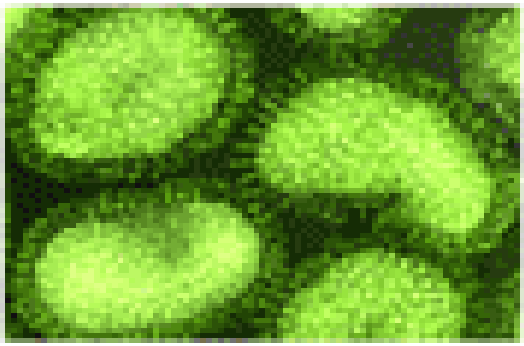
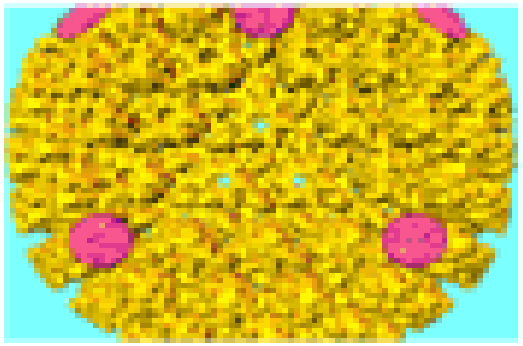
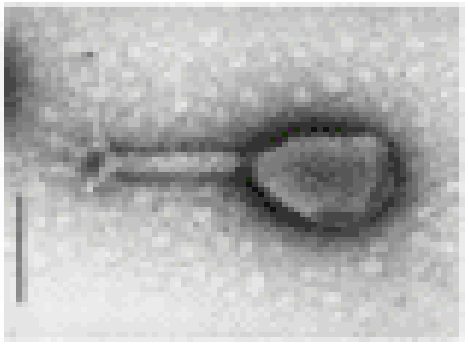
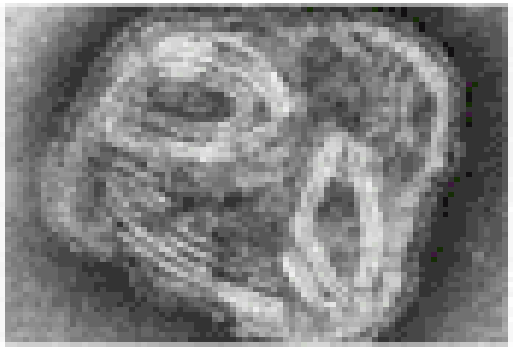
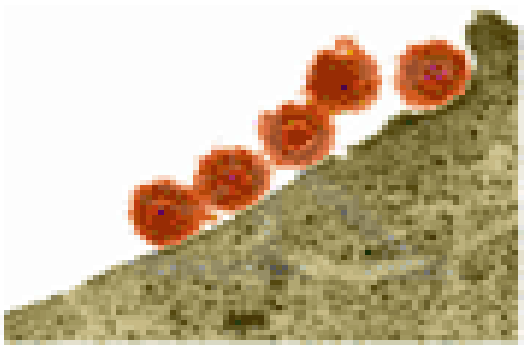
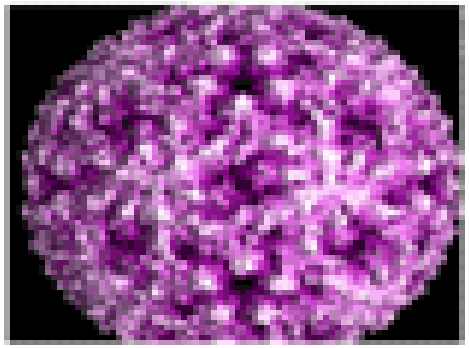
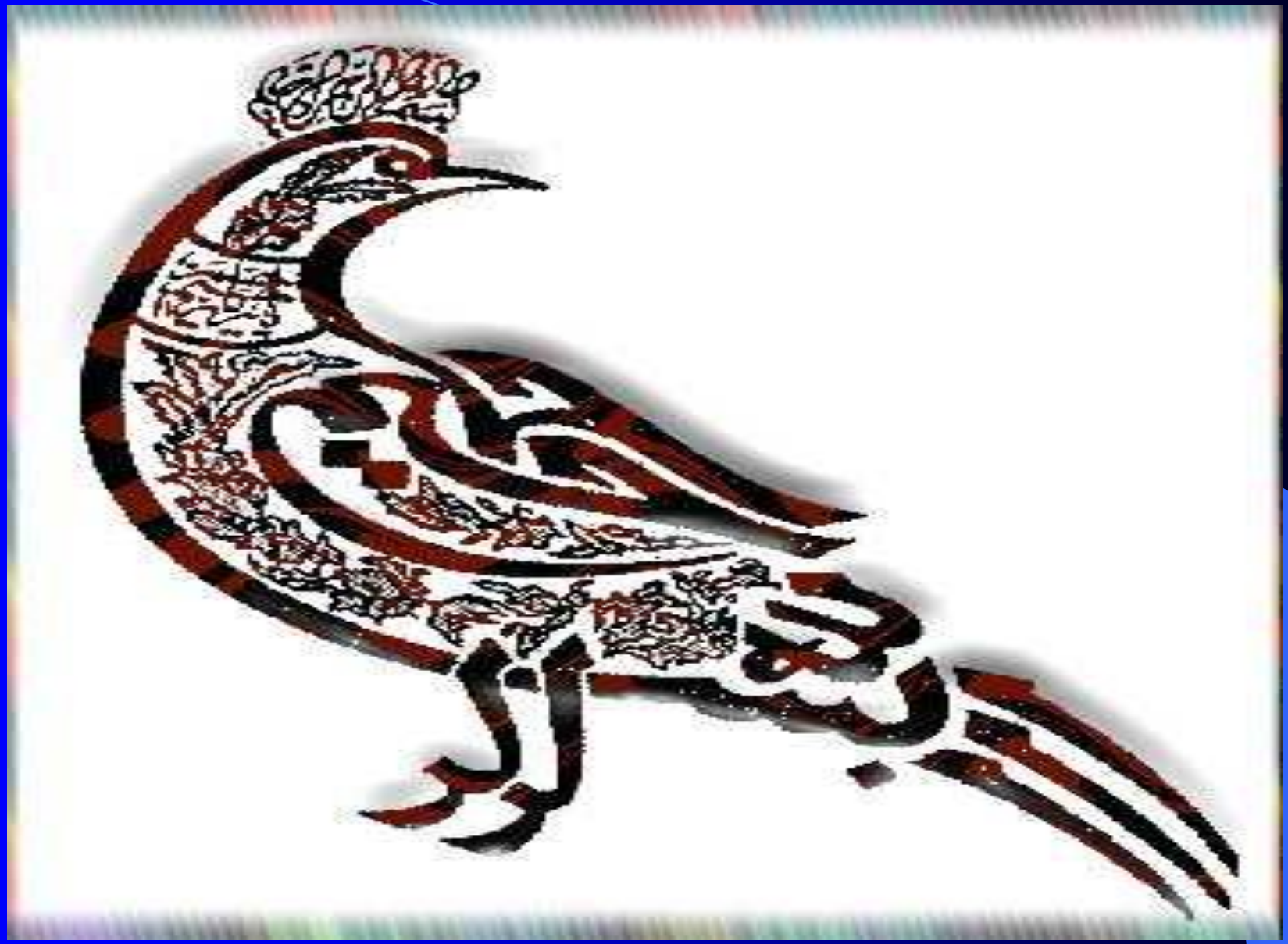
Qazvin University of Medical Sciences

Classification of Viruses

Dr. M . Aslanimehr

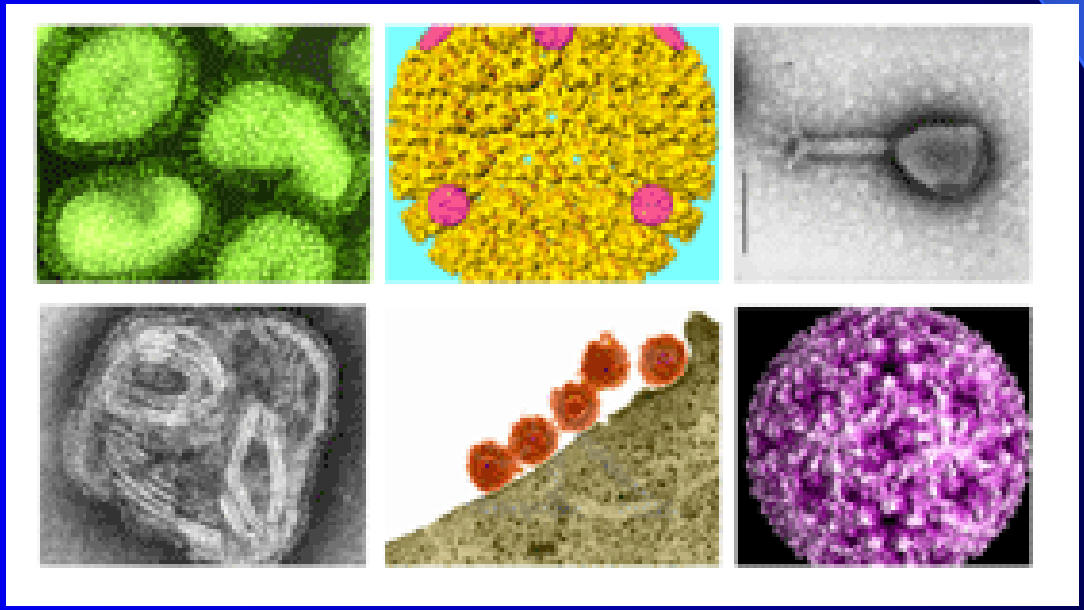


Classification of Viruses

1-Jawetez , Melnick, Adelbergs , Medical Microbiology 2019

2- Murray , Medical Microbiology 2021

3- ICTV



Box 4–3. Means of Classification and Naming of Viruses

Structure: size, morphology, and nucleic acid (e.g., picornavirus [small RNA], togavirus)
Biochemical characteristics: structure and mode of replication*
Disease: encephalitis and hepatitis viruses, for example
Means of transmission: arbovirus spread by insects, for example
Host cell (host range): animal (human, mouse, bird), plant, bacteria
Tissue or organ (tropism): adenovirus and enterovirus, for example

**This is the current means of taxonomic classification of viruses.*

Classification of Viruses

The following properties have been used as a basis for the classification of viruses :

Genome sequencing is now often performed early in virus identification,

and comparisons with databases provide detailed information on

the viral classification, predicted protein composition, and taxonomic relatedness to other viruses.

properties have been used as a basis for the classification of viruses

- (1) Virion morphology, including size, shape, type of symmetry, presence or absence of peplomers, and presence or absence of membranes.
- (2) Virus genome properties, including type of nucleic acid (DNA or RNA), size of genome in kilobases (kb) or kilobase pairs (kbp), strandedness (single or double), whether linear or circular, sense (positive, negative, ambisense), segments (number, size), nucleotide sequence, G + C content, and presence of special features [repetitive elements, isomerization, 5'-terminal cap, 5'-terminal covalently linked protein, 3'-terminal poly(A) tract].
- (3) Physicochemical properties of the virion, including molecular mass, buoyant density, pH stability, thermal stability, and susceptibility to physical and chemical agents, especially ether and detergents.

properties have been used as a basis for the classification of viruses

- (4) Virus protein properties, including number, size, and functional activities of structural and nonstructural proteins, amino acid sequence, modifications (glycosylation, phosphorylation, myristylation), and special functional activities (transcriptase, reverse transcriptase, neuraminidase, fusion activities).
- (5) Genome organization and replication, including gene order, number and position of open reading frames, strategy of replication (patterns of transcription, translation), and cellular sites (accumulation of proteins, virion assembly, virion release).
- (6) Antigenic properties.
- (7) Biologic properties, including natural host range, mode of transmission, vector relationships, pathogenicity, tissue tropisms, and pathology.

Universal System of Virus Taxonomy

International Committee on Taxonomy of Viruses (ICTV) which oversees virus taxonomy.

در طبقه‌بندی جانداران هشت طبقهٔ اصلی وجود دارد که از بزرگ به کوچک بدین قرارند:

Domain: دامنه، قلمرو ← در تاکسونومی ویروسها Realm

Kingdom: (فرمانرو) ، سلسله

Phylum: شاخه :در مورد جانوران //// Division: دسته در مورد گیاهان

Class: رده

Order: راسته

Family: خانواده با کابرد عمومی‌تر

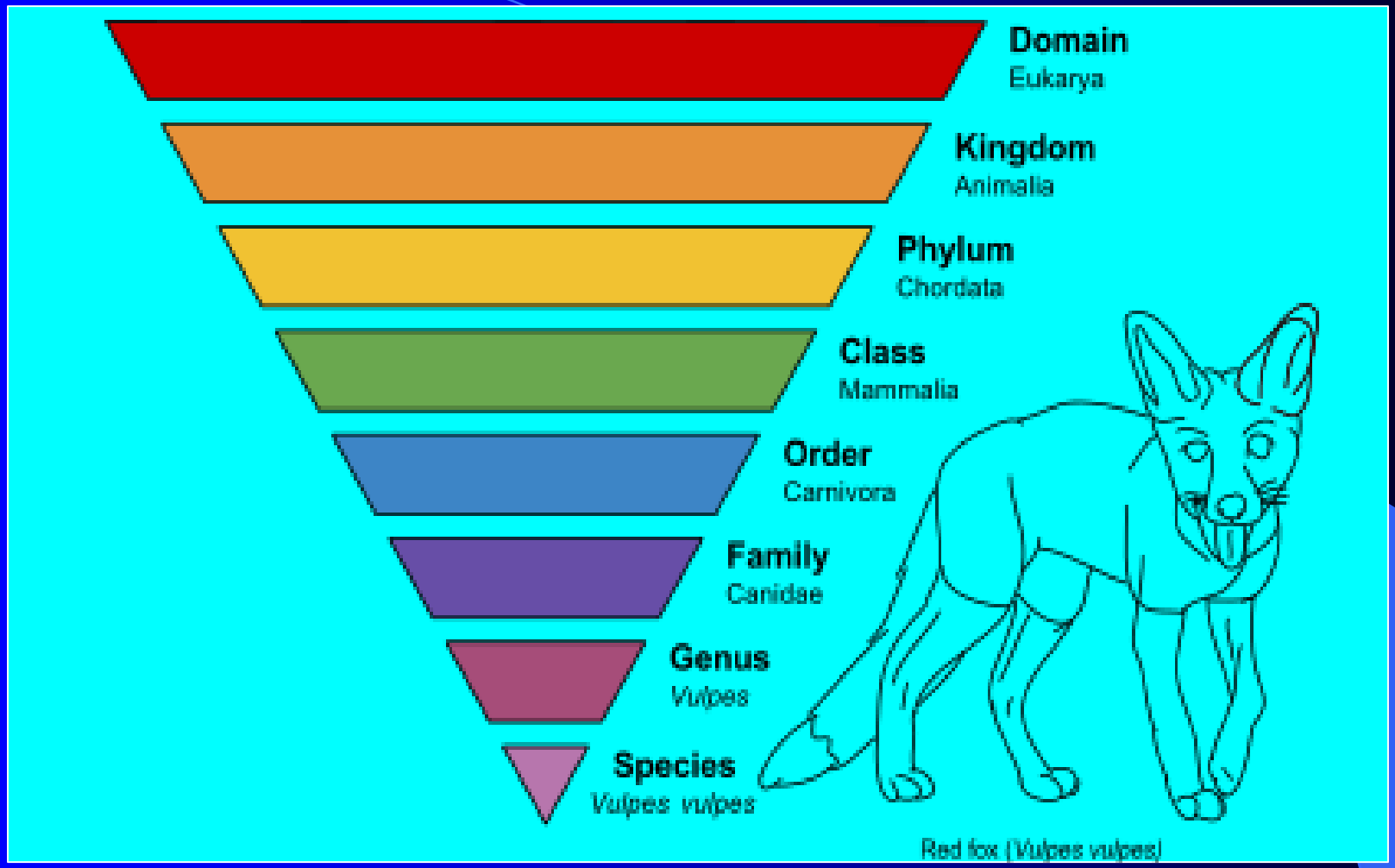
Genus: جنس

Species: گونه

طبقه‌ها (رتبه‌ها) ی گیاه‌شناسی، جانورشناسی و ویروسشناسی گاهی اندکی متفاوتند.

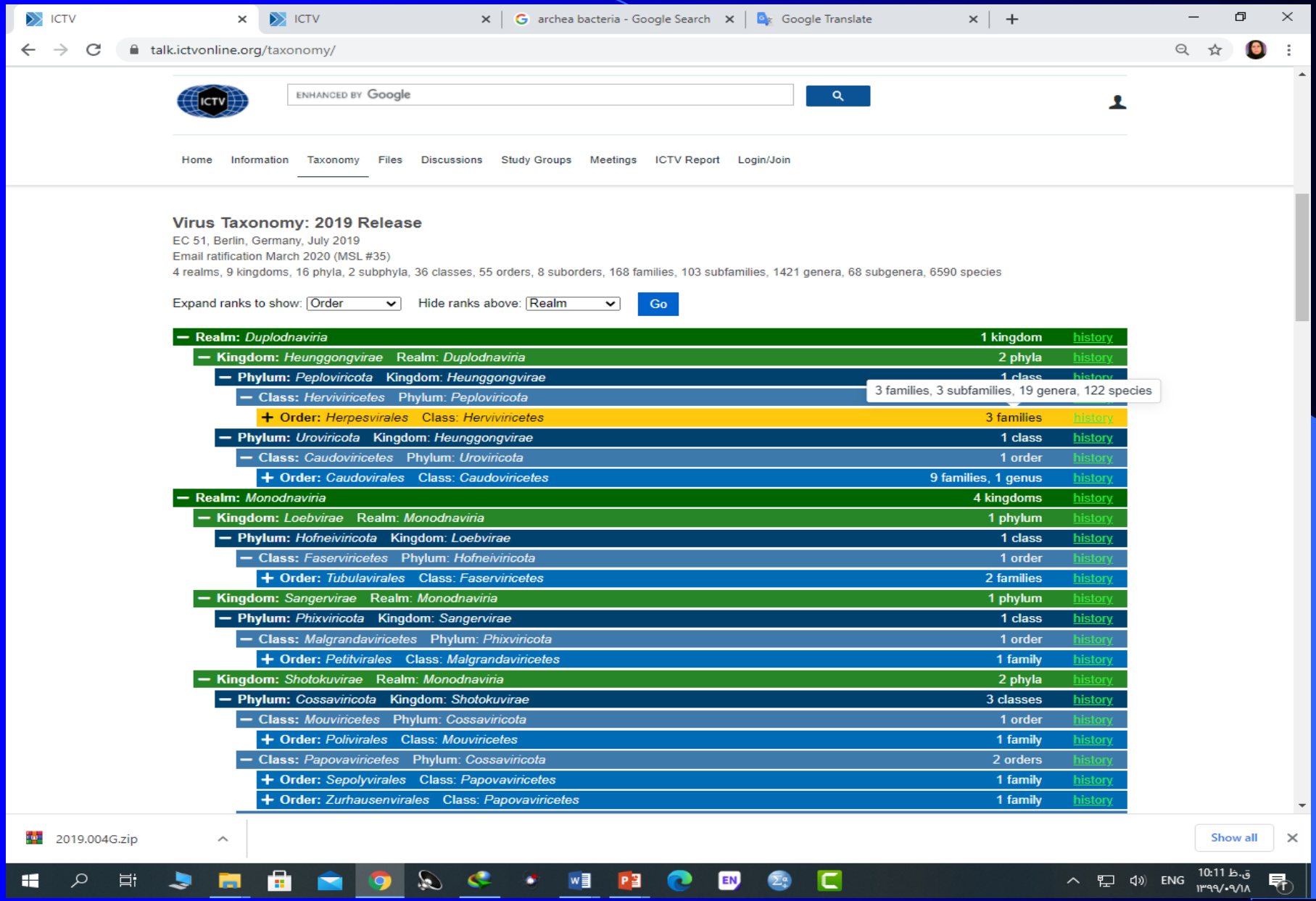

Life
Domain
Kingdom
Phylum
Class
Order
Family
Genus
Species
جاندار
دامنه
فرمانرو
شاخه
رده
راسته
خانواده
سرده
گونه

Classification of Red Fox for example



Three Domain considered for live organism:
1-Eukaryia , 2 Bacteria, 3- Archaea

Classification of Viruses by (ICTV)



Based on Text :Jawetez 2019

order Mononegavirales

- Virus orders may be used to group virus families that share common characteristics.
- For example, order Mononegavirales encompasses the
- Bornaviridae,
- Filoviridae,
- Paramyxoviridae,
- and Rhabdoviridae families.

Universal System of Virus Taxonomy

- Since 2017,
- the International Committee on Taxonomy of Viruses had organized more than
- 4400 virus species into
- 122 families and
- 735 genera.

Jawetez 2019

Table 2. Summary of taxonomic changes ratified in February 2019

Rank	New	Abolish	Rename	Merge	Split	Total MSL34[a]
Realm	1	0	0	0	0	1
Phylum	0	0	0	0	0	1
Subphylum	0	0	0	0	0	2
Class	0	0	0	0	0	6
Order	0	0	0	0	0	14
Suborder	0	0	0	0	0	7
Family	7	0	0	0	0	150
Subfamily	15	0	0	0	0	79
Genus	175	0	137	0	2	1019
Subgenus	0	0	0	0	0	59
Species	614	11	59	2	0	5,560

[a]Total number of taxa in the ICTV Master Species List MSL34

Realm (دامنه ، قلمرو)

- In virology, **realm** is the highest taxonomic rank established for viruses by the ICTV, which oversees virus taxonomy.
- The rank of realm corresponds to the rank of domain used for cellular life, but differs in that viruses in a realm do not necessarily share a common ancestor based on common descent nor do the realms share a common ancestor.

Realm in virology ICTV 2021

- **Four virus realms are recognized** and united by specific highlyconserved traits:
- *1- Duplodnavira*, which contains all double-stranded DNA (dsDNA) viruses that encode the HK97-fold major capsid protein;
- *2- Monodnaviria*, which contains all single-stranded DNA (ssDNA) viruses that encode a HUH superfamily endonuclease and their descendents;
- *3- Riboviria*, which contains all RNA viruses that encode RNA-dependent RNA polymerase and all viruses that encode reverse transcriptase;
- *4- Varidnaviria*, which contains all dsDNA viruses that encode a vertical jelly roll major capsid protein.

Realm in virology ICTV online March 2022

- **6 virus realms are recognized** and united by specific highlyconserved traits:

Virus Taxonomy: 2021 Release

EC 53, Online, July 2021

Email ratification March 2022 (MSL #37)

6 realms, 10 kingdoms, 17 phyla, 2 subphyla, 39 classes, 65 orders, 8 suborders, 233 families, 168 subfamilies, 2606 genera, 84 subgenera, 10434 species

Expand ranks to show: Realm Hide ranks above: Realm Go

+ **Realm:** *Adnaviria*	1 kingdom	history
+ **Realm:** *Duplodnaviria*	1 kingdom	history
+ **Realm:** *Monodnaviria*	4 kingdoms	history
+ **Realm:** *Riboviria*	2 kingdoms, 2 families, 4 genera	history
+ **Realm:** *Ribozyviria*	1 family	history
+ **Realm:** *Varidnaviria*	2 kingdoms	history

In formal taxonomic usage

The accepted names of virus, viroid and satellite

- realms, subrealms, kingdoms, subkingdoms, phyla, subphyla, classes, subclasses, orders, suborders, families, subfamilies, genera and subgenera are printed in *italics* and the first letters of the names are capitalized.
- Examples of correct form:
  - *Murray Valley encephalitis virus*
  - *Tobacco mosaic virus*
- Examples of incorrect forms:
  - Ustilago maydis virus (not italicized),
  - *Murray valley encephalitis virus* (Valley is a proper noun) or tobacco mosaic virus (not capitalized or italicized).

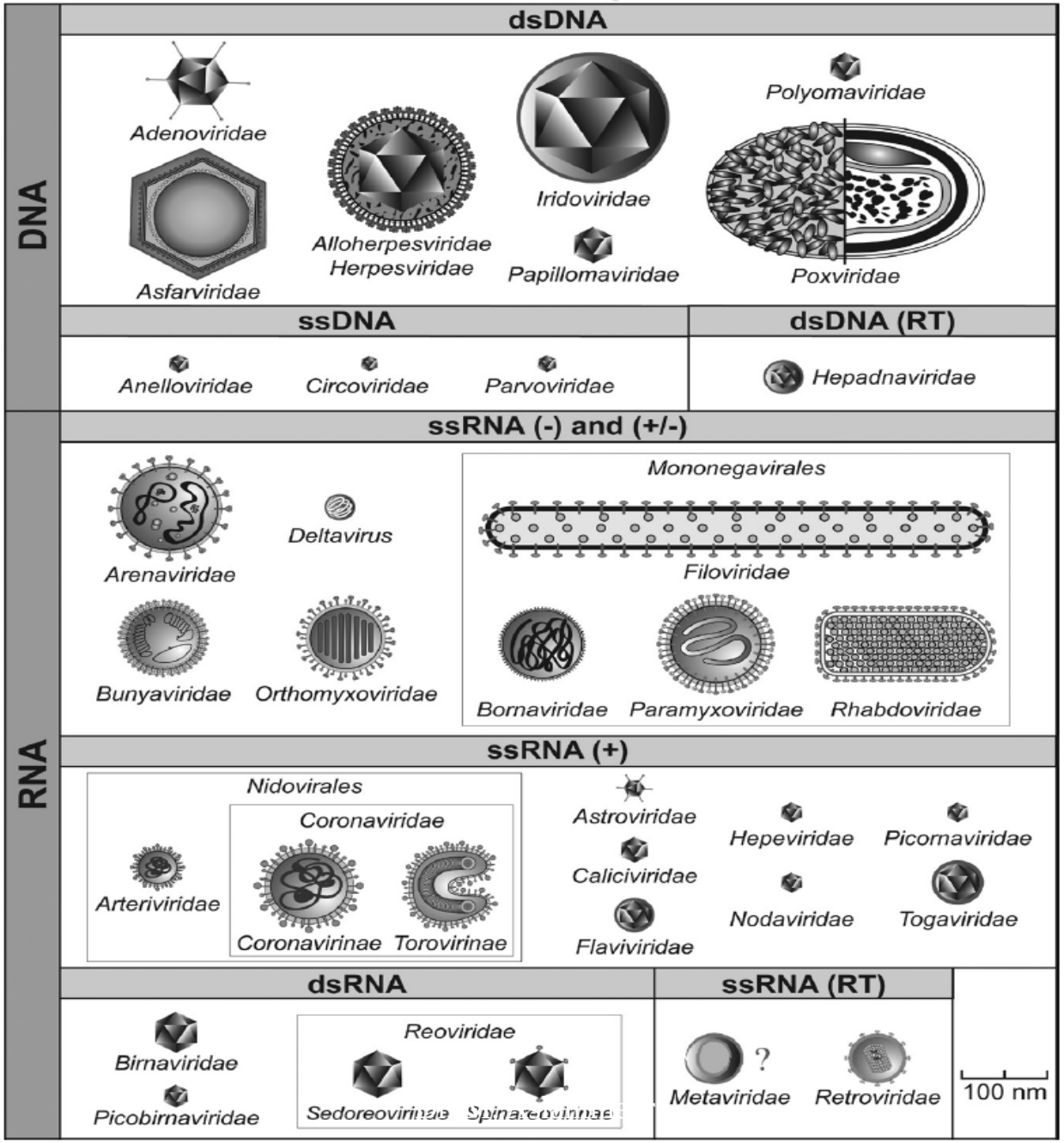
Universal System of Virus Taxonomy

- A system has been established in which viruses are separated into major groupings called families on the basis of virion morphology, genome structure, and strategies of replication. Virus family names have the suffix **-viridae.**

- Within each family, subdivisions called genera are usually based on physicochemical or serologic differences. Criteria used to define genera vary from family to family.
- Genus names carry the suffix -*virus*.
- In four families (Poxviridae, Herpesviridae, Parvoviridae, Paramyxoviridae).
- A larger grouping called subfamilies has been defined, reflecting the complexity of relationships among member viruses.

Conventions for Naming Viruses

Taxonomic Hierarchy	Ending	Example
Order	-virales	Mononegavirales
Family	-viridae	Paramyxoviridae
Subfamily	-virinae	Pneumovirinae
Genus	-virus	Pneumovirus
Species	None	Human respiratory syncytial virus


Virus Taxa Infecting Vertebrates
DNA
dsDNA
Adenoviridae
Asfarviridae
Alloherpesviridae
Herpesviridae
Iridoviridae
Papillomaviridae
Polyomaviridae
Poxviridae
ssDNA
Anelloviridae
Circoviridae
Parvoviridae
dsDNA (RT)
Hepadnaviridae
RNA
ssRNA (-) and (+/-)
Arenaviridae
Deltavirus
Bunyaviridae
Orthomyxoviridae
Mononegavirales
Filoviridae
Bornaviridae
Paramyxoviridae
Rhabdoviridae
ssRNA (+)
Nidovirales
Arteriviridae
Coronaviridae
Coronavirinae
Torovirinae
Astroviridae
Caliciviridae
Flaviviridae
Hepeviridae
Nodaviridae
Picornaviridae
Togaviridae
dsRNA
Birnaviridae
Picobirnaviridae
Reoviridae
Sedoreovirinae
Spinareovirinae
ssRNA (RT)
Metaviridae
Retroviridae
100 nm

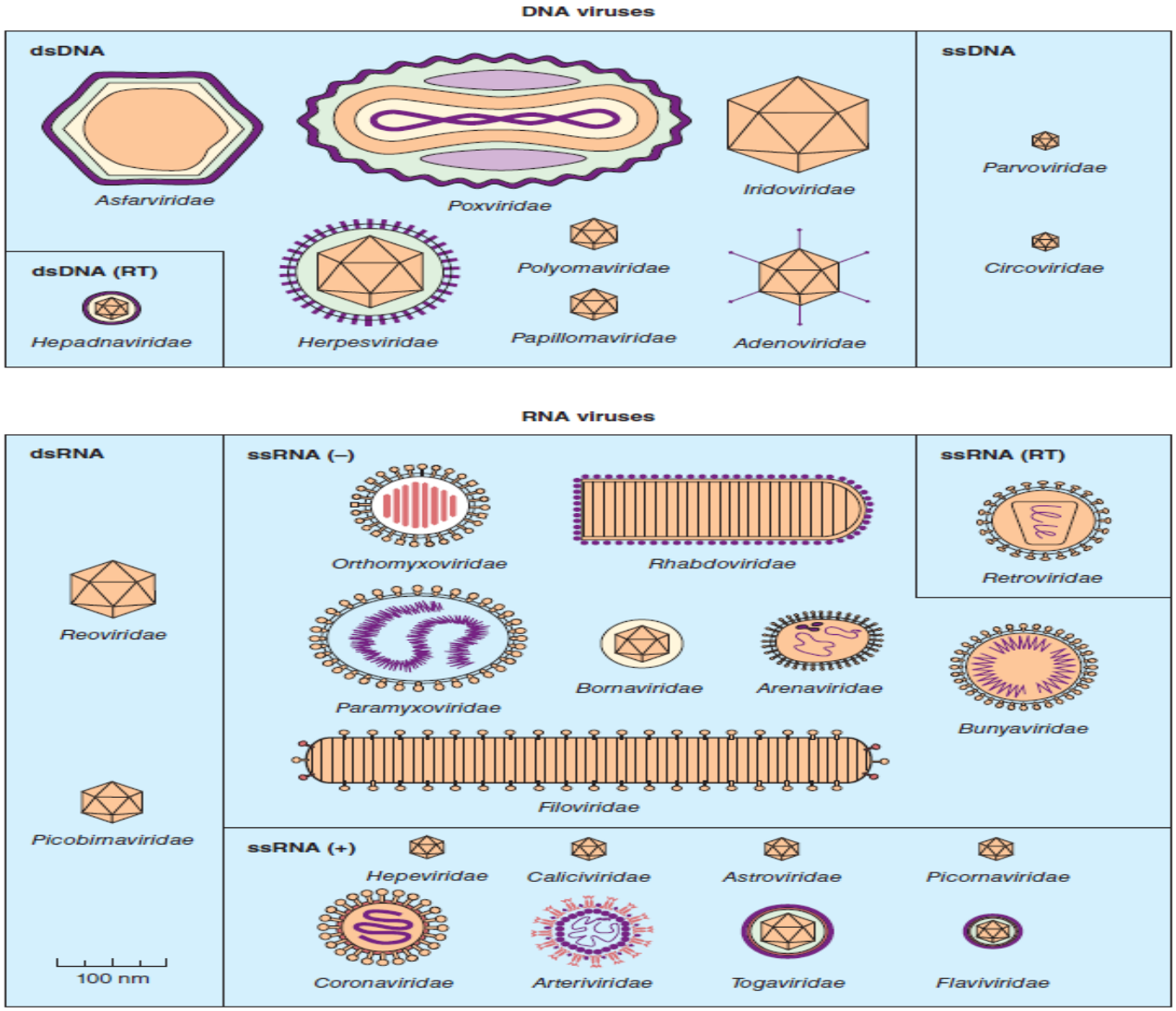


FIGURE 29-2 Shapes and relative sizes of animal viruses of families that infect vertebrates. In some diagrams, certain internal structures of the particles are represented. Only those families that include human pathogens are listed in Table 29-1 and described in the text. (Reproduced with permission from van Regenmortel MHV, Fauquet CM, Bishop DHL, et al [editors]: *Virus Taxonomy: Classification and Nomenclature of Viruses. Seventh Report of the International Committee on Taxonomy of Viruses*. Academic Press, 2000.)

E 29-1 Families of Animal Viruses That Contain Members Able to Infect Humans

Capsid Symmetry	Virion: Enveloped or Naked	Ether Sensitivity	Number of Capsomeres	Virus Particle Size (nm)[a]	Size of Nucleic Acid in Virion (kb/kbp)	Physical Type of Nucleic Acid[b]	Virus Family
Icosahedral	Naked	Resistant	32	18–26	5.6	ss	Parvoviridae
				30	2.0–3.9	ss circular	Anelloviridae
			72	45	5	ds circular	Polyomaviridae
			72	55	8	ds circular	Papillomaviridae
			252	70–90	26–45	ds	Adenoviridae
	Enveloped	Sensitive	180	40–48	3.2	ds circular[c]	Hepadnaviridae
			162	150–200	125–240	ds	Herpesviridae
Complex	Complex coats	Resistant[d]		230 × 400	130–375	ds	Poxviridae
Icosahedral	Naked	Resistant	32	28–30	7.2–8.4	ss	Picornaviridae
				28–30	6.4–7.4	ss	Astroviridae
			32	27–40	7.4–8.3	ss	Caliciviridae
				27–34	7.2	ss	Hepeviridae
				35–40	4	ds segmented	Picobirnaviridae
				60–80	16–27	ds segmented	Reoviridae
	Enveloped	Sensitive	42	50–70	9.7–11.8	ss	Togaviridae
Unknown or complex	Enveloped	Sensitive		40–60	9.5–12.5	ss segmented	Flaviviridae
				50–300	10–14		Arenaviridae
				120–160	27–32	ss	Coronaviridae
				80–110	7–11[e]	ss diploid	Retroviridae
Helical	Enveloped	Sensitive		80–120	10–13.6	ss segmented	Orthomyxoviridae
				80–120	11–21	ss segmented	Bunyaviridae
				80–125	8.5–10.5	ss	Bornaviridae
				75 × 180	13–16	ss	Rhabdoviridae
				150–300	16–20	ss	Paramyxoviridae
				80 × 1000[f]	19.1	ss	Filoviridae

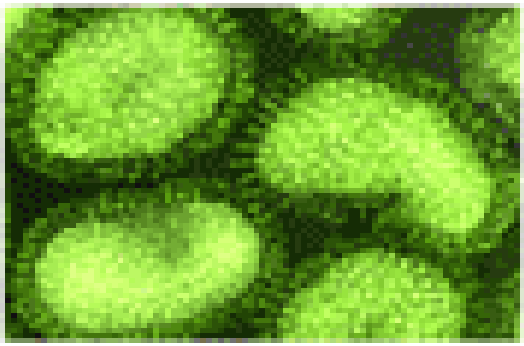
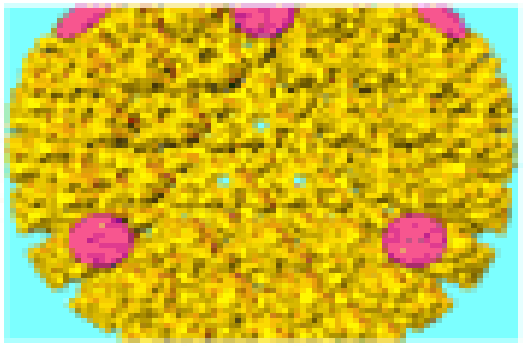
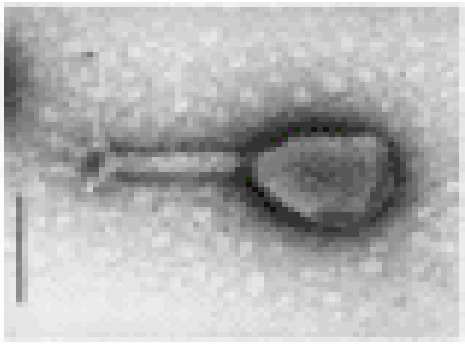
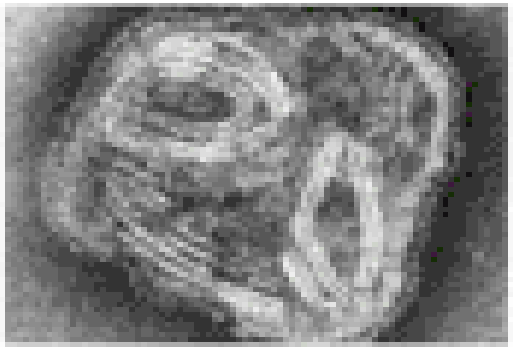
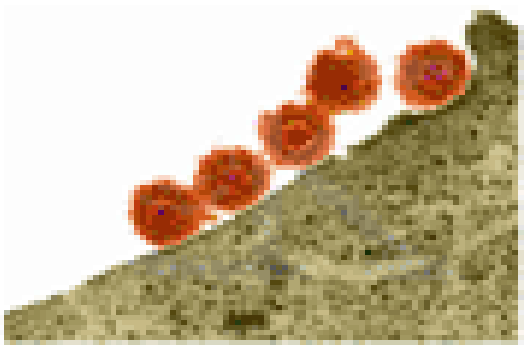
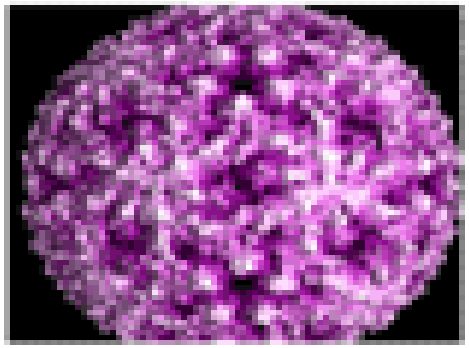
r, or diameter × length.
le stranded; ss, single stranded.
itive-sense strand has a constant length of 3.2 kb; the other varies in length, leaving a large single-stranded gap.
us *Orthopoxvirus*, which includes the better-studied poxviruses (eg, vaccinia), is ether resistant; some of the poxviruses belonging to other genera are ether

توجه دانشجویان عزیز

- لطفا طبقه بندی ویروس ها بر اساس جدول کتاب جاوتز فرا گرفته شود. به همان خوبی که جدول ضرب را فراگرفته اید.
- لطفا ویروس های مهم هر خانواده به جدول کتاب جاوتز اضافه شود .

Qazvin University of Medical Sciences

Classification of RNA Viruses

Dr. M . Aslanimehr

In virology

the International Committee on Taxonomy of Viruses's virus classification includes 15 taxa (8 main taxa):

realm, subrealm, kingdom, subkingdom, phylum, subphylum, class, subclass, order, suborder, family, subfamily, genus, subgenus, and species, to be applied for viruses, viroids and satellite nucleic acids.

The names for these ranks shall be single words ending with the suffixes “-viria”, “-vira”, “-virae”, “-virites”, “-viricota”, “-viricotina”, “viricetes”, “-viricetidae”, “-virales”, “-virineae”, “-viridae”, “-virinae”, “-virus" and “-virus”, respectively.

Realm(قلمرو) in virology

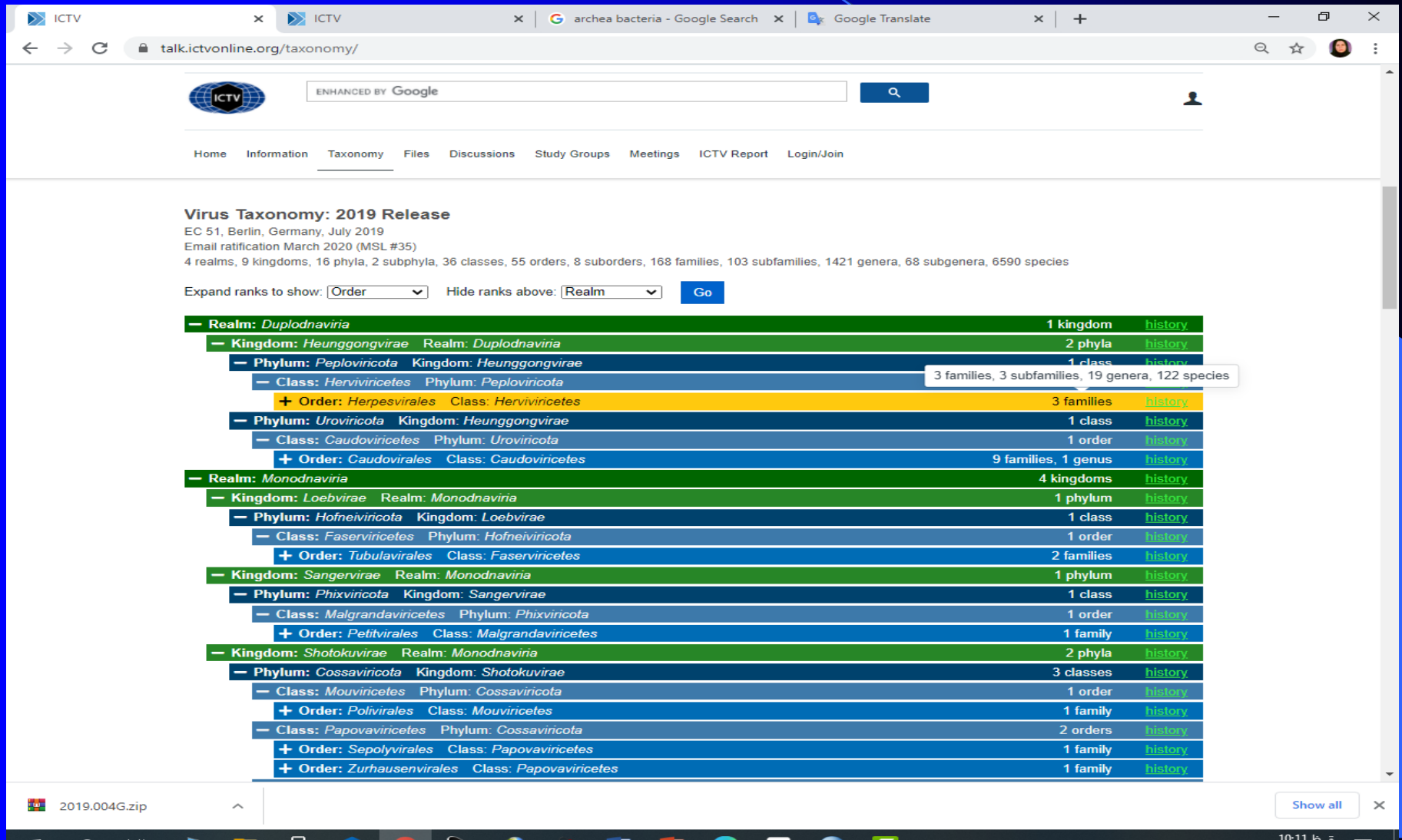
- In virology, **realm** is the highest taxonomic rank established for (ICTV),
- Four virus realms are recognized.

- Realm of Riboviria in 2018 and the other three realms in 2019 were added

Four Realm considered for viruses (ICTV online 2020)

- : *Duplodnaviria*, which contains all double-stranded DNA (dsDNA) viruses that encode the HK97-fold major capsid protein, There are two groups of viruses in *Duplodnaviria*:
  tailed bacteriophages of the order *Caudovirales*, which infect prokaryotes, and herpesviruses of the order *Herpesvirales*, which infect animals.
- *Monodnaviria*, which contains all single-stranded DNA (ssDNA) viruses that encode a HUH superfamily endonuclease and their scendents ,
- *Riboviria*, which contains all RNA viruses that encode RNA-dependent RNA polymerase (RdRP, RDR) or RNA replicase and all viruses that encode reverse transcriptase,
- *Varidnaviria*, which contains all dsDNA viruses that encode a vertical jelly roll major capsid protein. (Pox , Adenoviridae)

Realm in virology ICTV online March 2020



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- 6 virus realms are recognized and united by specific highlyconserved traits:

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EC 53, Online, July 2021

Email ratification March 2022 (MSL #37)

6 realms, 10 kingdoms, 17 phyla, 2 subphyla, 39 classes, 65 orders, 8 suborders, 233 families, 168 subfamilies, 2606 genera, 84 subgenera, 10434 species

Expand ranks to show: Realm Hide ranks above: Realm Go

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+ **Realm:** *Duplodnaviria*	1 kingdom	history
+ **Realm:** *Monodnaviria*	4 kingdoms	history
+ **Realm:** *Riboviria*	2 kingdoms, 2 families, 4 genera	history
+ **Realm:** *Ribozyviria*	1 family	history
+ **Realm:** *Varidnaviria*	2 kingdoms	history

Main reference for classification

TABLE 29-1 Families of Animal Viruses That Contain Members Able to Infect Humans

Nucleic Acid Core	Capsid Symmetry	Virion: Enveloped or Naked	Ether Sensitivity	Number of Capsomeres	Virus Particle Size (nm)[a]	Size of Nucleic Acid in Virion (kb/kbp)	Physical Type of Nucleic Acid[b]	Virus Family
DNA	Icosahedral	Naked	Resistant	32	18–26	5.6	ss	Parvoviridae
					30	2.0–3.9	ss circular	Anelloviridae
				72	45	5	ds circular	Polyomaviridae
				72	55	8	ds circular	Papillomaviridae
				252	70–90	26–45	ds	Adenoviridae
		Enveloped	Sensitive	180	40–48	3.2	ds circular[c]	Hepadnaviridae
				162	150–200	125–240	ds	Herpesviridae
	Complex	Complex coats	Resistant[d]		230 × 400	130–375	ds	Poxviridae
RNA	Icosahedral	Naked	Resistant	32	28–30	7.2–8.4	ss	Picornaviridae
					28–30	6.4–7.4	ss	Astroviridae
				32	27–40	7.4–8.3	ss	Caliciviridae
					27–34	7.2	ss	Hepeviridae
					35–40	4	ds segmented	Picobirnaviridae
					60–80	16–27	ds segmented	Reoviridae
		Enveloped	Sensitive	42	50–70	9.7–11.8	ss	Togaviridae
	Unknown or complex	Enveloped	Sensitive		40–60	9.5–12.5	ss segmented	Flaviviridae
					50–300	10–14		Arenaviridae
					120–160	27–32	ss	Coronaviridae
					80–110	7–11[e]	ss diploid	Retroviridae
	Helical	Enveloped	Sensitive		80–120	10–13.6	ss segmented	Orthomyxoviridae
					80–120	11–21	ss segmented	Bunyaviridae
					80–125	8.5–10.5	ss	Bornaviridae
					75 × 180	13–16	ss	Rhabdoviridae
					150–300	16–20	ss	Paramyxoviridae
					80 × 1000[f]	19.1	ss	Filoviridae

[a]Diameter, or diameter × length.
[b]ds, double stranded; ss, single stranded.
[c]The negative-sense strand has a constant length of 3.2 kb; the other varies in length, leaving a large single-stranded gap.
[d]The genus *Orthopoxvirus*, which includes the better-studied poxviruses (eg, vaccinia), is ether resistant; some of the poxviruses belonging to other genera are ether sensitive.
[e]Size of monomer.
[f]Filamentous forms vary greatly in length.

Jawetz , Clinical Virology 2019

TABLE 36.2 Properties of Virions of Human DNA Viruses

	GENOME[a]		VIRION		
Family	Molecular Mass x 10^6 Da	Nature	Shape	Size (nm)	Encodes Polymerase?[b]
Poxviridae	85–140	ds, linear	Brick-shaped, enveloped	300 x 240 x 100	+[c,e]
Herpesviridae	100–150	ds, linear	Icosadeltahedral, enveloped	Capsid, 100–110 Envelope, 120–200	+
Adenoviridae	20–25	ds, linear	Icosadeltahedral with fibers	70–90	+
Hepadnaviridae	1.8	ds, circular[d]	Spherical, enveloped	42	+[c,f]
Polyomaviridae and Papillomaviridae	3–5	ds, circular	Icosadeltahedral	45–55	–
Parvoviridae	1.5–2.0	ss, linear	Icosahedral	18–26	–

Murray , Clinical Virology 2021

TABLE 36.3 Families of RNA Viruses and Some Important Members

Family[a]	Members[b]
PARAMYXOVIRIDAE	Parainfluenza virus, Sendai virus, *measles virus*, mumps virus, respiratory syncytial virus, metapneumovirus
ORTHOMYXOVIRIDAE	*Influenza virus* types A, B, C and thogotoviruses
CORONAVIRIDAE	*Coronavirus*, SARS virus, MERS virus
Arenaviridae	*Lassa fever virus*, Tacaribe virus complex (Junin and Machupo viruses), lymphocytic choriomeningitis virus
Rhabdoviridae	*Rabies virus*, vesicular stomatitis virus
Filoviridae	*Ebola virus*, Marburg virus
Bunyaviridae	*California encephalitis virus*, La Crosse virus, sandfly fever virus, hemorrhagic fever virus, hantavirus
Retroviridae	Human T-cell leukemia virus types I and II, *HIV*, animal oncoviruses
Reoviridae	*Rotavirus*, Colorado tick fever virus
Togaviridae	Rubella virus; *western, eastern, and Venezuelan equine encephalitis virus*; Ross River virus; Sindbis virus; Semliki Forest virus; chikungunya virus
Flaviviridae	*Yellow fever virus*, dengue virus, St. Louis encephalitis virus, West Nile virus, hepatitis C virus
Caliciviridae	*Norwalk virus*, calicivirus
Picornaviridae	Rhinoviruses, *poliovirus*, echoviruses, parechovirus, coxsackievirus, hepatitis A virus
Hepeviridae	Hepatitis E virus
Astroviridae	Astrovirus
Delta	Delta agent

[a]The size of the type is indicative of the relative size of the virus.
[b]The italicized virus is the prototype virus for the family.
MERS, Middle East respiratory syndrome; *SARS*, severe acute respiratory syndrome; *HIV*, human immunodeficiency virus

Murray , Clinical Virology 2021

Table 31–1. Classification of DNA viruses.

Virus Family	Envelope Present	Capsid Symmetry	Particle Size (nm)	DNA MW ($\times 10^6$)	DNA Structure[1]	Medically Important Viruses
Parvovirus	No	Icosahedral	22	2	SS, linear	B19 virus
Papovavirus	No	Icosahedral	55	3–5	DS, circular, supercoiled	Papillomavirus
Adenovirus	No	Icosahedral	75	23	DS, linear	Adenovirus
Hepadnavirus	Yes	Icosahedral	42	1.5	DS, incomplete circular	Hepatitis B virus
Herpesvirus	Yes	Icosahedral	100[2]	100–150	DS, linear	Herpes simplex virus, varicella-zoster virus, cytomegalovirus, Epstein-Barr virus
Poxvirus	Yes	Complex	250 × 400	125–185	DS, linear	Smallpox virus, vaccinia virus

[1]SS, single-stranded; DS, double-stranded.
[2]The herpesvirus nucleocapsid is 100 nm, but the envelope varies in size. The entire virus can be as large as 200 nm in diameter.

Table 31–2. Classification of RNA viruses.

Virus Family	Envelope Present	Capsid Symmetry	Particle Size (nm)	RNA MW ($\times 10^6$)	RNA Structure[1]	Medically Important Viruses
Picornavirus	No	Icosahedral	28	2.5	SS linear, nonsegmented, positive polarity	Poliovirus, rhinovirus, hepatitis A virus
Calicivirus	No	Icosahedral	38	2.7	SS linear, nonsegmented, positive polarity	Norwalk virus, hepatitis E virus
Reovirus	No	Icosahedral	75	15	DS linear, 10 segments	Rotavirus
Flavivirus	Yes	Icosahedral	45	4	SS linear, nonsegmented, positive polarity	Yellow fever virus, dengue virus, West Nile virus, hepatitis C virus
Togavirus	Yes	Icosahedral	60	4	SS linear, nonsegmented, positive polarity	Rubella virus
Retrovirus	Yes	Icosahedral	100	7[2]	SS linear, 2 segments, positive polarity	HIV, human T-cell leukemia virus
Orthomyxovirus	Yes	Helical	80–120	4	SS linear, 8 segments, negative polarity	Influenza virus
Paramyxovirus	Yes	Helical	150	6	SS linear, nonsegmented, negative polarity	Measles virus, mumps virus, respiratory syncytial virus
Rhabdovirus	Yes	Helical	75 × 180	4	SS linear, nonsegmented, negative polarity	Rabies virus
Filovirus	Yes	Helical	80[3]	4	SS linear, nonsegmented, negative polarity	Ebola virus, Marburg virus
Coronavirus	Yes	Helical	100	10	SS linear, nonsegmented, positive polarity	Coronavirus
Arenavirus	Yes	Helical	80–130	5	SS circular, 2 segments with cohesive ends, negative polarity	Lymphocytic choriomeningitis virus
Bunyavirus	Yes	Helical	100	5	SS circular, 3 segments with cohesive ends, negative polarity	California encephalitis virus, hantavirus
Deltavirus	Yes	Uncertain[4]	37	0.5	SS circular, closed circle, negative polarity	Hepatitis delta virus

[1]SS, single-stranded; DS, double-stranded.
[2]Retrovirus RNA contains 2 identical molecules of MW 3.5 × 10^6.
[3]Particles are 80 nm wide but can be thousands of nanometers long.
[4]The nucleocapsid appears spherical but its symmetry is unknown.

Box 4–7. Properties of DNA Viruses

DNA is not transient or labile.
Many DNA viruses establish persistent infections (e.g., latent, immortalizing).
DNA genomes reside in the nucleus (except for poxviruses).
Viral DNA resembles host DNA for transcription and replication.
Viral genes must interact with host transcriptional machinery (except for poxviruses).
Viral gene transcription is temporally regulated.
Early genes encode DNA-binding proteins and enzymes.
Late genes encode structural and other proteins.
DNA polymerases require a primer to replicate the viral genome.
The larger DNA viruses encode means to promote efficient replication of their genome.
Parvovirus: requires cells undergoing DNA synthesis to replicate.
Papovavirus: stimulates cell growth and DNA synthesis.
Hepadnavirus: stimulates cell growth and encodes its own polymerase.
Adenovirus: stimulates cellular DNA synthesis and encodes its own polymerase.
Herpesvirus: stimulates cell growth, encodes its own polymerase and enzymes to provide deoxyribonucleotides for DNA synthesis, establishes latent infection in host.
Poxvirus: encodes its own polymerase and enzymes to provide deoxyribonucleotides for DNA synthesis, replication machinery, and transcription machinery in the cytoplasm.

Box 4–8. Properties of RNA Viruses

RNA is labile and transient.
Most RNA viruses replicate in the cytoplasm.
Cells cannot replicate RNA. RNA viruses must encode an RNA-dependent RNA polymerase.
The genome structure determines the mechanism of transcription and replication.
RNA viruses are prone to mutation.
The genome structure and polarity determine how viral messenger RNA (mRNA) is generated and proteins are processed.
RNA viruses, except (+) RNA genome, must carry polymerases.
All (—) RNA viruses are enveloped.

Picornaviruses, togaviruses, flaviviruses, caliciviruses, and coronaviruses

(+) RNA genome resembles mRNA and is translated into a polyprotein, which is proteolyzed. A (—) RNA template is used for replication. Togaviruses, coronaviruses, and noroviruses have early and late genes.

Orthomyxoviruses, paramyxoviruses, rhabdoviruses, filoviruses, and bunyaviruses

(—) RNA genome is a template for individual mRNAs, but full-length (+) RNA template is required for replication. Orthomyxoviruses replicate and transcribe in nucleus, and each segment of the genome encodes one mRNA and template.

Reoviruses

(+/—) Segmented RNA genome is a template for mRNA. (+) RNA may also be encapsulated to generate the (+/—) RNA and then more mRNA.

Retroviruses

(+) Retrovirus RNA genome is converted into DNA, which is integrated into the host chromosome and transcribed as a cellular gene.

خسته نباشید ، به امید دیدار

پاسخ سوالات : تعریف ویروس

- ویروس ها یکی از کوچک ترین ذرات عفونی و ارگانیسم هایی هستند که ساختار سلولی ندارند (**Acellular organisms**).
- این ارگانیسم های فاقد سلول، دارای ماده ژنتیکی از جنس نوکلئیک اسید می باشند. آنها انگل اجباری در سطح ژنتیکی بوده و دارای طیف وسیعی از میزبانان می باشند (انسان ، حیوان ، گیاهان و سایر ارگانیسم ها و میکرو ارگانیسم ها و حتی سایر ویروس ها).

ویروس ها فاقد متابولیسم مستقل ، سیستم آنزیمی مستقل و فاقد اندامک های سلولی هستند و برای تکثیر و ساخت ماکرو مولکول های خود نیاز به میزبان زنده مناسب دارند.

تعریف ویروس ادامه

- ولیکن ویروس ها به عنوان مهمترین ویژگی یک موجود زنده توانایی تکثیرخود را فقط در درون سلول زنده دارا می باشند. تکثیر ویروسی متفاوت از تقسیم دوتایی ، میتوز و میوز می باشد و در طی چرخه تکثیری ویروس از یک ویروس می تواند هزاران ویروس ساخته شود.
- به نظرمن، ویروس ها نشانه بارز سیر تکاملی و تداوم خط تکاملی و ادامه حیات با کمترین نیاز ها و بالاترین کارایی و تامین اغلب نیاز ها از منابع میزبان می باشند .
- هر چند نظرات بسیار متفاوتی در مورد زنده بودن ویروس ها وجود دارد ولیکن به نظر عده ای از دانشمندان «ویروس ها زنده اند و شکل متفاوتی از حیات را دارا می باشند.
- «حیات فاقد ساختار سلولی» - دکتر معصومه اصلانی مهر مدرس ویروس شناسی