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**NAD and NADP.** Abbreviations for NICOTINAMIDE ADENINE DINUCLEOTIDE and its phosphate.

**Nairobi sheep disease virus.** Family *Bunyaviridae*, genus *Nairovirus*. Causes haemorrhagic gastro-enteritis in sheep and goats with high mortality. The spleen is enlarged and the female genital tract is also involved. In man, the virus can cause fever. Encephalitis ensues in mice inoculated i.c. Transmission is by tick. The virus will grow in cell cultures of lamb and goat tissues.

**Nairovirus.** A genus in the family *Bunyaviridae*, containing the important CRIMEAN-CONGO HAEMORRHAGIC FEVER and NAIROBI SHEEP DISEASE VIRUSES.

**naked virus.** A virus without a lipoprotein envelope, e.g. picornaviruses, many plant viruses.

**Nandina mosaic virus.** A possible *Potexvirus*. Francki, R.I.B. *et al.* (1985) *In Atlas of Plant Viruses*. Vol. 2. p. 159. CRC Press: Boca Raton, Florida.

**Nandina stem pitting virus.** A possible member of the *Capillovirus* group. Ahmed, N.A. *et al.* (1983) *Phytopath* **73**, 470.

**narcissus degeneration virus.** A *Potyvirus*. Francki, R.I.B. *et al.* (1985) *In Atlas of Plant Viruses*. Vol. 2. p. 183. CRC Press: Boca Raton, Florida.

**narcissus late season yellows virus.** A possible *Potyvirus*. Francki, R.I.B. *et al.* (1985) *In Atlas of Plant Viruses*. Vol. 2. p. 183. CRC Press: Boca Raton, Florida.

**narcissus latent virus.** A *Carlavirus*. Brunt, A.A. (1976) *CMI/AAB Descriptions of Plant Viruses* No. 170. Francki, R.I.B. *et al.* (1985) *In Atlas of Plant*

*Viruses*. Vol. 2. p. 173. CRC Press: Boca Raton, Florida.

**narcissus mosaic virus.** A *Potexvirus*. Mowat, W.P. (1971) *CMI/AAB Descriptions of Plant Viruses* No. 45.

Francki, R.I.B. *et al.* (1985) *In Atlas of Plant Viruses*. Vol. 2. p. 159. CRC Press: Boca Raton, Florida.

**narcissus tip necrosis virus.** A possible member of the *Carmovirus* group.

Mowat, W.P. (1976) *CMI/AAB Descriptions of Plant Viruses* No. 166.

Francki, R.I.B. *et al.* (1985) *In Atlas of Plant Viruses*. Vol. 2. p. 235. CRC Press: Boca Raton, Florida.

Morris, T.J. and Carrington, J.C. (1988) *In The Plant Viruses*. Vol. 3, p.73. ed. R. Koenig. Plenum Press: New York.

**narcissus yellow stripe virus.** A *Potyvirus*. Brunt, A.A. (1971) *CMI/AAB Descriptions of Plant Viruses* No. 76.

Francki, R.I.B. *et al.* (1985) *In Atlas of Plant Viruses*. Vol. 2. p. 183. CRC Press: Boca Raton, Florida.

**Nariva virus.** Family *Paramyxoviridae*, genus *Paramyxovirus*. Isolated from forest rodents in Trinidad. Kills mice when injected i.c. Hamsters and guinea pigs can be infected without causing disease.

**nascent cleavage.** Proteolytic cleavage of a polypeptide while it is being synthesised by ribosomes.

**nascent RNA.** Oligoribonucleotides in the process of being transcribed from template DNA or RNA. REPLICATIVE INTERMEDIATES contain such RNA.

**nasturtium mosaic virus.** A possible *Carla-*

## 140 Navarro virus

*virus.*

Francki, R.I.B. *et al.* (1985) *In Atlas of Plant Viruses*. Vol. 2. p. 173. CRC Press: Boca Raton, Florida.

**Navarro virus.** Family *Rhabdoviridae*, genus unassigned. Isolated from turkey vulture in Colombia.

**navel orange infectious mottling virus.** An unclassified plant virus with isometric particles. Occurs in Japan.

Doi, Y. *Personal communication.*

**Ndumu virus.** Family *Togaviridae*, genus *Alpha virus*. Isolated from mosquitoes in South Africa. Kills new-born mice on injection.

**nearest neighbour sequence analysis.** A technique for studying the relationship between nucleic acids. The relative frequencies with which pairs of the four bases occur in adjacent positions is determined; this can distinguish between nucleic acids with identical or similar base compositions.

**Nebraska calf diarrhoea virus.** Family *Reoviridae*, genus *Rotavirus*. Causes gastro-enteritis in calves. Can be grown in bovine embryo kidney cell cultures.

**neck.** The region in TAILED PHAGE particles that links the phage head to the tail. In some phages, e.g. those which have contractile tails (MYOVIRIDAE) the neck is complex, including a connector, collar and whiskers (*see* T4 PHAGE).

**Neckar river virus.** A *Tombusvirus* isolated from the water of the river Neckar in West Germany.

Koenig, R. and Lesemann, D-E. (1985) *Phytopath. Z.* **112**, 105.

Gallitelli, D. and Russo, M. (1987) *J. Phytopath.* **119**, 106.

Martelli, G.P. *et al.* (1988) *In The Plant Viruses*. Vol. 3, p.13. ed. R. Koenig. Plenum Press: New York.

**necrosis (necrotic).** The death of cells. This may be due to virus infection or may occur in the surrounding uninfected cells following the release of toxic materials from the infected cell. *See* LOCAL LESION.

**necrotic rhinitis virus.** *See* BOVID HERPESVIRUS 1.

**Necrovirus group.** (necrosis). (Type member TOBACCO NECROSIS VIRUS). Genus of plant viruses with isometric particles, 28 nm. in diameter, which sediment at 118S and band in CsCl at 1.40 g/cc. The capsid has icosahedral symmetry



100nm

( $T=3$ ), the coat protein subunit having  $mw. = 22.6 \times 10^3$ . Each particle contains one molecule of linear (+)-sense ssRNA ( $mw. 1.3-1.6 \times 10^6$ ).

The host range is wide. Virus particles are found in most cell types. Necroviruses are easily mechanically transmitted. They are transmitted naturally by Chytrid fungi, *Olpidium* spp. Matthews, R.E.F. (1982) *Intervirolgy* **17**, 146. Francki, R.I.B. *et al.* (1985) *In Atlas of Plant Viruses*. Vol. 1. p. 171. CRC Press: Boca Raton, Florida.

**Neethling virus.** *See* LUMPY SKIN DISEASE VIRUS.

**negative staining.** A method of visualising virus particles in the electron microscope. The electron dense 'stain' dries down on the electron microscope grid, thus outlining the particles and revealing surface structures. It does not directly stain the particles. *See* PHOSPHOTUNGSTIC ACID, URANYL ACETATE.

Brenner, S. and Horne, R.W. (1959) *Biochim. Biophys. Acta* **34**, 103.

**negative-sense strand (negative strand).** Nucleic acid complementary to the PLUS STRAND. Some ssRNA viruses (e.g. PARAMYXOVIRUS, ORTHOMYXOVIRUS, RHABDOVIRUS) package the negative strand within the virus particle.

**negative-strand virus.** A virus whose genome is NEGATIVE-SENSE RNA. Five families of negative-strand viruses have been recognised: ARENAVIRIDAE, BUNYAVIRIDAE, ORTHOMYXOVIRIDAE, PARAMYXOVIRIDAE AND RHABDOVIRIDAE.

**Negishi virus.** Family *Flaviviridae*, genus *Flavivirus*. Isolated from cases of fatal encephalitis in man in Japan. Transmitted by ticks.

**Negri body.** Inclusion body found in the cytoplasm of brain cells of animals infected with RABIES VIRUS. Used in diagnosis. Named after A. Negri who first reported them in 1903.

**negro coffee mosaic virus.** A possible *Potexvirus*.

Francki, R.I.B. *et al.* (1985) *In Atlas of Plant Viruses*, Vol. 2. p. 159. CRC Press: Boca Raton, Florida.

**Nelson Bay virus.** Family *Reoviridae*, genus *Reovirus*. Isolated from blood of flying fox in Australia. Causes paralysis and death in mice inoculated i.c. Can be grown in pig kidney cells.

**Neochek-S.** Preparation of the nuclear polyhedrosis virus of the pine sawfly, *Neodiprion sertifer*, produced on an industrial scale by the US Forest Service for Pine Sawfly control.

**Neodiprion sertifer nuclear polyhedrosis virus.** A BACULOVIRUS (Subgroup A) of the SNPV type isolated from larvae of the pine sawfly, *N. sertifer*. It is host-specific and highly infectious for larvae of the homologous host. As with all known NPV infections of hymenopteran larvae, virus replication is restricted to cells of the gut epithelium. It has been available as a selective biological control agent for pine sawfly since 1974 in Finland and was registered for use in the USA in 1983 (as 'Neochek-S') and in the UK in 1985 (as 'Virox'). Comparative studies of *N. sertifer* NPV and NPVs isolated from lepidopteran hosts have revealed that the polyhedrins are distantly related.

Cunningham, J.C. and Entwistle, P.F. (1981) *In Microbial Control of Pests and Plant Diseases 1979-1980*, p. 379. ed. H.D. Burges. Academic Press: London.

**neonatal calf diarrhoea virus.** Family *Coronaviridae*, genus *Coronavirus*. Causes diarrhoea in very young calves. When serially transmitted, virus becomes attenuated. Can be grown in bovine kidney cell cultures.

**neoplasm.** An aberrant new growth of abnormal cells or tissues. *See* TUMOUR.

**neotope.** *See* EPITOPE.

**Nepovirus group.** (Sigla from nematode polyhedral). (Type member TOBACCO RINGSPOT VIRUS). Genus of MULTICOMPONENT plant viruses with isometric particles 28 nm. in diameter which sediment at 115-134S (bottom (B) component), 86-128S (middle (M) component) and 49-56S (top (T) component which lacks nucleic acid); CsCl banding densities (g/cc) are 1.51-1.53 (B),



100nm

1.43-1.48 (M) and 1.28 (T). The capsids are made up of subunits of a single polypeptide species (mw. 55-60 x 10<sup>3</sup>) which is possibly an oligomer or may contain repeated amino acid sequences. The genome is two species of linear (+)-sense ssRNA, RNA-1 (mw. 2.8 x 10<sup>6</sup>) and RNA-2 (mw. 1.3-2.4 x 10<sup>6</sup>); the 5' terminus has a vpg (mw. 3.6 x 10<sup>3</sup>), the 3' terminus is polyadenylated. M component particles contain a single molecule of RNA-2 and B component particles one molecule of RNA-1 or sometimes two molecules of RNA-2. RNA-1 codes for its replication; RNA-2 encodes the coat protein. The host ranges of nepoviruses are wide. Particles are found in most cell types. They are readily mechanically transmitted. Seed transmission is common. Most members are transmitted by soil-inhabiting nematodes of the longidorid genus.

Matthews, R.E.F. (1982) *Intervirology* **17**, 163. Harrison, B.D. and Murant, A.F. (1977) *CMI/AAB Descriptions of Plant Viruses* No. 185.

Francki, R.I.B. *et al.* (1985) *In Atlas of Plant Viruses*, Vol. 2. p. 23. CRC Press: Boca Raton, Florida.

**Nepuyo virus.** Family *Bunyaviridae*, genus *Bunyavirus*. Isolated from bats and mosquitoes in several countries in the Caribbean and in Brazil.

**Nerine latent virus.** A *Carlavirus*.

Francki, R.I.B. *et al.* (1985) *In Atlas of Plant Viruses*, Vol. 2. p. 173. CRC Press: Boca Raton, Florida.

**Nerine virus.** A possible *Potyvirus*.

Francki, R.I.B. *et al.* (1985) *In Atlas of Plant Viruses*, Vol. 2. p. 183. CRC Press: Boca Raton, Florida.

**Nerine virus X.** A *Potexvirus*.

Francki, R.I.B. *et al.* (1985) *In Atlas of Plant Viruses*, Vol. 2. p. 159. CRC Press: Boca Raton, Florida.

**neuraminic acid.** Constituent of cell receptor recognised by orthomyxovirus haemagglutinin.

**neuraminidase.** A glycoprotein carried on the surface of members of the ortho- and paramyxoviruses. In orthomyxoviruses it forms a distinct spike, whereas in paramyxoviruses it forms a joint spike with the viral HAEMAG-

**GLUTININ.** The detailed structure of influenza virus neuraminidase is known. It has enzymic activity which cleaves N-acetylneuraminic acid from the glycoprotein receptors on the cell membrane. In influenza virus it is serotype-specific as is haemagglutinin. Colman, P.M. *et al.* (1983) *Nature* **303**, 41.

**neutral red.** A photoreactive dye. It decreases the infectivity of REOVIRUSES.

**neutralisation.** The inactivation of infectious virus by reaction with its specific antibody, thereby blocking sites on the virus which normally adsorb to susceptible cells. However, other mechanisms have been proposed.

Dimmock, N.J. (1984) *J. gen. Virol.* **65**, 1015.

Dimmock, N.J. (1987) *Trends in Biochem. Sci.* **12**, 70.

**neutralising antibody.** An antibody which inhibits the infectivity of a virus.

**New Minto virus.** Family *Rhabdoviridae*, genus unassigned. Isolated from ticks in Alaska. Kills mice when injected i.c. Grows in Vero cells.

**New South Wales kashmir bee virus.** Unclassified small RNA virus (possible INSECT PICORNAVIRUS) isolated from the honey bee, *Apis mellifera*. The virus is physically indistinguishable from KASHMIR BEE VIRUS. Virions contain three major proteins (mw. 44.5, 35.4 and 25 x 10<sup>3</sup>). Serologically related to, but distinct from, KASHMIR BEE VIRUS, QUEENSLAND KASHMIR BEE VIRUS and SOUTH AUSTRALIA KASHMIR BEE VIRUS.

Bailey, L. *et al.* (1979). *J. gen. Virol.* **43**, 641.

**Newcastle disease virus.** Synonym: AVIAN PNEUMOENCEPHALITIS VIRUS, RANIKHET VIRUS. Family *Paramyxoviridae*, genus *Paramyxovirus*. Causes respiratory disease in many species of birds, with nasal discharge and diarrhoea. Occasionally, nervous system is involved with paralysis. Also infects man, causing conjunctivitis. Transmission in birds is by drinking water or dust. Encephalitis is produced when virus is inoculated into mice or hamsters. Can be grown in eggs or many types of cell culture.

**nicked circular DNA.** Synonym: OPEN CIRCULAR DNA.

**Nicotiana velutina mosaic virus.** A possible member of the *Furovirus* group.

Randles, J.W. (1978) CMI/AAB Descriptions of Plant Viruses No. 189.

Brunt, A.A. and Shikata, E. (1986) *In The Plant Viruses*. Vol. 2. p. 305. ed. M.H.V. van Regenmortel and H. Fraenkel-Conrat. Plenum Press: New York.

**Nigerian horse virus.** Family *Rhabdoviridae*, genus *Lyssavirus*. Isolated from the brain of a horse with staggers (meningo-encephalomyelitis). Infects mice when inoculated i.c.

**NIH.** National Institutes of Health. A group of medical research institutes in Bethesda, Maryland, U.S.A. and also the principal US Government agency for funding bio-medical research in universities.

**Nique virus.** Family *Bunyaviridae*, genus *Phlebovirus*. Isolated from *Lutzomyia panamensis* in Panama.

**nitrocellulose.** A nitrated derivative of cellulose which is used either as a powder or is made into membrane filters of defined porosity. Used to bind nucleic acids in NORTHERN BLOTTING and SOUTHERN BLOTTING procedures and proteins in WESTERN BLOTTING.

**Noctua pronuba Cytoplasmic Polyhedrosis Virus.** Cytoplasmic polyhedrosis virus (CPV) isolated in the United Kingdom from larvae of the cutworm, *Noctua (=Triphaena) pronuba* (Noctuidae, Lepidoptera). The virus is the type member of 'type 7' CPVs. Unrelated to *Bombyx mori* (type 1) CPV on the basis of RNA electropherotype. Viruses of similar electropherotype have been observed in other Lepidoptera (*see* APPENDIX B).

Payne, C.C. and Mertens, P.P.C. (1983) *In The Reoviridae*. p. 425. ed. W.K. Joklik. Plenum Press: New York.

**Nodamura virus.** Family *Nodaviridae*. Type species of the NODAVIRUS genus, isolated from the mosquito *Culex tritaeniorhynchus*, obtained in the village of Nodamura near Tokyo, Japan. Less-intensively studied than some other Nodaviruses, particularly BLACK BEETLE VIRUS. Unlike other Nodaviruses, it replicates not only in insects but is also pathogenic for suckling mice. It has a wide host range in insects being infectious for bees (*Apis mellifera*), Lepidoptera (e.g. *Galleria mellonella*) and Diptera (e.g. *Aedes aegypti*).

Moore, N.F. *et al.* (1985) *J. gen. Virol.* **66**, 647.

**Nodaviridae.** (Nodamura, village in Japan where virus first isolated.) A family of RNA viruses containing a single genus (NODAVIRUS). Virions are small unenveloped isometric particles c.30 nm. in diameter with T=3 symmetry; they sediment at 135-142S and have buoyant densities



100nm

in CsCl of 1.30-1.35 g/cc. The particles contain one major polypeptide (mw.  $39 \times 10^3$ ) and one minor species ( $43 \times 10^3$ ) derived by proteolytic cleavage of a  $44 \times 10^3$  precursor protein which may also be present in small amounts in the mature particle. The (+)-sense ssRNA genome consists of two RNA molecules, one each of  $1.1 \times 10^6$  (RNA1) and  $0.48 \times 10^6$  (RNA2) in the same particle. Both RNAs are required for productive infection. The viruses replicate in the cytoplasm of susceptible cells. Infected cells contain three ssRNAs. RNA1 codes for a  $104 \times 10^3$  polymerase. RNA2 codes for the coat protein and RNA3 ( $0.15 \times 10^6$  and derived from RNA1) codes for a protein (mw.  $10 \times 10^3$ ) of unknown function. RNAs 1 and 2 are required for the production of virions. Nodaviruses have only been naturally isolated from insects (Diptera, Coleoptera or Lepidoptera). Experimentally, most can be propagated in the wax moth, *Galleria mellonella* and in cultured *Drosophila* cells. However, Nodamura virus, unlike other members, grows in suckling mice but not in *Drosophila* cells.

Moore, N.F. *et al.* (1985) *J. gen. Virol.* **66**, 647.

**Nodavirus.** The only genus of viruses currently classified within the *Nodaviridae*. The type species is NODAMURA VIRUS. Other known members are BLACK BEETLE VIRUS, BOOLARRA VIRUS, FLOCK HOUSE VIRUS, *LYMANTRIA DISPAR* NODAVIRUS, MANAWATU VIRUS; Arkansas, Boolarra and flock house viruses have similarities. All are serologically related. See also ENDOGENOUS *DROSOPHILA* LINE VIRUS.

**Nola virus.** Family *Bunyaviridae*, genus *Bunyavirus*. Isolated from mosquitoes in Central African Republic.

**non-inclusion virus.** See NON-OCCLUDED VIRUS.

**non-ionic detergent.** A detergent with no net surface charge, e.g. the TRITON series, NONIDET P40.

**non-occluded Baculovirus.** Proposed subgroup C of the *BACULOVIRUS* genus, characterised by virus particles containing rod-shaped nucleocapsids singly enveloped by a unit membrane, which replicate in the nucleus. Unlike productive infections with members of the other *BACULOVIRUS* subgroups (NUCLEAR POLYHEDROSIS and GRANULOSIS VIRUSES), no virus occlusion bodies are produced during infection. The type species is *ORYCTES RHINOCEROS* virus. Other morphologically-similar viruses include HZ-1 *BACULOVIRUS* and isolates from *Gyrinus natator*, *Hypera* sp., *Diabrotica undecimpunctata* (Insecta: Coleoptera), *Aphis* spp. (Insecta: Homoptera), *Gryllus campestris* (Insecta: Orthoptera), *Solenopsis* sp. (Insecta: Hymenoptera), *Bacillus rossius* (Insecta: Phasmatodea), *Chaoborus crystallinus* (Insecta: Diptera), *Panonychus* spp., *Pisaura mirabilis* (Arachnida), *Carcinus* spp. *Callinectes sapidus* and *Penaeus japonicus* (Crustacea). Some braconid parasitoid virus particles (e.g. *Mesoleius tenthredenis* virus) have similar properties. Brief descriptions of these viruses are given elsewhere in the Dictionary under the generic name of the host e.g. *GYRINUS BACULOVIRUS*. Granados, R.R. and Federici, B.A. (1986) *The Biology of Baculoviruses*. Vols. I and II. CRC Press: Boca Raton, Florida.

**non-occluded rod-shaped nuclear viruses.** See NON-OCCLUDED *BACULOVIRUS*.

**non-occluded virus.** Usually applied to describe insect-pathogenic viruses which do not produce proteinaceous OCCLUSION BODIES during infection (including NON-OCCLUDED *BACULOVIRUS*, *DENSOVIRUS*, *IRIDOVIRUS*, *INSECT PICORNAVIRUS*).

**non-permissive cells.** Cells in which a specific virus will not infect and replicate. The barrier may be lack of viral receptors or some cell factor or lack of cell factor which inhibits replication.

**non-persistent transmission.** The relationship between certain viruses (e.g. *POTYVIRUSES*) and their arthropod vectors which is characterised by a very short acquisition period after which the vector does not retain the virus for long after the initial transmission feed. The virus particles are thought to associate with the vector's mouth parts, those particles passing into the gut not being transmitted. See *PERSISTENT TRANSMISSION*.

**non-producer cells.** Cells carrying all or part of

## 144 non-structural protein

a viral genome but not producing virus particles. They are usually transformed by the virus.

**non-structural protein.** Protein encoded by a viral genome but not involved in the structure of the virus particle. It is usually functional during replication.

**Nonidet P40.** A non-ionic detergent comprising octylphenol ethylene condensate. Used to disrupt cells and viral membranes.

**nonsense codon.** See STOP CODON.

**nonsense mutant.** Caused by a mutation that results in the premature termination of a polypeptide chain.

**North American plum line pattern virus.** An *Iarvirus*.  
Matthews, R.E.F. (1982) *Intervirology* **17**, 175.

**northern blotting.** A procedure analogous to SOUTHERN BLOTTING but involving the transfer of RNA on to nitrocellulose or activated paper sheets.

**northern cereal mosaic virus.** A plant *Rhabdovirus*, subgroup 1; transmitted by planthoppers. Toriyama, S. (1986) AAB descriptions of Plant Viruses No. 322.  
Francki, R.I.B. *et al.* (1985) In *Atlas of Plant Viruses*. Vol. 1. p. 73. CRC Press: Boca Raton, Florida.

**Northway virus.** Family *Bunyaviridae*, genus *Bunyavirus*. Isolated from mosquitoes in Alaska.

**Norwalk agent.** Unclassified but probably a *Calicivirus*. Causes acute gastro-enteritis in man.

**Nothoscordum mosaic virus.** A *Potyvirus*.  
Francki, R.I.B. *et al.* (1985) In *Atlas of Plant Viruses*. Vol. 2. p. 183. CRC Press: Boca Raton, Florida.

**notifiable disease.** A disease which must be notified to the medical or agricultural authorities in a given country, e.g. in the UK, measles, foot-and-mouth disease, beet rhizomania.

**NOV.** Abbreviation sometimes used for 'non-occluded virus', often referring to those BACULOVIRUS particles which are not incorporated within occlusion bodies during infection.

**Novobiocin.** An antibiotic whose primary action is to inhibit DNA synthesis. Probably acts on DNA GYRASE.

**NPV.** Common abbreviation for NUCLEAR POLYHEDROSIS VIRUS.

**Ntaya virus.** Family *Flaviviridae*, genus *Flavivirus*. Isolated from mosquitoes in several countries in Africa.

**nuclear magnetic resonance (NMR) spectroscopy.** The measurement of absorption of energy by magnetic atomic nuclei placed in a strong magnetic field. Can give atomic detail of small macromolecules.

**nuclear membrane.** The membrane which surrounds the nucleus of a eukaryotic cell. It is really two membranes, the inner and the outer; the outer is contiguous with the endoplasmic reticulum.

**nuclear polyhedrosis virus (NPV).** Subgroup A of the *Baculovirus* genus. Virus particles may consist of one rod-shaped nucleocapsid surrounded by an envelope (SNPV morphotype), or two or more nucleocapsids surrounded by a common envelope (MNPV morphotype). An NPV from the silkworm, *Bombyx mori*, is characteristic of the SNPV type while the type species of NPVs, *Autographa californica* NPV, is of the MNPV type. During infection of susceptible insect hosts, many NPV virus particles are occluded in large numbers within large (0.5 to 15  $\mu\text{m}$ ) proteinaceous occlusion bodies which help maintain virus viability for many years outside the insect host. Most of the biochemical properties of the virus particles are shared with members of the baculovirus subgroups B and C (see BACULOVIRUS, GRANULOSIS VIRUS, NON-OCCLUDED BACULOVIRUS), including a large circular supercoiled dsDNA genome, about 25 structural polypeptides and an occlusion body matrix protein (see POLYHEDRIN), mw. about  $29 \times 10^3$ . The structure and replication of the type species has been intensively studied (see *AUTOGRAPHA CALIFORNICA* NPV); this virus and several other NPV isolates from Lepidoptera have been propagated successfully in insect cell culture. The majority of NPV isolates have been obtained from Lepidoptera, though NPVs have also been reported in Hymenoptera, Diptera, Neuroptera, Coleoptera, Trichoptera, Crustacea and mites. In lepidopteran larvae, virus infection predominates in the fat body tissue and is generally lethal. In Hymenop-

tera, the virus replicates only in the gut epithelial cells. Some NPV isolates (e.g. *Neodiprion sertifer* NPV) have very high host specificity, infecting only one insect species or a group of closely-related species. Others (e.g. *A. californica* NPV and *Mamestra brassicae* NPV) have a broader host range within one order of insects. No NPV infections have been recorded outside the Arthropoda. There is no formal nomenclature for each virus isolate. Viruses have usually been named after the host from which they were first isolated; names are often abbreviated in the literature e.g. AcNPV for *A. californica* NPV. Many NPVs have high pathogenicity for their insect hosts and several have been used on a commercial or semi-commercial scale as biological pest control agents. These include the NPVs of the cotton bollworm, *Heliothis zea*; gypsy moth, *Lymantria dispar*, pine sawfly, *Neodiprion sertifer*; Douglas fir tussock moth, *Orgyia pseudotsugata*, and cabbage moth, *Mamestra brassicae*. A list of insect hosts in which NPV infections have been recorded is given in Appendix A. Granados, R.R. and Federici, B.A. (1986) The Biology of Baculoviruses. Vols. I and II. CRC Press: Boca Raton, Florida.

**nuclease.** An enzyme which can hydrolyse the internucleotide linkages of a nucleic acid.

**nucleic acid.** A long chain of repeating units built up from nucleotides. When the sugar is ribose the nucleic acid is ribonucleic acid (RNA); when deoxyribose it is deoxyribonucleic acid (DNA).

**nucleocapsid.** Viral nucleic acid enclosed by a protein capsid. Thus it is the particle of rod-shaped and simple isometric viruses. In more complex viruses, e.g. RHABDOVIRUSES, BACULOVIRUSES, the nucleocapsid or core is enclosed in a membranous structure or envelope.

**nucleoid.** The electron-dense central region observed in certain viruses, e.g. C-TYPE VIRUSES, in the electron microscope.

**nucleopolyhedrosis virus.** Synonym: NUCLEAR POLYHEDROSIS VIRUS.

**nucleoprotein.** A complex of nucleic acid with protein.

**nucleoside.** A constituent of nucleic acids comprising a sugar (ribose or deoxyribose) joined to a base. See NUCLEIC ACID.

**nucleosome.** Structures found in large DNA genomes and chromosomes which comprise DNA and histones (CHROMATIN). These structures alternate with protein-free stretches of nucleic acid.

**nucleotide.** A constituent of nucleic acid comprising a phosphate group joined to a sugar (ribose or deoxyribose) which, in turn, is joined to a base. See NUCLEIC ACID.

**nucleotide phosphohydrolase.** An enzyme which removes a phosphate group from the triphosphate end of nucleotides. Found in the virions of REOVIRUSES where it may be involved in the inhibition of host cell DNA synthesis or in the formation of the 5' terminal CAP sequence on mRNA.

**nucleotide sequence.** See SEQUENCE.

**nucleus.** In eukaryotes, a membrane enclosed organelle that contains the chromosomes.

**Nudaurelia  $\beta$  virus.** Type species of the TETRAVIRUS genus, isolated from the pine emperor moth, *Nudaurelia cytherea capensis* (Saturniidae; Lepidoptera), in South Africa. Virus particles are isometric, 35-38 nm. in diameter, sediment at 213S and have a buoyant density of 1.30 g/cc. Particles contain a single structural polypeptide with a mw. of about  $60 \times 10^3$ . The capsid contains 240 copies of this protein arranged in a T=4 symmetry. The genome is a (+)-sense ssRNA, mw.  $1.8 \times 10^6$ . Several other related viruses have been identified by their serological reactions with antiserum against *Nudaurelia  $\beta$*  virus.

Moore, N.F. *et al.* (1985) J. gen. Virol. **66**, 647.

**Nudaurelia  $\beta$  virus group.** Vernacular name for the *Tetraviridae*.

**Nudaurelia  $\epsilon$  virus.** Unclassified (probable RNA-containing) virus isolated from larvae of the pine emperor moth, *Nudaurelia cytherea capensis*. Particles are isometric, 40 nm. in diameter, sediment at 217S and have a buoyant density of 1.28 g/cc. (cf. *Nudaurelia  $\beta$*  virus; 213S; 1.30 g/cc.). The virus is serologically distinct from *Nudaurelia  $\omega$*  virus.

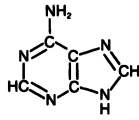
Juckes, I.R.M. (1979) J. gen. Virol. **42**, 89.

**Nudaurelia  $\omega$  virus.** Unclassified small RNA-containing virus isolated from larvae of the pine

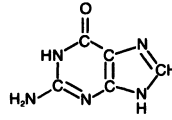
146 nucleic acid

**Bases**

**Purines**

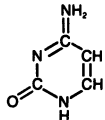


Adenine

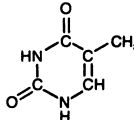


Guanine

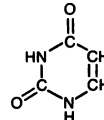
**Pyrimidines**



Cytosine

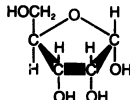


Thymine

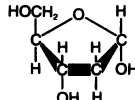


Uracil

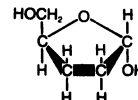
**Sugars**



ribose

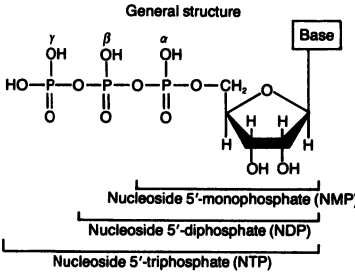


deoxyribose

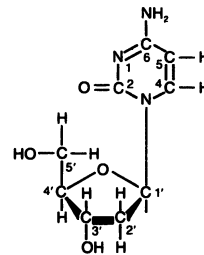


dideoxyribose

**Nucleotides**

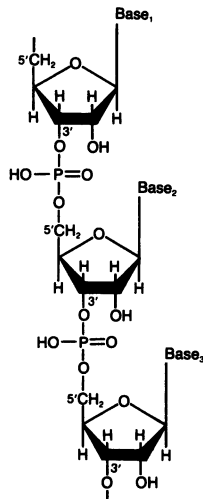


Numbering system (cytosine deoxyribonucleoside)

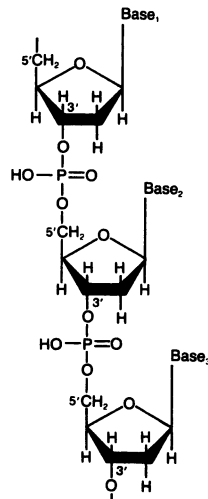


**Polynucleotides**

**RNA**



**DNA**





## CONSTITUENTS OF NUCLEIC ACIDS

BASE		NUCLEOSIDE		NUCLEOTIDE	
Name	Abbreviation	Name	Abbreviation	Nucleoside monophosphate	Nucleoside diphosphate
<b>PURINE</b>					
Adenine	A	Adenosine	Ado	AMP*	ADP
Guanine	G	Guanosine	Guo	GMP	GDP
		2-Deoxyguanosine	dGuo	dGMP	dGDP
<b>PYRIMIDINE</b>					
Cytosine	C	Cytidine	Cyd	CMP	CDP
		2-Deoxycytidine	dCyd	dCMP	dCDP
Thymine	T	2-Deoxythymidine	dThd	dTMP	dTDP
Uracil	U	Uridine	Urd	UMP	UTP

\*Full names:

AMP Adenosine 5'-monophosphate; Adenosine 5'-phosphoric acid; Adenylic acid.

dAMP Deoxyadenosine 5'-monophosphate; Deoxyadenosine 5'-phosphoric acid; Deoxyadenylic acid.

ADP Adenosine 5'-diphosphate; Adenosine 5'-pyrophosphoric acid.

dADP Deoxyadenosine 5'-diphosphate; Deoxyadenosine 5'-pyrophosphoric acid.

ATP Adenosine 5'-triphosphate; Adenosine 5'-triphosphoric acid.

dATP Deoxyadenosine 5'-triphosphate; Deoxyadenosine 5'-triphosphoric acid.

## PROPERTIES OF NUCLEOSIDE TRIPHOSPHATES.

Abbreviation	mw. pH 7.0 (nm.)	$\lambda_{\max}$ $\times 10^{-3}$	$\eta_{\max}$
ATP	507.2	259	15.4
dATP	491.2	259	15.2
GTP	523.2	252	13.7
dGTP	507.2	253	13.7
CTP	483.2	271	9.1
dCTP	467.2	271	9.1
dTTP	482.2	267	9.6
UTP	484.2	262	10.0

Abbreviations: *See Table*

$L\lambda_{\max}$  Wavelength of maximum ABSORPTION  
 $\lambda_{\max}$  SPECIFIC ABSORPTION at  $\lambda_{\max}$

148 **nugget virus**

emperor moth, *Nudaurelia cytherea capensis*. Particles are isometric, 40 nm. in diameter, and have a buoyant density in CsCl of 1.285 g/cc. There is a single major structural protein (mw.  $65 \times 10^3$ ; slightly larger than the protein of *Nudaurelia*  $\beta$  virus). Preliminary studies suggest that the RNA genome may exist as two molecules (mw.  $0.9 \times 10^6$  and  $1.8 \times 10^6$ ). Virus particles are serologically distinct from *Nudaurelia*  $\epsilon$  virus, *Nudaurelia*  $\beta$  virus and tetraviruses isolated from *Antheraea eucalypti* and *Dasychira pudibunda*. Hendry, D. *et al.* (1985) *J. gen Virol.* **66**, 627.

**nugget virus.** Family *Reoviridae*, genus

*Orbivirus*. Isolated from nymphs of *Ixodes uriae* on Macquarie Island. Antibodies found in penguins.

**Nyabira virus.** Family *Reoviridae*, genus *Orbivirus*.

**Nyamanini virus.** Unclassified. Isolated from birds and ticks in Africa and Egypt. Kills newborn mice on injection.

**Nyando virus.** Unclassified isolated from man and mosquitoes in Kenya and Central African Republic. No disease reported.