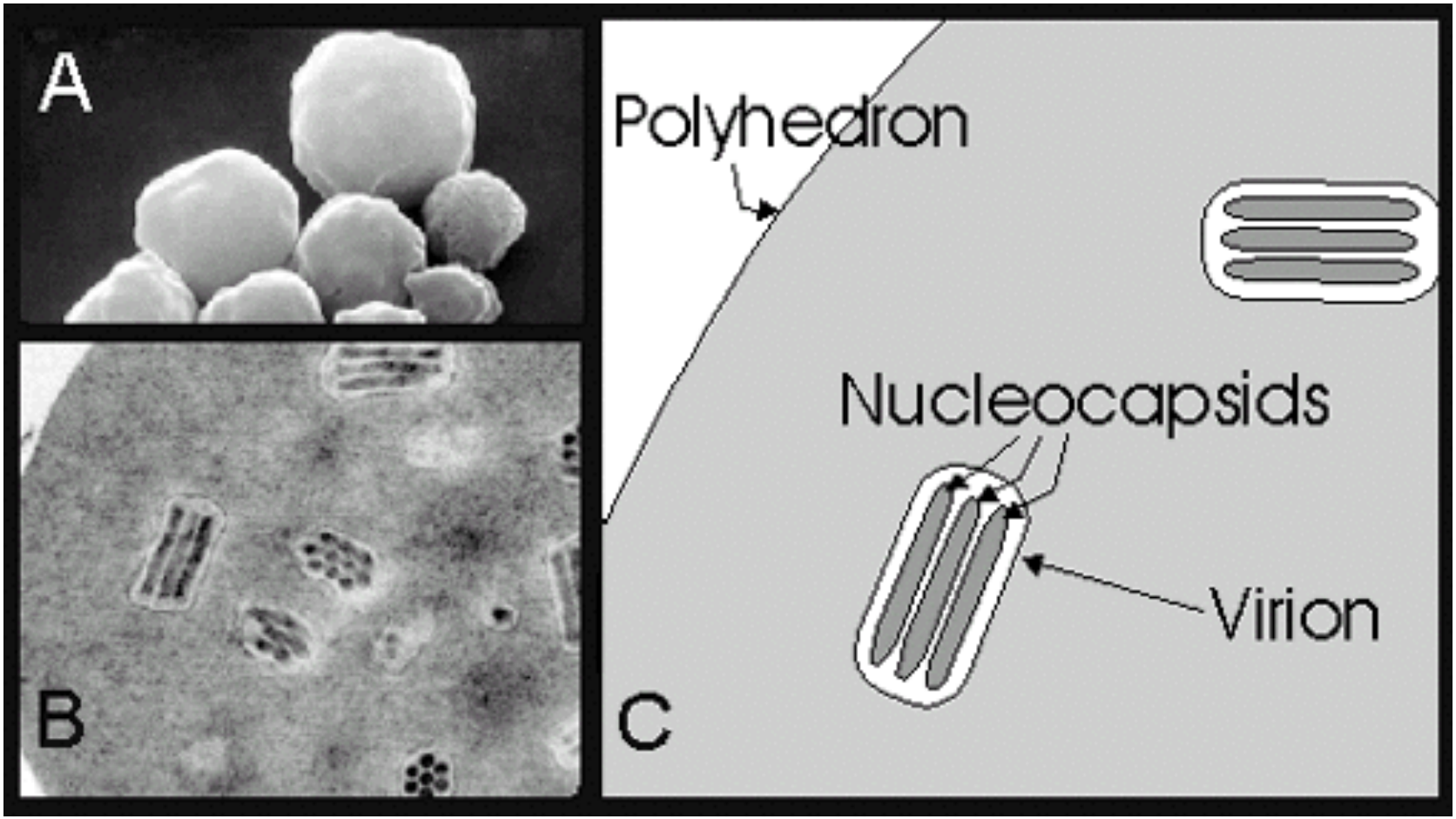
- **PARVOVIRIDAE, parvoviruses**
  - **Densovirus, densonucleosis virus**



バキュロウイルス(Baculovirus)とは

昆虫を主な宿主として病気を引き起こすウイルスは、9つのグループに分類される。そのなかで、4つのグループは**封入体**を作るという特徴がある。この封入体はウイルス粒子を包埋するタンパク性の結晶構造物で、しかもその封入体はウイルス自身にコードされているタンパク質です。それらのウイルスの中で、環状2本鎖で約130Kbpの1断片のDNAをゲノムとするのが、**バキュロウイルス**（Baculovirus）科に属する**核多角体病ウイルス**（nucleopolyhedrovirus: **NPV**）です。（注：NPVの英名は、nuclear polyhedrosis virusから、nucleopolyhedrovirusに変更になりました）。



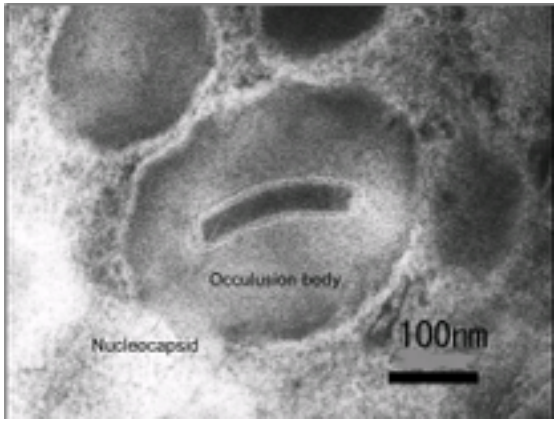


A) Baculovirus particles, or polyhedra; **B)** Cross-section of a polyhedron; **C)** Diagram of polyhedron cross-section.

顆粒病ウイルス
（granulovirus）

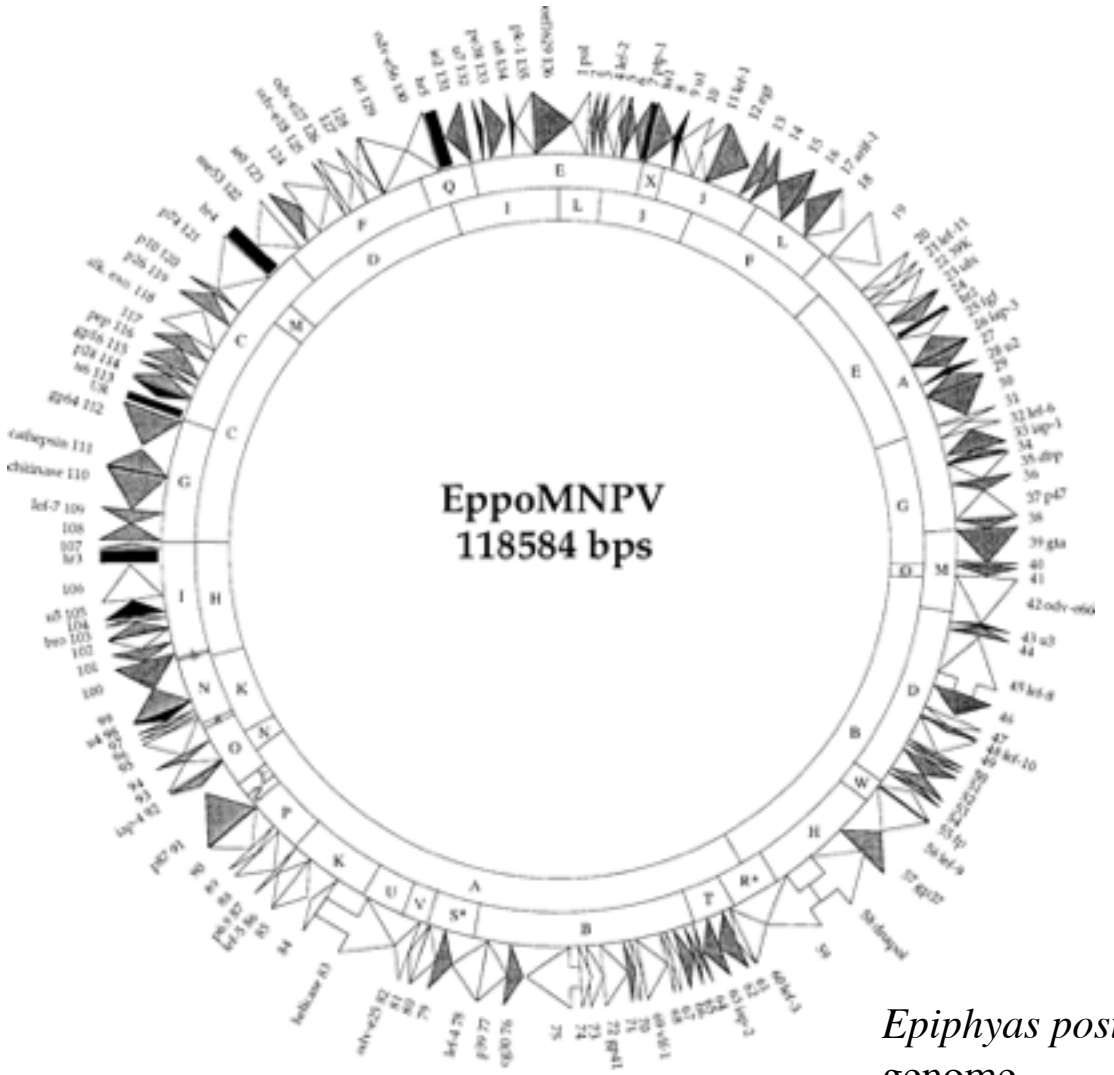
顆粒病ウイルスは、

核多角体病ウイルスと同じバキュロウイルス科に属す



沖縄に生息するチビカクモンハマキから新規に分離されたチビカクモンハマキ顆粒病ウイルス(上)

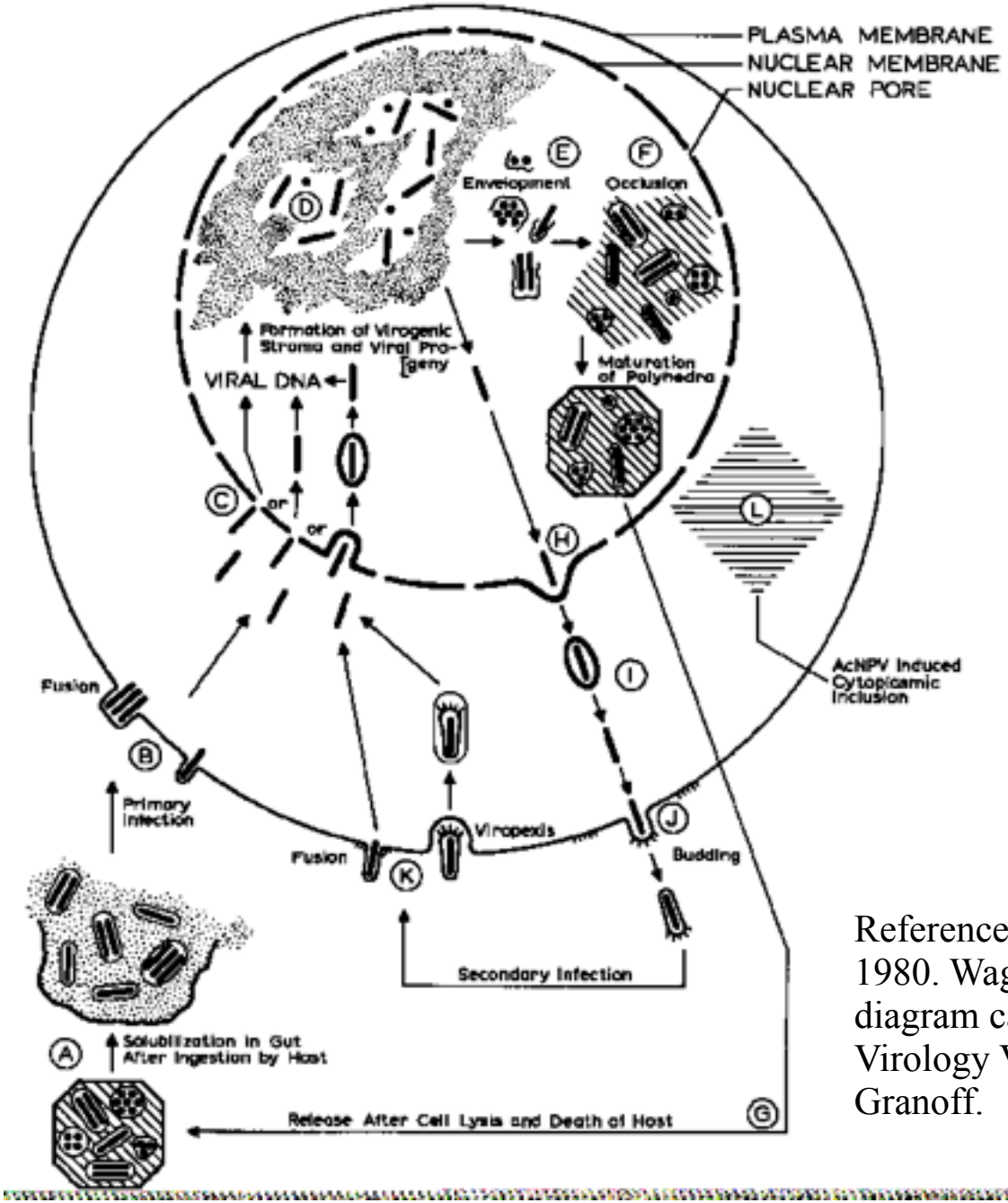
チャノコカクモンハマキ顆粒病ウイルスに感染したチャノコカクモンハマキ幼虫(下)



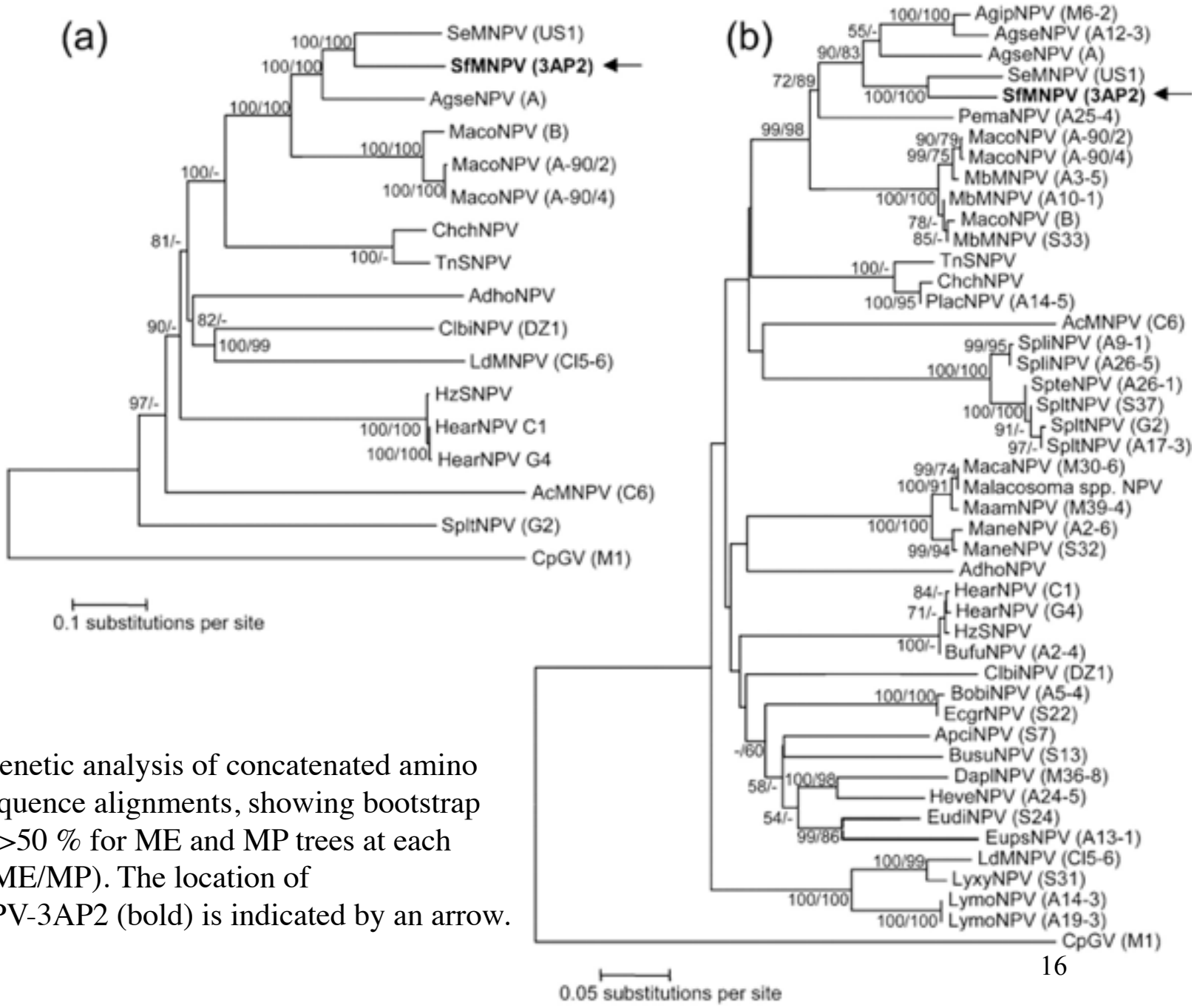
Circular map of the EppoMNPV genome.
The sites for the restriction enzymes HindIII (outer circle) and EcoRI (inner circle) are shown with fragments named according to size. Fragments R and S (*) are reversed from the original map published by Hyink et al. (1998) . Arrows indicate the size, location and direction of the 136 ORFs identified on the EppoMNPV genome.

Open arrows indicate ORFs conserved between all the sequenced baculoviruses shaded arrows indicate ORFs that have homologues in some but not all baculoviruses and black arrows indicate ORFs unique to EppoMNPV.
The positions of repeat regions are indicated by black boxes.
The unique repeat is identified as UR.

Epiphyas postvittana nucleopolyhedrovirus (EppoMNPV) genome



Reference: C.P. van der Beek. Doctoral Thesis 1980. Wageningen, The Netherlands a similar diagram can be found in the:Encyclopedia of Virology Vol. 1, page 134. eds. Webster and Granoff.



Phylogenetic analysis of concatenated amino acid sequence alignments, showing bootstrap values >50 % for ME and MP trees at each node (ME/MP). The location of SfMNPV-3AP2 (bold) is indicated by an arrow.

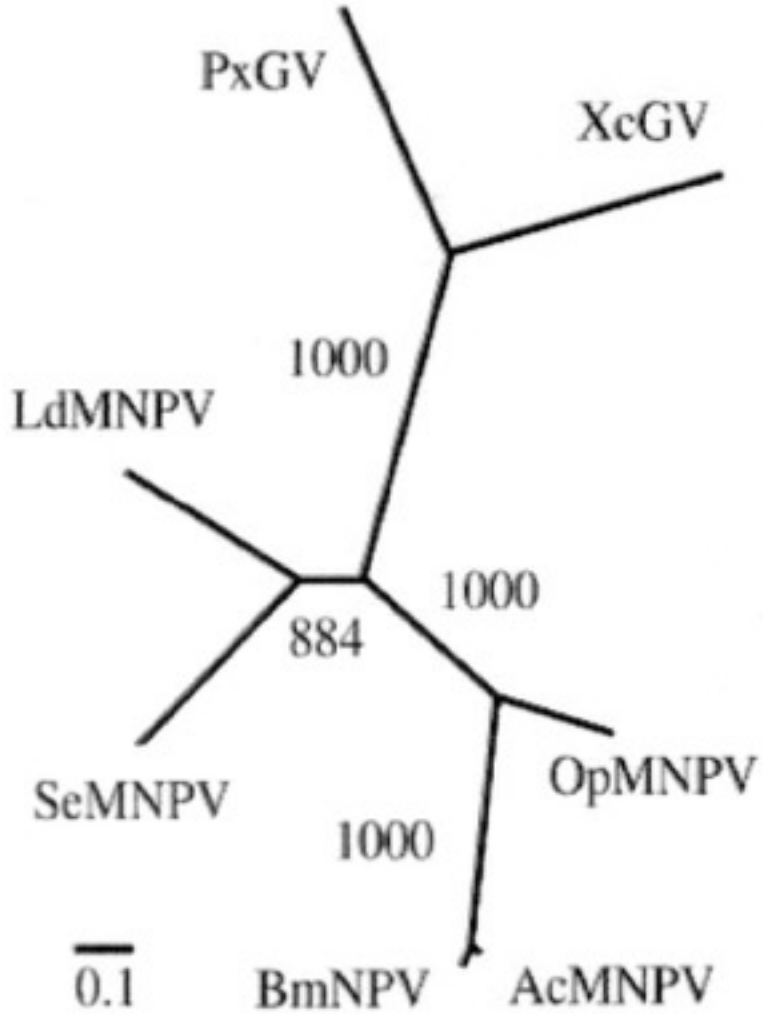


FIG. 4. Baculovirus phylogeny based on the major capsid protein. The sequences of Ac89 (vp39-capsid) and its homologs were determined using CLUSTAL W (Thompson *et al.*, 1994) and TREEVIEW (Page, 1996). Numbers are values determined by bootstrap analyses. For references, see Table 1.

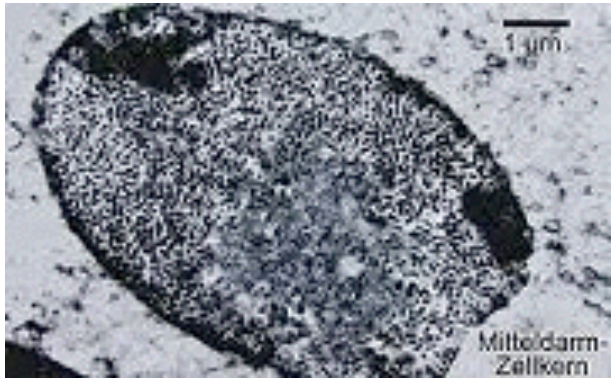
Oryctes Virus:

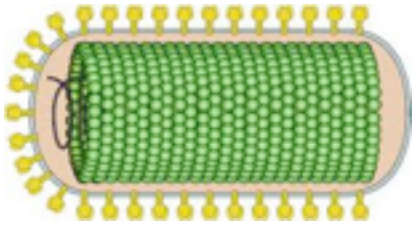
Family of INSECT VIRUSES containing two subfamilies: Eubaculovirinae (occluded baculoviruses) and Nudibaculovirinae (nonoccluded baculoviruses).

USE OF MICROBES FOR CONTROL AND ERADICATION OF INVASIVE ARTHROPODS
Progress in Biological Control, 2009, Volume 6, Part IV, 133-140, DOI: 10.1007/978-1-4020-8560-4_8

The Use of *Oryctes* Virus for Control of Rhinoceros Beetle in the Pacific Islands

Trevor A. Jackson





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Double-stranded DNA, nonenveloped

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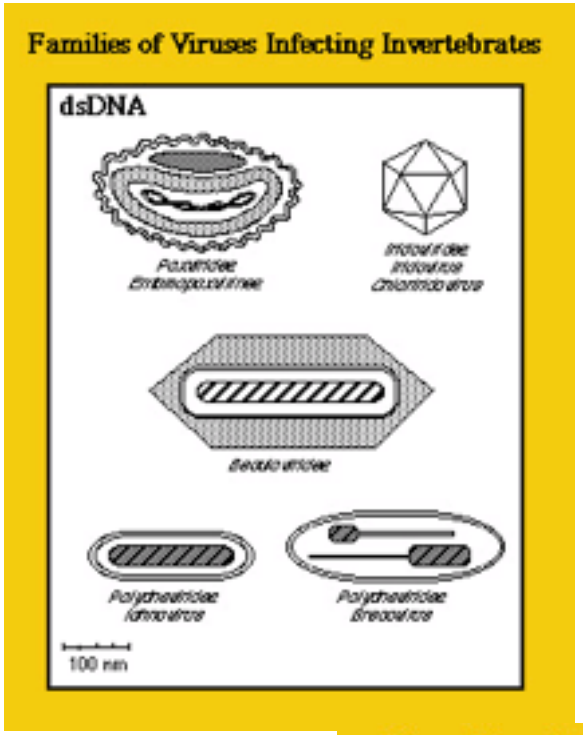
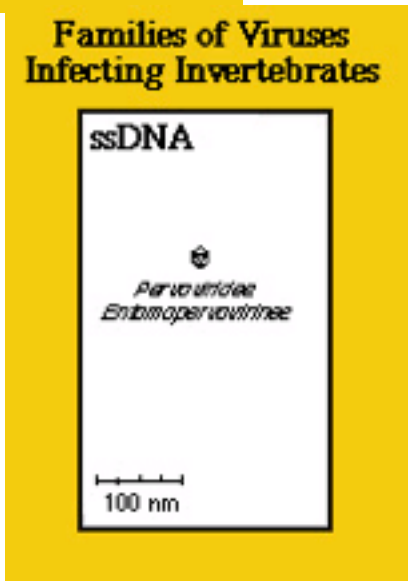




The **Polydnaviruses** (PDV) are a family of insect viruses that contain two genera: Ichnoviruses (IV) and Bracoviruses (BV). The genome of the virus is composed of multiple segments of double-stranded, superhelical DNA packaged in capsid proteins and a double layer (IV) or single layer (BV) envelope.

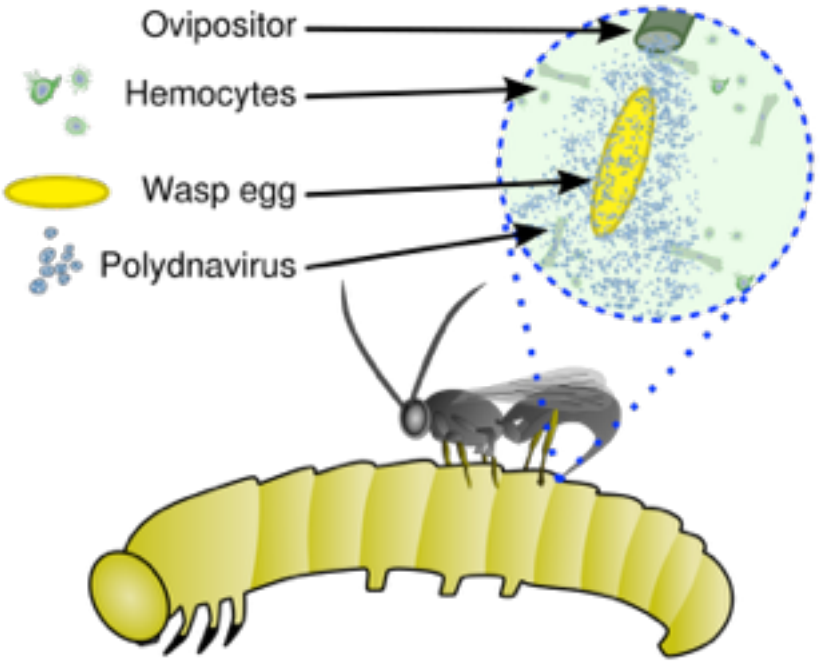


Diagram of a PDV host association

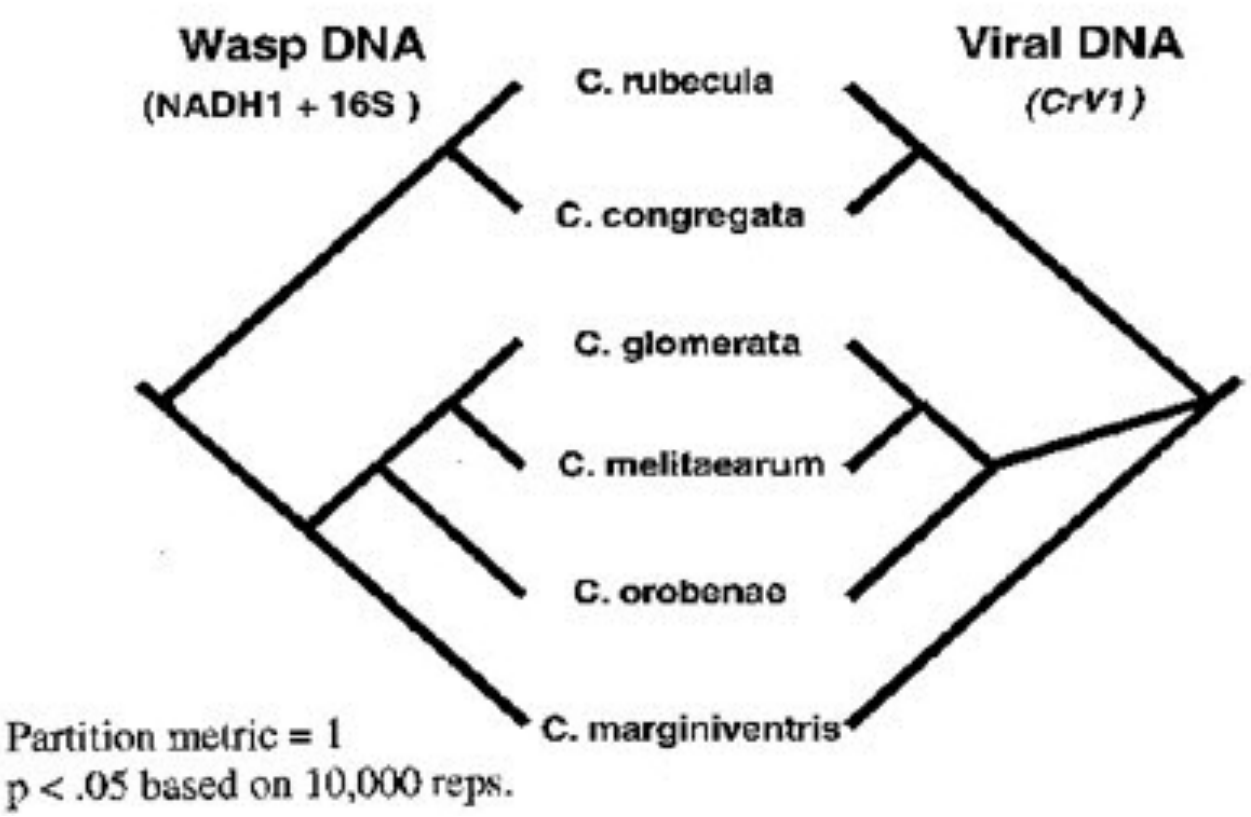
Both genera of PDV share certain characteristics:

- the virus particles of each contain multiple segments of dsDNA with each segment containing only part of the full genome (much like chromosomes in eukaryotic organisms);
- the genome of each is integrated into the host wasp genome;
- the virus particles are only replicated (produced) in specific cell types in the female wasp reproductive organs.

However, the morphology of the two genera are different when observed by electron microscopy. Ichnoviruses tend to be ovoid (egg-shaped) while bracoviruses are short rods.

Also, as their names suggest, the ichnoviruses occur in ichneumonid wasps (**ヒメバチ科)** species and bracoviruses in braconid wasps (**コマユバチ科)**.

Coevolution of Polydnaviruses with Braconid Wasps



C. rubecula cocoon

Polydnaviruses are apparently mutualistic hereditary viruses that are injected into host caterpillars by some parasitoid wasps and aid in suppression of the host immune system and redirection of host physiology to aid the survival of developing wasp eggs and larvae.

J. B. Whitfield with N. E. Beckage, University of California, Riverside

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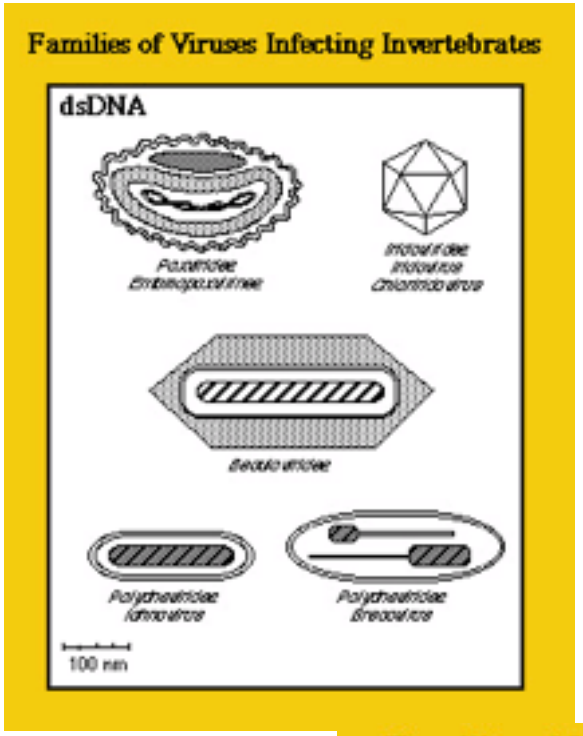
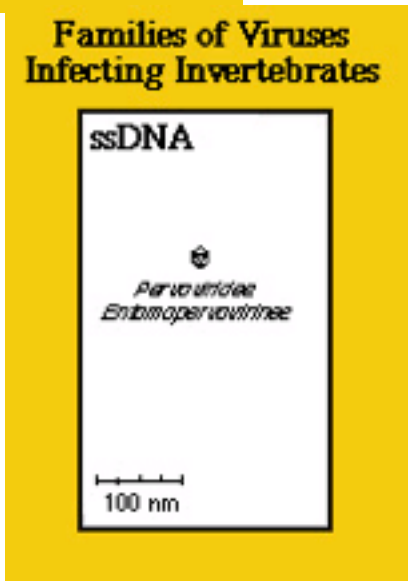
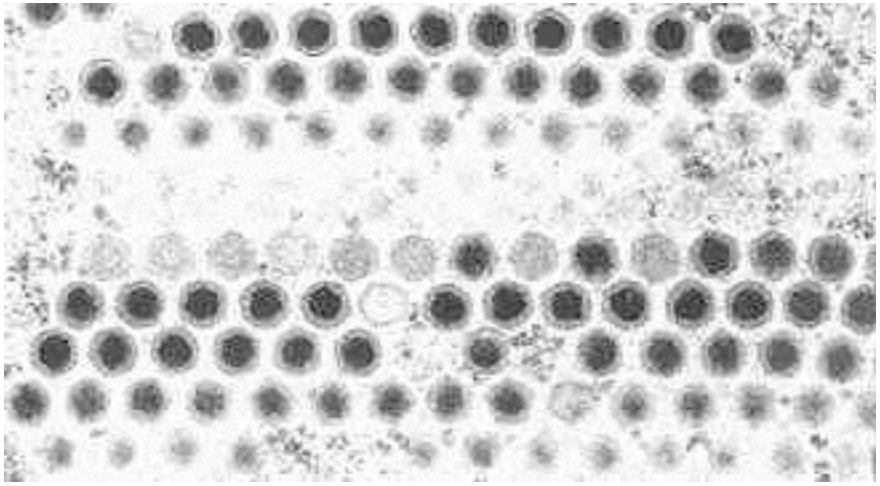




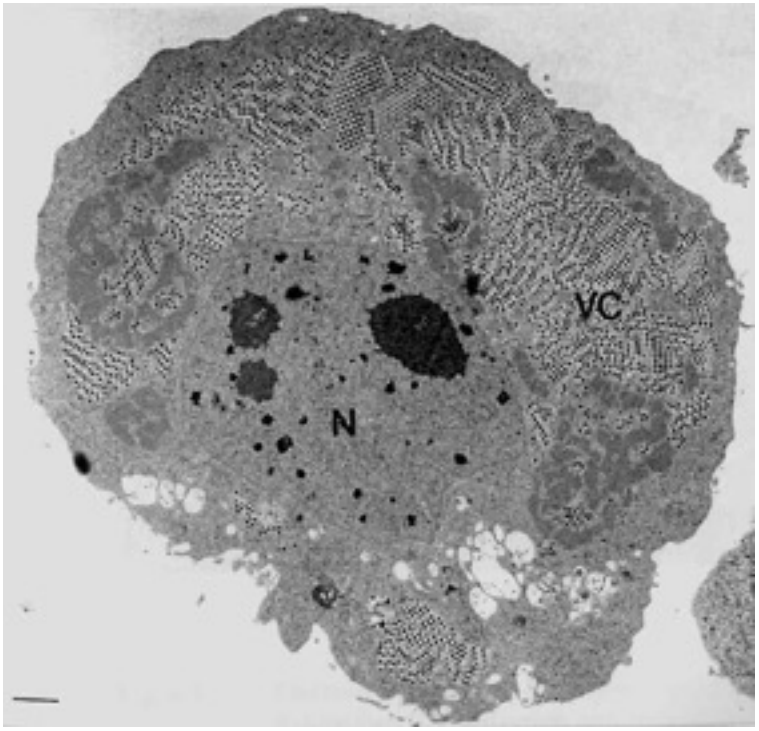
The family Iridoviridae is comprised of four genera, two infecting vertebrates and two infecting invertebrates

Genus	Vernacular name	Host species	Type species
Iridovirus	Small iridescent insect virus	Invertebrates (mainly insects)	Chilo iridescent virus (IV6)
Chloriridovirus	Large iridescent insect viruses	Mosquitos	Mosquito iridescent virus (IV3)
Lymphocystivirus	Lymphocystis disease virus	Fish	Lymphocystivirus type 1 (LCDV-1)
Ranavirus	Frog virus	Amphibia	Frog Virus 3 (FV3)

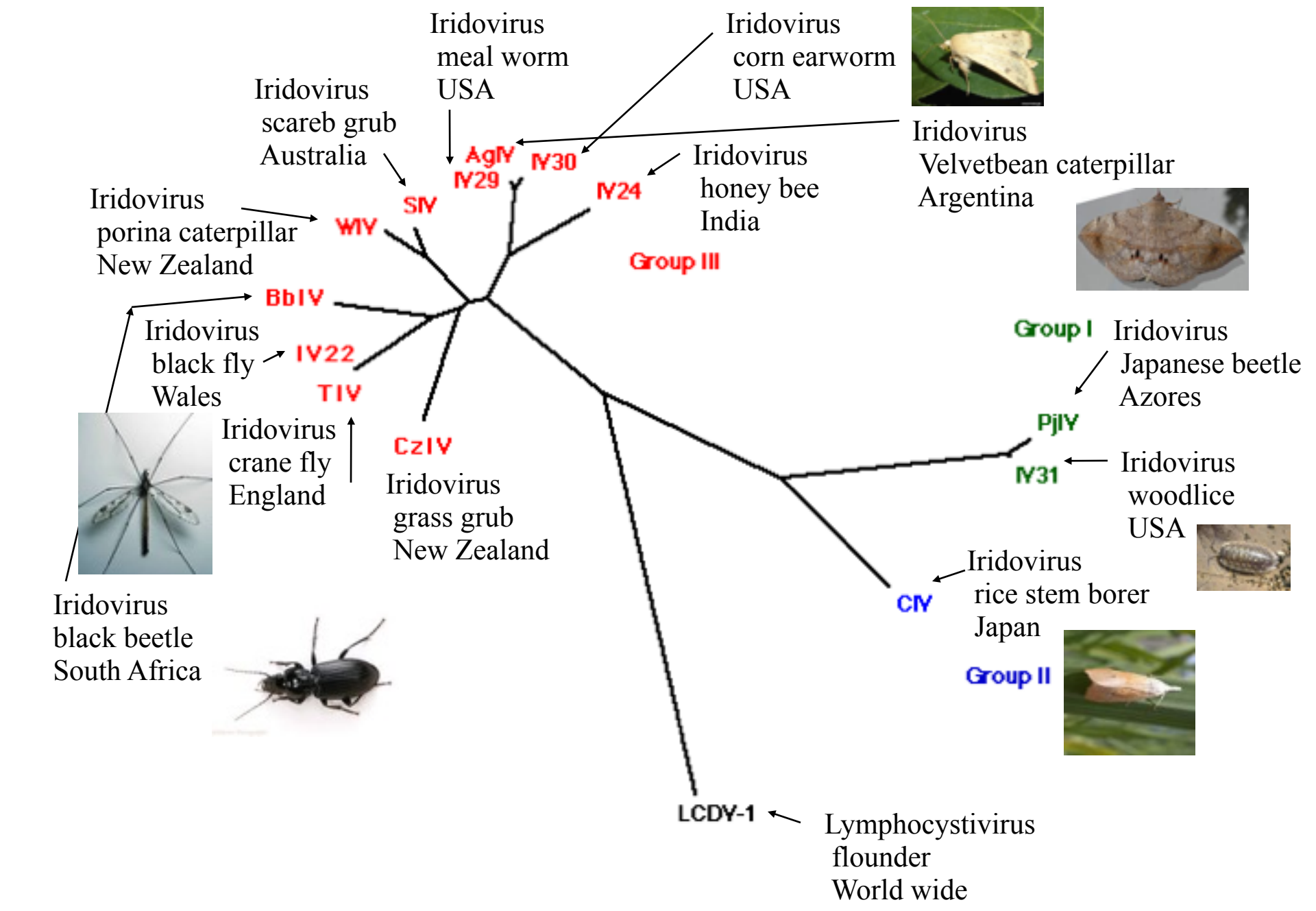
Larvae of the grass grub *Costelytra zealandica* displaying blue colouration of the hindgut due to iridovirus infection



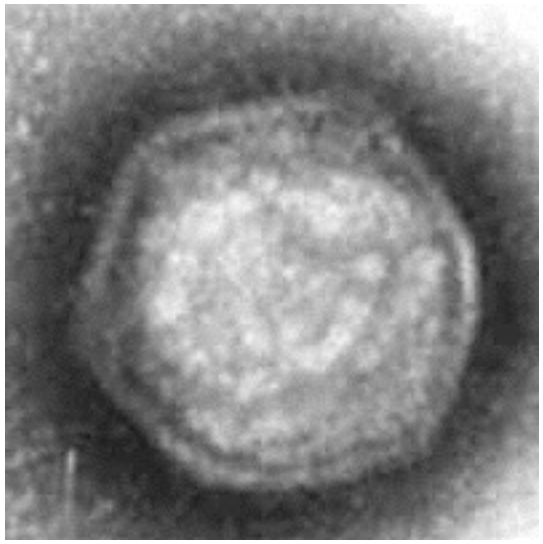
Paracrystalline array of virus particles within infected cell



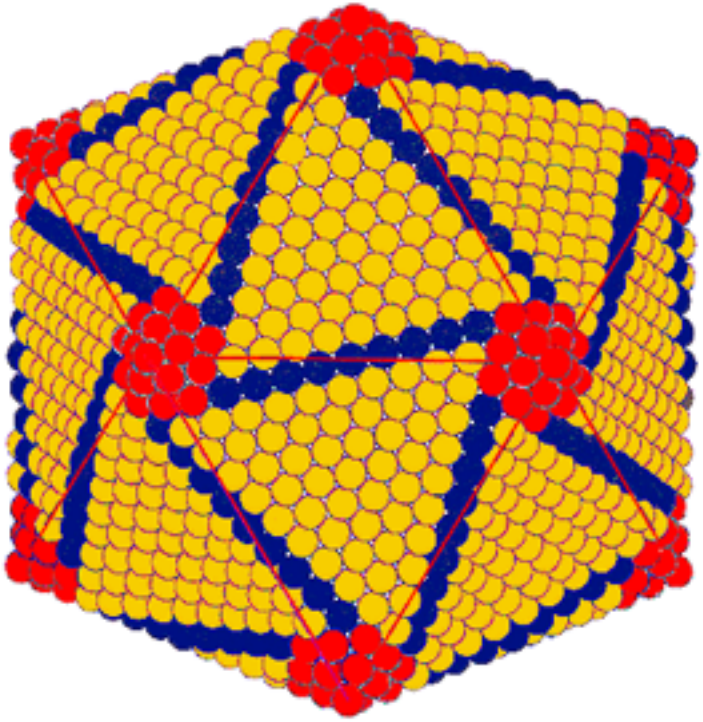
Sf21 tissue culture cell showing cytoplasmic localisation of assembling Wiseana iridescent virus particles. N= nucleus, VC = viroplasmic centre



Phylogenetic tree of the genus Iridovirus based on partial MCP sequence

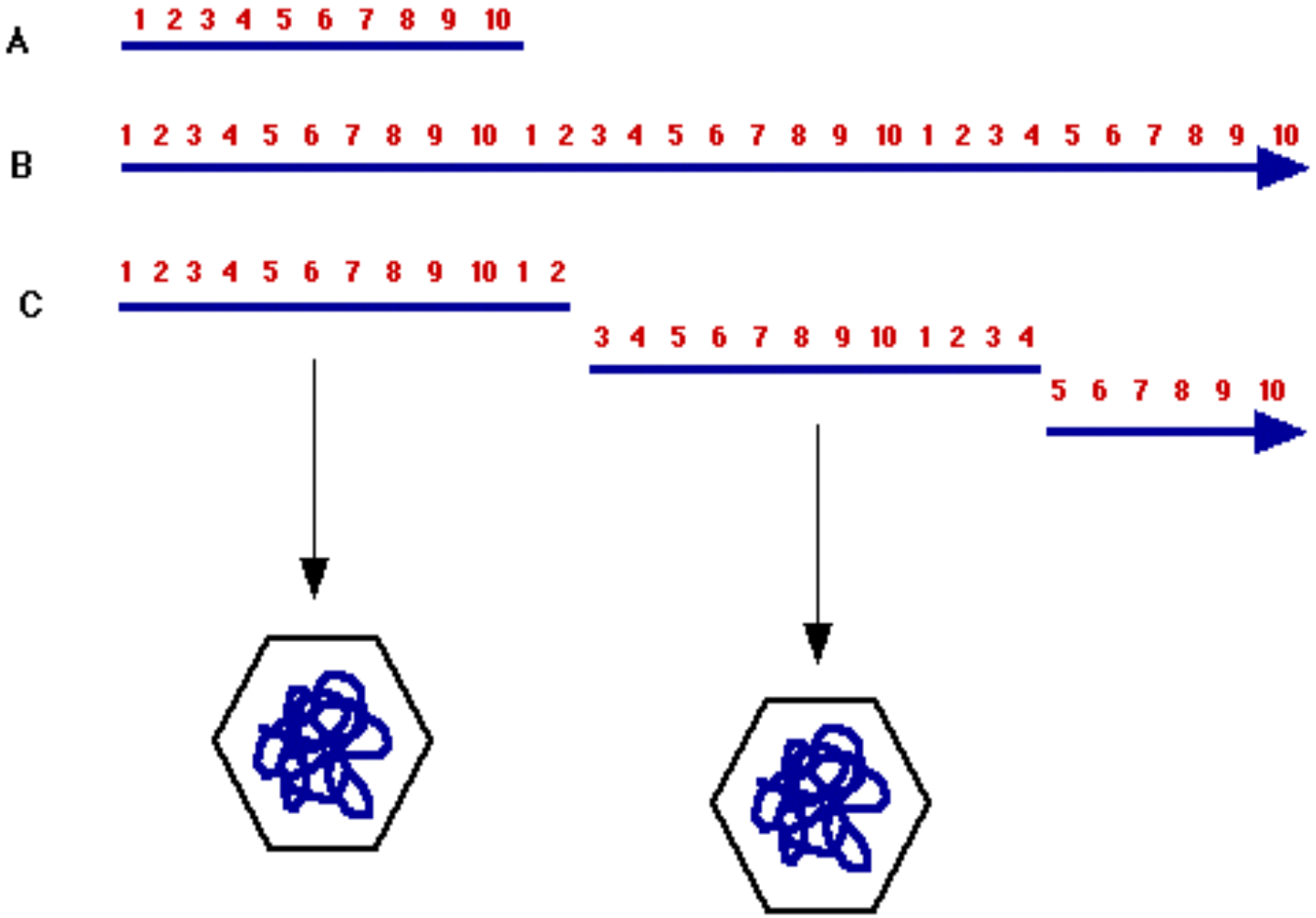


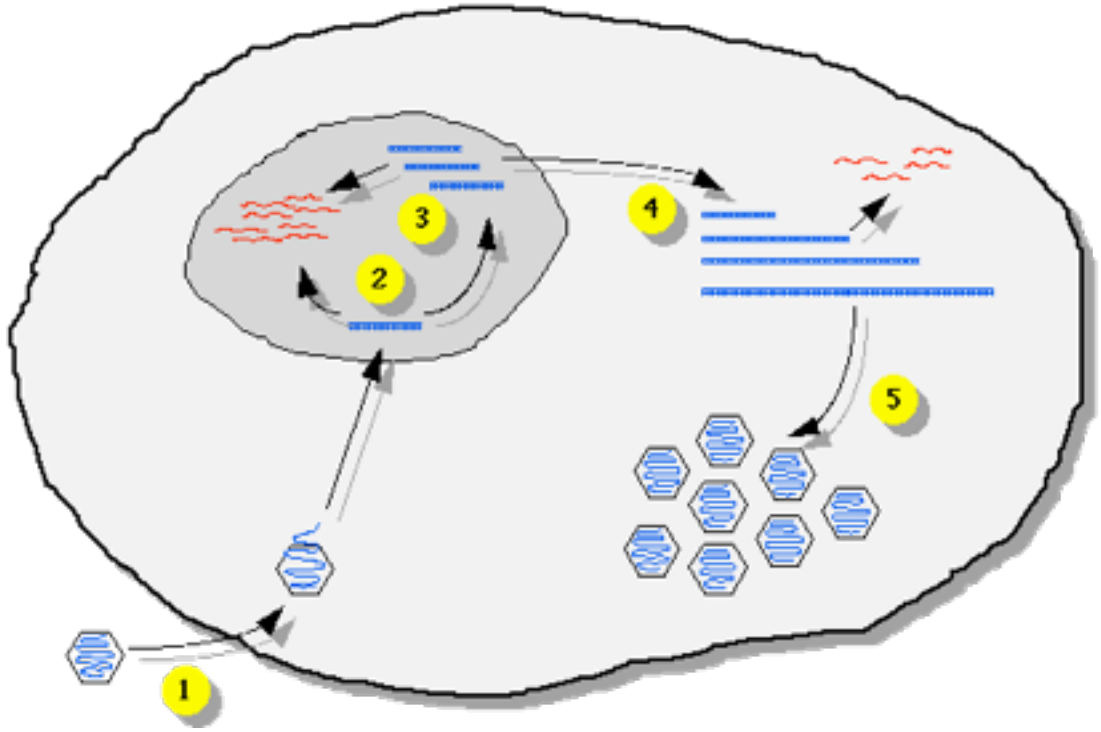
Electron micrograph of a typical iridovirus



Schematic diagram adapted from N.G. Wrigley 1969 (J. Gen. Virol. 5:123-134)

Iridoviruses contain a single copy linear dsDNA genome that ranges in size from 150 to 280 kbp depending on viral species. The genomes appear unique within the eucaryotic viruses in that they are terminally redundant and cyclically permuted. This structure is a result of the resolution of genome concatamers during DNA replication (see replication).





FV3 replication model adapted from R. Goorha 1982 (J. Virol. 43(2):519-528)

1) Virus particles enter the cell by pinocytosis and uncoating occurs.
2) Viral DNA is transported to the cell nucleus where host macromolecular synthesis is rapidly shutdown. Transcription is initiated by virally modified host RNA polymerase II.
3) Parental DNA is used to produce genome and greater than genome length DNA. This becomes the template for cytoplasmic replication.
4) Progeny DNA is transported into the cytoplasm where large concatamers of viral DNA are formed by recombination. Transcription of very late transcripts may also take place in the cytoplasm.
5) Concatamers are resolved into packaged lengths, possibly by a headful packaging approach. Virions exit the cell by budding or cell lysis.

Families and Groups of Viruses Associated with Insect

DNA VIRUSES

Double-stranded DNA, enveloped

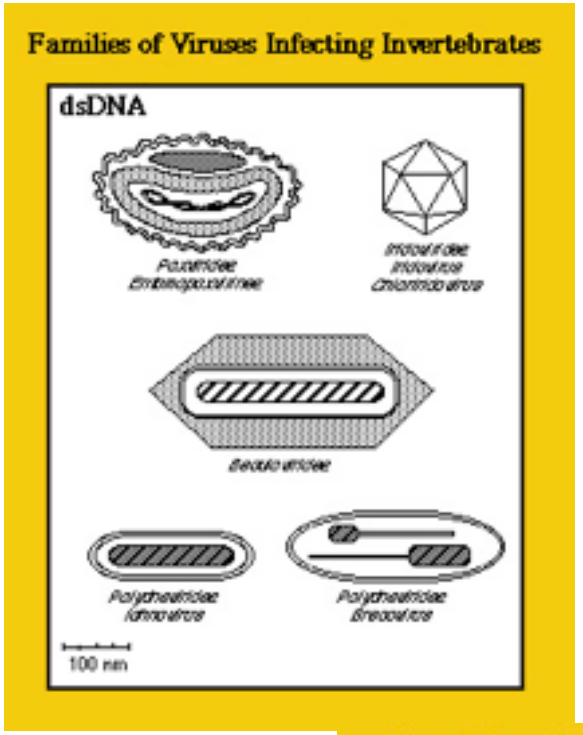
- **POXVIRIDAE, Poxviruses**
  - **ENTOMOPOXVIRINAE, Poxviruses of insects**
    - **Three probable genera**
  - **BACULOVIRIDAE**
    - **Baculovirus**
      - **Subgroup A, nuclearpolyhedro virus**
      - **Subgroup B, granulosis virus**
      - **Subgroup C, enveloped nonoccluded rod-shaped nuclear virus**
  - **POLYDNAVIRIDAE**
    - **Polydnavirus**
      - **Subgroup A, polydnavirus with fusiform nucleocapsids**
      - **Subgroup B, polydnavirus with rod-shaped nucleocapsids**

Double-stranded DNA, nonenveloped

- **IRIDOVIRIDAE, icosahedral cytoplasmic deoxyriboviruses**
  - **Iridovirus, small iridescent insect virus**
  - **Chloriridovirus, large iridescent insect virus**

Single-stranded DNA, nonenveloped

- **PARVOVIRIDAE, parvoviruses**
  - **Densovirus, densonucleosis virus**



Parvoviruses **Sub-Family Densovirinae**

Densovirus	*Junonia coenia* densovirus
Iteravirus	*Bombyx mori* virus
Contravirus	*Aedes aegypti* densovirus

One genus in the family Parvoviridae has been recovered from insects, Densovirus (DNV). First isolated from the waxworm, *Galleria mellonella*, these viruses have now been recovered from Diptera, Orthoptera, Blattodea, Odonata, and other Lepidoptera (Kawase, 1985). This ssDNA, nonenveloped virus is characterized by its effects on the nucleus of host cells, and it attacks most host tissues. Infection results in extreme hypertrophy of cell nuclei and the filling of the nuclei with small isometric particles. The nuclei become strongly eosinophilic (dense nuclei, thus the name densovirus). Discoloration and paralysis of the host often occur. These viruses can be very virulent and infectious, and the type species, GmDNV, has caused serious problems for the waxworm bait industry in the Midwest in recent years. Despite their high virulence, densoviruses do not replicate in vertebrates (Bergoin and Tijssen, 1998).

Biological Control:

High virulence and the presence in insect pests have precipitated some interest in use of densoviruses in biological control (Bergoin and Tijssen, 1998). Infected waxworms were placed in beehives to successfully eliminate waxworms from the hives (Lavie et al., 1961). Other pest species have also been successfully treated, for example, the palm oil defoliator, Sibine fusca (Genty and Mariau, 1975). The sequence homologies between densoviruses and vertebrate parvoviruses, however, have presented concerns about use, despite lack of evidence that this genus can infect vertebrates. These viruses have insectidical potential, therefore specificity and tissue tropism should be studied more thoroughly (Bergoin and Tijssen, 1998).

Subfamily. Densovirinae

Genus 00.050.2.01. Densovirus

Type Species 00.050.2.01.001. Junonia coenia densovirus (JcDNV)

List of Species in the Genus

Species, their serotypes, strains and isolates

00.050.2.01.002. Galleria mellonella densovirus [L32896] (GmDNV)
00.050.2.01.003. Junonia coenia densovirus [S17265] (JcDNV)
00.050.2.01.006. Mythimna loreyi densovirus (MlDNV)
00.050.2.01.007. Pseudoplusia inludens densovirus (PiDNV)

Tentative Species in the Genus

00.050.2.81.014. Acheta domestica densovirus (AdDNV)
00.050.2.81.008. Culex pipiens densovirus (CpDNV)
00.050.2.81.005. Diatraea saccharalis densovirus (DsDNV)
00.050.2.81.009. Periplanata fuliginosa densovirus (PfDNV)

Genus 00.050.2.02. Iteravirus

Type Species 00.050.2.02.001. Bombyx mori densovirus (BmDNV)

List of Species in the Genus

Species, their serotypes, strains and isolates

00.050.2.02.001. Bombyx mori densovirus [M15123] (BmDNV)
00.050.2.02.001. Bombyx mori densovirus [M60583]
00.050.2.02.001. Bombyx mori densovirus [M60584]

Tentative Species in the Genus

00.050.2.83.004. Casphalia extranea densovirus (CeDNV)

Genus 00.050.2.03. Brevidensovirus

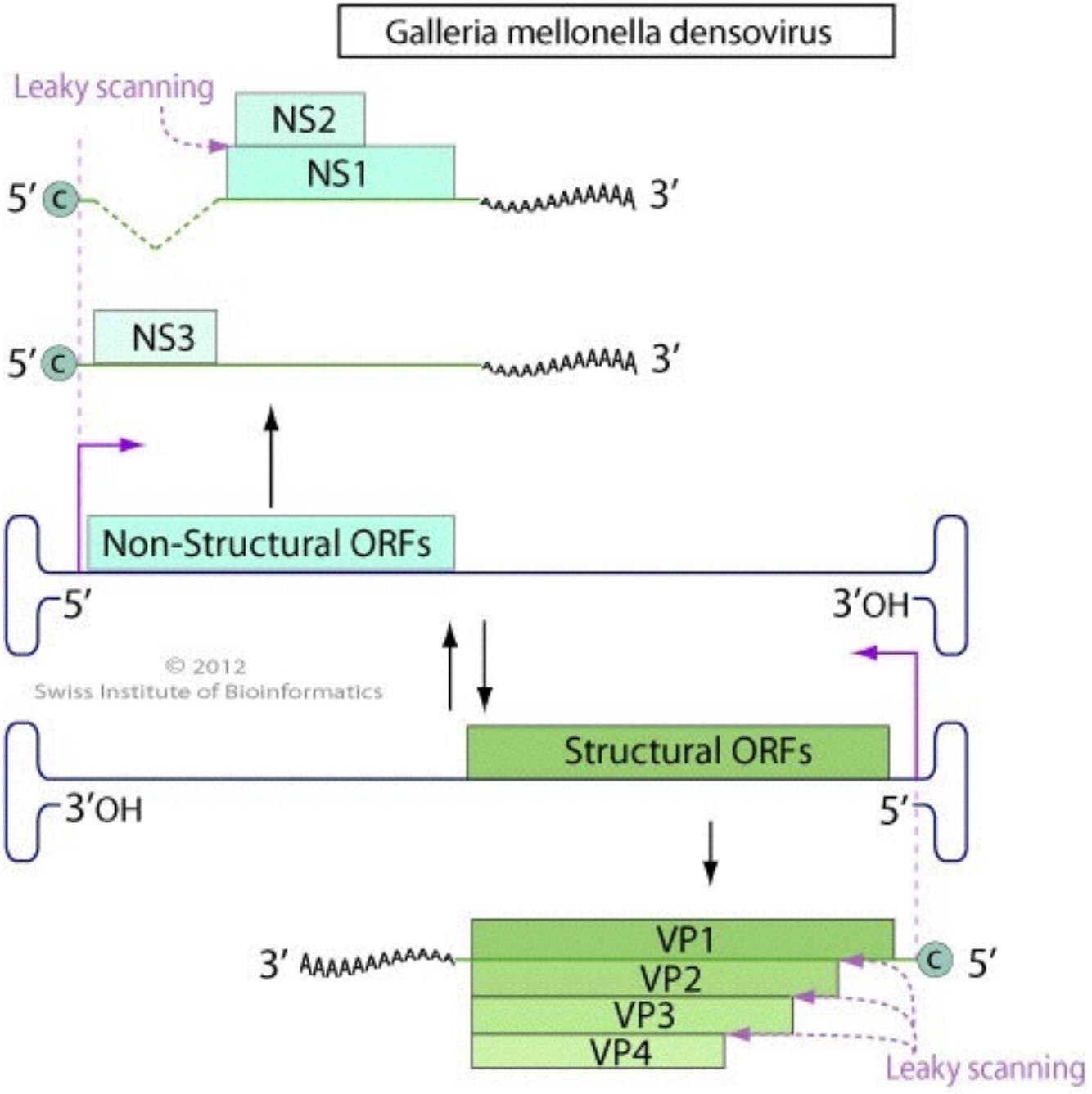
Type Species 00.050.2.03.001. Aedes aegypti densovirus (AaDNV)

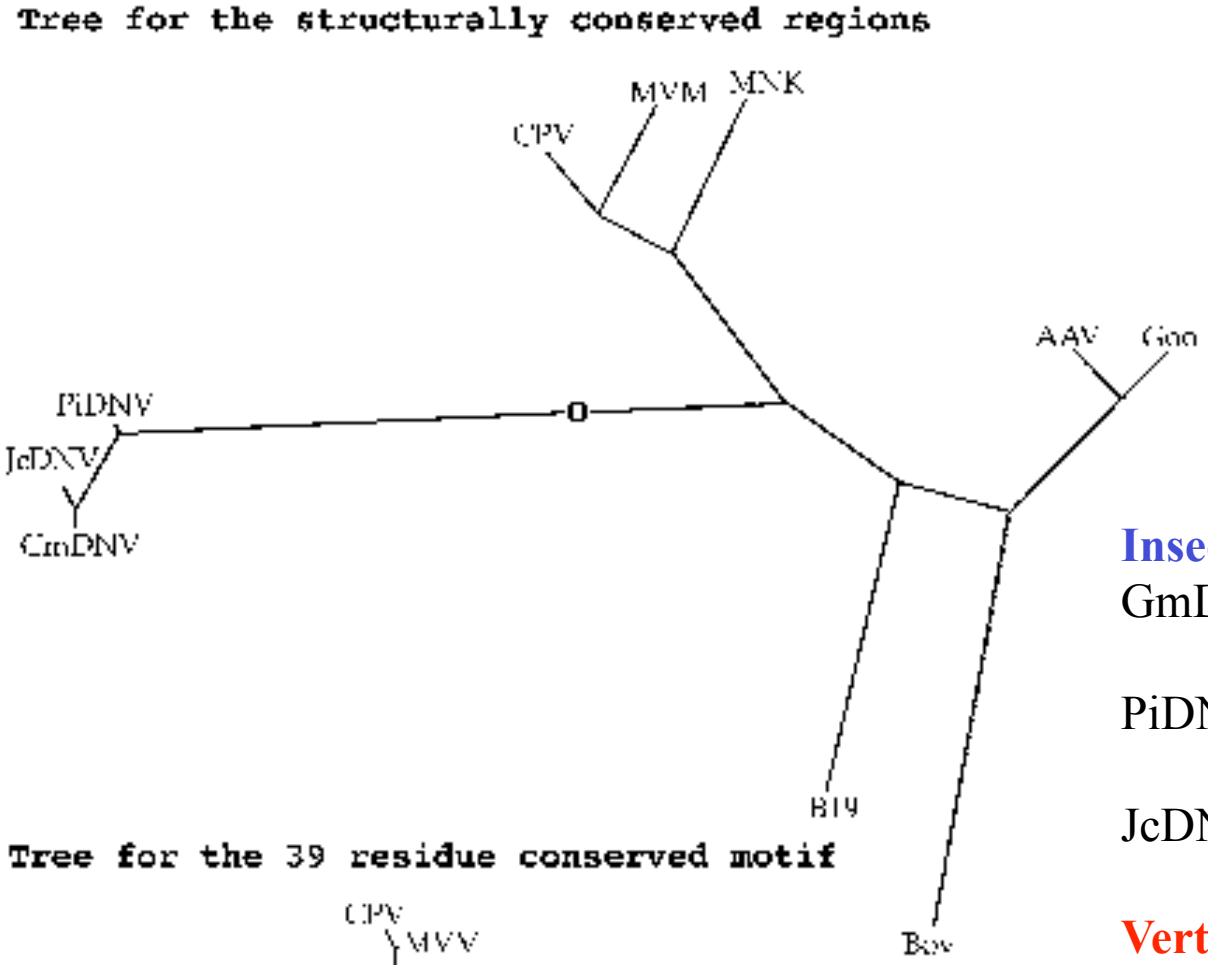
List of Species in the Genus

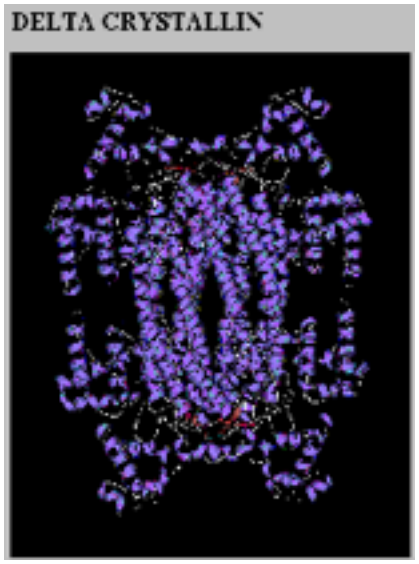
00.050.2.03.001. Aedes aegypti densovirus (AaDNV)
00.050.2.03.002. Aedes albopictus densovirus (AlDNV)

Tentative Species in the Genus

00.050.2.83.014. Acheta domestica densovirus (AdDNV)
00.050.2.83.015. Aedes pseudoscutellaris densovirus (ApDNV)
00.050.2.83.003. Agraulis vanillae densovirus (AvDNV)
00.050.2.83.004. Casphalia extranea densovirus (CeDNV)
00.050.2.83.005. Diatraea saccharalis densovirus (DsDNV)
00.050.2.83.006. Euxoa auxiliaris densovirus (EaDNV)
00.050.2.83.007. Leucorrhinia dubia densovirus (LdDNV)
00.050.2.83.008. Lymantria dubia densovirus (LdDNV)
00.050.2.83.009. Periplanata fuliginosa densovirus (PfDNV)
00.050.2.83.010. Pieris rapae densovirus (PrDNV)
00.050.2.83.011. Pseudaletia includens densovirus (PiDNV)
00.050.2.83.012. Sibine fusca densovirus (SfDNV)
00.050.2.83.013. Simulium vittatum densovirus (SvDNV)
00.050.2.83.016. Aedes Thai densovirus (AThDNV)
00.050.2.83.017. Haemagogus equinus densovirus (HeDNV)
00.050.2.83.018. Toxorhynchites amboinensis densovirus (TaDNV)


Galleria mellonella densovirus
Leaky scanning
NS2
NS1
5′
C
AAAAAAAAAAA
3′
NS3
5′
C
AAAAAAAAAAA
3′
Non-Structural ORFs
5′
3′OH
© 2012
Swiss Institute of Bioinformatics
Structural ORFs
3′OH
5′
3′
AAAAAAAAAAA
VP1
VP2
VP3
VP4
C
5′
Leaky scanning



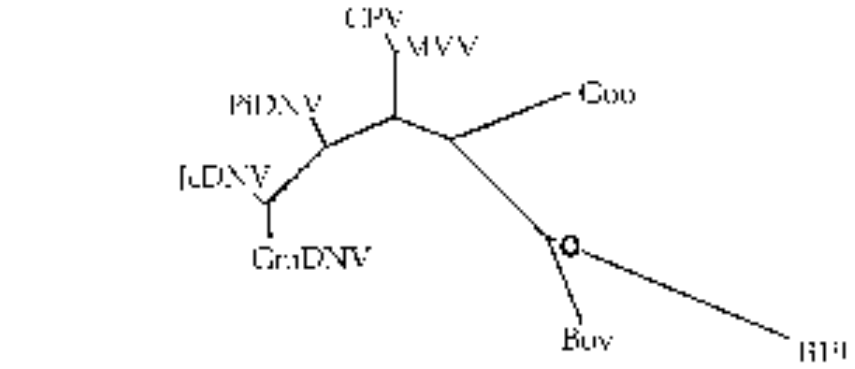


Insect parvovirsues (densoviruses):

GmDNV :Galleria mellonella:
wax moth densovirus.

PiDNV :Pseudoplusia includens:
oybean looper densovius

JcDNV :Junonia coenia densovirus



Vertebrate parvoviruses:

CPV :Canine parvovirus

MVM :Minute virus of mouse.

Bov :Bovine parvovirus

AAV :Adeno-associated virus

Mnk :Aleutian virus of mink

B19 :B19 (humnan) parvovirus

Goo :Goose parvovirus

RNA VIRUSES

Double-stranded RNA, nonenveloped

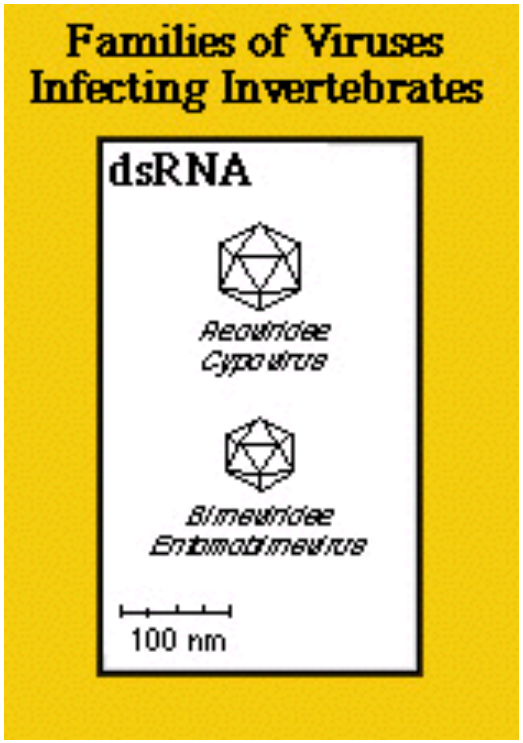
- REOVIRIDAE, reoviruses
  - Cytoplasmic polyhedrosis virus
- BIRNAVIRIDAE, bisegmented dsRNA viruses
  - Birnavirus, Drosophila X virus

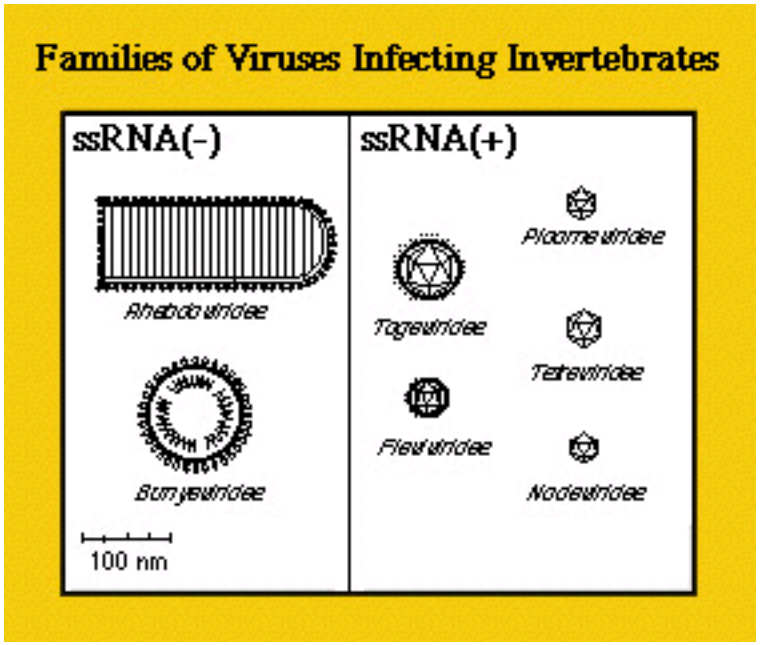
Single-stranded RNA, enveloped

- RHABDOVIRIDAE, bullet-shaped viruses
  - Sigmavirus, CO2 sensitivity virus

Single-stranded RNA, nonenveloped

- PICORNAVIRIDAE, picornaviruses
  - Cricket paralysis virus
  - Drosphila C virus
  - Gonometa virus
  - Infectious flacherie virus
  - Rhopalosiphum padi virus
- CALICIVIRIDAE, caliciviruses
  - Amyelosis chronic stunt virus
- Nudaurelia virus group
  - Nudaurelia virus
- Trichoplusia RNA virus
  - Related viruses isolated from other Lepidoptera
- NODAVIRIDAE
  - Nodavirus
    - Nodamura virus
    - Black beetle virus





Species in the Genus
Cypovirus 1 (CPV-1)
Bombyx mori cypovirus 1 (BmCPV-1)
Dendrolimus spectabilis cypovirus 1 (DsCPV-1)
Lymantria dispar cypovirus 1 (LdCPV-1)
Cypovirus 2 (CPV-2)
Aglais urticae cypovirus 2 (AuCPV-2)
Agraulis vanillae cypovirus 2 (AvaCPV-2)
Arctia caja cypovirus 2 (AcCPV-2)
Arctia villica cypovirus 2 (AviCPV-2)
Boloria dia cypovirus 2 (BdCPV-2)
Dasychira pudibunda cypovirus 2 (DpCPV-2)
Eriogaster lanestris cypovirus 2 (ElCPV-2)
Hyloicus pinastri cypovirus 2 (HpCPV-2)
Inachis io cypovirus 2 (IiCPV-2)
Lacanobia oleracea cypovirus 2 (LoCPV-2)
Malacosoma neustria cypovirus 2 (MnCPV-2)
Mamestra brassicae cypovirus 2 (MbCPV-2)
Operophtera brumata cypovirus 2 (ObCPV-2)
Papilio machaon cypovirus 2 (PmCPV-2)
Phalera bucephala cypovirus 2 (PbCPV-2)
Pieris rapae cypovirus 2 (PrCPV-2)
Cypovirus 3 (CPV-3)
Anaitis plagiata cypovirus 3 (ApCPV-3)
Arctia caja cypovirus 3 (AcCPV-3)
Danaus plexippus cypovirus 3 (DpCPV-3)
Gonometa rufibrunnea cypovirus 3 (GrCPV-3)
Malacosoma neustria cypovirus 3 (MnCPV-3)
Operophtera brumata cypovirus 3 (ObCPV-3)
Phlogophera meticulosa cypovirus 3 (PmCPV-3)
Pieris rapae cypovirus 3 (PrCPV-3)
Spodoptera exempta cypovirus 3 (SexmCPV-3)
Cypovirus 4 (CPV-4)
Actias selene cypovirus 4 (AsCPV-4)
Antheraea mylitta cypovirus 4 (AmCPV-4)
Antheraea pernyi cypovirus 4 (ApCPV-4)
Cypovirus 5 (CPV-5)
Euxoa scandens cypovirus 5 [J04338] Seg 10 (EsCPV-5)
Heliothis armigera cypovirus 5 (HaCPV-5)
Orgyia pseudosugata cypovirus 5 (OpCPV-5)
Spodoptera exempta cypovirus 5 (SexmCPV-5)
Trichoplusia ni cypovirus 5 (TnCPV-5)
Cypovirus 6 (CPV-6)
Aglais urticae cypovirus 6 (AuCPV-6)
Agrochola helvolva cypovirus 6 (AhCPV-6)
Agrochola lychnidis cypovirus 6 (AlCPV-6)
Anaitis plagiata cypovirus 6 (ApCPV-6)
Anti xanthomista cypovirus 6 (AxCPV-6)
Biston betularia cypovirus 6 (BbCPV-6)
Eriogaster lanestris cypovirus 6 (ElCPV-6)
Lasiocampa quercus cypovirus 6 (LqCPV-6)
Cypovirus 7 (CPV-7)
Mamestra brassicae cypovirus 7 (MbCPV-7)
Noctua pronuba cypovirus 7 (NpCPV-7)
Cypovirus 8 (CPV-8)
Abraxas grossulariata cypovirus 8 (AgCPV-8)
Heliothis armigera cypovirus 8 (HaCPV-8)
Malacosoma disstria cypovirus 8 (MdCPV-8)
Nudaurelia cytherea cypovirus 8 (NcCPV-8)
Phlogophora meticulosa cypovirus 8 (PmCPV-8)
Spodoptera exempta cypovirus 8 (SexmCPV-8)
Cypovirus 9 (CPV-9)
Agrotis segetum cypovirus 9 (AsCPV-9)
Cypovirus 10 (CPV-10)
Aporophyla lutulenta cypovirus 10 (AlCPV-10)

Cypovirus 11 (CPV-11)
- Heliothis armigera cypovirus 11 (HaCPV-11)
- Heliothis zea cypovirus 11 (HzCPV-11)
- Lymantria dispar cypovirus 11 (LdCPV-11)
- Mamestra brassicae cypovirus 11 (MbCPV-11)
- Pectinophora gossypiella cypovirus 11 (PgCPV-11)
- Pseudaletia unipuncta cypovirus 11 (PuCPV-11)
- Spodoptera exempta cypovirus 11 (SexmCPV-11
- Spodoptera exigua cypovirus 11 (SexgCPV-11)

Cypovirus 12 (CPV-12)
- Autographa gamma cypovirus 12 (AgCPV-12)
- Mamestra brassicae cypovirus 12 (MbCPV-12)
- Pieris rapae cypovirus 12 (PrCPV-12)
- Spodoptera exempta cypovirus 12 (SexmCPV-12)

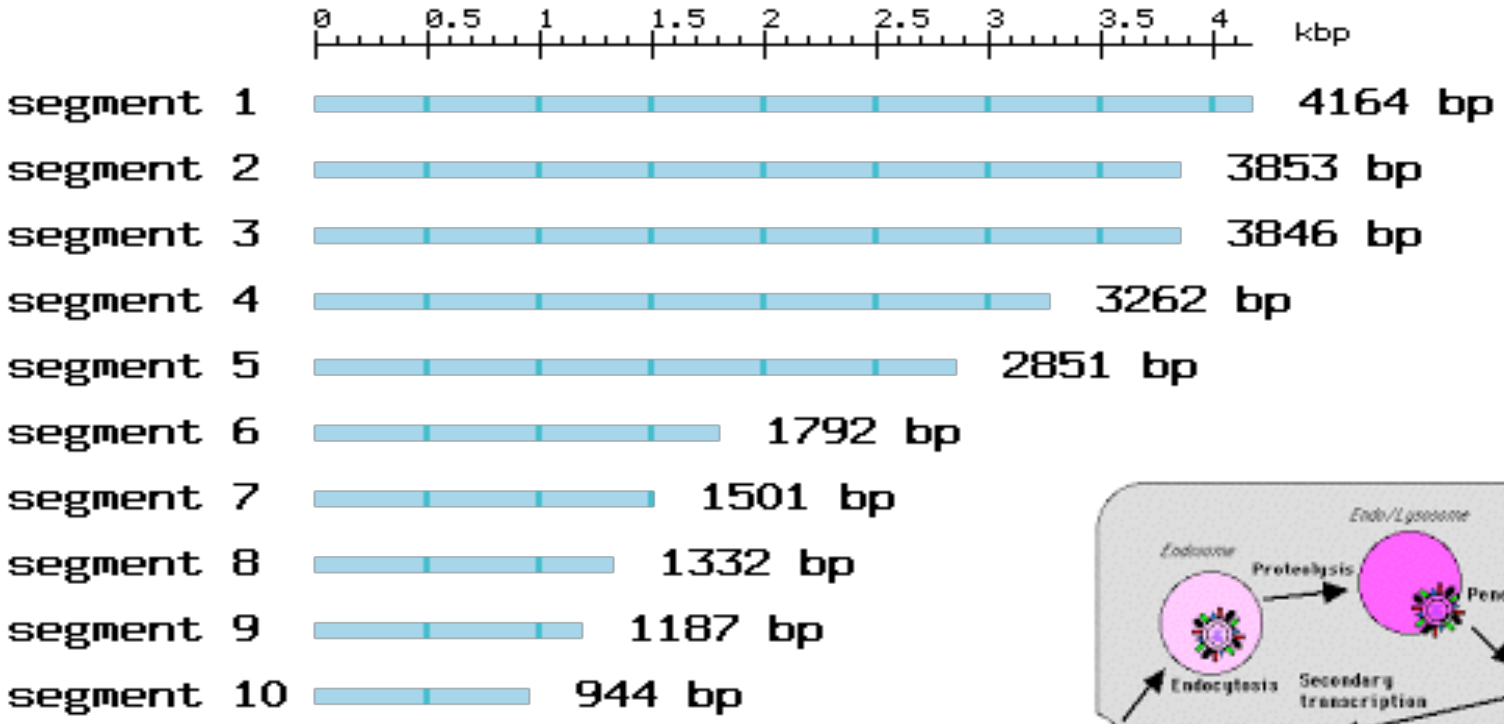
Cypovirus 13 (CPV-13)
- Polistes hebraeus cypovirus 13 (PhCPV-13)

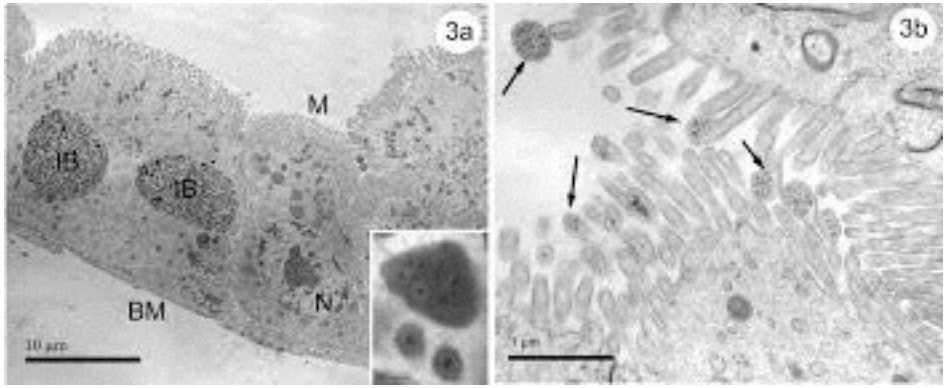
Cypovirus 14 (CPV-14)
- Heliothis armigera cypovirus 14 ('A' strain) (HaCPV-14)

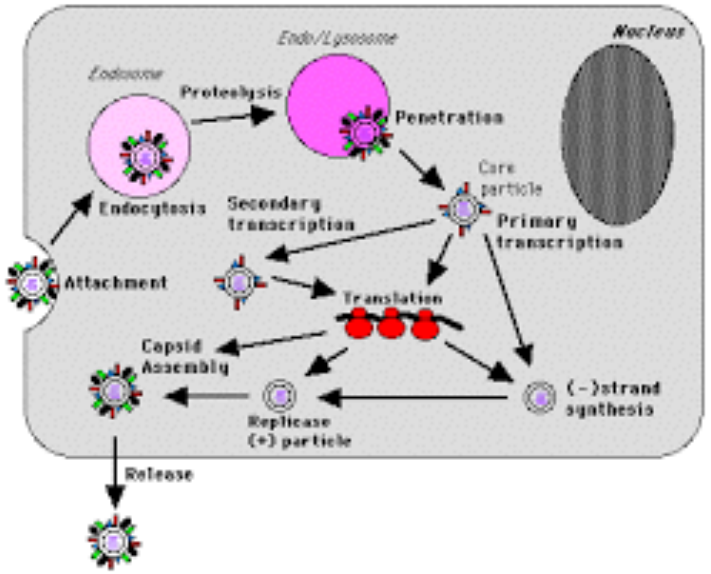
Taxonomic Structure of the Genus

Cypoviruses are currently classified within 14 species that were initially characterised by their distinctive dsRNA electropherotype patterns. Cross-hybridisation analyses of dsRNA, limited comparative RNA sequence data and serological comparisons of cypovirus proteins have confirm the validity of this classification. However, only a few cypoviruses have been analysed in this way.

Lymantria dispar cypovirus 1 complete genome

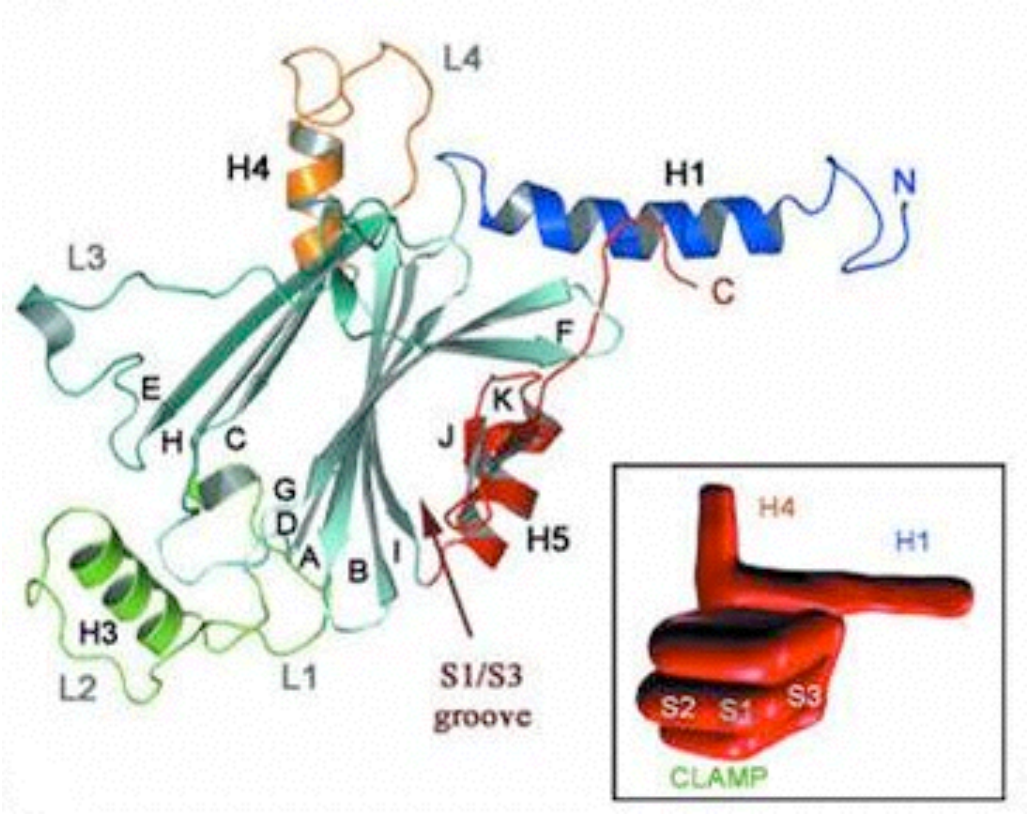


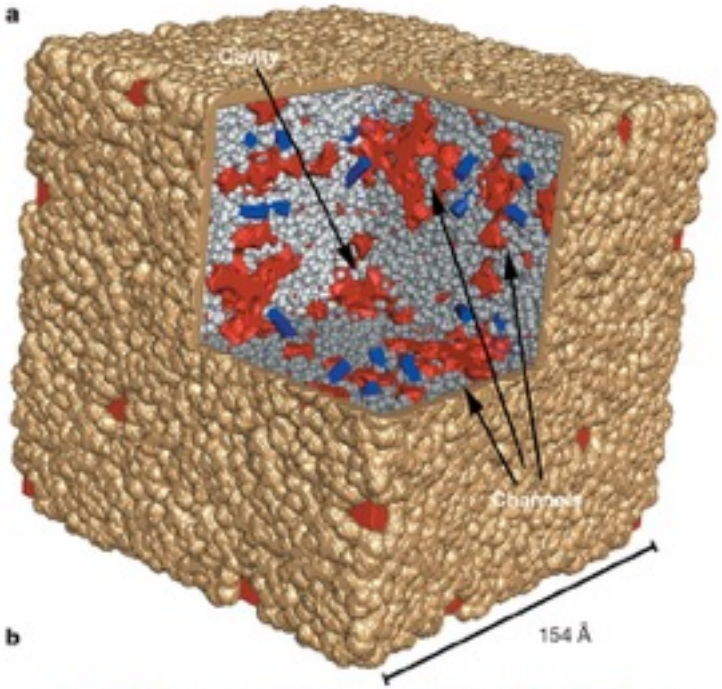


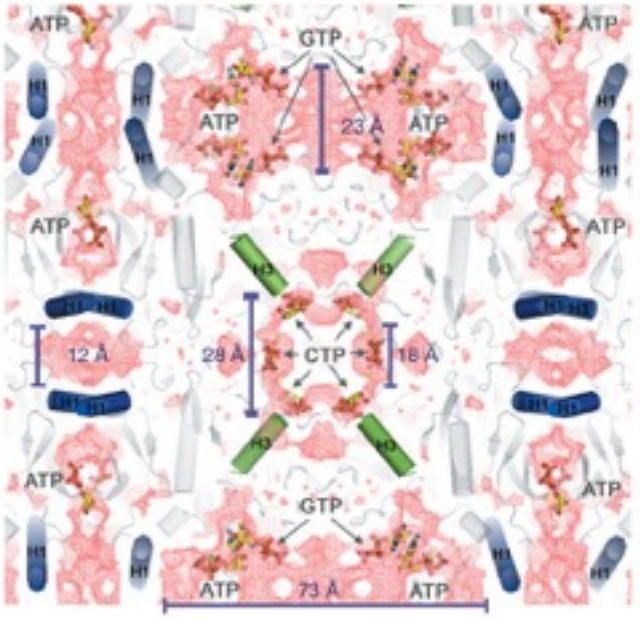


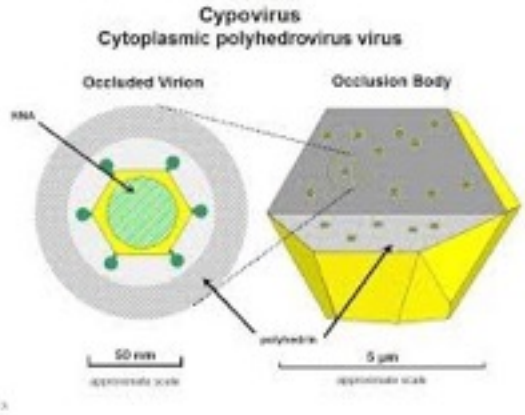
Lineage:Cypovirus; Reoviridae; dsRNA viruses

多角体の構造解析　[nature（Vol.446 p.97-101）]









RNA VIRUSES

Double-stranded RNA, nonenveloped

- REOVIRIDAE, reoviruses
  - Cytoplasmic polyhedrosis virus
- BIRNAVIRIDAE, bisegmented dsRNA viruses
  - Birnavirus, Drosophila X virus

Single-stranded RNA, enveloped

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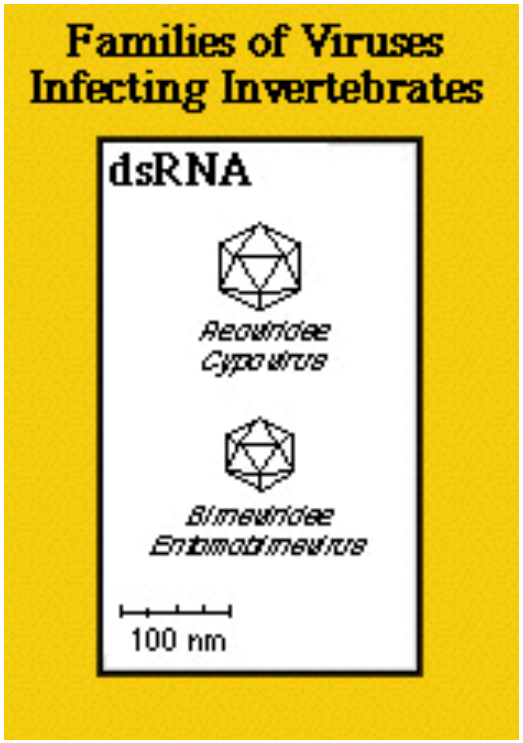
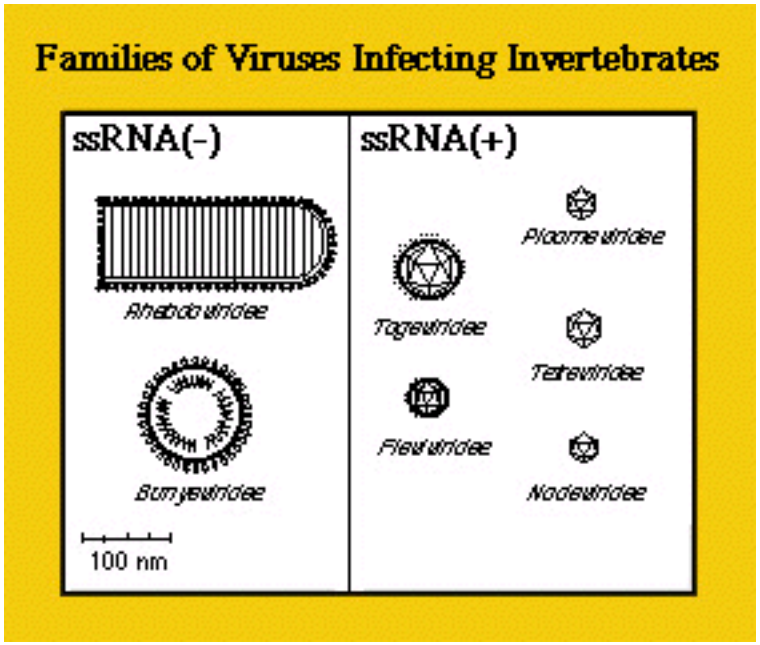




Family 00.009. Birnaviridae

Genus 00.009.0.01. Aquabirnavirus
Genus 00.009.0.02. Avibirnavirus
Genus 00.009.0.03. Entomobirnavirus

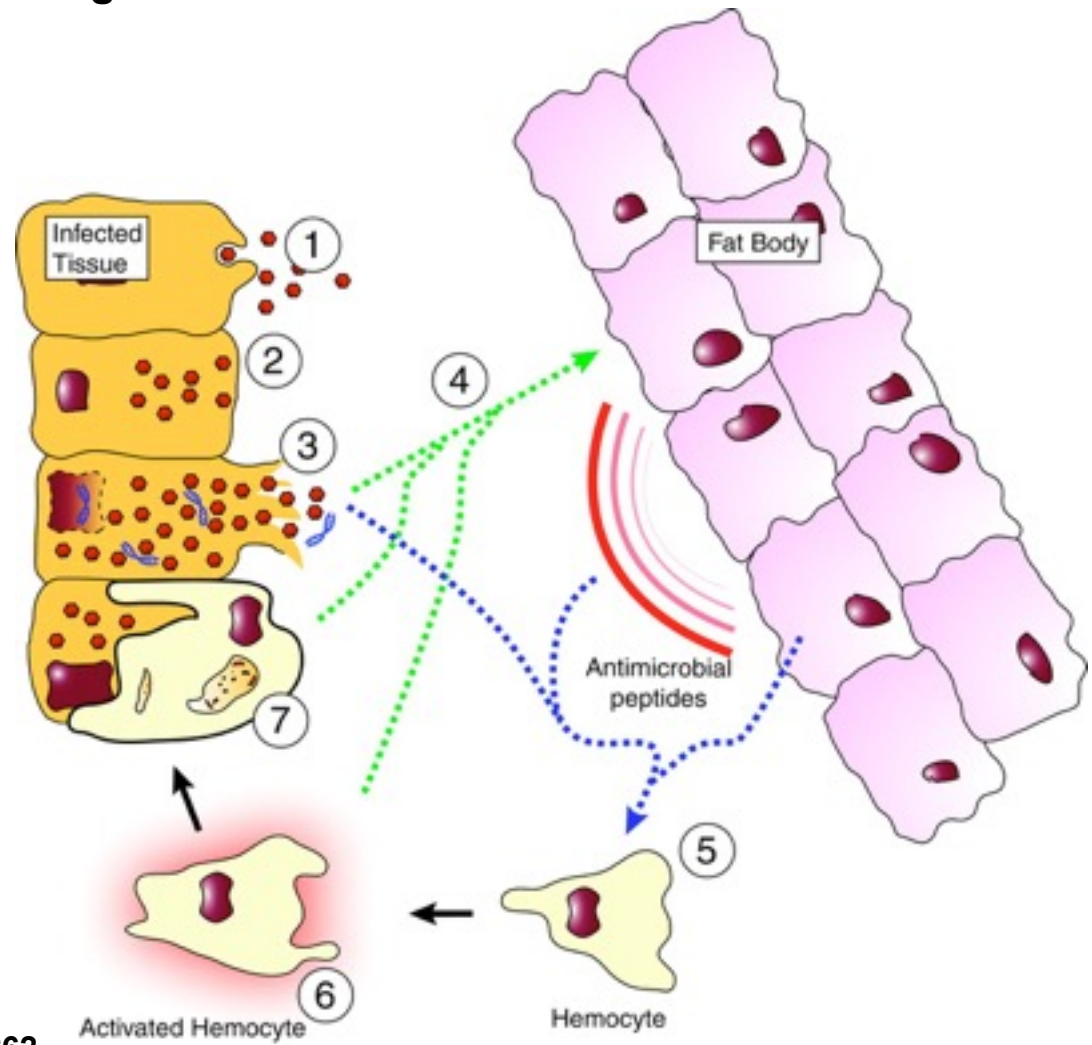
Species, their serotypes, strains and isolates

00.009.0.03.001. Drosophila X virus [U60650] RNA-A (DXV)

Sequence analysis of the bicistronic Drosophila X virus genome segment A and its encoded polypeptides

Tentative Species in the Genus
None reported.

Model for Drosophila antiviral response. 1, Virus enters system and infects the cell. 2, Virus replication. 3, Lysis of infected cell, releasing internal cellular compounds and virus. 4, Released materials activate the IMD and Toll humoral immune pathways and cause local activation of the cellular response. 5, Global activation of hemocytes via Toll pathway signaling. 6, Activated hemocytes signal to the fat body enhancing Toll and IMD pathways activation. 7, Hemocytes recognize aberrant infected cells and engulf and eliminate these cells



Zambon R. A. et.al. PNAS;2005;102:7257-7262

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  - Amyelosis chronic stunt virus
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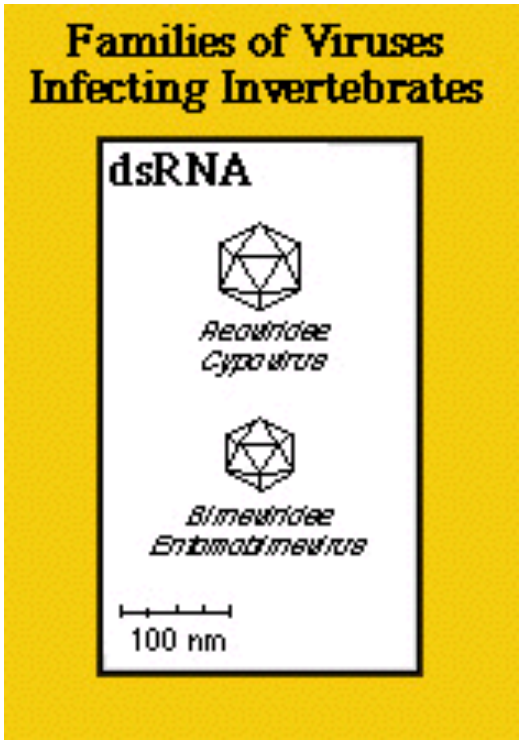
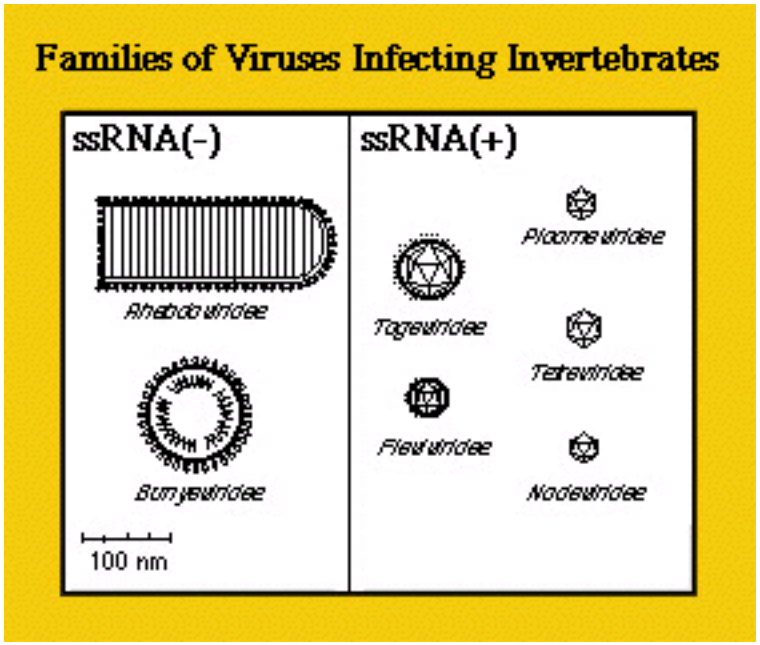
    - Nodamura virus
    - Black beetle virus





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ARTICLES

Carbon dioxide sensitivity in mosquitoes infected with sigma, vesicular stomatitis, and other rhabdoviruses

L Rosen

Carbon dioxide, usually an innocuous narcotic for insects, kills mosquitoes infected with rhabdoviruses. Such toxicity was originally observed in Drosophila harboring a hereditary virus, sigma, and has been considered unique to Drosophila. The new findings support the possibility that insects with piercing and sucking mouthparts harbor similar hereditary viruses and transmit some of them to vertebrates or plants.

RNA VIRUSES

Double-stranded RNA, nonenveloped

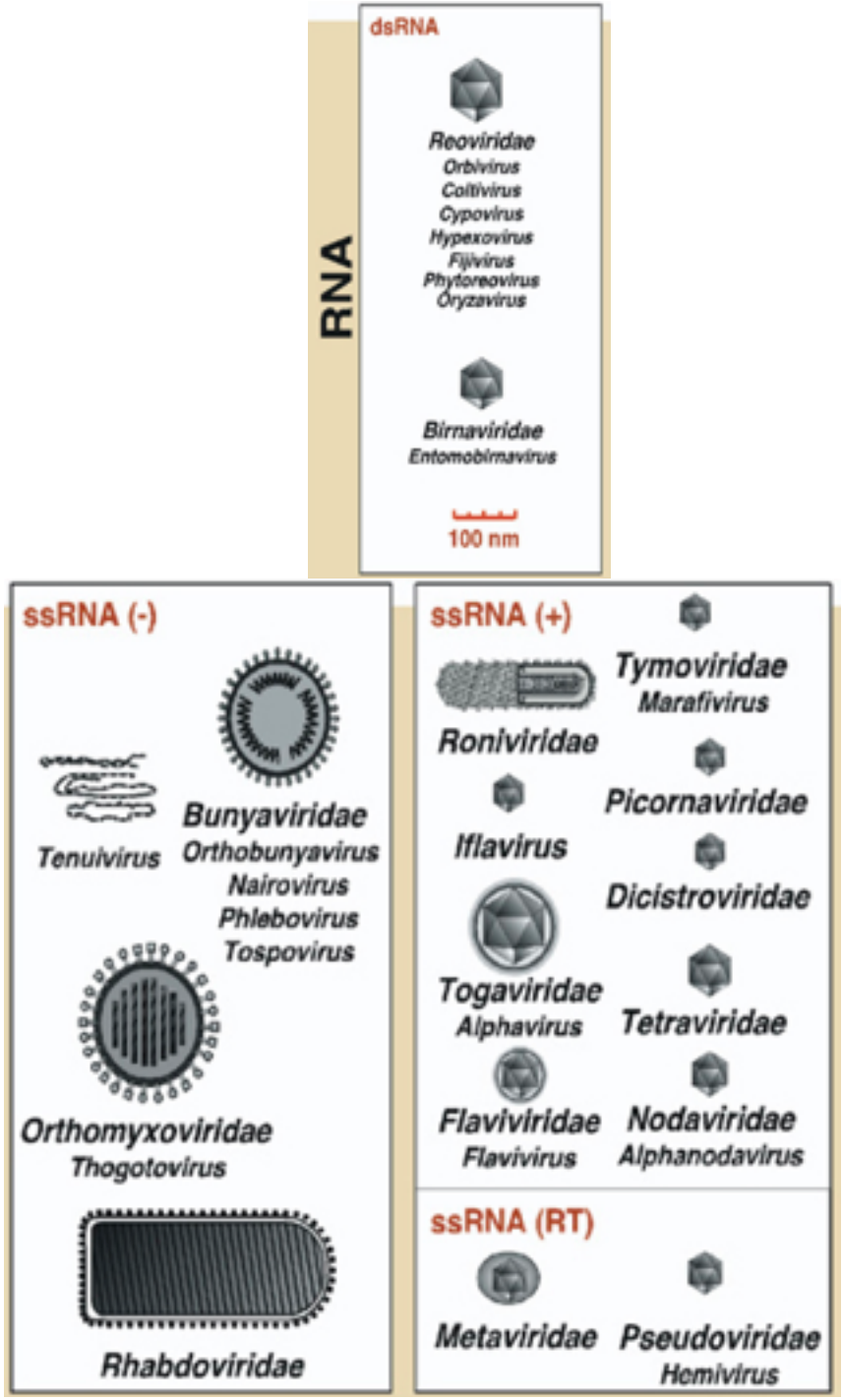
- REOVIRIDAE, reoviruses
  - Cytoplasmic polyhedrosis virus
- BIRNAVIRIDAE, bisegmented dsRNA viruses
  - Birnavirus, Drosophila X virus

Single-stranded RNA, enveloped

- RHABDOVIRIDAE, bullet-shaped viruses
  - Sigmavirus, CO2 sensitivity virus

Single-stranded RNA, nonenveloped

- PICORNAVIRIDAE, picornaviruses
  - Cricket paralysis virus
  - Drosphila C virus
  - Gonometa virus
  - Infectious flacherie virus
  - Rhopalosiphum padi virus
- CALICIVIRIDAE, caliciviruses
  - Amyelosis chronic stunt virus
- Nudaurelia virus group
  - Nudaurelia virus
- Trichoplusia RNA virus
  - Related viruses isolated from other Lepidoptera
- NODAVIRIDAE
  - Nodavirus
    - Nodamura virus
    - Black beetle virus



List of Invertebrate Picorna Viruses -listed by N.J. Knowles

Viruses isolated from **Orthoptera** （直翅目：コオロギ）

Cricket paralysis virus (CrPV) field crickets, Teleogryllus oceanicus and T. commodus
Reinganum et al., 1970

Viruses isolated from **Diptera** （双翅目：カ・ハエ）

Drosophila C virus (DCV) Fruit fly, Drosophila melanogaster Jousset et al., 1972
Drosophila P virus (DPV) Fruit fly, Drosophila melanogaster
Plus and Duthoit, 1969; Tenniges and Plus, 1972
Drosophila A virus (DAV) Fruit fly, Drosophila melanogaster ?
Queensland fruit fly virus (QFFV) Fruit fly Dacus tryoni Bashiruddin et al., 1988
Aedes taeniorhynchus virus ? Mosquito, Aedes taeniorhynchus Wagner et al., 1974
Kawino virus (KV) mosquito, Mansonia uniformis Pudney et al., 1978

Viruses isolated from **Lepidoptera** （鱗翅目：チョウ・ガ）

Gonometa virus ? caterpillar, Gonometa podocarpi Harrap et al., 1966
Infectious flacherie virus (IFV) silkworm, Bombyx mori Kawase et al., 1980
Latoia viridissima virus ? oil palm pest, Latoia viridissima Fediere et al., 1990
Pectinophora gossypiella virus (PgV) cotton pink bollworm, Pectinophora gossypiella
Monsarrat et al., 1995
Perina nuda picornavirus (PnPV) Ficus transparent wing moth, Lymantriidae Perina nuda
Wang et al., 1999

Viruses isolated from **Hymenoptera**（膜翅目：ハチ）

Bee slow paralysis virus (BSPV) honey bee, Apis mellifera Bailey and Woods, 1974
Bee acute paralysis virus (BAPV) honey bee, Apis mellifera Bailey et al., 1963
bee virus X (BVX) honey bee, Apis mellifera Bailey and Woods, 1974
sacbrood virus (SBV) honey bee, Apis mellifera Bailey et al., 1964
Thai sacbrood virus ? Eastern hive bee, Apis cerana Bailey et al., 1982
Egypt bee virus (EBV) honey bee, Apis mellifera Bailey et al., 1979
Kashmir bee virus (KBV) Eastern hive bee, Apis cerana Bailey et al., 1979
South Australia Kashmir bee virus ? honey bee, Apis mellifera Bailey et al., 1979
black queen-cell virus (BQCV) honey bee, Apis mellifera Bailey and Woods, 1977

Viruses isolated from **Hemiptera**　（半翅目：アブラムシ・カメムシ）

Rhopalosiphum padi virus (RhPV) Oat bird cherry aphid, Rhopalosiphum padi
D'Arcy et al., 1981
aphid lethal paralysis virus (ALPV) Oat bird cherry aphid, Rhopalosiphum padi
Williamson et al., 1988
Acyrthosiphon pisum virus (APV) pea aphid, Acyrthosiphon pisum
van den Heuvel et al., 1997; van der Wilk et al., 1997
Triatoma virus (TrV) Kissing bug, Triatoma infestans Muscio et al., 1987, 1988
Plautia stali intestine virus (PSIV) Brown-winged green bug, Plautia stali Nakashima et al., 1998

Viruses isolated from **Isoptera**（等翅目：シロアリ）

termite paralysis virus (TPV) Termite Gibbs et al.,

タンパク質合成開始の新機構

中　島　信　彦

真核生物の普通の伝令RNA（mRNA）の先頭にはキャップ構造があり，この構造を翻訳開始因子類が認識し，そこにリボソームが結合する事によって翻訳が始まるとされています。これに対して，ポリオウイルスやC型肝炎ウイルスなど一部のRNAウイルスは，mRNAのコード領域の上流にリボソーム内部進入部位（Internal Ribosome Entry Site，略してIRES）というRNAの高次構造を形成し、この構造を足掛かりにリボソームがmRNAに結合します。そのため翻訳開始の際にキャップ構造も，翻訳開始因子類のいくつかも必要ありません。しかし，どちらの場合にも翻訳開始メチオニンtRNAという翻訳開始の時にだけ使用される特殊なtRNAが，既にリボソームに組み込まれた状態でmRNAに結合します。したがって、蛋白質の合成は必ずメチオニンから始まります。つまり，これまではメチオニン以外のアミノ酸からのタンパク質合成開始は不可能と考えられていました。

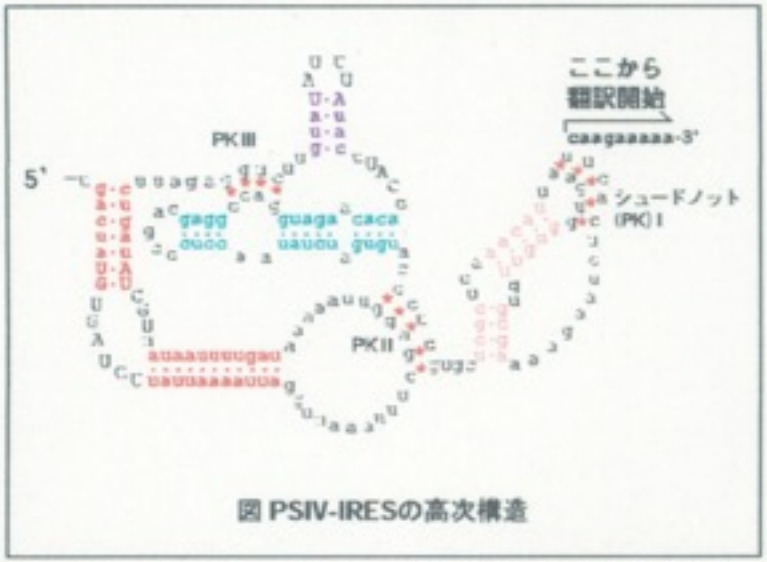


図 PSIV-IRESの高次構造

しかし，チャバネアオカメムシ腸管ウイルス（PSIV）の外被タンパク質遺伝子の翻訳開始では，翻訳開始メチオニンtRNAと翻訳開始コドンとの塩基対合は不要です。図に示したRNAの高次構造が自分で翻訳開始部位を決める働きをしているからです。これまでの研究結果から，PSIVのIRESでは約180塩基があれば翻訳開始を行うことができ，その中には，赤，紫，緑，ピンクで示した４本のステム構造と，赤のアスタリスクで表した３カ所のシュードノット構造が形成されます。このようなRNAの高次構造が形成されれば，このシュードノットの直ぐ下流から翻訳が始まります。また，外被タンパク質はウイルスにとって最も大量に合成する必要のあるタンパク質で，このIRESはタンパク質を大量合成するために特殊化したと考えられます。今後さらに解析が進めば，任意のアミノ酸からの蛋白質合成が可能になるかもしれません。

（昆虫適応遺伝研究グループ昆虫共生媒介機構研究チーム主任研究官）

Picorna-like viruses of invertebrates

FAMILY I:

Cricket paralysis virus (CrPV)	CG 9185 AF218039	Wilson et al., 2000
Drosophila C virus (DCV) EB	CG 9264 AF014388	Johnson and Christian, 1998
Plautia stali intestine virus (PSIV)	CG 8797 AB006531	Sasaki et al., 1998
Rhopalosiphum padi virus (RhPV)	CG 10011 AF022937	Moon et al., 1998
Himetobi P virus (HiPV)	CG 9275 AB017037	Nakashima et al., 1999
South African	CG 8550 AF183905	Leat et al., 2000
Triatoma virus (TrV)	CG 9010 AF178440	Czibener et al., 2000
Taura syndrome virus (TSV)	capsid-coding region 3278 AF277378	Robles-Sikisaka et al., 2001

FAMILY 2:

Acyrthosiphon pisum virus (APV)	CG 10035 AF024514	van der Wilk et al., 1997

FAMILY 3:

Infectious flacherie virus (IFV)	CG 9650 AB000906	Isawa et al., 1998
Sacbrood virus (SBV) Rothamstead	CG 8832 AF092924	Ghosh et al., 1999

CG = complete genome; (p) = partial gene sequence;
N/A = not available on the EMBL/GenBank/DDBJ databases

Unclassified small spherical RNA viruses

Arkansas bee virus
Bee acute paralysis virus
Bee chronic paralysis virus associate
Bee slow paralysis virus
Bee virus X
Bee virus Y
Black queen cell virus
Cloudy wing virus
Crystalline array virus
Drosophila A virus
Drosophila P virus
Kashmir bee virus
Kelp fly virus
Sacbrood virus

Unclassified small ovoid RNA viruses

Bee chronic paralysis virus
Drosophila RS virus

OTHER UNCLASSIFIED VIRUSES

Rod-shaped, enveloped

Cricket macronucleosis virus
Hypera virus

Long flexuous rod, enveloped

Bee filamentous virus

APV	Acute Paralysis Virus
ArkBV	Arkansas Bee Virus
BQCV	Black Queen Cell Virus
BVX	Bee Virus X
BVY	Bee Virus Y
CBPV	Chronic Bee Paralysis Virus
CWV	Cloudy Wing Virus
DWV	Deform Wing Virus
EBV	Egypt Bee Virus
FBV	Filamentous Virus
JEBV	Japon strain of Egypt Virus
KBV	Kashmir Bee Virus
SBV	Sacbrood Bee Virus
SPV	Slow Paralysis Virus

Drosophila (ショウジョウバエ)のRNAウイルス

Drosophila ananassae Tom virus (DanTomV) Metaviridae
Drosophila C virus (DCV) "CrPV-like viruses"
Drosophila F virus (DFV) Reoviridae
Drosophila line virus (DLV) Nodaviridae
Drosophila melanogaster 17.6 virus (Dme176V) Metaviridae
Drosophila melanogaster 1731virus (Dme1731V) Pseudoviridae
Drosophila melanogaster 297 virus (Dme297V) Metaviridae
Drosophila melanogaster 412 virus (Dme412V) Metaviridae
Drosophila melanogaster copia virus (DmeCopV) Pseudoviridae
Drosophilamelanogaster gypsy virus (DmeGypV) Metaviridae
Drosophila melanogaster mdg1virus (DmeMdg1V) Metaviridae
Drosophila melanogaster mdg4 virus (DmeMdg4V) Metaviridae
Drosophila melanogaster micropia virus (DmeMicV) Metaviridae
Drosophila P virus (DPV) Unassigned
Drosophila S virus (DSV) Reoviridae
Drosophila virilis Ulysses virus (DviUllV) Metaviridae
Drosophila X virus (DXV) Birnaviridae
Drosophilia A virus (DAV) Unassigned