Taxonomic Changes and Additions for Human and Animal Viruses, 2012 to 2015

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ABSTRACT Taxonomical classification of newly discovered viruses and reclassification of previously discovered viruses provide an important foundation for detailing biological differences of scientific and clinical interest. The development of molecular analytical methods has enabled finer levels and more precise levels of classification. Periodically, there is need to refresh the literature and common understanding of current taxonomic classification, which we attempt to do here in addressing changes in human and animal viruses of medical significance between 2012 and 2015.

KEYWORDS classification, taxonomy, virology

The use of molecular analysis has led to a number of taxonomical changes to viruses in the past several years. In addition, a number of new viruses have been discovered and characterized, including those medically relevant to humans, such as severe fever with thrombocytopenia syndrome (SFTS) virus, and those relevant to animals, particularly the growing number in bats which are of special interest because of their zoonotic potential.

The International Committee on Taxonomy of Viruses (ICTV) maintains a universal taxonomy of viruses and has released nine taxonomy reports since 1971. The last report was released in 2011. Additional taxonomy updates are provided on the ICTV website (<http://www.ictvonline.org/>). Herein, we list the new species names and revised names of existing species of viruses of significance to humans and to animals published or provided on the ICTV website between 2012 and 2015.

METHODS

A review of the ICTV website was conducted to identify new virus species or proposed name changes of existing species published between January 2012 and December 2015. The date of last access of the ICTV website was 2 March 2016, which included taxonomical updates through 2014.

Tables 1 to 5 include all viruses of relevance to humans as well as to animals

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TABLE 1 New species of human significance, 2012 to 2015^a

Species	Genus	Family	Source	Clinical relevance	Reference(s)
<i>Gammapapillomavirus</i> (11–20)	<i>Gammapapillomavirus</i>	<i>Papillomaviridae</i>	Human	Infection	3
<i>Madariaga virus</i>	<i>Alphavirus</i>	<i>Togaviridae</i>	Humans and other vertebrate species	Encephalitis	5, 6
<i>Rotavirus H</i>	<i>Rotavirus</i>	<i>Reoviridae</i>	Human	Enteritis	7
SFTS virus	<i>Phlebovirus</i>	<i>Bunyaviridae</i>	Human blood, subsequently from animals and ticks	Severe fever with thrombocytopenia; China	1

^aInternational Committee on Taxonomy of Viruses updates, 2012 to 2014.

TABLE 2 New species of animal significance, 2012 to 2015^a

Species	Genus	Family	Source	Clinical relevance	Reference(s) or source
<i>Alethinophid 1 reptarenavirus</i> , <i>Alethinophid 2 reptarenavirus</i> , <i>Alethinophid reptarenavirus 3</i>	<i>Reptarenavirus</i>	<i>Arenaviridae</i>	Snake	Snake inclusion body disease	8
<i>Avisivirus A</i>	<i>Avisivirus</i>	<i>Picornaviridae</i>	Turkey	Enteritis	9
<i>Bat hepatitis virus</i>	<i>Orthohepadnavirus</i>	<i>Hepadnaviridae</i>	Long-fingered bat	Not reported	10
<i>Bokeloh bat lyssavirus</i>	<i>Lyssavirus</i>	<i>Rhabdoviridae</i>	Natterer's bat	Rabies in Natterer's bats; unknown risk to human and animal health	11
<i>Cadicivirus A</i>	<i>Dicipivirus</i>	<i>Picornaviridae</i>	Dog	Not reported	12
<i>Cardiovirus C</i>	<i>Cardiovirus</i>	<i>Picornaviridae</i>	Laboratory brown rat	Not reported	http://www.google.com /patents /US20140024015
<i>Chipapillomavirus 3</i>	<i>Chipapillomavirus</i>	<i>Papillomaviridae</i>	Dog	Infection	3
<i>Deltapapillomavirus 6</i>	<i>Deltapapillomavirus</i>	<i>Papillomaviridae</i>	Dromedary	Infection	3
<i>Durham virus</i>	<i>Tupavirus</i>	<i>Rhabdoviridae</i>	Coot	Encephalitis, death	13
<i>Dyoiotapapillomavirus 2</i>	<i>Dyoiotapapillomavirus</i>	<i>Papillomaviridae</i>	Horse	Infection	3
<i>Dyokappapapillomavirus 1</i>	<i>Dyokappapapillomavirus</i>	<i>Papillomaviridae</i>	Sheep	Infection	3
<i>Dyolambdapapillomavirus 1</i>	<i>Dyolambdapapillomavirus</i>	<i>Papillomaviridae</i>	Bush-tailed bettong	Infection	3
<i>Dyomupapillomavirus 1</i>	<i>Dyomupapillomavirus</i>	<i>Papillomaviridae</i>	Python	Infection	3
<i>Dyonupapillomavirus 1</i>	<i>Dyonupapillomavirus</i>	<i>Papillomaviridae</i>	Sea lion	Infection	3
<i>Dyoomikronpapillomavirus 1</i>	<i>Dyoomikronpapillomavirus</i>	<i>Papillomaviridae</i>	Common squirrel monkey	Infection	3
<i>Dyopipapillomavirus 1</i>	<i>Dyopipapillomavirus</i>	<i>Papillomaviridae</i>	Harbor porpoise	Infection	3
<i>Dyorchopapillomavirus 1</i>	<i>Dyorchopapillomavirus</i>	<i>Papillomaviridae</i>	Horse	Infection	3
<i>Dyosigmapapillomavirus 1</i>	<i>Dyosigmapapillomavirus</i>	<i>Papillomaviridae</i>	Beaver	Infection	3
<i>Dyoxipapillomavirus 1</i>	<i>Dyoxipapillomavirus</i>	<i>Papillomaviridae</i>	Cattle	Infection	3
<i>Gallivirus A</i>	<i>Gallivirus</i>	<i>Picornaviridae</i>	Poultry	Enteritis	14
<i>Hunnivirus A</i>	<i>Hunnivirus</i>	<i>Picornaviridae</i>	Cattle, sheep	Not reported	15
<i>Ikoma lyssavirus</i>	<i>Lyssavirus</i>	<i>Rhabdoviridae</i>	African civet	Rabies in African civet that attacked a child	4
<i>Kunsagivirus A</i>	<i>Kunsagivirus</i>	<i>Picornaviridae</i>	Migrant bird, European roller	Not reported	16
<i>Lambdapapillomavirus 5</i>	<i>Lambdapapillomavirus</i>	<i>Papillomaviridae</i>	Hyena	Infection	3
<i>Lloviu cuevavirus</i>	<i>Cuevavirus</i>	<i>Filoviridae</i>	Long-fingered bat	Found in dead bats	17
<i>Luna virus (Luna mammarynavirus)</i>	<i>Arenavirus (Mammarenavirus)</i>	<i>Arenaviridae</i>	Multimammate muse	Not reported	18
<i>Lunk mammarynavirus</i>	<i>Mammarenavirus</i>	<i>Arenaviridae</i>	African pygmy mouse	Not reported	19
<i>Madariaga virus</i>	<i>Alphavirus</i>	<i>Togaviridae</i>	Human and other vertebrate species	Encephalitis	5, 6
<i>Merino Walk mammarynavirus</i>	<i>Mammarenavirus</i>	<i>Arenaviridae</i>	Karoo bush rat	Not reported	20
<i>Midway nyavirus, Nyamanini nyavirus</i>	<i>Nyavirus</i>	<i>Nyamiviridae</i>	Avian species	Not reported	21
<i>Mischivirus A</i>	<i>Mischivirus</i>	<i>Picornaviridae</i>	Bent-wing bat	Not reported	22
<i>Mosavirus A</i>	<i>Mosavirus</i>	<i>Picornaviridae</i>	Canyon mouse	Not reported	23
<i>Orthohepevirus C</i>	<i>Orthohepevirus</i>	<i>Hepeviridae</i>	Rat, ferret	Not reported	24
<i>Orthohepevirus D</i>	<i>Orthohepevirus</i>	<i>Hepeviridae</i>	Bat	Not reported	25
<i>Oscivirus A</i>	<i>Oscivirus</i>	<i>Picornaviridae</i>	Avian species	Not reported	26
<i>Papiine herpesvirus 3, Aotie herpesvirus 1, Saimiriine herpesvirus 4, Cebine herpesvirus 1</i>	<i>Cytomegalovirus</i>	<i>Herpesviridae</i>	Various primate species	Infection	27
<i>Pasivirus A</i>	<i>Pasivirus</i>	<i>Picornaviridae</i>	Pig	Not reported	28
<i>Passerivirus A</i>	<i>Passerivirus</i>	<i>Picornaviridae</i>	Avian species	Not reported	26
<i>Perch rhabdovirus, Anguillid rhabdovirus, Sea trout rhabdovirus</i>	<i>Perhabdovirus</i>	<i>Rhabdoviridae</i>	Several fish species	Disease	29
<i>Pike fry rhabdovirus</i>	<i>Sprivirus</i>	<i>Rhabdoviridae</i>	Various fish species	Infection	30
<i>Piscihepevirus A</i>	<i>Piscihepevirus</i>	<i>Hepeviridae</i>	Cutthroat trout	Not reported	31
<i>Psittaciform 1 bornavirus, Passeriform 1 bornavirus, Passeriform 2 bornavirus, Waterbird 1 bornavirus</i>	<i>Bornavirus</i>	<i>Bornaviridae</i>	Several avian species	Proventricular dilatation disease	32, 33
<i>Rosavirus A</i>	<i>Rosavirus</i>	<i>Picornaviridae</i>	Canyon mouse	Not reported	23
<i>Rotavirus F, Rotavirus G</i>	<i>Rotavirus</i>	<i>Reoviridae</i>	Chicken	Enteritis	34
<i>Sakobuvirus A</i>	<i>Sakobuvirus</i>	<i>Picornaviridae</i>	Cat in Portugal	Not reported	35
<i>Sangassou virus</i>	<i>Hantavirus</i>	<i>Bunyaviridae</i>	African wood mouse	Not reported	36
<i>Sicinivirus A</i>	<i>Sicinivirus</i>	<i>Picornaviridae</i>	Chicken in Ireland	Not reported	37
<i>Skua adenovirus A</i>	<i>Siadenovirus</i>	<i>Adenoviridae</i>	South Polar skua	Found in dead skuas	38
<i>Taupapillomavirus 2</i>	<i>Taupapillomavirus</i>	<i>Papillomaviridae</i>	Dog	Infection	2
<i>Upsilonpapillomavirus 3</i>	<i>Upsilonpapillomavirus</i>	<i>Papillomaviridae</i>	Common porpoise	Infection	2
<i>Xipapillomavirus 2</i>	<i>Xipapillomavirus</i>	<i>Papillomaviridae</i>	Cattle	Infection	2

^aInternational Committee on Taxonomy of Viruses updates, 2012 to 2014.

TABLE 3 List of revised virus taxa significant to animals, 2012 to 2015^a

Previous name	Revised name	Family	Other information/clinical significance	Reference(s)
Genus <i>Adenovirus</i>	Genera <i>Atadenovirus</i> , <i>Aviadenovirus</i> , <i>Ichtadenovirus</i> , <i>Mastadenovirus</i> , <i>Siadenovirus</i>	<i>Adenoviridae</i>	Various vertebrate species	None
<i>Aichi virus</i> , <i>Bovine kobuvirus</i>	<i>Aichivirus A</i> , <i>Aichivirus B</i>	<i>Picornaviridae</i>	Enteritis in humans and other vertebrates	39, 40
<i>Avian encephalomyelitis virus</i>	<i>Tremovirus A</i>	<i>Picornaviridae</i>	Infection	None
<i>Avian hepatitis E virus</i>	<i>Orthohepevirus B</i>	<i>Hepeviridae</i>	Infects avian species	25
<i>Duck hepatitis A virus</i>	<i>Avihepatovirus A</i>	<i>Picornaviridae</i>	Infection	None
<i>Encephalomyocarditis virus</i>	<i>Cardiovirus A</i>	<i>Picornaviridae</i>	Infection	None
<i>Equine rhinitis B virus</i>	<i>Erbovirus A</i>	<i>Picornaviridae</i>	Infection	None
GB viruses GBV-A, GBV-C (hepatitis G virus), and GBV-D	<i>Pegivirus A</i> (GBV-A, GBV-C); <i>Pegivirus B</i> (GBV-D)	<i>Flaviviridae</i>	Acute hepatitis in humans and primates	41
<i>Hepatitis E virus</i>	<i>Orthohepevirus A</i>	<i>Hepeviridae</i>	Infects humans and other mammals	25
<i>Ljungan virus</i>	<i>Parechovirus B</i>	<i>Picornaviridae</i>	Infection	None
<i>Porcine sapelovirus</i>	<i>Sapelovirus A</i>	<i>Picornaviridae</i>	Infection	None
<i>Porcine teschovirus</i>	<i>Teschovirus A</i>	<i>Picornaviridae</i>	Infection	None
<i>Seneca Valley virus</i>	<i>Senecavirus A</i>	<i>Picornaviridae</i>	Infection	None
<i>Simian sapelovirus</i>	<i>Sapelovirus B</i>	<i>Picornaviridae</i>	Infection	None
<i>Theilovirus</i>	<i>Cardiovirus B</i>	<i>Picornaviridae</i>	Infection	None

^aInternational Committee on Taxonomy of Viruses updates, 2012 to 2014.

(nonhuman vertebrates). Human viruses were restricted to those associated with disease. Many of the animal viruses listed have not been associated with disease in animals or humans.

RESULTS AND DISCUSSION

Table 1 lists new virus species of medical importance to humans. This includes new species of well-known viruses, such as rotavirus and human papillomavirus, as well as SFTS virus, a virus associated with thrombocytopenia and discovered in China in 2011 (1). The majority of new and revised species names have occurred among viruses

TABLE 4 List of revised virus taxa significant to humans, 2012 to 2015^a

Previous name	Revised name	Family	Other information/clinical significance	Reference(s)
Genus <i>Adenovirus</i> , species <i>Human adenovirus A-G</i>	Genus <i>Mastadenovirus</i> , species <i>Human mastadenovirus A-G</i>	<i>Adenoviridae</i>	Human infections	None
Genus <i>Adenovirus</i>	Genera <i>Atadenovirus</i> , <i>Aviadenovirus</i> , <i>Ichtadenovirus</i> , <i>Mastadenovirus</i> , <i>Siadenovirus</i>	<i>Adenoviridae</i>	Various vertebrate species	None
<i>Aichi virus</i> , <i>Bovine kobuvirus</i>	<i>Aichivirus A</i> , <i>Aichivirus B</i>	<i>Picornaviridae</i>	Enteritis in humans and other vertebrates	39, 40
GB viruses GBV-A, GBV-C (hepatitis G virus), and GBV-D	<i>Pegivirus A</i> (GBV-A, GBV-C); <i>Pegivirus B</i> (GBV-D)	<i>Flaviviridae</i>	Acute hepatitis in humans and primates	41
<i>Hepatitis A virus</i>	<i>Hepatovirus A</i>	<i>Picornaviridae</i>	Acute hepatitis	None
<i>Hepatitis E virus</i>	<i>Orthohepevirus A</i>	<i>Hepeviridae</i>	Infects humans and other mammals	25
<i>Human parechovirus</i>	<i>Parechovirus A</i>	<i>Picornaviridae</i>	Human infections	None
<i>Human parvovirus B19</i>	<i>Primate erythroparvovirus 1</i>	<i>Parvoviridae</i>	Human infections	None

^aInternational Committee on Taxonomy of Viruses updates, 2012 to 2014.

TABLE 5 Other viral taxonomy changes, 2012 to 2015^a

Change	Comment	Source
Rename 1 genus and 25 species in family <i>Arenaviridae</i>	Change genus <i>Arenavirus</i> to <i>Mammarenavirus</i> . Replace species names ("virus") with non-Latinized binomial names (" <i>mammarenavirus</i> "), e.g., change <i>Lymphocytic choriomeningitis virus</i> to <i>Lymphocytic choriomeningitis mammarenavirus</i>	http://talk.ictvonline.org/files/ictv_official_taxonomy_updates_since_the_8th_report/m/vertebrate-official/5153.aspx
Extension of taxonomy of the family <i>Parvoviridae</i>	Five new genera, names expanded, new species, e.g., <i>Human parvovirus</i> B19 changed to <i>Primate erythroparvovirus 1</i> ; new species created for human bocaviruses	http://talk.ictvonline.org/files/ictv_official_taxonomy_updates_since_the_8th_report/m/vertebrate-official/4844.aspx

^aInternational Committee on Taxonomy of Viruses updates, 2012 to 2014.

infecting animals, with many associated with infection and, in some instances, disease (Tables 2 and 3). Many of the new species detected from animals are in the families *Picornaviridae* and *Papillomaviridae*. Tables 3 and 4 list revised taxa affecting animals and humans, respectively. The genus *Arenavirus* has been renamed *Mammarenavirus* (Table 5).

This review lists most, if not all, of the proposed new or revised species names and classification changes associated with viruses for the years 2012 through 2015. The source of these changes is the ICTV. All changes are official and have been approved and ratified by the ICTV. It is important to note that the updates provided in the ICTV website are through 2014. Some recently reported clinically significant novel viruses, such as Bourbon virus (a tick-transmitted *Thogotovirus* species) (2) are not included because they have not been approved by the ICTV.

Educators and diagnostic laboratory scientists should incorporate viral taxonomic changes into their teaching and reporting of diagnostic laboratory test results. Until the taxonomic changes become familiar, it is common practice to provide both the new and old names side by side (e.g., *Hepatovirus A* [formerly *Hepatitis A virus*]).

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