

CLASSIFICATION OF VIRUSES

&

VIRUKILL'S TESTED EFFICACY

(Information given below is from

1. ICTVdB: "The Universal Virus Database of the International Committee on Taxonomy of Viruses";
2. Microbiology 3rd Ed. Murray et al. Chapter 6;
3. ICA Group of Companies independent test reports.

The internationally agreed system of virus classification is based on the structure/composition of the virus particle (virion). Viruses are classified into various families on this basis.

INTERNATIONAL CLASSIFICATION OF VIRUSES

Primary characteristics used in classification

Viruses are classified according to the nature of their genome and their structure

| VIRAL CLASSIFICATION | |
|----------------------|--|
| Nucleic acid | RNA or DNA |
| | single-stranded or double-stranded |
| | non-segmented or segmented |
| | linear or circular |
| | if genome is single stranded RNA, can it function as mRNA? |
| | whether genome is diploid (it is in retroviruses) |
| Virion structure | symmetry (icosahedral, helical, complex) |
| | enveloped or not |
| | number of capsomers |

VIRUS STRUCTURE

Viruses range in size from less than 100 nanometers in diameter to several hundred nanometers in length in the case of the *filoviridae*.

All viruses contain a nucleic acid genome (RNA or DNA) and a protective protein coat (called the capsid). The nucleic acid genome plus the protective protein coat is called the nucleocapsid which may have icosahedral, helical or complex symmetry. Viruses may or may not have an envelope. Enveloped viruses obtain their envelope by budding through a host cell membrane. In some cases, the virus buds through the plasma membrane but in other cases the envelope may be derived from other membranes such as those of the Golgi body or the nucleus. Some viruses bud through specialized parts of the plasma membrane of the host cell; for example, Ebola virus associates with lipid rafts that are rich in sphingomyelin, cholesterol and glypiated proteins. Poxviruses are exceptional in that they wrap themselves in host cell membranes using a mechanism that is different from the usual budding process used by other viruses.

Enveloped viruses do not necessarily have to kill cells in order to be released, since they can bud out of the cell - a process which is not necessarily lethal to the cell - hence some budding viruses can set up **persistent infections**.

Enveloped viruses are readily infectious only if the envelope is intact (since the viral attachment proteins which recognize the host cell receptors are in the viral envelope if it is an enveloped virus). So agents which damage the envelope, such as alcohols, detergents and disinfectants reduce infectivity or cause inactivation of the virus. Viruses with this lipid-containing envelope are relatively more sensitive to disinfectants. Naked or Nonenveloped viruses such as Feline Calicivirus (moderately resistant RNA virus) and Canine Parvovirus (highly resistant DNA virus) are protected by a resistant protein capsid and are therefore consider as suitable models for assessment of efficacy of disinfectants. In published trials where Parvovirus is inactivated, all other viruses can also be inactivated.

VIRUKILL'S EFFICACY TO INACTIVATE DIFFERENT VIRUS FAMILIES

Since viruses are **obligatory intercellular parasites** (*can only multiply in host living cells & relies entirely upon the host cell's ability to create the energy necessary to perform all of the manufacturing processes*) laboratory tests to determine disinfectants ability to inactivate them are limited to viruses where the technology has been development to do this. To determine **Virukill's** efficacy as disinfectant against viruses, an attempt was made to choose viruses representing each classification group and with focus on naked or nonenveloped virus which are consider to be much more resistant to disinfectants. Laboratory evaluations were all conducted under GLP conditions. The list below shows the various viruses from each classification group that was tested and proven to be highly effective to inactivate the specific viruses. The standard laboratory conditions used for these tests various from **Virukill** rates of 0.5 to 2% and exposure times between 10 – 20 minutes. As an indication of **Virukill's** efficacy the minimum inhibition concentration (MIC) of **Virukill** against *Paramyxoviridae* was determined in a laboratory test as 0.008% with 20 minutes contact time (not included in this list).

From the results it's clear that **Virukill** has the ability to inactivate viruses from all classification groups. From only the "DNA Reverse Transcribing Virus group", which consists of two families, no representing virus was tested. However, more important is **Virukill's** proven efficacy against various naked viruses which are generally considered more resistant to disinfectants. Included is the latest test report on **Virukill's** proven activity against Avian Influenza subtype H5N1 (Bird Flu), at rate of 0.5% with 10 min contact time.

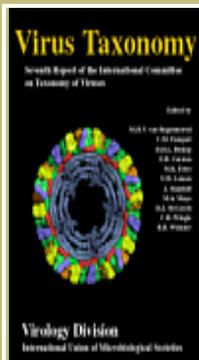
ICTV approved Virus Orders, Families and Genera

The taxonomic structure of virus families

compiled from

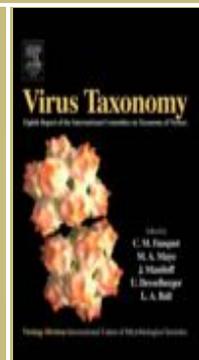
Virus Taxonomy

Reports of the International Committee on Taxonomy of Viruses



Seventh Report
M.H. van Regenmortel,
C.M. Fauquet,
D.H.L. Bishop et al. (eds.)
Academic Press,
1024 pp. (2000)
San Diego, Wien New York.

Eighth Report
C.M. Fauquet, M.A. Mayo,
J. Maniloff, U. Desselberger,
and L.A. Ball (eds)
Academic Press, 1162 pp. (2004)
Elsevier
Publication Date: 27 May 2005



Virus Taxonomy - 2005

Primarily based on the 8th ICTV Report plus subsequent taxonomic decisions. Copyright 2002 ICTV.
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The DNA Viruses

The DNA Viruses - The dsDNA Viruses

| Family | Specific Type Species Tested Against Virukill |
|-------------------------|---|
| <i>Adenoviridae</i> | <u><i>Egg Drop Syndrome Virus</i></u> (Naked or Nonenveloped) |
| <i>Ascoviridae</i> | |
| <i>Asfarviridae</i> | |
| <i>Baculoviridae</i> | |
| <i>Corticoviridae</i> | |
| <i>Fuselloviridae</i> | |
| <i>Guttaviridae</i> | |
| <i>Herpesviridae</i> | <u><i>Feline Calicivirus</i></u> (Naked or Nonenveloped) <u><i>Marek's Disease Virus</i></u> (Enveloped) <u><i>Infectious Lyringotracheitis Virus</i></u> (Enveloped) |
| <i>Iridoviridae</i> | |
| <i>Lipothrixviridae</i> | |
| <i>Myoviridae</i> | |
| <i>Nimaviridae</i> | |
| <i>Phycodnaviridae</i> | |
| <i>Plasmaviridae</i> | |
| <i>Podoviridae</i> | |
| <i>Poxviridae</i> | <u><i>Avian Poxvirus</i></u> (Enveloped) |
| <i>Rudiviridae</i> | |
| <i>Siphoviridae</i> | |
| <i>Tectiviridae</i> | |

The DNA Viruses

The DNA Viruses - The ssDNA Viruses

| Family | Specific Type Species Tested Against Virukill |
|----------------------|--|
| <i>Circoviridae</i> | <u><i>Chicken Anemia Virus</i></u> (Naked or Nonenveloped) |
| <i>Geminiviridae</i> | |
| <i>Inoviridae</i> | |
| <i>Microviridae</i> | |
| <i>Nanoviridae</i> | |
| <i>Parvoviridae</i> | <u><i>Canine Parvovirus</i></u> (Naked or Nonenveloped) |

The DNA and RNA Reverse Transcribing Viruses

The DNA Reverse Transcribing Viruses

| Family | Type Species |
|-----------------------|--------------|
| <i>Caulimoviridae</i> | |
| <i>Hepadnaviridae</i> | |

The RNA Reverse Transcribing Viruses

The RNA Viruses

The dsRNA Viruses

| Family | Specific Type Species Tested Against Virukill |
|-----------------------|--|
| <i>Birnaviridae</i> | <i>Infectious Bursal Disease Virus (Enveloped)</i> |
| <i>Chrysoviridae</i> | |
| <i>Cystoviridae</i> | |
| <i>Hypoviridae</i> | |
| <i>Partitiviridae</i> | |
| <i>Reoviridae</i> | <i>Reovirus (Naked or Nonenveloped)</i> |
| <i>Totiviridae</i> | |

The RNA Viruses

The negative-sense ssRNA Viruses

| Family | Specific Type Species Tested Against Virukill |
|-------------------------|--|
| <i>Arenaviridae</i> | |
| <i>Bornaviridae</i> | |
| <i>Bunyaviridae</i> | |
| <i>Filoviridae</i> | |
| <i>Orthomyxoviridae</i> | <i>Avian Influenza Virus subtype H7N1 (Enveloped)</i> <i>Avian Influenza Virus subtype H5N1 (Enveloped)</i> |
| <i>Paramyxoviridae</i> | <i>Newcastle Disease Virus (Enveloped)</i> |
| <i>Rhabdoviridae</i> | |

The RNA Viruses

The positive-sense ssRNA Viruses

| Family | Specific Type Species Tested Against Virukill |
|------------------------|--|
| <i>Arteriviridae</i> | |
| <i>Astroviridae</i> | |
| <i>Barnaviridae</i> | |
| <i>Bromoviridae</i> | |
| <i>Caliciviridae</i> | <i><u>Feline Calicivirus</u></i> (Naked or Nonenveloped) |
| <i>Closteroviridae</i> | |
| <i>Comoviridae</i> | |
| <i>Coronaviridae</i> | <i><u>Infectious Bronchitis Virus</u></i> (Enveloped) |
| <i>Dicistroviridae</i> | |
| <i>Flaviviridae</i> | |
| <i>Flexiviridae</i> | |
| <i>Leviviridae</i> | |
| <i>Luteoviridae</i> | |
| <i>Nodaviridae</i> | |
| <i>Picornaviridae</i> | |
| <i>Potyviridae</i> | |
| <i>Roniviridae</i> | |
| <i>Sequiviridae</i> | |
| <i>Tetraviridae</i> | |
| <i>Togaviridae</i> | |
| <i>Tombusviridae</i> | |
| <i>Tymoviridae</i> | |