

The Type Species in virus taxonomy

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Introduction

Definitions of “species” and “type species” have been problematic in the taxonomy of different types of biological organisms. For virus taxonomy, the problems have been addressed by the International Committee on Taxonomy of Viruses (ICTV) and the results are compiled in The International Code of Virus Taxonomy and Nomenclature [4, 8]. The Code defines a virus species as a polythetic class of viruses that constitutes a replicating lineage and occupies a particular ecological niche. The application of this definition to virus taxonomy has been reviewed by van Regenmortel [7]. However, although the rules and procedures of virus taxonomy have referred to “type species” in connection with descriptions of genera for a number of years, the virus “type species” has not been explicitly defined. The requirement for virus type species arises from two sections of The Code [4.8]:

2. Principles of Nomenclature

2.4 The application of names of taxa is determined, explicitly or implicitly, by means of nomenclatural types.

3. Rules of Classification and Nomenclature

IV – Rules about Genera

3.28 Approval of a new genus must be accompanied by the approval of a type species.

These Rules require the explicit use of nomenclatural types (i.e. Type species) for genera. The implicit usage is current practice for other taxa (see below). However it has been argued recently that Type Species are unnecessary and that their use should be abandoned. This article attempts to present the purpose of having Type Species in virus taxonomy.

History of the concept in virological nomenclature

The current version of The Code [4, 8] has evolved by successive revisions of sets of Rules by the Presidents of ICTV and their Executive Committees. In 1971, the International

Committee on Nomenclature of Viruses (the fore-runner of the ICTV) recognised four policy elements [9]: (1) groups (or genera) of viruses must be defined and listed, (2) type members (species) of these groups would be provided, (3) names for the groups (genera) would be proposed, and (4) use of the cryptogram as a taxonomic device would be explored. These were developed into a set of rules for virus taxonomy [1]. Although “types” were not mentioned in these early Rules, in 1982 Matthews [3] introduced a new Rule (Rule 22) that stated: “Approval of a new family must be linked to approval of a type genus; approval of a new genus must be linked to approval of a type species”. Successive versions of the Rules of Nomenclature (now The International Code of Virus Taxonomy and Nomenclature) have retained a Rule about the designation of “types,” although the explicit recognition of the need for a Type Genus has been omitted from recent versions. However, there has been no explicit statement of what is meant by “Type Species”.

Some examples from other disciplines

It is interesting (though not necessarily always helpful) to look at what other biologists do in their taxonomies. The Zoological Code [5] declares a Principle of Name-bearing Types (Article 61).

This states:

Each nominal taxon has, actually or potentially, its name-bearing type. Thus, the name-bearing type of a nominal family-group taxon is a nominal genus, that of a nominal genus-group taxon is a nominal species ... The name-bearing type provides the objective standard of reference by which the application of the name it bears is determined, no matter how the boundaries of the taxon may change.

The Bacteriological Code [6] has a Rule 15 that states:

A taxon consists of one or more elements. For each named taxon there shall be designated a **nomenclatural type**. The nomenclatural type, referred to in this Code as “**type**”, is that element of the taxon with which the name is permanently associated. The nomenclatural type is not necessarily the most typical or representative element of the taxon.

Types for the various taxonomic categories are summarized as:

- Species – Designated strain; in special cases the place of the type strain may be taken by a description, a preserved specimen, or an illustration.
- Genus – Designated species.
- Family – Genus on whose name the name of the higher taxon is based.

In the Bacteriological Code [6], it is also emphasized (Rule 20f) that the publication of a new genus name as a deliberate substitute for an earlier one does not change the type species of the genus.

Virological practice

There is no fundamental difference between the principles of naming taxa of viruses and of naming taxa of other agents. Thus when a taxon is recognised, a member of the taxon is identified as typifying the use of the name of the taxon. This member is then a “nomenclat-

ural type”. This process is intrinsic to taxonomic action, as has already been discovered during the development of Rules for virus taxon nomenclature [3]. For this reason, the application of nomenclatural types is listed as one of the “principles” of virus taxonomic nomenclature (Article 2.4) in the International Code [4, 8].

The consequence of the definition of type members

As is clear from the practice in bacteriology and zoology, the link between the taxon and the name-bearing type is fundamental. When the boundaries of a taxon change, the name-bearing type (i.e. Type Species) remains unaltered and is a fixed and extant definition of the taxon. The Type Species does not represent any sort of “typical” member of the taxon, and nor need it be the member of a taxon about which most is known. Thus if species A is the Type Species of genus B, then whatever happens to the membership of genus B by way of splitting or lumping, when a genus is named B it is the genus that contains species A and when species A is in a genus, that genus has the name B. Thus, it is a logical inconsistency to cause genus B to have a different Type Species as a taxonomic act, and it is doubly absurd to place species A into a different genus from that which it previously typified.

To give a named example, *Brome mosaic virus* (BMV) is the Type Species of the genus *Bromovirus*. This fixes a link. The genus called *Bromovirus* is defined as that which contains BMV. If the genus needs to be split, possibly after adding some other species to the cluster, the new genus that contains BMV would be named *Bromovirus* and a new name would be needed for the other new genus. This becomes more obviously necessary when species names contain the genus name (as for some virus species and all Linnean-style biological names). Also, should a genus name need to be changed, the Type Species would not change, thereby showing that the new name applies to the old taxon.

A Type Species need not be typical

The species that could be said to typify a genus (i.e. one that has the greatest number of characteristics of the genus or has “average” properties) will differ according to who is making the value judgements about the characters. For example, a molecular perspective and a pathological perspective could yield very different ‘typical’ members for a particular genus. Type Species are not supposed to be ‘typical’ in this sense. They typify the use of the taxon name. Hence the phrase ‘nomenclatural types’. However, the Type Species is a member of a genus and its properties might be considered typical of species in that genus.

In practical virology, it is useful to have reference types. These are particular isolates of a virus (i.e. a member of a species) that can be thought of as being representative of a particular species and its genus. Cultures of reference types can be exchanged between laboratories so as to enable direct comparisons to be made with any novel isolate. A reference type is therefore fundamentally distinct from a Type Species, which as a species is an abstraction and not a virus culture. In bacteriology, a “Type Strain” is defined as “the type of a species where that is a living culture” [2]. Reference isolates or reference strains of virus species are thus directly analogous to these “type strains”.

Any assignment of isolates to the status of being references would not be formal taxonomic acts and would not need ICTV review.

Proposed definition of a Type Species for the International Code

A Type Species is a species whose name is linked to the use of a particular genus name. The genus so typified will always contain the Type Species.

Acknowledgement

MAM acknowledges the support of the Scottish Executive Environment and Rural Affairs Department during the compilation of this paper.

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