

Abbreviations used in this book

(+) DNA	plus strand (positive strand) DNA
(-) DNA	minus strand (negative strand) DNA
(+) RNA	plus strand (positive strand) RNA
(-) RNA	minus strand (negative strand) RNA
A	adenine
ADP	adenosine diphosphate
AIDS	acquired immune deficiency syndrome
AP-1	activator protein 1
ATP	adenosine triphosphate
b	base(s)
BL	Burkitt's lymphoma
bp	base pair(s)
BSE	bovine spongiform encephalitis
C	cytosine
C terminus	carboxy terminus
cccDNA	covalently closed circular DNA
CD	cluster of differentiation
cDNA	copy DNA
CJD	Creutzfeldt-Jakob disease
cos	cohesive end
CP	coat protein
CPE	cytopathic effect
DIP	defective interfering particle
DNA	deoxyribose nucleic acid
ds	double-stranded
DTR	direct terminal repeat
E	early
EBV	Epstein-Barr virus
EF	elongation factor

ELISA	enzyme-linked immunosorbent assay
ERV	endogenous retrovirus
<i>E. coli</i>	<i>Escherichia coli</i>
Ff	F-specific filamentous
G	guanine
GFP	green fluorescent protein
HAV	hepatitis A virus
HBV	hepatitis B virus
HBsAg	hepatitis B surface antigen
HCV	hepatitis C virus
HIV	human immunodeficiency virus
HPV	human papillomavirus
HSV	herpes simplex virus
HTLV-1	human T-lymphotropic virus 1
IC ₅₀	50% inhibitory concentration
ICTV	International Committee on Taxonomy of Viruses
ICTVdB	International Committee on Taxonomy of Viruses database
IE	immediate early
IG	intergenic
IRES	internal ribosome entry site
ITR	inverted terminal repeat
kb	kilobase(s)
kbp	kilobase pair(s)
kD	kiloDalton(s)
KSHV	Kaposi's sarcoma-associated herpesvirus
LDI	long distance interaction
LE	left end
LIN	lysis inhibition
LPS	lipopolysaccharide
LTR	long terminal repeat
Mbp	megabase pair(s)
MHC	major histocompatibility complex
MJ	Min Jou
m.o.i.	multiplicity of infection
MP	movement protein
mRNA	messenger RNA
N terminus	amino terminus
NF- κ B	nuclear factor kappa B
NK cell	natural killer cell

nm	nanometre(s) (10^{-9} metre)
NPC	nasopharyngeal carcinoma
NSP	non-structural protein
O	operator
ORF	open reading frame
<i>ori</i>	origin (replication)
P	promoter
PBS	primer binding site
PCR	polymerase chain reaction
pfu	plaque-forming unit
phage	bacteriophage
PS	packaging signal
RBS	ribosome binding site
RE	right end
RF	replicative form
RI	replicative intermediate
RNA	ribose nucleic acid
RNAi	RNA interference
RNase H	ribonuclease H
rRNA	ribosomal RNA
RT-PCR	reverse transcriptase–polymerase chain reaction
S	Svedberg unit
SARS	severe acute respiratory syndrome
S-D	Shine–Dalgarno
SI	selectivity index
SIV	simian immunodeficiency virus
Sp1	stimulatory protein 1
ss	single-stranded
ssb	single-stranded binding
T	thymine
TCID ₅₀	virus dose that infects 50% of tissue cultures
TK	thymidine kinase
tRNA	transfer RNA
TSE	transmissible spongiform encephalitis
U	uracil
UV	ultra-violet
vCJD	variant Creutzfeldt-Jakob disease
VP	virus protein
VPg	virus protein, genome linked
VSV	vesicular stomatitis virus

Virologists' vocabulary

Brief definitions of terms used in virology, plus a selection of relevant terms from cell biology, molecular biology, immunology and medicine.

Abortive infection	Infection of a cell where the virus replication cycle is not completed and no progeny virions are formed.
Ambisense genome	A virus genome composed of ssRNA or ssDNA that is partly plus sense and partly minus sense.
Antibody	A glycoprotein synthesized in a plasma cell, which is derived from a B cell that has interacted with a specific antigen. The antibody molecule can bind specifically to this antigen.
Antigen	A molecule that (a) triggers synthesis of antibody and/or a T cell response; (b) binds specifically to an antibody or a lymphocyte receptor.
Antiserum (plural antisera)	Blood serum from an animal that has been injected with an antigen. The serum contains antibodies specific to that antigen.
Anti-termination	A mechanism involved in the control of transcription in which termination is overcome at specific terminator sites. Anti-terminator proteins allow RNA polymerase to read through these sites into genes downstream.
Apoptosis	Programmed cell death. Cell suicide. A process controlled by a cell that results in the death of the cell.
Archaea	One of two major groups of prokaryotes, the other being the bacteria.
Assembly	The stage in the virus replication cycle when components come together to form virions.
Asymptomatic infection	An infection without symptoms or signs of disease.
Attachment	Binding of a virion to specific receptors on the host cell.
Attenuated strain of a virus	A strain of a pathogenic virus that has much reduced virulence, but can still replicate in its host. The virulence is said to have been attenuated.
Avirulent strain of a virus	A strain of a virus that lacks virulence, but can still replicate in its host.

B lymphocyte (B cell)	A cell with surface receptors that can recognize a specific antigen. Antigen binding can trigger a B cell to develop into an antibody-secreting plasma cell.
Bacteriophage (phage)	A type of virus that infects bacteria.
Baltimore classification	A scheme that classifies viruses into seven groups on the basis of the nature of the genome and the way in which it is transcribed.
Bicistronic mRNA	An mRNA with two open reading frames.
Bronchiolitis	Inflammation of the bronchioles.
Burst size	The average number of new virions released from a single infected cell.
Cap	A methylated guanosine triphosphate joined to the 5' end of an mRNA by a 5'-5' bond.
Capsid	The protein coat that encloses the nucleic acid of a virus.
Capsomere	A discrete component of a capsid, constructed from several identical protein molecules.
CD (cluster of differentiation)	CD antigens are cell surface molecules recognized by monoclonal antibodies. CD4 is the receptor for HIV.
Chemokine	A cytokine that stimulates the migration and activation of cells in the animal body, especially cells involved in inflammation.
Cirrhosis	Liver disease characterized by scarring and loss of function.
Cohesive end (<i>cos</i>)	A single-stranded end of a dsDNA molecule with a base sequence complementary to another single-stranded end of the same or a different DNA molecule, allowing hydrogen bonding between the two ends.
Coliphage	A bacteriophage that infects <i>E. coli</i> .
Complement	A series of proteins that is activated when the body is infected. Activation has a number of anti-viral effects, including lysis of infected cells and enhancement of phagocytosis.
Concatemer	A very long DNA molecule composed of multiple repeats of a nucleotide sequence.
Conditional lethal mutant	A mutant virus that expresses wild-type characteristics under certain (permissive) conditions, but mutant (lethal) characteristics under other (non-permissive/restrictive) conditions, e.g. a temperature-sensitive mutant.
Confocal microscopy	The use of a microscope that excludes light from out-of-focus regions of the specimen, producing clear images of thick and fluorescently labelled specimens.
Conservative replication	The replication mode of some dsRNAs. The parental double strand is conserved and both strands of the progeny molecule are newly synthesized.
Continuous cell line	A clone of cells that is immortal and can be subcultured indefinitely.

Co-receptor	A second cell receptor to which some viruses must bind in order to infect a cell.
Cryo-electron microscopy	Examination of frozen specimens in an electron microscope with a cold stage.
Cytokine	A protein that is secreted from a cell and has a specific effect on other cells, including cells of the immune system.
Cytopathic effect (CPE)	Change in the appearance of a cell culture induced by virus infection.
Defective interfering particle	A virus that lacks part of its genome and interferes with the replication of standard virus.
Defective virus	A virus that lacks part of its genome and is unable to complete the replication cycle without the aid of a helper virus.
Diploid	Having two copies of the genome.
DNA-dependent RNA polymerase	An enzyme that synthesizes RNA from a DNA template.
Domain	A discrete portion of a protein or a nucleic acid with its own structure and function.
Elongation factor (EF)	A specific protein required for polypeptide elongation during translation.
Encephalitis	Inflammation of the brain.
Endemic	Describes a disease that is constantly present or commonly present in a geographical area.
Endocytosis	A process whereby eukaryotic cells take in extracellular materials by engulfing them in endosomes.
Endogenous retroviruses	Retrovirus sequences present in the genomes of vertebrate animals.
Endosome	A vesicle formed during endocytosis by membrane pinching off from the plasma membrane.
Enhancer	A short DNA sequence that can increase the frequency of transcription initiation.
Envelope	A lipid bilayer and associated protein forming the outer component of an enveloped virion.
Enzyme-linked immunosorbent assay (ELISA)	A serological method used to assay antigens and antibodies. Positive results detect an enzyme label.
Epidemic	A rapid increase in the number of cases of a disease that spreads over a larger geographical area.
Epitope	The part of an antigen that binds to an antibody or a lymphocyte receptor.
<i>Escherichia coli</i> (<i>E. coli</i>)	Gram-negative bacterium that inhabits the human colon.
Exogenous retrovirus	A normal infectious retrovirus, cf. endogenous retrovirus.

Exon	Part of a eukaryotic gene that is transcribed and usually translated into protein.
Exonuclease	An enzyme that digests a DNA or RNA strand one nucleotide at a time from either the 5' end or the 3' end.
F pilus	A specialized pilus, encoded by the F plasmid, required for conjugation in <i>E. coli</i> .
Fluorescence microscopy	The use of a microscope fitted with an appropriate source of light, e.g. an arc lamp or a laser, to examine fluorescent specimens.
Fusion protein	(a) A virus protein that fuses the membrane of an enveloped virus with a cell membrane. (b) A protein generated by joining two genes together e.g. a foreign protein fused to a coat protein in phage display.
Genome	The DNA or RNA that encodes the genes of an organism or a virus.
Genotype	The complete set of genes of an organism or a virus.
Glycoprotein	A protein with one or more oligosaccharide groups covalently attached.
Glycosylation	The process of adding oligosaccharide groups to proteins.
Golgi complex	A membranous organelle found in most eukaryotic cells. Its primary function is to process and sort proteins.
Green fluorescent protein (GFP)	A jellyfish protein that fluoresces green. The GFP gene can be fused to a gene of interest, producing a 'tagged' fusion protein, and the localization or movement of the protein in living cells can be visualized. The GFP gene can also be used to monitor the expression of a gene of interest in living cells; the control sequences for the gene of interest are linked to the GFP gene.
Guanylyl transferase	An enzyme that adds guanosine 5'-monophosphate to the 5' end of mRNA when it is capped.
Hairpin	A structure formed by hydrogen bonding within a single-stranded nucleic acid molecule, producing a double-stranded stem and a loop of unpaired nucleotides.
Helical symmetry	A type of capsid symmetry present in many ssRNA viruses where the RNA forms a helix that is coated with protein.
Helicase	An enzyme that unwinds a DNA duplex at replication forks.
Helper virus	A virus that can provide function(s) missing from a defective virus, thereby enabling the latter to complete its replication cycle.
Hepatocyte	The main cell type in the liver.
Heteroploid cell	A cell with an abnormal number of chromosomes.
Hexon	A type of capsomere surrounded by six other capsomeres.
Histones	Proteins comprised mainly of basic amino acids, associated with DNA in the cells of eukaryotes and some archaea. Histones play roles in gene regulation.

Horizontal gene transfer	Transfer of genetic material laterally from one organism to another, mediated in bacteria by conjugation, transduction and transformation.
Host	A cell or an organism in which a virus or a plasmid can replicate.
Host-controlled restriction	A mechanism by which bacteria can cleave unmodified foreign DNA by a restriction endonuclease that recognizes a specific nucleotide sequence.
Icosahedral symmetry	A type of symmetry present in viruses where the capsid is constructed from protein molecules arranged to form 20 triangular faces.
Immunofluorescence	The detection of an antigen using an antibody labelled with a fluorescent dye.
Immunogenic	The ability of a substance to induce an immune response.
Immunoglobulin	A glycoprotein that functions as an antibody.
Incubation period	The time between infection of a host and the appearance of the first signs and/or symptoms of disease.
Induction	Activation of a latent infection or an inactive gene.
Infectivity	The ability of virions to initiate an infection.
Integral membrane protein	A protein that is closely associated with a membrane. Most integral membrane proteins have one or more sequences that span the lipid bilayer.
Integrase	An enzyme that integrates virus DNA into host DNA.
Interferon	Protein produced by animal cells in response to virus infection. There are several types of interferon and they interfere with virus replication in a variety of ways.
Intergenic (IG) region	A sequence of nucleotides between two genes.
Internal ribosome entry site (IRES)	A binding site for eukaryotic ribosomes, present in the RNAs of some plus-strand viruses. The site is internal (near the 5' end of the RNA), in contrast to most eukaryotic mRNAs, which bind ribosomes at the 5' end.
Intron	A non-coding sequence interrupting coding sequences (exons) in a gene. The intron is transcribed into RNA, but is subsequently excised by a splicing reaction during processing of the primary transcript into mRNA. Introns are common in eukaryotes and their viruses, but rare in prokaryotes and their viruses.
Isometric virion	A virion that has the same size from all perspectives. Virions that have icosahedral symmetry are isometric or almost isometric.
Kilobase (kb)	A measure of length for DNA and RNA equal to 1000 bases.
Kinase	An enzyme that catalyses phosphorylation.
Laboratory strain	A virus strain derived from a wild strain after propagation in the laboratory.

Latent infection	Infection of a cell where the replication cycle is not completed, but the virus genome is maintained in the cell.
Ligase	An enzyme that can catalyse bond formation between two similar types of molecule. A DNA ligase can join two DNA molecules by catalysing the formation of a phosphodiester bond between the 5' end of a polynucleotide chain and the 3' end of another (or the same) polynucleotide chain.
Ligation	The joining of two molecules, e.g. DNA.
Lipopolysaccharide (LPS)	A compound comprising lipid and polysaccharide that is a key component of the outer membrane of Gram-negative bacteria.
Lysis	Destruction of a cell caused by the rupture of its membrane and release of contents, e.g. the bursting of a cell and release of progeny virions at the end of the replication cycle.
Lysogen	A bacterium containing the genome of a phage that is in the prophage state and thus repressed for lytic functions. Such a bacterium is said to be lysogenic for (name of the phage).
Lysogenic conversion (phage conversion)	When a cell becomes lysogenized, occasionally extra genes (unrelated to the lytic cycle or lysogeny) carried by the prophage are expressed in the host cell. These genes can change the phenotype of the host.
Lysogeny	Latent infection of a bacterial cell with a phage.
Lysosome	Membrane-bounded organelle in the cytoplasm of eukaryotic cells. Lysosomes contain enzymes, e.g. proteases and nucleases, that can digest virions.
Major histocompatibility complex (MHC)	A region of the vertebrate genome that encodes major histocompatibility proteins. MHC class I and class II molecules are cell surface proteins that play important roles in immune responses.
Meningitis	Inflammation of the meninges (membranes covering the brain and the spinal cord).
Meningoencephalitis	Inflammation of the meninges and the brain.
Methyl transferase	An enzyme that catalyses the transfer of methyl groups from one molecule to another. Methyl transferases play a role in capping eukaryotic mRNA.
Microarray	A substrate with an orderly array of small spots of material (e.g. DNA or protein) attached. Each spot contains a specific probe that can detect specific target molecules in a sample.
Microtubule	Protein structure in eukaryotic cells, forming a component of the cytoskeleton, with roles in intracellular transport and mitosis.
Minus strand (negative strand, (-) strand)	A nucleic acid strand that has the nucleotide sequence complementary to that of the mRNA.
Monocistronic mRNA	An mRNA with one open reading frame.
Monoclonal antibody	A single type of antibody produced by a clone of identical cells.
Monolayer	A layer of cells growing on the surface of a plastic or glass vessel.
Multiplicity of infection (m.o.i.)	The ratio of virions to cells in a virion–cell mixture.

Mutation	An alteration in the sequence of DNA or RNA. Mutations may occur spontaneously or they may be induced.
Myristylation (myristoylation)	The addition of a myristyl (myristoyl) group to a molecule.
Naked virus	A virus that does not have an envelope on the virion.
Negative staining	The use of a compound containing a heavy metal to reveal the structure of specimens in a transmission electron microscope.
Neurone	The main type of cell in the nervous system.
Neurovirulence	A measure of the severity of nervous system disease that a virus (or any micro-organism) is capable of causing.
Neutralization	The inactivation of virus infectivity by reaction with specific antibody.
Non-structural protein	A virus protein that is not a component of the virion, but has one or more roles in the replication cycle.
Northern blotting	The transfer of RNA molecules to a membrane after gel electrophoresis. Specific RNAs can be detected on the membrane using probes.
Nuclear envelope	The structure, composed of two membranes, that separates the nucleus from the cytoplasm in a eukaryotic cell.
Nuclear localization signal	A positively charged sequence in a protein that directs the protein through nuclear pores into the nucleus of a cell.
Nuclear pore	A protein complex in the nuclear envelope of a eukaryotic cell through which materials are transported in and out of the nucleus.
Nucleic acid hybridization	The formation of double-stranded nucleic acids by base-pairing between complementary single strands.
Nucleocapsid	The virus genome enclosed in a protein capsid.
Nucleoside	A nitrogen base (purine or pyrimidine) joined to a sugar (ribose or deoxyribose).
Nucleotide	A nitrogen base (purine or pyrimidine) joined to a sugar, which is joined to one or more phosphate groups.
Okazaki fragment	A short fragment of DNA with the RNA primer attached, produced during discontinuous DNA synthesis. Okazaki fragments are joined by a DNA ligase to form the lagging strand.
Oncogene	A cell or virus gene, the expression of which can cause a cell to become transformed. This may lead to the development of a cancer.
Open reading frame (ORF)	A sequence of nucleotides, starting with an initiation codon and finishing with a termination codon, that encodes the amino acids of a protein.
Origin (<i>ori</i>)	A specific sequence of DNA at which replication is initiated.
Packaging signal (PS)	A nucleotide sequence in a virus genome that is recognized by a virus protein during virion assembly.
Pandemic	A disease outbreak throughout the world.

Pararetrovirus	A virus with a DNA genome that is replicated via RNA.
Passage	'Subculture' of a virus in cell culture or in an organism. 'Subculture' of a prion in an organism.
Penton	A type of capsomere surrounded by five other capsomeres.
Perforin	Protein present in CD8 T cells and NK cells. These cells can kill a virus-infected cell by releasing perforins, which form pores in the plasma membrane of the target cell.
Persistent infection	A long-term, possibly life-long, infection of a host. A persistent virus infection may be productive or latent.
Phage display	Display of recombinant proteins on the surface of a phage e.g. M13.
Phagemid	A cloning vector that combines features of a phage and plasmid replicon and can replicate in either mode. The vector carries a plasmid <i>ori</i> for replication in plasmid mode, and a filamentous phage <i>ori</i> , leading to production of single-stranded copies of the phagemid when the cell is infected with the relevant helper phage.
Phenotype	The observable characteristics of an organism or virus, determined by its genotype and environmental factors.
Phosphoprotein	A protein with one or more phosphate groups covalently attached.
Phosphorylation	The addition of one or more phosphate groups to a molecule.
Phylogenetic tree	A diagram showing evolutionary relationships between viruses or other organisms.
Pilin	The protein subunit that is polymerized into the pilus in bacteria.
Plaque	(a) An area of lysis in a layer of cells, usually initiated by a single virion infecting a cell, followed by the spread of infection to surrounding cells. (b) An aggregate of prion fibrils in the central nervous system of a human or animal with a transmissible spongiform encephalopathy.
Plaque-forming unit	The quantity of virus (often a single virion) that can initiate formation of one plaque.
Plaque-purified virus	A clone of virus derived from an individual plaque.
Plasma membrane	The membrane at the surface of a eukaryotic cell.
Plasmid	A self-replicating, extrachromosomal dsDNA molecule that is generally circular, though can be linear. Plasmids are common in prokaryotes and rare in eukaryotes. Artificial plasmids can be created to clone DNA sequences.
Plus strand (positive strand, (+) strand)	A nucleic acid strand that has the same sequence as the mRNA.
Poly(A) polymerase	An enzyme that adds adenylate residues to the 3' end of a eukaryotic mRNA.
Polyadenylation	The process of adding adenylate residues to the 3' end of a eukaryotic mRNA.
Polycistronic mRNA	An mRNA with more than one open reading frame.

Polymerase chain reaction (PCR)	An <i>in vitro</i> technique for amplifying specific DNA sequences.
Polyprotein	A large protein that is cleaved to form smaller functional proteins.
Post-translational modification	A modification to a protein after it has been translated. Examples: glycosylation, cleavage.
Primary transcript	An RNA molecule synthesized during transcription. Introns may be removed from the primary transcript to form functional RNAs.
Primase	An enzyme that synthesizes RNA primers for DNA synthesis.
Primer	A molecule (often RNA, sometimes DNA or protein) that provides a free –OH group at which a polymerase can initiate synthesis of DNA or RNA.
Primosome	A complex of proteins involved in the priming action that initiates DNA replication on ϕ X-type origins.
Probe	A specific sequence of DNA or RNA used to detect nucleic acids by hybridization. A probe may be labelled, e.g. with a fluorescent molecule, to enable detection and quantification of the hybrid.
Procapsid	A precursor of a capsid.
Processivity factor	A protein that increases the efficiency of DNA synthesis by enhancing the ability of a DNA polymerase to remain associated with, and to process along, its template.
Productive infection	Infection of a cell that results in the production of progeny virions.
Promoter	A specific DNA sequence, usually upstream of the transcription start point of a gene, to which DNA-dependent RNA polymerase binds to initiate transcription.
Proofreading	A mechanism for correcting errors in nucleic acid or protein synthesis.
Prophage	A phage genome that resides in a bacterial host in a latent state. The prophages of most phages are integrated into the bacterial genome, but some are not.
Protease	An enzyme that cleaves protein molecules by breaking peptide bonds.
Proto-oncogene	A cell gene that can become an oncogene (tumour gene) if activated or over-expressed.
Provirus	The dsDNA copy of a retrovirus genome RNA.
Pseudoknot	An ssRNA secondary structure with two loops, formed when a sequence in a loop base-pairs with a complementary sequence outside the loop.
Reading frame	The phase in which the nucleotides of a nucleic acid are read in triplets.
Reassortment	A category of recombination that may occur with those segmented genome viruses that have all the segments packaged in one virion. Reassortment occurs in a cell co-infected with two virus strains, and is the formation of progeny virions containing mixtures of genome segments from the two parental strains.
Receptor	A molecule on a cell surface to which a virus specifically attaches.

Recombinant	An organism or a virus with a new genome, produced as a result of recombination. May also be used to describe the genome of the organism or virus.
Recombination	A process of combining genetic sequences that results in the production of a new genome, derived from two parental genomes. For a cellular organism, recombination can take place between DNA molecules within a cell. For viruses, recombination may occur when a cell is co-infected with two related viruses.
Replicase	An RNA polymerase that replicates the genome of an RNA virus by synthesizing both (+) RNA and (–) RNA.
Replication cycle	The process whereby a virus is replicated. For most viruses the process starts with attachment to a host cell and this is followed by entry into the cell. The process ends with exit of progeny virions from the cell. Some authors use the terms 'infection cycle' and 'life cycle'.
Replicative intermediate	A structure formed during ssRNA replication, consisting of a template RNA associated with nascent RNAs of varying length. The nascent RNAs have the opposite polarity to the template RNA.
Restriction endonuclease	An enzyme, usually from a bacterium, that cuts dsDNA at a specific site.
Retrovirus	A member of the family <i>Retroviridae</i> , so named because these viruses carry out reverse transcription.
Reverse genetics	The generation of an RNA virus genome from a cloned copy DNA.
Reverse transcriptase	An enzyme that can synthesize DNA using (a) an RNA template and (b) a DNA template.
Reverse transcription	Synthesis of DNA from an RNA template.
Reverse transcription-polymerase chain reaction (RT-PCR)	An <i>in vitro</i> technique for amplifying the data in RNA sequences by first copying the RNA to DNA using a reverse transcriptase. The DNA is then amplified by a PCR.
Ribonuclease (RNase)	An enzyme that hydrolyses RNA.
Ribonuclease H (RNase H)	A ribonuclease that specifically digests the RNA in an RNA–DNA duplex.
Ribosomal frameshifting	A mechanism that allows a ribosome to read two overlapping open reading frames (ORF1 and ORF2) in an mRNA. A ribosome reading ORF 1 shifts into a different reading frame towards the end of the ORF. The ORF 1 stop codon is therefore not recognized and the ribosome now reads ORF 2 to produce an elongated version of the ORF 1 protein.
RNA-dependent RNA polymerase	An enzyme that synthesizes RNA from an RNA template.
RNA interference (RNAi, RNA silencing)	A process that interferes with the expression of a specific gene. The process is induced by a dsRNA and results in the destruction of mRNA that has the same sequence as the dsRNA.
RNA polymerase	An enzyme that synthesizes RNA.

RNA polymerase II	The eukaryotic cell enzyme that synthesizes mRNA.
Rough endoplasmic reticulum	A system of membranes and ribosomes in the cytoplasm of eukaryotic cells.
Satellite virus	A defective virus that depends on a helper virus to provide one or more functions.
Scaffolding protein	A protein that facilitates the assembly of a procapsid. The scaffolding protein is removed in the final stages of assembly and is therefore not present in the mature virion.
Segmented genome	A virus genome that is composed of two or more nucleic acid molecules.
Self-assembly	The ability of a biological structure, e.g. a virus particle, to form spontaneously from its component parts.
Semi-conservative replication	The replication mode of dsDNA and some dsRNAs in which the parental double strand is not conserved. Each progeny molecule consists of one parental strand and one newly synthesized strand.
Serology	The study of antigen–antibody reactions and their use in tests to detect specific antigens and antibodies.
Seropositive	A person or an animal is said to be seropositive for an antigen, e.g. a virus, if their blood contains antibodies specific for that antigen.
Serotype	A strain of a virus or micro-organism distinguished by its antigens.
Sex pilus	A thin protein appendage for bacterial mating.
Shine-Dalgarno (S-D) sequence	A purine-rich sequence in prokaryotic mRNA just upstream of the translation start. The sequence can base-pair with a sequence near the 3'-end of 16S ribosomal RNA and facilitates the initiation of protein synthesis.
Sigma (σ) factor	A subunit of bacterial RNA polymerase, responsible for the recognition of a specific promoter. Different sigma factors allow recognition of different promoter sequences.
Single-stranded binding (ssb) protein	A basic protein with a high affinity for ssDNA. Ssb protein protects ssDNA from nuclease attack and prevents it from re-annealing into dsDNA.
Southern blotting	The transfer of DNA molecules to a membrane after gel electrophoresis. Specific DNA can be detected on the membrane using probes.
Splicing	The process of removing introns from primary transcripts and joining the exons to form mRNA.
Start (initiation) codon	A codon on mRNA for initiation of protein synthesis: commonly AUG, less commonly GUG and rarely UUG.
Stop (termination) codon	A codon on mRNA for termination of protein synthesis: UAG, UAA or UGA. When a ribosome encounters a stop codon a termination factor interacts with the ribosome, causing polypeptide synthesis to stop and the ribosome to dissociate from the mRNA.

Structural protein	A protein that is a virion component.
Superinfection	Infection by a virus of a cell that is already infected (often as a latent infection) with that virus or a related virus.
Superinfection immunity (homoimmunity)	The immunity of a lysogen to superinfection by a phage with a similar regulatory mechanism.
Synchronous infection	Near simultaneous infection of all cells in a culture with a virus. This can be achieved by e.g. using a high multiplicity of infection, or by limiting the time of attachment then diluting the culture so that virions and cells are unlikely to make contact.
Syncytium (plural syncytia)	A multinucleated giant cell formed by the fusion of membranes of a number of individual cells. A number of viruses can cause the formation of syncytia when they infect cells.
T lymphocyte (T cell)	A cell with surface receptors that can recognize a specific antigen. Antigen binding can trigger a T cell to perform one of several roles, including helper T cell or cytotoxic T cell.
Tailed phage	A phage that has a tail attached to the head, which contains the genome.
TATA box	A DNA sequence in a eukaryotic promoter, typically 15–25 nucleotides upstream from the transcription start.
TCID₅₀	The dose of virus that infects 50 per cent of tissue cultures inoculated with aliquots of a virus preparation.
Tegument	A layer of protein and RNA between the capsid and the envelope of a herpesvirus particle.
Temperate phage	A phage capable of either establishing a lysogenic state in a susceptible bacterial host or of entering the lytic cycle.
Temperature-sensitive mutant	A virus mutant that is unable to replicate at some temperatures (non-permissive temperatures) at which the wild-type virus can replicate, but is able to replicate at other temperatures (permissive temperatures).
Titre	The concentration of virus, antibody or other material in a preparation, determined by titration.
Transcriptase	An enzyme that carries out transcription.
Transcription	Synthesis of RNA from a DNA or an RNA template.
Transcription factor	A protein that binds specifically to a promoter or enhancer to control gene expression.
Transfection	A process for introducing nucleic acids (e.g. a virus genome) into cells.
Transformation	(a) Changes in an animal cell that result in it developing into a tumour cell. (b) Bacterial gene transfer process involving uptake of naked DNA and acquisition of an altered genotype.
Translation	Synthesis of protein from the genetic information in mRNA.
Transmission electron microscope	A microscope in which the image is formed by electrons transmitted through the specimen.

Transovarial transmission	Transmission of a virus from a female, e.g. insect, to the next generation within eggs.
Uncoating	The release of the virus genome (and associated protein in some cases) from a virion when a cell is infected.
Upstream	The region of a nucleic acid extending in the 5' direction from a gene; in the opposite direction to that of transcription.
Vector	(a) An organism that transmits a virus from an infected host to an uninfected host. (b) A virus or plasmid DNA, into which foreign DNA can be inserted for the purpose of transferring it to a host cell for amplification/cloning or gene therapy.
Vertical transmission	Transmission of a genetic element, virus or micro-organism to the next generation of the host.
Viraemia	The presence of infectious virus in the bloodstream.
Virion	Virus particle.
Viroplasm	A morphologically distinct region in which virus replication occurs within an infected cell.
Virulence	A measure of the severity of disease that a virus (or micro-organism) is capable of causing.
Virulent strain of a virus	A virus strain that can cause disease when it infects a host.
Virulent phage	A phage that can produce only a lytic infection; it is unable to induce lysogeny.
Virus attachment site	The surface regions of one or more virion proteins, which form a site that attaches to the receptor on a host cell.
Western blotting	The transfer of protein molecules to a membrane after gel electrophoresis. Specific proteins can be detected on the membrane.
Wild strain	A virus strain isolated from a naturally infected host, cf. laboratory strain.
Wild-type virus	The parental strain of a mutant or laboratory-adapted virus.
Zinc finger	A region of a nucleic acid-binding protein that resembles a finger and binds a zinc ion.

GLOSSARY AND ABBREVIATIONS

Terms shown in the text in **bold-coloured** print are defined in this glossary. A guide to pronunciation is shown in parentheses; this information is intended only as a guide, as 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 virus genome that contains genetic information encoded in both the positive (i.e., virus-sense) and negative (i.e., complementary) orientations (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 virulence; attenuated viruses are the basis of live altered and displays decreased 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 if such agents really exist—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 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 non-histone 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

- 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 which 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**).

molecule) genetic regions; for example, transcriptional promoters and enhancers are *cis*-acting sequences adjacent to the genes whose transcription they control.

enhancer (‘en-han-ser’)	<i>cis</i> -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. (<i>Note:</i> 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.
haemagglutination (‘hay-ma-glut-in-nation’)	The (specific) agglutination of red blood cells by a virus or other protein.
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: Like a helix.
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: 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.
- isometric**
(‘eye-so-met-rik’)
A solid displaying **cubic** symmetry, of which the icosahedron is one form.
- kb**
(‘kilobase’)
1000 nucleotide residues—a unit of measurement of single-stranded nucleic acid molecules; sometimes (wrongly) used to mean **kbp** (below).
- kbp**
(‘kilobase pair’)
1000 base pairs (see above)—a unit of measurement of double-stranded nucleic acid molecules.
- latent period**
(‘lay-tent peer-ee-od’)
The time after infection before the first new extracellular virus particles appear (see Chapter 4).
- lysogeny**
(‘lie-soj-en-ee’)
Persistent, latent infection of bacteria by **temperate bacteriophages** such as phage λ .
- lytic virus**
(‘lit-ik vy-rus’)
Any virus (or virus infection) that results in the death of infected cells and their physical breakdown.
- maturation**
(‘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).
- monocistronic**
(‘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. **polycistronic**).
- monolayer**
(‘mono-layer’)
A flat, contiguous sheet of adherent cells attached to the solid surface of a culture vessel.
- mosaicism**
(‘mo-say-iss-cis-em’)
The appearance of thinner, yellow areas on the leaves of plants caused by the cytopathic effects of plant viruses.
- movement protein**
(‘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.
- mRNA**
(‘messenger RNA’)
Messenger RNA.
- multiplicity of infection (m.o.i.)**
(‘multi-pliss-itty of in-fect shon’)
The (average) number of virus particles that infect each cell in an experiment.
- necrosis**
(‘neck-ro-sis’)
Cell death, particularly that caused by an external influence (cf. **apoptosis**).
- negative-sense**
(‘neg-at-iv sense’)
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.’)
- nonpropagative**
(‘non-prop-a-gate-iv’)
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’; that is, the virus does not circulate in the vector population.
- nt**
(‘nucleotide’)
A single nucleotide residue in a nucleic acid molecule.

- nucleocapsid**
(‘new-clio-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’)
polycistronic
(‘poly-sis-tron-ik’)
polyprotein
(‘poly-pro-teen’)
- positive-sense**
(‘pos-it-iv sense’)
- 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.
- A messenger RNA that encodes more than one polypeptide (cf. **monocistronic**).
- A large protein that is posttranscriptionally cleaved by proteases to form a series of smaller proteins with differing functions.
- 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.’)

- primary cell**
(‘pri-mary sell’) A cultured cell explanted from an organism that is capable of only a limited number of divisions (cf. **immortalized cell**).
- prion**
(‘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).
- productive infection**
(‘pro-duct-iv in-fect-shon’) A ‘complete’ virus infection in which further infectious particles are produced (cf. **abortive infection**).
- prokaryote**
(‘pro-kary-ote’) An organism whose genetic material is not separated from the cytoplasm of the cell by a nuclear membrane.
- promoter**
(‘pro-mote-er’) A **cis-acting** regulatory region upstream of the coding region of a gene that promotes transcription by facilitating the assembly of proteins in transcriptional complexes.
- propagative transmission**
(‘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).
- prophage**
(‘pro-fage’) The lysogenic form of a temperate bacteriophage genome integrated into the genome of the host bacterium.
- proteome**
(‘pro-tee-ome’) The total set of proteins expressed in a cell at a given time.
- provirus**
(‘pro-vy-rus’) The double-stranded DNA form of a retrovirus genome integrated into the **chromatin** of the host cell.
- pseudoknot**
(‘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.
- pseudorevertant**
(‘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 **suppression**.
- 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).
- satellites**
(‘sat-el-ites’)
Small RNA molecules (500–2000 nt) which 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 which occurs during some virus infections, resulting in cell damage and/or death (see Chapter 7).
- splicing**
(‘sp-lice-ing’)
Posttranscriptional modification of primary RNA transcripts that occurs in the nucleus of **eukaryotic** cells during which **introns** are

	removed and exons are joined together to produce cytoplasmic mRNAs .
superantigens (‘super-anti-gens’)	Molecules that short-circuit the immune system, resulting in massive activation of T-cells by binding to both the variable region of the β -chain of the T-cell receptor (V β) and to MHC class II molecules, cross-linking them in a nonspecific way (Figure 7.3).
superinfection (‘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.
suppression (‘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).
syncytium (‘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 .
systemic infection (‘sis-tem-ik infect-shon’)	An infection involving multiple parts of a multicellular organism.
temperate bacteriophage (‘temper-ate bac-teer-ee-o-fage’)	A bacteriophage capable of establishing a lysogenic infection (cf. virulent bacteriophage, a bacteriophage that is not capable of establishing a lysogenic infection and always kills the bacteria in which it replicates).
terminal redundancy (‘ter-minal ree-dun-dance-ee’)	Repeated sequences present at the ends of a nucleic acid molecule.
titre (titer) (‘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.
trans-acting (‘trans-acting’)	A genetic element encoding a diffusible product which 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 present on any stretch of nucleic acid present in a cell, such as transcription factors (cf. cis-acting).
transcriptase (‘trans-crypt-aze’)	An enzyme, usually packaged into virus particles, responsible for the transcription of RNA virus genomes (see replicase).

- transfection**
(‘trans-fect-shon’)
- transformation**
(‘trans-form-ay-shon’)
- transgenic**
(‘trans-gene-ik’ OR
‘trans-gen-ik’)
- transposons**
(‘trans-pose-ons’)
- triangulation number**
(‘tri-ang-u-lay-shon
num-ber’)
- tropism**
(‘trope-ism’)
- uncoating**
(‘un-coat-ing’)
- vaccination**
(‘vax-sin-ay-shon’)
- vaccine**
(‘vax-seen’)
- variolation**
(‘var-ee-o-lay-shon’)
- virion**
(‘vir-ee-on’)
- viroid**
(‘vy-royd’)
- Infection of cells mediated by the introduction of nucleic acid rather than by virus particles.
- Any change in the morphological, biochemical, or growth parameters of a cell.
- 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.
- Specific DNA sequences that are able to move from one position in the genome of an organism to another (see Chapter 3).
- A numerical factor that defines the symmetry of an icosahedral solid (see Chapter 2).
- The types of tissues or host cells in which a virus is able to replicate.
- 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).
- The administration of a **vaccine**.
- 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).
- The ancient practice of inoculating immunologically naive individuals with material obtained from smallpox patients—a primitive form of vaccination (see Chapter 1).
- Morphologically complete (mature) infectious virus particle.
- 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

- virus-attachment protein**
(‘vyr-us at-tatch-ment pro-teen’)
- virusoids**
(‘vy-rus-oyds’)
- zoonosis**
(‘zoo-no-sis’)
- products. Some viroid RNAs have ribozyme activity (self-cleavage) (cf. **satellites**, **virusoids**).
- A virus protein responsible for the interaction of a virus particle with a specific cellular receptor molecule.
- Small satellite RNAs with a circular, highly base-paired structure similar to 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**)
- Infection transmitted from an animal to a human.
Plural: **zoonoses**.