

# Glossary and Abbreviations

Terms shown in the text in **bold-colored** print are defined in this glossary. A guide to pronunciation is shown in parentheses; this information is intended only as a guide, since there are alternative pronunciations and regional differences in the way many words are pronounced.

**abortive infection**  
(a-bore-tiv in-fec-shon)

The initiation of infection without completion of the infectious cycle and therefore without the production of infectious particles (cf. **productive infection**).

**adjuvant**  
(aj-oo-vant)

A substance included in a medication to improve the action of the other constituents; usually, a component of vaccines that boosts their immunogenicity (e.g., aluminum sulfate).

**ambisense**  
(ambi-sense)

A single-stranded RNA virus genome that contains genetic information encoded in both the positive (i.e., virus-sense) and negative (i.e., complementary) orientations on the same strand of RNA (e.g., *Bunyaviridae* and *Arenaviridae*; see Chapter 3).

**anergy**  
(an-er-gee)

An immunologically unresponsive state in which lymphocytes are present but not functionally active.

**apoptosis**  
(ape-oh-toe-sis)

The genetically programmed death of certain cells that occurs during various stages in the development of multicellular organisms and may also be involved in control of the immune response.

**assembly**  
(ass-embly)

A late phase of viral replication during which all the components necessary for the formation of a mature virion collect at a particular site in the cell and the basic structure of the virus particle is formed (see Chapter 4).

**attachment**  
(a-tatch-ment)

The initial interaction between a virus particle and a cellular receptor molecule; the phase of viral replication during which this occurs (see Chapter 4).

**attenuated**  
(at-ten-u-ated)

A pathogenic agent that has been genetically altered and displays decreased virulence; attenuated viruses are the basis of live virus vaccines (see Chapter 6).

**autocrine**  
(auto-krine)

The production by a cell of a growth factor that is required for its own growth; such positive feedback mechanisms may result in cellular transformation (see Chapter 7).

**avirulent**  
(a-vir-u-lent)

An infectious agent that has *no* disease-causing potential. It is doubtful that such agents really exist, because even the most innocuous organisms may cause disease in certain circumstances (e.g., in immunocompromised hosts).

**bacteriophage**  
(back-teer-ee-o-fage)

A virus that replicates in a bacterial host cell.

**bp**  
(base pair)

Base pair: a single pair of nucleotide residues in a double-stranded nucleic acid molecule held together by Watson–Crick hydrogen bonds (see **kbp**).

**budding**  
(bud-ding)

A mechanism involving release of a virus particle from an infected cell by extrusion through a membrane. The site of budding may be at the surface of the cell or may involve the cytoplasmic or nuclear membranes, depending on the site of assembly. Virus **envelopes** are acquired during budding.

**capsid**  
(cap-sid)

The protective protein coat of a virus particle (see Chapter 2).

**chromatin**  
(cro-mat-in)

The ordered complex of DNA plus proteins (histones and nonhistone chromosomal proteins) found in the nucleus of **eukaryotic** cells.

**cis-acting**  
(sis-acting)

A genetic element that affects the activity of contiguous (i.e., on the same nucleic acid molecule) genetic regions; for example, transcriptional promoters and enhancers are *cis*-acting sequences adjacent to the genes whose transcription they control.

**complementation**  
(comp-lee-men-tay-shon)

The interaction of virus gene products in infected cells that results in the yield of one or both of the parental mutants being enhanced while their genotypes remain unchanged.

**conditional lethal mutant**  
(con-dish-on-al lee-thal mu-tant)

A conditional mutation whose phenotype is (relatively) unaffected under permissive conditions, but is severely inhibitory under nonpermissive conditions.

**conditional mutant**  
(con-dish-on-al mu-tant)

A mutant phenotype that is replication competent under permissive conditions but not under restrictive or nonpermissive conditions; for example, a virus with a temperature-sensitive (t.s.) mutation may be able to replicate at the permissive temperature of 33°C but unable to replicate or severely inhibited at the nonpermissive temperature of 38°C.

**cytopathic effect (c.p.e.)**  
(sy-toe-path-ik ee-fect)

Cellular injury caused by virus infection; the effects of virus infection on cultured cells, visible by microscopic or direct visual examination (see Chapter 7).

**defective interfering (D.I.) particles**  
(dee-fect-ive inter-feer-ing part-ik-els)

Particles encoded by genetically deleted virus genomes that lack one or more essential functions for replication.

**ds**  
(double stranded)

Double-stranded (nucleic acid).

**eclipse period**  
(ee-clips peer-ee-od)

An early phase of infection when virus particles have broken down after penetrating cells, releasing their genomes within the host cell as a prerequisite to replication; often used to refer specifically to bacteriophages (see Chapter 4).

**emergent virus**  
(ee-merge-ent vy-rus)

A virus identified as the cause of an increasing incidence of disease, possibly as a result of changed environmental or social factors (see Chapter 7).

**endemic**  
(en-dem-ik)

A pattern of disease that recurs or is commonly found in a particular geographic area (cf. **epidemic**).

**enhancer**  
(en-han-ser)

*cis*-acting genetic elements that potentiate the transcription of genes or translation of mRNAs.

**envelope**  
(en-vel-ope)

An outer (bounding) lipoprotein bilayer membrane possessed by many viruses. (*Note:* Some viruses contain lipid as part of a complex outer layer, but these are not usually regarded as enveloped unless a bilayer unit membrane structure is clearly demonstrable.)

**epidemic**  
(epy-dem-ik)

A pattern of disease characterized by a rapid increase in the number of cases occurring and widespread geographical distribution (cf. **endemic**); an epidemic that encompasses the entire world is known as a **pandemic**.

**eukaryote/eukaryotic**  
(u-kary-ote)

An organism whose genetic material is separated from the cytoplasm by a nuclear membrane and divided into discrete chromosomes.

**exon**  
(x-on)

A region of a gene expressed as protein after the removal of **introns** by posttranscriptional splicing.

**fusion protein**

(few-shon pro-teen)

A virus protein required and responsible for fusion of the virus **envelope** (or sometimes, the **capsid**) with a cellular membrane and, consequently, for entry into the cell (see Chapter 4).

**genome**

(gee-nome or gen-ome)

The nucleic acid comprising the entire genetic information of an organism.

**helix**

(hee-licks)

A cylindrical solid formed by stacking repeated subunits in a constant relationship with respect to their amplitude and pitch (see Chapter 2). (**Helical**: Shaped like a helix.)

**hemagglutination**

(hay-ma-glut-in-nation)

The (specific) agglutination of red blood cells by a virus or other protein.

**heterozygosis**

(het-er-o-zy-go-sis)

Aberrant packaging of multiple genomes may on occasion result in multiploid particles (i.e., containing more than a single genome), which are therefore heterozygous.

**hnRNA**

(heavy nuclear RNA)

Heterogeneous nuclear RNA or heavy nuclear RNA—the primary, unspliced transcripts found in the nucleus of eukaryotic cells.

**hyperplasia**

(hyper-play-see-a)

Excessive cell division or the growth of abnormally large cells; in plants, results in the production of swollen or distorted areas due to the effects of plant viruses.

**hypoplasia**

(high-po-play-see-a)

Localized retardation of cell growth. Numerous plant viruses cause this effect, frequently leading to **mosaicism** (the appearance of thinner, yellow areas on the leaves).

**icosahedron**

(eye-cos-a-heed-ron)

A solid shape consisting of 20 triangular faces arranged around the surface of a sphere; the basic symmetry of many virus particles (see Chapter 2). (**Icosahedral**: Shaped like an icosahedron.)

**immortalized cell**

(im-mort-al-ized sell)

A cell capable of indefinite growth (i.e., number of cell divisions) in culture. On rare occasions, immortalized cells arise spontaneously but are more commonly caused by mutagenesis as a result of virus **transformation** (see Chapter 7).

**inclusion bodies**

(in-klusion bod-ees)

Subcellular structures formed as a result of virus infection; often a site of virus assembly (see Chapter 4).

**intron**

(in-tron)

A region of a gene removed after transcription by splicing and consequently not expressed as protein (cf. **exon**).

**IRES (internal ribosome entry site)**

(eye-res)

An RNA secondary structure found in the 5' untranslated region (UTR) of (+)sense RNA viruses such as picornaviruses and flaviviruses, which functions as a ribosome landing pad, allowing internal initiation of translation on the vRNA.

<b>isometric</b> (eye-so-met-rik)	A solid displaying <b>cubic</b> symmetry, of which the icosahedron is one form.
<b>kb</b> (kilobase)	1000 nucleotide residues—a unit of measurement of single-stranded nucleic acid molecules; sometimes (wrongly) used to mean <b>kbp</b> .
<b>kbp</b> (kilobase pair)	1000 base pairs (see <b>kb</b> )—a unit of measurement of double-stranded nucleic acid molecules.
<b>latent period</b> (lay-tent peer-ee-od)	The time after infection before the first new extracellular virus particles appear (see Chapter 4).
<b>lysogeny</b> (lie-soj-en-ee)	Persistent, latent infection of bacteria by <b>temperate bacteriophages</b> such as phage $\lambda$ .
<b>lytic virus</b> (lit-ik vy-rus)	Any virus (or virus infection) that results in the death of infected cells and their physical breakdown.
<b>maturation</b> (mat-yoor-ay-shon)	A late phase of virus infection during which newly formed virus particles become infectious; usually involves structural changes in the particle resulting from specific cleavages of capsid proteins to form the mature products, or conformational changes in proteins during assembly (see Chapter 4).
<b>monocistronic</b> (mono-sis-tron-ik)	A messenger RNA that consists of the transcript of a single gene and which therefore encodes a single polypeptide; a virus genome that produces such an mRNA (cf. <b>polycistronic</b> ).
<b>monolayer</b> (mono-layer)	A flat, contiguous sheet of adherent cells attached to the solid surface of a culture vessel.
<b>mosaicism</b> (mo-say-iss-cis-em)	The appearance of thinner, yellow areas on the leaves of plants caused by the cytopathic effects of plant viruses.
<b>movement protein</b> (move-ment pro-teen)	Specialized proteins encoded by plant viruses that modify plasmodesmata (channels that pass through cell walls connecting the cytoplasm of adjacent cells) and cause virus nucleic acids to be transported from one cell to the next, permitting the spread of a virus infection.
<b>mRNA</b> (messenger RNA)	Messenger RNA.
<b>multiplicity of infection (m.o.i.)</b> (multi-pliss-itly of in-fect-shon)	The (average) number of virus particles that infect each cell in an experiment.
<b>necrosis</b> (neck-ro-sis)	Cell death, particularly that caused by an external influence (cf. <b>apoptosis</b> ).

**negative-sense**

(neg-at-iv sense)

**nonpropagative**

(non-prop-a-gate-iv)

**nt**

(nucleotide)

**nucleocapsid**

(new-clip-cap-sid)

**oncogene**

(on-co-gene)

**ORF**

(open reading frame)

**packaging signal**

(pack-a-jing sig-nal)

**pandemic**

(pan-dem-ik)

**penetration**

(pen-ee-tray-shon)

**phage**

(fage)

**phenotypic mixing**

(fee-no-tip-ik mix-ing)

**plaque**

(plak)

**plaque-forming units**

**(p.f.u.)**

(plak forming units)

**plasmid**

(plas-mid)

The nucleic acid strand with a base sequence complementary to the strand that contains the protein-coding sequence of nucleotide triplets or a virus whose genome consists of a negative-sense strand. (Also minus-sense or (−)sense.)

A term describing the transmission via secondary hosts (such as arthropods) of viruses that do not replicate in the vector organism (e.g., geminiviruses). Also known as noncirculative transmission (i.e., the virus does not circulate in the vector population).

A single nucleotide residue in a nucleic acid molecule.

An ordered complex of proteins plus the nucleic acid genome of a virus.

A gene that encodes a protein capable of inducing cellular **transformation**.

Open reading frame—a region of a gene or mRNA that encodes a polypeptide, bounded by an AUG translation start codon at the 5' end and a termination codon at the 3' end. Not to be confused with the poxvirus called orf.

A region of a virus genome with a particular nucleotide sequence or structure that specifically interacts with a virus protein(s) resulting in the incorporation of the genome into a virus particle.

An **epidemic** that encompasses the entire world.

The phase of virus replication at which the virus particle or genome enters the host cell (see Chapter 4).

See **bacteriophage**.

Individual progeny viruses from a mixed infection that contain structural proteins derived from both parental viruses.

A localized region in a cell sheet or overlay in which cells have been destroyed or their growth retarded by virus infection.

A measure of the amount of viable virus present in a virus preparation; includes both free virus particles and infected cells containing infectious particles (infectious centers).

An extrachromosomal genetic element capable of autonomous replication.

<b>polycistronic</b> (poly-sis-tron-ik)	A messenger RNA that encodes more than one polypeptide (cf. <b>monocistronic</b> ).
<b>polyprotein</b> (poly-pro-teen)	A large protein that is posttranscriptionally cleaved by proteases to form a series of smaller proteins with differing functions.
<b>positive-sense</b> (pos-it-iv sense)	The nucleic acid strand with a base sequence that contains the protein-coding sequence of nucleotide triplets or a virus whose genome consists of a positive-sense strand. (Also plus-sense or (+)sense.)
<b>primary cell</b> (pri-mary sell)	A cultured cell explanted from an organism that is capable of only a limited number of divisions (cf. <b>immortalized cell</b> ).
<b>prion</b> (pree-on)	A proteinaceous infectious particle, believed to be responsible for transmissible spongiform encephalopathies such as Creutzfeldt–Jakob disease (CJD) or bovine spongiform encephalopathy (BSE; see Chapter 8).
<b>productive infection</b> (pro-duct-iv in-fect-shon)	A complete virus infection in which further infectious particles are produced (cf. <b>abortive infection</b> ).
<b>prokaryote</b> (pro-kary-ote)	An organism whose genetic material is not separated from the cytoplasm of the cell by a nuclear membrane.
<b>promoter</b> (pro-mote-er)	A <b>cis-acting</b> regulatory region upstream of the coding region of a gene that promotes transcription by facilitating the assembly of proteins in transcriptional complexes.
<b>propagative transmission</b> (prop-a-gate-iv trans-mish-on)	A term describing the transmission via secondary hosts (such as arthropods) of viruses that are able to replicate in both the primary host and the vector responsible for their transmission (e.g., plant reoviruses). Also known as circulative transmission (i.e., the virus circulates in the vector population).
<b>prophage</b> (pro-fage)	The lysogenic form of a temperate bacteriophage genome integrated into the genome of the host bacterium.
<b>proteome</b> (pro-tee-ome)	The total set of proteins expressed in a cell at a given time.
<b>provirus</b> (pro-vy-rus)	The double-stranded DNA form of a retrovirus genome integrated into the <b>chromatin</b> of the host cell.
<b>pseudoknot</b> (s'yoo-doh-not)	An RNA secondary structure that causes frame-shifting during translation, producing a hybrid peptide containing information from an alternative reading frame.
<b>pseudorevertant</b> (s'yoo-doh-re-vert-ant)	A virus with an apparently wild-type phenotype but which still contains a mutant genome—may be the result of genetic <b>suppression</b> .

- pseudotyping**  
(sue-do-type-ing)  
Where the genome of one virus is completely enclosed within the capsid or, more usually, the envelope of another virus. An extreme form of **phenotypic mixing**.
- quasi-equivalence**  
(kwayz-eye-ee-kwiv-al-ense)  
A principle describing a means of forming a regular solid from irregularly shaped subunits in which subunits in *nearly* the same local environment form *nearly* equivalent bonds with their neighbors (see Chapter 2).
- quasispecies**  
(kwayz-eye-spee-sees)  
A complex mixture of rapidly evolving and competing molecular variants of RNA virus genomes that occurs in most populations of RNA viruses.
- receptor**  
(ree-sep-tor)  
A specific molecule on the surface of a cell to which a virus attaches as a preliminary to entering the cell. May consist of proteins or the sugar residues present on glycoproteins or glycolipids in the cell membrane (see Chapter 4).
- recombination**  
(ree-com-bin-nation)  
The physical interaction of virus genomes in a **superinfected** cell resulting in progeny genomes that contain information in nonparental combinations.
- release**  
(ree-lease)  
A late phase of virus infection during which newly formed virus particles leave the cell (see Chapter 4).
- replicase**  
(rep-lick-aze)  
An enzyme responsible for replication of RNA virus genomes (see **transcriptase**).
- replicon**  
(rep-lick-on)  
A nucleic acid molecule containing the information necessary for its own replication; includes both **genomes** and other molecules such as **plasmids** and **satellites**.
- retrotransposon**  
(ret-tro-trans-pose-on)  
A transposable genetic element closely resembling a retrovirus genome, bounded by long terminal repeats (see Chapter 3).
- RNAi (RNA interference)**  
(ar-en-ay-eye)  
A system in cells that helps to control the activity of genes by means of small RNAs that bind to other RNAs and either increase or decrease their activity.
- satellites**  
(sat-el-ites)  
Small RNA molecules (500–2000 nt) that are dependent on the presence of a helper virus for replication but, unlike defective viruses, show no sequence homology to the helper virus genome. Larger satellite RNAs may encode a protein (cf. **viroids**, **virusoids**).
- shutoff**  
(shut-off)  
A sudden and dramatic cessation of most host-cell macromolecular synthesis that occurs during some virus infections, resulting in cell damage and/or death (see Chapter 7).



<b>splicing</b> (sp-lice-ing)	Posttranscriptional modification of primary RNA transcripts that occurs in the nucleus of <b>eukaryotic</b> cells during which <b>introns</b> are removed and <b>exons</b> are joined together to produce cytoplasmic <b>mRNAs</b> .
<b>superinfection</b> (super-infect-shon)	Infection of a single cell by more than one virus particle, especially two viruses of distinct types, <i>or</i> deliberate infection of a cell designed to rescue a mutant virus.
<b>suppression</b> (sup-press-shon)	The inhibition of a mutant phenotype by a second suppressor mutation, which may be either in the virus genome or in that of the host cell (see Chapter 3).
<b>syncytium</b> (sin-sit-ee-um)	A mass of cytoplasm containing several separate nuclei enclosed in a continuous membrane resulting from the fusion of individual cells. Plural: syncytia.
<b>systemic infection</b> (sis-tem-ik infect-shon)	An infection involving multiple parts of a multicellular organism.
<b>temperate bacteriophage</b> (temper-ate bac-teer-ee-o-fage)	A bacteriophage capable of establishing a <b>lysogenic</b> infection (cf. virulent bacteriophage, a bacteriophage that is not capable of establishing a lysogenic infection and always kills the bacteria in which it replicates).
<b>terminal redundancy</b> (ter-minal ree-dun-dance-ee)	Repeated sequences present at the ends of a nucleic acid molecule.
<b>titre (titer)</b> (tight-er <i>or</i> teet-er)	A relative measure of the amount of a substance (e.g., virus or antibody) present in a preparation.
<b>trans-acting</b> (trans-acting)	A genetic element encoding a diffusible product that acts on regulatory sites whether or not these are contiguous with the site from which they are produced, for example, proteins that bind to specific sequences on any stretch of nucleic acid present in a cell, such as transcription factors (cf. <b>cis-acting</b> ).
<b>transcriptase</b> (trans-crypt-aze)	An enzyme, usually packaged into virus particles, responsible for the transcription of RNA virus genomes (see <b>replicase</b> ).
<b>transfection</b> (trans-fect-shon)	Infection of cells mediated by the introduction of nucleic acid rather than by virus particles.
<b>transformation</b> (trans-form-ay-shon)	Any change in the morphological, biochemical, or growth parameters of a cell.
<b>transgenic</b> (trans-gene-ik <i>or</i> trans-gen-ik)	A genetically manipulated eukaryotic organism (animal or plant) that contains additional genetic information from another species. The additional genes may be carried and/or expressed only in the somatic cells of the transgenic organism or in the cells of the germ line, in which case they may be inheritable by any offspring.

**transposons**

(trans-pose-ons)

Specific DNA sequences that are able to move from one position in the genome of an organism to another (see Chapter 3).

**triangulation number**

(tri-ang-u-lay-shon  
num-ber)

A numerical factor that defines the symmetry of an icosahedral solid (see Chapter 2).

**tropism**

(trope-ism)

The types of tissues or host cells in which a virus is able to replicate.

**uncoating**

(un-coat-ing)

A general term for the events that occur after the penetration of a host cell by a virus particle during which the virus capsid is completely or partially removed and the genome is exposed, usually in the form of a nucleoprotein complex (see Chapter 4).

**vaccination**

(vax-sin-ay-shon)

The administration of a **vaccine**.

**vaccine**

(vax-seen)

A preparation containing an antigenic molecule or mixture of such molecules designed to elicit an immune response. Virus vaccines can be divided into three basic types: subunit, inactivated, and live vaccines (see Chapter 6).

**variolation**

(var-ee-o-lay-shon)

The ancient practice of inoculating immunologically naive individuals with material obtained from smallpox patients—a primitive form of vaccination (see Chapter 1).

**virion**

(vir-ee-on)

Morphologically complete (mature) infectious virus particle.

**viroid**

(vy-royd)

Autonomously replicating plant pathogens consisting solely of unencapsidated, single-stranded, circular (rod-like) RNAs of 200 to 400 nucleotides. Viroids do not encode any protein products. Some viroid RNAs have ribozyme activity (self-cleavage; cf. **satellites**, **virusoids**).

**virus-attachment protein**

(vy-r-us at-tatch-ment  
pro-teen)

A virus protein responsible for the interaction of a virus particle with a specific cellular receptor molecule.

**virusoids**

(vy-rus-oyds)

Small satellite RNAs with a circular, highly base-paired structure similar to that of a viroid; depend on a host virus for replication and encapsidation but do not encode any proteins. All virusoid RNAs studied so far have ribozyme activity (cf. **satellites**, **viroids**).

**zoonosis**

(zoo-no-sis)

Infection transmitted from an animal to a human. Plural: zoonoses.