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Discussion document:
Latinized binomial nomenclature for virus species names

1. What is meant by a Latinized binomial nomenclature?

Binomial nomenclature is the formal system of naming species of living things by giving each a name composed of two parts, both of which use Latin grammatical forms, although they can be based on words from other languages. The first part of the name identifies the genus to which the species belongs; the second part (the specific epithet) identifies the species within the genus. For example, humans belong to the genus *Homo* and within this genus to the species *Homo sapiens*. The formal introduction of this system of naming species is credited to the Swedish natural scientist Carl Linnaeus beginning with his work Species Plantarum in 1753, although it has earlier origins. This system is now used for all organisms (both current and fossil) with minor differences in the rules governing zoology and botany, for example [paragraph adapted from Wikipaedia].

In most branches of biology, the application of species names is determined by priority of valid publication of a specimen description and associated with a physical type specimen. For these reasons, scientific species names are often followed (particularly at first use in a publication) by an authority (the name of the author of the description) and sometimes a date. However, virus taxonomy and nomenclature are decided simultaneously by decisions of the ICTV and the rule of priority is explicitly excluded. This current document therefore discusses only the format of species names – there is no intention to consider adopting the entire 'Linnaean system' of taxonomy.

In the virus context, genus names are already single words ending in '…virus' and could therefore be used without change. An example (purely a possibility for illustrative purposes) could therefore be that *Barley yellow mosaic virus* (the type species of the genus *Bymovirus*, family *Potyviridae*) could be renamed *Bymovirus luteohordei*.

2. The current format of virus species names

Species names in use by ICTV are currently in a bewildering variety of patterns, examples of which are shown in Table 1 for a selection of current type species.

Species name	Pattern
Escherichia virus T4	Host genus+'virus'+phage name
Human alphaherpesvirus 1	Host common name+subfamily+number
Mammalian 1 bornavirus	Host group name+number+genus
Alfalfa mosaic virus	Host common name+symptom+'virus'
Alphacoronavirus 1	Genus+number
Cardiovirus A	Genus+letter
Potato virus X	Host common name+'virus'+letter (not in series)
Rhizosolenia setigera RNA virus 01	Host species name+genome+'virus'+number
Tomato spotted wilt tospovirus	Host common name+symptom+genus
Human mastadenovirus C	Host common name+genus+letter
Autographa californica multiple nucleopolyhedrovirus	Host species name+virion feature/defunct genus name
Drosophila X virus	Host genus+letter (not in series)+'virus'
Sapporo virus	Place name+'virus'
Rosellinia necatrix quadrivirus 1	Host species name+genus+number
Colorado tick fever virus	Disease name+'virus'

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As can be seen, some of these names incorporate the name of the genus into which the virus species is classified but this is not done in a consistent pattern and some words look like genus names but are not (alphaherpesvirus, nucleopolyhedrovirus).

The variety of naming patterns derives in part from the different practices for naming viruses adopted, for example by those working on plant viruses, arboviruses, picornaviruses etc. When the International Committee on Nomenclature of Viruses (the forerunner of ICTV) was established, it was expected that a Latin binomial system would be used for species naming and the aspiration was included in the Rules of Nomenclature that were adopted. However, this aim was eventually abandoned. In the early years there was fundamental uncertainty about whether (and how) viruses might be classified into species (and in some cases, genera) so it would clearly have been impractical. There was also opposition to the use of Latin binomials, particularly from plant virologists, and the formal adoption of virus species was apparently delayed through fears that Latin binomials would have to be used (van Regenmortel, 2000). In consequence, the species names adopted were often identical to the virus names already in use, except that they were written in italics and always had an initial capital letter.

It would be a bold person who presumed to speak on behalf of the whole virology community but there is at least anecdotal evidence that there is less hostility to Latinized binomial nomenclature than there was once. Virologists have lived with the idea of virus species for over 20 years and it may be time to revisit this possibility once again.

3. Benefits/reasons for changing to a Latinized binomial nomenclature

1. This system is used almost universally in biology and its operation is understood by scientists, editors etc., many of whom have not really understood the current ICTV system.
2. The system would make integration of virus data with other biological databases (including the sequence databases) much easier.
3. It would clearly distinguish the scientific name of the species from the virus names, which would all become common (vernacular) names. In some cases, these common names would describe any member of the entire species, whereas in others the virus name would be that of a sub-specific entity. These distinctions are easily understood and easily applied.
4. It would clearly be a universal system, bringing consistency to the pattern of names. Viruses of prokaryotes, plants, vertebrates etc., would be named in exactly the same way.
5. We expect to be at the beginning of a huge explosion in the numbers of virus species and this is therefore a good time to put in place an easily-managed but flexible system.

4. Objections to a Latinized binomial nomenclature

1. Introducing new names for every virus species violates the principle of stability. Article 2.1 of the International Code of Virus Classification and Nomenclature states that 'The essential principles of virus nomenclature are:- (i) to aim for stability; (ii) to avoid or reject the use of names which might cause error or confusion; (iii) to avoid the unnecessary creation of names.' Article 3.9 states 'Existing names of taxa shall be retained whenever feasible' and there is a comment: 'A stable nomenclature is one of the principal aims of taxonomy and therefore changes to names that have been accepted will only be considered if the accepted name conflicts with the Rules or if a change is necessary to remove ambiguities or confusion.' It should, however, be noted that many current species names have in fact been changed in recent years.
2. It would be a huge task to devise all the new names and there have already been multiple suggestions for Latinized species names for some well-known viruses, like tobacco mosaic virus (see van Regenmortel, 2000; Table 1). It is, however, possible that with genus names already established, the task may not be as great as feared.

3. It is unnecessary to use Latin (or Latinized) nomenclature. When Linnaeus did his work, Latin was the international language of science. Indeed, for many years it was necessary to publish descriptions of new species in Latin. The international language is now English and few people understand Latin well enough to create the species names in a correct form.
4. Latinized species names may be acceptable for living organisms but viruses are non-living biological entities and should not use the same system. This is either an objection to the creation of virus species in the first place, or an assertion that virus species are fundamentally different in nature to the species of living organisms and so should be named differently.
5. Current species that are assigned to a family or subfamily but not to a genus could not be incorporated into this system. There are not large numbers of these, but the objection is nevertheless valid.

5. Final remarks

1. Current rules for naming virus species are rather flexible and no change would be needed to allow the creation of Latinized binomial species names. However, while there is nothing that forbids their use, it would add further to the existing confusion if ICTV were to start creating Latinized binomial species names as an additional option.
2. Some species names are already in a form very similar to a Latinized binomial but use a number or letter in place of a specific epithet (e.g. *Alphacoronavirus 1*, *Cardiovirus A*). Some may wish to argue that this is a preferable pattern for the future, avoiding the need to create Latinized specific epithets and (at least with the numbers), providing an easy and infinitely expandable way of naming species. Such names are, however, not very memorable.
3. The EC will need to decide if, and how, to take this matter forward. If the majority are against, the matter should obviously be dropped. Otherwise, we will probably want to find a way to consult more widely. Perhaps a VDN article based on this paper (and any additional arguments) could be considered linked to some sort of online poll – not just a vote of ICTV members or even of SGs.

Literature cited

Van Regenmortel MHV (2000). On the relative merits of italics, Latin and binomial nomenclature in virus taxonomy. Arch Virol 145:433-441