VIROLOGY

Directory & Dictionary of Animal, Bacterial and Plant Viruses

病毒学：动物、细菌和植物病毒指南和字典[英]

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Introduction

Virology brings together many branches of science ranging from human pathology to plant pathology, entomology to biochemistry, immunology to biophysics, and molecular biology to evolution. This confluence of subjects has resulted in a diversity of terminology which can confuse even leading workers. The aim of this dictionary is to provide a ready reference for all scientists working in or teaching virology and also for people interested in the subject. The dictionary comprises names of viruses and their higher order taxa as well as terms which are commonly used in the virological literature. In many cases references are given to recent reviews and papers so that readers have access to yet further information.

The virus classification is based on that approved by the International Committee on the Taxonomy of Viruses (ICTV) which is the regulatory body in this area. The most recent definitive listing published by R.E.F. Matthews (1982, Intervirology 17, 1) has been updated using the minutes from subsequent meetings of the ICTV. Various groupings of viruses, not yet approved by the ICTV, are listed and are identified as being unofficial.

The ICTV classification groups viruses into families and subfamilies, genera, subgenera or groups and subgroups, and species or individual viruses. There is not yet full concordance amongst virologists on the formal classification and this is reflected in the plant virus entries which are under groups and individual viruses. We have attempted to list most, if not all, viruses of vertebrates, invertebrates, plants and bacteria. In some cases we have omitted older names of viruses; in other cases, with less well-characterised viruses, it is likely that the same virus has two or more names. For each virus we record the family or group to which it belongs and it is at this level of classification that the characteristic features of the virus will be found.

The general terms include those relating to techniques and laboratory reagents frequently used in virology as well as some historical facts and organisations closely associated with the subject. It is in these general terms that the overlap with other disciplines becomes obvious and we hope that this dictionary will also be of use to scientists other than virologists. We have included some useful formulae and facts so that the "bench virologist" can have easy access to this information.

We extend our most sincere thanks to those who have helped us in this venture: Dr. H.W. Ackermann, Université Laval, Quebec, Canada; Professor K.W. Buck, Imperial College, University of London; Professor D.A. Ritchie, University of Liverpool; Dr. N. E. Crook, AFRC Institute of Horticultural Research, Littlehampton, and to the numerous colleagues who have been pestered with questions about definitions. These acknowledgements are not a delegation of responsibility and we take full blame for any mistakes. We are indebted to Mrs. Patricia Thomas (KITES Project, University of Surrey) for assembling and collating many of the entries, to Mr. John Hodder, Computing Unit, University of Surrey, and to our respective wives for their continuous support.

Abbreviations

The following abbreviations are used throughout this dictionary. Other abbreviations are identified as entries.

(+)-sense	plus-sense (nucleic acid)
(−)-sense	minus-sense (nucleic acid)
CNS	central nervous system
DNA	deoxyribonucleic acid
ds	double-stranded (nucleic acid)
E. coli	*Escherichia coli*
kb	kilobases
kbp	kilobase pairs
mRNA	messenger ribonucleic acid
mw.	molecular weight
RBC	red blood cells
RF	replicative form
RNA	ribonucleic acid
r.p.m.	revolutions per minute
ss	single-stranded (nucleic acid)
tRNA	transfer ribonucleic acid
UV	ultraviolet (radiation)

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A Note on Use

The head words defined in the dictionary are placed in alphabetical order as if the complete term regardless of spaces and hyphens. For example, **bee virus** X appears before **beet cryptic virus 1**.

Where numerals occur they count first in the alpha ordering, unless they are placed before the first letter. Thus **H3 virus** appears before **Haden virus**, but **7348 B virus** appears under '**B**' before ***Babahoyo virus***.

Cross references appear in SMALL CAPITALS.

Contents

A

A-type inclusion body. Inclusion bodies produced late in infection in the cytoplasm of cells infected with certain pox viruses (e.g. fowlpox, ectromelia, cowpox, canarypox). Some contain virus particles. In cowpox virus infections the inclusions consist almost entirely of a single protein species (mw. 160 x 10^3), abundantly synthesised late in infection. Cytoplasmic A-type inclusions of some vertebrate poxviruses (e.g. fowlpox) resemble POLYHEDRA in several properties as they contain virus particles, are infective, can be isolated intact, are resistant to digestion by some proteases and are extremely resistant to prolonged storage.
Patel, D.D. *et al.* (1986) Virology **149**, 174.

A-type virus particle. A term used originally for a morphologically defined group of RNA virus particles, often found in tumour cells. They are double-shelled spherical particles with a diameter of 65-75 nm. for the outer and 50 nm. for the inner shell; the inner ring appears denser. Various members of RETROVIRIDAE have A-type particles. *See* B-, C-, D-TYPE VIRUS PARTICLE.
Dalton, A.J. (1972) J. Natl. Canc. Inst. **49**, 323.

AAB. *See* CMI/AAB.

Abadina virus. Family *Reoviridae*, genus *Orbivirus*. Isolated from *Culicoides*.

Abelson leukaemia virus. Family *Retroviridae*, subfamily *Oncovirinae*, genus *Type C Oncovirus*, sub-genus *Mouse type C Oncovirus*. A virus isolated from Balb/c mice inoculated with Moloney leukaemia virus. Produces lymphoid leukaemia and can transform mouse cells *in vitro*. Requires a helper virus for virus replication. Risser, R. *et al.* (1978) J. exp. Med. **148**, 714.

abortive infection. An infection which does not produce infectious progeny. The cell may not allow the expression of all the viral genes or the virus may be defective.

abortive transformation. A TRANSFORMATION of cells which is unstable so the cells revert to normal after a few generations.

abras virus. Family *Bunyaviridae*, genus *Bunyavirus*.

Abraxas grossulariata Cytoplasmic Polyhedrosis Virus. CYTOPLASMIC POLYHEADROSIS VIRUS (CPV) isolated in the United Kingdom from larvae of the magpie moth, *Abraxas grossulariata* (Geometridae, Lepidoptera). The virus is the type member of 'type 8' 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.

Absettarov virus. Family *Flaviviridae*, genus *Flavivirus*. Isolated from a boy with biphasic fever and signs of meningitis. Tick-borne. Found in many countries. Pathogenic in Rhesus monkeys.

absorbance. Amount of light absorbed by a substance at a particular wavelength. It has no official units although the term optical density units is often used. *See* SPECIFIC ABSORBANCE.

absorption spectrum. Graphical representation of ABSORBANCE of a substance at different wavelengths. Valuable in obtaining an approximate estimate of the percentage of nucleic acid in a virus from the ratio of absorbances at 254 and 280 nm. Spectral characteristics of nucleotides can be found in Sober, H.A. ed. (1968) Handbook of Biochemistry: Selected Data for Molecular Biology. CRC Press: Cleveland, Ohio.

Abu Hammad virus. Family *Bunyaviridae*,

genus *Nairovirus*. Isolated from a tick *Argas hermanni* in Egypt.

Abu Mina virus. Family *Bunyaviridae*, genus *Nairovirus*.

abutilon mosaic virus. A possible *Geminivirus*, subgroup B.
Jaske, H. and Schuchalter-Eicke, G. (1984) **Phytopath. Z. 109**, 353.

acado virus. Family *Reoviridae*, genus *Orbivirus*. Isolated from *Culex antennatus* and *Culex univittatus neavi* in Ethiopia.

acara virus. Family *Bunyaviridae*, genus *Bunyavirus*. Isolated from sentinel mice *Culex* sp. and *Nectomys squamipes* in Brazil and Panama.

acholeplasmavirus. Virus isolated from *Acholeplasma* sp. e.g. phages L1, L2 and L3.

AcMNPV. Abbreviation for *Autographa californica* nuclear polyhedrosis virus.

AcNPV. Abbreviation for *Autographa californica* nuclear polyhedrosis virus.

acquired immunodeficiency syndrome (AIDS). A disease of man caused by HUMAN IMMUNODEFICIENCY VIRUS (HIV). AIDS is primarily a disease of the immune system so the infection usually results in a wide range of adverse immunological and clinical conditions. The opportunistic infections (i.e. those caused by micro-organisms that seldom cause disease in persons with normal defence mechanisms) and cancers resulting from immune deficiency are generally the most severe but neurological problems such as dementia resulting from infection of the brain can also occur. It is now recognised that the disease is likely to be fatal. The disease is generally transmitted sexually but is also prevalent among drug addicts and occurs occasionally in children from infected mothers and in patients receiving blood transfusions. It can be controlled by AZT (AZIDOTHYMIDINE) but the side effects of the drug are not negligible.

acridine orange. A compound used for determining the nature of the nucleic acid in virus particles or cells. It binds to the nucleic acid and, when exposed to UV-light, fluoresces green if bound to ds nucleic acid and orange if bound to ss nucleic acid.

acriflavine. A dye which inactivates viruses in the presence of light (photodynamic inactivation) by binding to nucleic acid. Also used as an ANTIBIOTIC.

acronym. A word created from the initial letters of the principal words in a compound term, e.g. enteric cytopathic human orphan virus = ECHO virus.

acrylamide. A chemical which is polymerised using a cross-linking agent to give polyacrylamide, one of the most commonly used supports for GEL ELECTROPHORESIS.

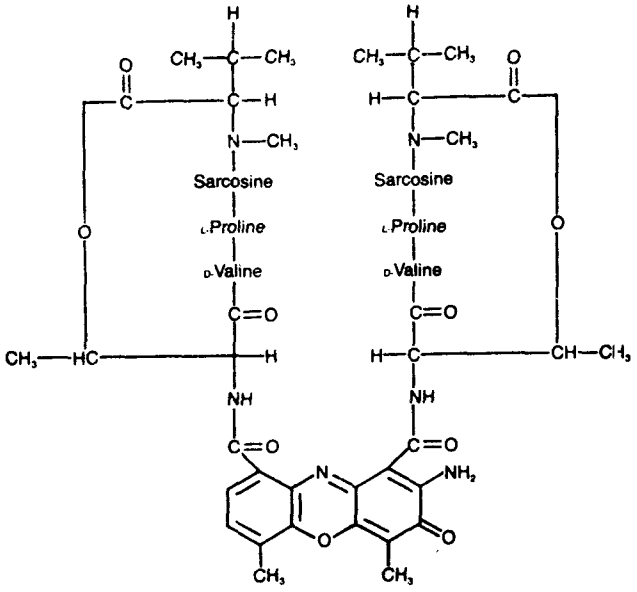
Actias selene Cytoplasmic Polyhedrosis Virus. Cytoplasmic polyhedrosis virus (CPV) isolated in the UK from laboratory-reared larvae of *Actias selene* bred from pupae obtained from a site in the Himalayas. The virus is the type member of 'type 4' CPVs. Unrelated to *Bombyx mori* (type 1) CPV on the basis 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.

actinomycin D. A compound which inhibits transcription by interacting with the guanine residues of helical DNA. Replication of DNA-containing viruses and those RNA viruses which require DNA to RNA transcription (e.g. RETROVIRIDAE, INFLUENZA VIRUS) is inhibited, while replication of other RNA-containing viruses is unaffected.

actinophages. Viruses infecting members of the order Actinomycetales (filamentous, branching bacteria; e.g. *Streptomyces, Nocardia, Mycobacterium*) and related organisms including *Corynebacterium, Arthrobacter* and *Kurthia*. All of the virus isolates of known morphology from these hosts are TAILED PHAGES (*see* PHAGE).

activator. In molecular biology an activator is a protein which binds to DNA upstream of a gene and activates transcription of that gene.

active immunity. Immunity induced by injection of a virus or virus subunit.



Actinomycin

acute bee-paralysis virus. *See* BEE ACUTE PARALYSIS VIRUS.

acute epidemic gastroenteritis virus of man. Unclassified. Consists of a group of viruses, Norwalk, Hawaii and Wollan. Viruses are *c.*30 nm. in diameter and are acid- and ether-stable. They are found in faeces by electron microscopy. Flewett, T.H. (1977) Rec. Adv. clin. Virol. **1**, 151.

acute haemorrhagic conjunctivitis virus. Family *Picornaviridae*, genus *Enterovirus*. Designated enterovirus 70. Causes acute haemorrhagic conjunctivitis in man in many parts of the world. Grows in several cell lines.

acute laryngo-tracheo-bronchitis virus. *See* PARAINFLUENZA VIRUS type 2.

acyclovir. (Synonym: acycloguanosine; Zovirax). An antiviral agent with a potent and specific action against HERPES VIRUS 1 and 2, both *in vitro* and *in vivo*. The compound is selectively PHOSPHORYLATED by herpes virus-induced THYMIDINE KINASE. The phosphorylated derivative inhibits herpes virus-induced DNA polymerase.

adenine. A constituent purine base of DNA and RNA. *See* NUCLEIC ACID.

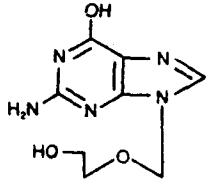
adenine arabinoside. *See* ARABINOSYL ADENINE.

adeno-associated virus. (Latin 'dependere' = to depend.) A genus in the family *Parvoviridae*. Replication is dependent on a helper adenovirus for complete virus replication. Multiplies in cells which support adenovirus replication. The virus particles contain either + or − DNA which are complementary and anneal to form dsRNA on extraction. Occurs in many species. Now known as the *Dependovirus* genus.

adenosine. A nucleoside of adenine and ribose. *See* NUCLEIC ACID.

adenosine 5'-monophosphate. Monophosphate of the nucleoside ADENOSINE.

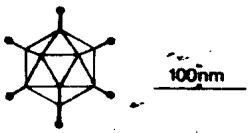
Acyclovir



adenosine 5'-triphosphate. Triphosphate of the nucleoside ADENOSINE *See* NUCLEIC ACID.

adenosine triphosphatase (ATPase). An enzyme which catalyses the conversion of ATP to ADP with the release of Pi. Some viruses (e.g. VACCINIA) possess an ATPase activity.

Adenoviridae. (Greek 'aden', 'adenos' = gland.) A family of DNA viruses with isometric particles 70-90 nm. in diameter which sediment at *c.*800S and band in CsCl at 1.33-1.35 g/cc. The capsid is



formed of 252 capsomeres, 8-9 nm. in diameter, of which the 12 pentons at the vertices have an outward projection with a knob at the end. The 240 non-vertex hexons are different from the penton bases. Antigens at the surface are mainly species-specific, the hexon for neutralisation, the fibre for haemagglutination. There are at least ten virion polypeptides, mw. ranging from 5-120 x 10^3. Each particle contains a single linear molecule of dsDNA, mw. 20-30 x 10^6 with inverted terminal repeats of *c.*100 base pairs. Genome transcription takes place in two stages, 'early' before initiation of viral DNA synthesis when non-virion polypeptides are synthesised and 'late' when viral DNA and structural polypeptides are synthesised. DNA replication is by strand-displacement mechanism. Transcription in the nucleus is followed by processing into mRNAs migrating into cytoplasm. Structural polypeptides are synthesised in cytoplasm but assembly is nuclear. The natural host range is mostly confined to one host or closely related animal species. Several species cause tumours in new-born hosts of heterologous species. Transmission is direct or indirect from throat, eye, faeces or urine. There are two genera, *MASTADENOVIRUS* and *AVIADENOVIRUS*.
Matthews, R.E.F. (1982) Intervirology **17**, 59.

adjuvant. Substance added to antigens to enhance immune response. Salts of aluminium (e.g. hydroxide or phosphate) acceptable for use in man. Saponin or FREUND'S ADJUVANT used in experimental animals.

AdoHcy. Abbreviation for S-adenosyl homocysteine.

AdoMet. Abbreviation for S-adenosyl methionine. Synonym: SAM.

adonis mosaic virus. An unclassified plant virus, isometric particles, occurs in Japan.
Doi, Y. *Personal communication.*

adsorption. The first stage of infection of a cell by a virus involves attachment at a receptor site. Often involves a specific interaction between a receptor on the cell surface and a component of the virus. It is independent of temperature.

adventitious virus. A foreign virus present in a vaccine or preparation of a different virus.

adzuki bean mosaic virus. *See* COWPEA APHID-BORNE MOSAIC VIRUS.

Aedes cells. Cell lines established from the mosquitoes *Aedes aegypti* and *Aedes albopictus* able to support the replication of a number of arboviruses. Usually grown in Mitsuhashi and Maramorosch medium.

aerobic. Requiring the presence of free oxygen or air.

aerosol. A gaseous suspension of ultramicroscopic particles or liquid droplets.

affinity chromatography. Chromatography using ligands attached to an insoluble support which interacts with the molecule of interest, retaining it and allowing unwanted molecules to be washed away. On changing the conditions the molecule of interest can be eluted. Examples are the selection of antigen by immobilised antibody and the selection of POLYADENYLATED mRNA using oligo dT sepharose.

African green monkey kidney cells. Cells used for growth of certain viruses of vertebrates, e.g. POLIOVIRUS.

African monkey cytomegalovirus. *See* CERCOPITHECID HERPESVIRUS 2.

African swine fever virus (ASFV). Synonym: WART HOG VIRUS. Unclassified. First seen in Africa. Often causes fatal disease in domestic pigs, following high fever, cough and diarrhoea but is

carried by wart hogs and bush pigs. Many strains cause chronic infection. Disease has now been spread to Western Europe, Brazil and Cuba, probably in waste food. Antibodies produced during infection do not give immunity.

AG80-24 virus. Family *Bunyaviridae*, genus *Bunyavirus*.

agar. Mixture of polysaccharides, some anionic, that forms a gel at temperatures below about 40°C. Used as a support medium when supplemented by appropriate buffers/media ingredients for electrophoresis, production of microbial cultures, overlaying tissue culture cells etc. Derived from red algae.

Agaricus bisporus virus 3 (AbV-3). An unclassified fungal virus with BACILLIFORM particles, 19 x 50 nm., a single capsid polypeptide species, mw. 24×10^3 and a single species of ssRNA, mw. 1.4×10^6.
Buck, K.W. (1986) In Fungal Virology p. 1. ed. K.W. Buck. CRC Press: Boca Raton. Florida.

Agaricus bisporus virus 4 (AbV-4). A member of the *Partitivirus* group.

agarose. One of the constituents of AGAR. Often used in preference to agar as it does not contain inhibitors of virus growth frequently present in agar and as lower temperature gelling products of agarose are now available. Also used widely in gel electrophoresis as the pore size is more uniform than that of agar.

agarose gel electrophoresis. Technique used for separating proteins or nucleic acids by passage of an electric current through the gel.

ageing *in vitro*. Synonym: LONGEVITY *IN VITRO*.

agglutination test. Some viruses will cause clumping of cells due to attachment to more than one cell. HAEMAGGLUTINATION of red blood cells by e.g. INFLUENZA VIRUS is by far the most spectacular example. Cells other than red blood cells also exhibit the phenomenon. Also used to refer to the clumping of inert particles, e.g. latex, coated with antibody and mixed with homologous virus antigens.

agouti endogenous type C retrovirus. Family *Retroviridae*, subfamily *Oncovirinae*, genus *Type C Oncovirus*, sub-genus *Mammalian Type C Oncovirus*. Isolated from kidney tissue of a New World rodent, the agouti *Dasyprocta puntata*. Has been transmitted to human and cat cells.

agropyron mosaic virus. Group: *Ryegrass mosaic virus*.
Stykhuis, J.T. (1973) CMI/AAB Descriptions of Plant Viruses No. 118.

Agrotis segetum Cytoplasmic Polyhedrosis Virus. Cytoplasmic polyhedrosis virus (CPV) isolated in the United Kingdom from larvae of the cutworm, *Agrotis segetum* (Noctuidae, Lepidoptera). The virus is the type member of 'type 9' CPVs. Unrelated to *Bombyx mori* (type 1) CPV on the basis of RNA electropherotype. Currently the sole recorded isolate of 'type 9' CPVs
Payne, C.C. and Mertens, P.P.C. (1983) In The *Reoviridae*. p. 425. ed. W.K. Joklik. Plenum Press: New York.

AIDS. Acronym for ACQUIRED IMMUNODEFICIENCY SYNDROME.

aino virus. Family *Bunyaviridae*, genus *Bunyavirus*. Isolated from *Culex tritaeniorhynchus* in Japan. May be same as SAMFORD VIRUS.
Doherty, R.L. *et al.* (1972) Aust. vet. J. 48, 81.

akabane virus. Family *Bunyaviridae*, genus *Bunyavirus*. Isolated from mosquitoes in Australia and Japan. *Culicoides* sp. are vectors. Sheep and goats can be infected experimentally causing disease in the foetus.
Kurogi, H. *et al.* (1975) Arch. Virol. 47, 71.

alagoas virus. Family *Rhabdoviridae*, genus *Vesiculovirus*. Isolated from a vesicular lesion on the tongue of a mule in Alagoas Brazil. Closely related to the classical strains of VESICULAR STOMATITIS VIRUS. Antibody present in several species in Brazil, including man. Causes fever and malaise in man.

alastrim virus. *See* VARIOLA MINOR VIRUS.

Aleutian disease of mink virus. Family *Parvoviridae*, genus *Parvovirus*. Causes an economically important, lethal disease in mink. The virus can cross the placenta to infect the foetus. Ferrets and skunks can be infected experimentally.
Porter, D.D. *et al.* (1977) Intervirology 8, 129.

alfalfa cryptic virus 1. A member of the *Cryptovirus* group, subgroup A.

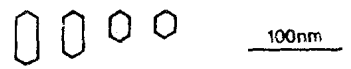
Boccardo, G. *et al.* (1987) Adv. Virus Res. **32**, 171.

alfalfa cryptic virus 2. Synonym: ALFALFA TEMPERATE VIRUS. A member of the *Cryptovirus* group, subgroup B.
Boccardo, G. *et al.* (1987) Adv. Virus Res. **32**, 171.

alfalfa latent virus. *See* PEA STREAK VIRUS.

alfalfa mosaic virus. Type member of the *Alfalfa mosaic virus* group.
Jaspars, E.M.J. and Bos, L. (1980) CMI/AAB Descriptions of Plant Viruses No. 229.

Alfalfa mosaic virus group. (Named after the type member ALFALFA MOSAIC VIRUS.) Monotypic genus of a MULTICOMPONENT plant virus with BACILLIFORM particles of at least four sizes. The four major RNA species are contained in separate components: bottom (B), 58 x 18 nm.; middle (M), 48 x 18 nm.; top b (Tb), 36 x 18 nm. and top a (Ta), 28x18 nm. Particles are stabilised primarily by protein-RNA interactions; they are sensitive to ribonuclease. Capsid structure considered to be based on icosahedral symmetry, the structural subunit being a single protein species of mw. 24 x 10^3. Genomic linear (+)-sense ssRNA comprises three species, RNA-1 (mw. 1.1 x 10^6; 3,644 nucleotides) in B component, RNA-2 (mw. 0.8 x 10^6; 2,593 nucleotides) in M component and RNA-3 (mw. 0.7 x 10^6; 2,037 nucleotides) in Tb component; in Ta component there is the MONOCISTRONIC mRNA for coat protein, RNA-4 (mw. 0.3 x 10^6; 881 nucleotides). RNAs 1-3 plus coat protein or RNA 4 are required for infection. Replication is in the cytoplasm and, for the genomic RNAs, is via distinct ds REPLICATIVE INTERMEDIATES; RNA-4 is derived from RNA-3. RNAs -1, -2 and -4 are monocistronic messengers for proteins of mw. 125, 89 and 24 (coat protein) x 10^3 respectively; RNA-3 is bicistronic encoding a protein of mw. 89 x 10^3 at the 5' end and having the coat protein cistron at the 3' end. The natural host range is wide. The particles are found in most cell types. The virus is readily transmitted mechanically. It is transmitted by aphids in the NON-PERSISTENT TRANSMISSION manner and is seed transmitted in some species. Alfalfa mosaic virus is considered by some to be in the *ILARVIRUS* group.
Matthews, R.E.F. (1982) Intervirology **17**, 77.
Jaspars, E.M.J. and Bos, L. (1980) CMI/AAB Descriptions of Plant Viruses No. 229.
Francki, R.I.B. *et al.* (1985) In Atlas of Plant Viruses. Vol. 2. p. 93. CRC Press.: Boca Raton, Florida.
Francki, R.I.B. (1985) In The Plant Viruses. Vol. 1. p. 1. ed. R.I.B. Francki. Plenum Press: New York.



alfalfa temperate virus. *See* ALFALFA CRYPTIC VIRUS 2.

Alfuy virus. Family *Flaviviridae*, genus *Flavivirus*. Isolated from mosquitoes in Queensland, Australia. Antibodies found in human sera but no disease in man has been reported.

algophage. Synonym: CYANOPHAGE.

alkaline phosphatase. An enzyme of relevance in molecular biology as it removes the 5' terminal phosphate of linear DNA molecules.

Allerton virus. *See* BOVID (ALPHA) HERPES VIRUS 2.

Almpiwar virus. Unclassified arthropod-borne virus. Isolated from a skink *Ablepharus boutinii virgatus* in Queensland, Australia.

alpha amanitin. A cyclic peptide which selectively inhibits DNA-DEPENDENT RNA POLYMERASES II and III of eukaryotic cells at low and high concentrations respectively. It binds to the polymerase and blocks RNA synthesis after initiation, thus preventing chain elongation. Isolated from the fungus *Amanita phalloides*. Viruses such as ADENOVIRUSES, INFLUENZA VIRUS and, RETROVIRUSES which require RNA polymerase II for their replication are inhibited.

Alphaherpesvirinae. A subfamily of the family *Herpesviridae*. Consists of two genera, *Human herpesvirus 1* and *Suid herpesvirus 1*. Replicate rapidly and latent infection is often demonstrable in nerve ganglia.

Alphavirus. (Greek letter 'a'.) A genus in the family *Togaviridae*. The type species is Sindbis virus. The members have an RNA with mw. 4 x 10^6, capped and polyadenylated, which forms c.6% of the particle. There is a capsid protein, mw. 30-34 x 10^3 and usually two envelope

proteins, E1 and E2, mw. 50-59 x 10^3. Sometimes there is a third envelope protein, E3. The genus contains many viruses of importance as disease agents and as tools for the study of virus replication. EASTERN, WESTERN and VENEZUELAN EQUINE ENCEPHALOMYELITIS VIRUSES and ROSS RIVER VIRUS are important disease agents. SEMLIKI FOREST VIRUS and SINDBIS VIRUS have been used extensively as laboratory models for studying replication.

alsike clover vein mosaic virus. An unclassified plant virus with isometric particles, 30 nm. in diameter, which sediments at 123S.
Gerhardson, B. and Lindsten, K. (1971) Phytopath. Z. **72**, 76.

amaas virus. *See* VARIOLA MINOR VIRUS.

amapari virus. Family *Arenaviridae*, genus *Arenavirus*. Isolated from forest rodents in the Ampari region of Brazil. Grows in Vero cells.

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

amber codon. *See* STOP CODON.

amber mutant. A mutation resulting in the CODON, UAG, which prematurely terminates an open reading frame.

ambisense expression strategy. The coding of proteins on both viral-sense and viral-complementary mRNAs. Shown by one genus of the *BUNYAVIRIDAE*, the phleboviruses.
Bishop, D.H.L. (1986) Microbiological Sciences **3**, 183.

American haemorrhagic fever viruses. Family *Arenaviridae*, genus *Arenavirus*. A group of viruses also known as the New World arenaviruses and the Tacaribe antigenic group. Wild rodents are the natural hosts but the viruses have also been isolated from mites.

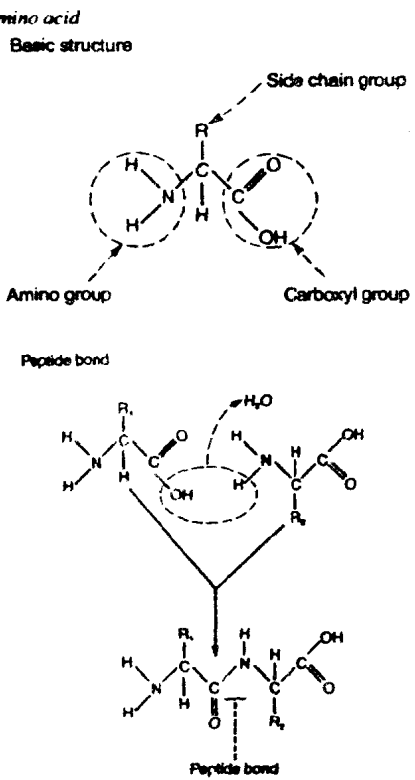
American oyster reo-like virus. Unclassified virus isolated from *Crassostrea virginica*, morphologically similar to reoviruses. Particles are isometric, 75 nm. in diameter with a double capsid shell containing at least five major proteins. Morphologically, the particles closely resemble members of the REOVIRUS genus, though the genome is composed of eleven segments of dsRNA (total mw. 15 x 10^6). The virus replicates in certain fish cell lines and it appears to have similar properties to reo-like viruses isolated from the fish hosts, golden shiner, chum salmon and channel catfish.
Winton, J.R. *et al.* (1987) J. gen. Virol. **68**, 353.

American plum line pattern virus. A possible member of the *Ilarvirus* group.
Fulton, R.W. (1984) CMI/AAB Descriptions of Plant Viruses No. 280.

Amino acid

Some common amino acids and their properties.

Amino acid	Abbreviation 3-letter	1-letter	mw.	Partial-specific volume (g/cc)	Properties
Alanine	Ala	A	71.1	0.74	Small, hydrophobic
Arginine	Arg	R	156.2	0.70	Large, basic
Asparagine	Asn	N	132.1	0.71	Small, hydrophilic
Aspartic acid	Asp	D	115.1	0.60	Small, acidic
Cysteine	Cys	C	102.2	0.61	Small, sulphydryl
Glutamic acid	Glu	E	129.1	0.66	Small, acidic
Glutamine	Gln	Q	146.2	0.67	Small, hydrophilic
Glycine	Gly	G	57.1	0.64	Small, hydrophobic
Histidine	His	H	137.1	0.67	Large, basic
Isoleucine	Ile	I	113.2	0.90	Hydrophobic
Leucine	Leu	L	113.2	0.90	Hydrophobic
Lysine	Lys	K	128.2	0.82	Large, basic
Methionine	Met	M	131.2	0.75	Hydrophobic
Phenylalanine	Phe	F	147.2	0.77	Large, hydrophobic
Proline	Pro	P	97.1	0.76	Small, hydrophilic
Serine	Ser	S	87.1	0.63	Small, hydrophilic
Threonine	Thr	T	101.1	0.70	Small, hydrophilic
Tryptophan	Trp	W	188.2	0.74	Large, hydrophobic
Tyrosine	Tyr	Y	163.2	0.71	Large, hydrophobic
Valine	Val	V	99.1	0.86	Hydrophobic



Francki, R.I.B. (1985) In The Plant Viruses. Vol. 1. p. 1. ed. R.I.B. Francki. Plenum Press: New York.

American Type Culture Collection (ATCC). Organisation which holds a large collection of micro-organisms and cells which are available on request on payment of a small fee. Address is Rockville, Maryland 20852, USA.

amino acid. Basic unit of proteins (*see* Figure), containing a carboxyl and an amino group and a variable side chain which determines the properties of the individual amino acid. The side chain may be simple (glycine) or a complicated ring structure (tryptophan). There are 20 commonly occurring amino acids in nature (*see* Table) and a few which occur much less frequently.

aminoacyl-tRNA. An amino acid linked via its carboxyl group to the hydroxyl group (2′ or 3′) of the ribose residue at the 3′ end of the tRNA. Amino acids are linked in this form during protein synthesis.

aminoacyl-tRNA synthetase. (Synonym: AMINOACYL-tRNA LIGASE). The enzyme which ligates the amino acid to its specific tRNA. There are 20 such enzymes, specific for each amino acid and its tRNA.

ammonium sulphate. Salt commonly used to precipitate enzymes, proteins and viruses without denaturation. Used frequently in the initial stages of protein purification as proteins precipitate at different concentrations of the salt.

AMP. Abbreviation for adenosine 5′-phosphate.

amphotericin B. An ANTIBIOTIC produced by *Streptomyces nodosus* which operates by affecting the permeability of the cytoplasmic membrane.

Amsacta moorei entomopoxvirus. Type species of probable subgenus B, *Entomopoxvirinae (Poxviridae)*, isolated from *A. moorei* (Lepioptera). Ovoid virions 350 x 250 nm. with a sleeve-shaped LATERAL BODY and cylindrical core. Particle surface has globular units 40 nm. in diameter. Virions have a buoyant density of 1.26-1.28 g/cc. and contain c.36 polypeptides and a single linear molecule of dsDNA (mw. 135 x 10^6). During replication, virions are occluded in large occlusion bodies (SPHEROIDS), 1-4 μm. in diameter. Smaller inclusions (SPINDLES) devoid of virions, are occasionally produced. Virus will infect some lepidopteran cell lines. Morphologically similar viruses have been found in other insects, specifically *Choristoneura, Euxoa, Oreopsyche, Operophtera, Oncopera* spp. (Lepidoptera) and *Melanoplus* sp. (Orthoptera).
Arif, B.M. (1984) Adv. Virus Res. **29**, 195.

Amyelois chronic stunt virus. A possible member of the *Caliciviridae* isolated from the navel orangeworm, *Amyelois transitella* (Lepidoptera). Virions are icosahedral, 38 nm. in diameter with characteristic cup-shaped surface depressions. Intact particles sediment at 185S and have a buoyant density of 1.32 g/cc. in CsCl. Particles contain ssRNA (mw. 2.5 x 10^6) and several proteins with two major species 29 x 10^3 and 55 x 10^3.
Hillman, B. *et al.* (1982) J. gen. Virol. 60, 115

analytical ultracentrifuge. Instrument used to sediment macromolecules at high centrifugal force with appropriate optics so that the rates of sedimentation and diffusion of macromolecules

can be measured with great accuracy. *See* DIFFUSION COEFFICIENT, SEDIMENTATION COEFFICIENT.
Markham, R. (1962) Adv. Virus Res. 9, 241.

Ananindena virus. Family *Bunyaviridae*, genus *Bunyavirus*.

Andean potato latent virus. A *Tymovirus*.
Francki, R.I.B. *et al.* (1985) In Atlas of Plant Viruses. Vol. 1. p. 117. CRC Press: Boca Raton, Florida.
Hirth, L. and Girard, L. (1988) In The Plant Viruses. Vol. 3. p. 163. ed. R. Koenig. Plenum Press: New York.

Andean potato mottle virus. A *Comovirus*.
Fribourg, C.E. (1979) CMI/AAB Descriptions of Plant Viruses No. 203.
Francki, R.I.B. *et al.* (1985) In Atlas of Plant Viruses. Vol. 2. p. 1. CRC Press: Boca Raton, Florida.

Anhanga virus. Family *Bunyaviridae*, genus *Phlebovirus*. Isolated from the sloth *Choloepus brasiliensis* in Brazil.

Anhembi virus. Family *Bunyaviridae*, genus *Bunyavirus*. Isolated from the rodent *Proechimys iheringi* and an arthropod *Phoniomyia pilicauda* in Brazil.

anionic detergent. A detergent having a negatively charged surface ion, e.g. sodium DEOXYCHOLATE, SODIUM DODECYL SULPHATE.

anisometric. Adjective to describe virus particles which are not isometric e.g. rod-shaped particles.

anisotropy of flow. Difference in the flow properties of a solution of macromolecules in different directions. Shown by a solution of a virus with rod-shaped particles e.g. TOBACCO MOSAIC VIRUS. On stirring the solution the particles become orientated along the line of flow and rotate polarised light.

annealing. The formation of ds nucleic acid molecules from ss molecules with complementary base sequences. This can be done (a) in solution, cooling the mixture of ss molecules slowly from a high temperature to below the MELTING TEMPERATURE or (b) with one strand immobilised on a solid support. Applied quantitatively, a measure of the complementarity between two ss nucleic acid molecules can be obtained.

Anopheles A virus group. Family *Bunyaviridae*, genus *Bunyavirus*. Isolated from *Anopheles* sp. in Columbia.

Anopheles B virus group. Family *Bunyaviridae*, genus *Bunyavirus*. Isolated from mosquitoes in South America.

anserid herpesvirus 1. Synonyms: DUCK ENTERITIS VIRUS, DUCK PLAGUE VIRUS. Member of family *Herpesviridae*. Causes infection of ducks and mallards, resulting in nasal and ocular discharge and diarrhoea. Most animals die. Ducks, geese, swans and chicks can be infected experimentally. The virus can be grown on the chorioallantoic membrane, killing the embryo, or in chick fibroblast cultures.

Antheraea eucalypti Cells. The first line of insect cells established in culture. Able to support the growth of a number of arboviruses. Usually grown in Grace's cell culture medium.

Antheraea eucalypti virus. Member of *Tetraviridae* (formerly the NUDAURELIA β VIRUS GROUP).

Antheraea satellite virus. Possible RNA-containing satellite virus associated with *ANTHERAEA EUCALYPTI* VIRUS. Virions are isometric, 13 nm. in diameter and sediment at 44S.
Longworth, J.F. (1978) Adv. Virus Res. 23, 103.

Anthoxanthum latent blanching virus. An unclassified plant virus with rod-shaped particles 135 nm. long, 22 nm. wide.
Catherall, P.L. and Chamberlain, J.A. (1981) Welsh Plant Breeding Sta. Ann. Rept. 1980, 153.

Anthoxanthum mosaic 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.

antibiotic. Substance used to inhibit the growth of micro-organisms including bacteria and fungi. Many different antibiotics are now available. Their principal application in virology is in tissue culture media used for the cultivation of cells and growth of viruses.