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Family and Generic Names for Viruses Approved by the International Committee on Taxonomy of Viruses, June 1974

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The following proposals, emanating from Study Groups of the Vertebrate Virus Subcommittee, were approved by the Vertebrate Virus Subcommittee and subsequently by the Executive Committee of the International Committee on Taxonomy of Viruses. The membership of the International Committee on Taxonomy of Viruses was consulted by postal vote during April-May 1974 and formally approved the names and definitions set out below. This paper aims to inform virologists of these decisions on nomenclature, and of the approved definitions of these families and genera.

A letter drawing attention to these approved names has been sent to the major international virological journals.

1 Togaviridae

- 1.1 The family name Togaviridae was approved with the following definitions: 'Virions contain single-stranded RNA, 3×10^6 to 4×10^6 daltons, have isometric, probably icosahedral, nucleocapsids surrounded by a lipoprotein envelope containing host cell lipid and

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virus-specified polypeptides including one or more glycopeptides. Virions yield infectious RNA'.

- 1.2 Two genera were approved with the following definitions:
- 1.2.1 *Alphavirus*: Enveloped RNA viruses which multiply in the cytoplasm and mature by budding. All serologically inter-related but unrelated to other Togaviridae. All have mosquitoes as invertebrate hosts. Includes Sindbis virus (type species), Aura virus, Chikungunya virus, Eastern equine encephalitis virus, Getah virus, Mayaro virus, Middleburg virus, Mucambo virus, Ndumu virus, O'Nyong-nyong virus, Pixuna virus, Ross River virus, Semliki Forest virus, Una virus, Venezuelan equine encephalitis virus, Western equine encephalitis virus, and Whataroa virus.
- 1.2.2 *Flavivirus*: Enveloped RNA viruses which multiply in the cytoplasm and mature by budding. All serologically inter-related but unrelated to other Togaviridae. Some have mosquitoes as invertebrate hosts, some have ticks, others have no known invertebrate hosts. Includes Yellow fever virus (type species), Apoi virus, Banzi virus, Bukalasa bat virus, Bussuquara virus, Cowbone Ridge virus, Dakar bat virus, Dengue viruses types 1-4, Edgell virus, Entebbe bat salivary gland virus, Ilheus virus, Israel turkey meningoencephalitis virus, Japanese encephalitis virus, Kokobera virus, Kunjin virus, Kyasanur Forest virus, Langat virus, Louping ill virus, Montana Myotis leukoencephalitis virus, Modoc virus, Murray Valley encephalitis virus, Negishi virus, Ntaya virus, Omsk hemorrhagic fever viruses, types 1 and 2, Powassan virus, Spondweni virus, St. Louis encephalitis virus, Stratford virus, Tick-borne encephalitis viruses, Uganda S virus, US bat salivary gland virus, Usutu virus, Wesselsbron virus, West Nile virus, and Zika virus.
- 1.3 The proposal that rubella virus, equine arteritis virus, bovine diarrhoea virus and hog cholera virus should be considered as possible genera within the family was referred back to the Study Group.

2 **Reoviridae**

- 2.1 It was approved that a family to be known as Reoviridae be constituted to encompass all viruses which (a) possess genomes consisting of several (generally 10 to 12) segments of double-stranded RNA with molecular weights ranging from 0.3×10^6 to 3×10^6 , all segments being encapsidated within a single virus particle; and (b) possess a

quasi-spherical capsid 60–80 nm in diameter which exhibits icosahedral symmetry elements.

2.2 It was approved that the following two genera be established within the family:

2.2.1 Genus *Reovirus* with the following distinguishing features:

- (a) The genome consists of ten segments of double-stranded RNA ranging in molecular weight from about 0.5 to 3 million. The total genome weighs 14–15 million daltons.
- (b) Virions also contain about 3,000 molecules of single-stranded oligoribonucleotides ranging from 2 to about 20 residues in length.
- (c) The virion possesses a double protein shell, the outer one of which is digested by proteolytic enzymes such as chymotrypsin, thereby generating the core. The entire capsid comprises 7 species of polypeptides ranging in molecular weight from about 35,000 to 155,000; the core comprises 4 polypeptide species.
- (d) Virions display no RNA-dependent RNA polymerase (transcriptase) activity; cores generated by treatment with proteolytic enzymes such as chymotrypsin do. Heating or removal of certain outer capsid shell polypeptides without removing certain others (partial removal of the outer shell) also causes this enzyme to become active.
- (e) Both virions and cores possess cubic symmetry, but the precise number of capsomers or the manner in which they are arranged is not known. The cores possess 12 spikes located as if on the vertices of an icosahedron.
- (f) The genome of infecting virions is not uncoated. The two strands of progeny genome RNA segments are formed sequentially. Both are unique features not exhibited by viruses of any other group.
- (g) Transmission of viruses in this group does not proceed via vectors. Their hosts are vertebrates.
- (h) Includes reoviruses types 1–3 (mammalian), five avian serotypes, and canine and simian reoviruses.

2.2.2 Genus *Orbivirus* with the following distinguishing features:

- (a) The genome consists of 10 segments of double-stranded RNA ranging in molecular weight from about 0.3 to 2.7 million daltons. The total genome weighs about 12 million daltons.
- (b) The *Orbivirus* virion possesses two protein shells. The outer shell appears to be skin-like and does not appear to be made up of

readily identifiable capsomers. The inner shell consists of 32 seemingly ring-shaped capsomers arranged with icosahedral symmetry which are also discernible in the presence of the outer shell, and which form the most characteristic feature of this group of viruses. The particle with only one shell is termed the **nucleocapsid**. The whole virion comprises 7 polypeptide species; the nucleocapsid 5. The nucleocapsid exhibits RNA-dependent RNA polymerase (transcriptase) activity; the optimum temperature of this enzyme is about 28°, in contrast with the optimum temperature of 45° of the reovirus transcriptase.

- (c) Many viruses belonging to the genus *Orbivirus* have been isolated only from insects, not from vertebrates.
- (d) Includes Bluetongue virus (type species), African horse sickness virus, Changuinola viruses, Colorado tick fever virus, Corriparta virus, Epizootic hemorrhagic disease of deer virus, Eubenangee virus, Kemerovo viruses, and Palyam virus.

2.3 Other possible genera of the family Reoviridae are under consideration by the Study Group.

3 **Poxviridae**

3.1 It was approved that a family to be known as Poxviridae be constituted, with the following characteristics:

- (a) **Morphology.** Largest animal viruses, 390 (200) × 260 (100) nm, brick-shaped. Structure of virion: external coat surrounding double membrane of phospholipids, cholesterol and protein (20–30 nm thick) with tubular protein subunits (filaments 7–15 nm × 100 nm) in irregular arrangements. Usually two lateral bodies (double element) between external coat and surface protein (peripheral layer) which embed an internal body (core) that consists of a double membrane with cylindrical subunits in a periodicity of ca. 9 nm. The core contains DNA and protein.

Viruses of the genus *Parapoxvirus* (see 3.2.5) differ in morphology in that the virion is smaller, ovoid or cylindrical [300 (226) × 170 (140) nm], its external coat and the filaments are thicker, the latter in parallel arrangement (probably a coil of a single thread); the double element, the peripheral protein layer and the inner body (core) are smaller.

- (b) **Chemical and physical properties:** Virion consists of over 90%

protein, 3.2% double-stranded DNA (MW 160×10^6 , GC 35–40%). Chloroform-sensitive. Virion contains enzymes, e.g., RNA polymerase. Characteristic virus multiplication cycle in cytoplasm (viroplasma zones). Intracytoplasmic inclusion bodies type B (common for all strains) and type A (different for strain and host systems). Mature particles may be released from microvilli at cell surface.

Virus-specific antigens: S antigen, LS antigen, NP antigen (at least one member of each genus has been shown to possess common NP antigen), serum-blocking antigen, hemagglutinin (not all). The hemagglutinin is produced as a by-product of viral replication and is a lipid-rich, pleomorphic particle 50–65 nm in diameter. Genetic recombination between closely related strains of a genus occurs often; recombination between more distantly related strains is more infrequent and probably absent between strains of different genera. Non-genetic reactivation occurs between strains of different genera.

- 3.2 It was approved that the following 6 genera be established within the family:
- 3.2.1 *Orthopoxvirus* with the following distinguishing features: Ether-resistant; close antigenic relationships between all members; agglutinate chicken red cells; members vary in virulence, host range and pathogenicity for experimental animals; genetic reactivation observable between all strains; mass of vaccinia virus about 5.5×10^{-15} g; density of rabbitpox virus DNA 1.6949. Includes the viruses of vaccinia, variola, alastrim, cowpox, ectromelia, rabbitpox, monkeypox.
- 3.2.2 *Avipoxvirus* with the following distinguishing features: Natural hosts: birds; ether-resistant; inclusion bodies type A contain lipids; antigenic relationships between members; molecular weight of viral DNA 200 to 240 million daltons; density of fowlpox DNA 1.6945; virion dimensions $390 (220) \times 240 (100)$ nm; molecular weight of virion 2,000 million daltons. Includes the viruses of fowlpox, pigeonpox, turkeypox, canarypox, quailpox and lovebirdpox.
- 3.2.3 *Capripoxvirus* with the following distinguishing features: Natural hosts: ungulates; ether-sensitive; antigenic relationships between all members; probably no hemagglutinating properties. Includes the viruses of sheeppox, goatpox and lumpy skin disease (Neethling).
- 3.2.4 *Leporipoxvirus* with the following distinguishing features: Natural

hosts: rodents; ether-sensitive; antigenic relationships between all members; possible mechanical transmission by arthropods. Includes the viruses of fibroma and myxoma.

- 3.2.5 *Parapoxvirus* with the following distinguishing features: No multiplication in embryonated eggs or common experimental animals; probable immunological relationships between members of the genus but distinct from all other poxviruses. Mass of virion (bovine papular stomatitis): $2-3.7 \times 10^{-15}$ g. Virus-specific antigens: S antigen, probably LS antigen, NP antigen common to all members of the genus and probably to all other poxviruses; no hemagglutinating properties; non-genetic reactivation between all members and probably with other poxviruses; ether-sensitive. Includes the viruses of orf, ulcerative dermatosis of sheep, bovine papular stomatitis, milker's nodule.
- 3.2.6 *Entomopoxvirus* with the following distinguishing features: Host range limited to arthropods; probably no multiplication in vertebrates.