UNIT XVI

Unit XVI Acronyms and Abbreviations

In many fields today abbreviations and acronyms are common. They provide a useful tool for shortening long words or expression in order to save time and space. Some well-known general examples are DVD (digital versatile disc), UNICEF (United Nations International Children's Emergency Fund), NASA (National Aeronautics and Space Administration), and UN (United Nations). Abbreviations are extensively used in the scientific and medical communities. It is common practice to use abbreviations for long names of many clinical diseases and procedures, and for scientific techniques that have to be repeated many times in medical or scientific papers, posters, and oral presentations. This can cause substantial communication difficulties for individuals who are not familiar with English abbreviations in their field. The example below is meaningless to individuals who are not familiar with the abbreviations used.

For example,

> *IHC study of CNS tissue from MS subjects demonstrated loss of PLP-expressing OLs.*

Many individuals, including native English speakers, do not know the difference between an acronym and an abbreviation. Acronyms and abbreviations are formed by combining the first letter or letters of several words. All acronyms are abbreviations, but not all abbreviations are acronyms. An acronym is a special type of abbreviation that can be pronounced as a single word (it can be said), while all other abbreviations are pronounced letter by letter (you say each letter individually or spell it out).

For example,

> ***AIDS** is an acronym for **A**cquired **I**mmune **D**eficiency **S**yndrome because you say the abbreviation as a word ("aydz"); whereas **HIV** is an abbreviation for **H**uman **I**mmunodeficiency **V**irus (in this case you say each letter individually).*

It can be extremely frustrating and time-consuming trying to find out what certain commonly used acronyms and abbreviations mean. Abbreviations that some

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consider universally known may be obscure to others. In addition, shortened forms used in one country may not be understood in another. In order to eliminate guesswork and prevent frustration, we have put together an alphabetized list of the most commonly used English acronyms and abbreviations in biomedical research. We feel that having a central reference list at your fingertips could be quite helpful for your scientific communications.

Abbreviation Rules and Style Conventions in English

Apply the following guidelines when using abbreviations:

- On the first occurrence of an abbreviation, spell out the full term, with the abbreviation in brackets. Thereafter the abbreviated form may be used by itself.

  For example,

  Oligodendrocytes (OLs) are the cells responsible for producing a fatty protein called myelin. Each OL can supply myelin for several axons and each axon can be supplied by several OLs.

- Abbreviations may be pluralized by adding an ***s*** to the end. Plurals of capitalized abbreviations should have no apostrophe because the apostrophe indicates possession. However, plurals of lowercase abbreviations have an apostrophe.

  Examples:

  PCRs (*not* PCR's)
  BACs (*not* BAC's)
  Drs. (*not* Dr's)
  rbc's (*not* rbcs)

  Exception 1: Plurals of some abbreviations, particularly in references, are not formed by merely adding an **s**.

  Examples:

  p for page and pp for pages (*not* ps or pgs)
  l for line and ll for lines (*not* ls)
  c for column and cc for columns (*not* cs)

  Exception 2: Singular and plural units of measure are abbreviated the same. An **s** is generally not added to the plurals.

  1 km and 5 km (*not* 5 kms)

Exception 3: If the abbreviation contains a period (full stop), form the plural with an apostrophe and an **s** ('s). This is probably because it looks more awkward without apostrophes:

For example,

Ph.D.'s
M.D.'s

Exception 4: Plurals of single-letter abbreviations are formed by adding ['s].

For example,

X's

- Abbreviations may be made possessive by adding **'s** for singular possessive, and **s'** for plural possessive.

  For example,

  EMBO's homepage

- Articles are usually omitted when acronyms are used, being included only when terms or names are written out in full.

  Example:

  The United Nations International Children's Emergency Fund is a voluntarily funded agency.
  UNICEF was created on December 11, 1946.

- The choice of an indefinite article (**a** or **an**) before letter-by-letter abbreviations depends on the pronunciation of the first letter of the abbreviation, not on the written representation of the first letter. If the abbreviation begins with a consonant sound, use **a**. If it begins with a vowel sound, use **an**.

  Examples:

  an mRNA molecule - although "m" is a consonant, we use the **an** article because the first sound we make is an "em" sound.
  an X-ray - this abbreviation begins with a consonant letter, but sounds like it starts with a vowel. The first sound we make is an "eks" sound.

There are several abbreviation styles used today. The only rule one should remember is to have a consistent style.

- Acronyms are generally presented in uppercase letters.

  Examples:

  AIDS, NATO, BBC, and SARS

However, some acronyms are no longer capitalized. Examples are laser, radar and sonar.

- A period is sometimes written after an abbreviated word (there is no strict rule). The general modern trend is to omit periods from abbreviations (to avoid an appearance of clutter).

Organizations, countries, and units of measure are not generally followed by periods.

Examples:

EU (*not* E.U.)
UN (*not* U.N.)
IBM (*not* I.B.M.)
5 mg (*not* 5 mg.)

Periods are optional with degree titles (this is a matter of preference). However, in modern usage, periods are usually omitted.

Examples where both forms are acceptable:

PhD or Ph.D.
BSc or B.Sc.
MD or M.D.

- If a sentence ends with an abbreviation that requires a period, do not add another period.

For example,

The technician will be here at 4 p.m.
not The technician will be here at 4 p.m.

- Abbreviations of chemicals from the periodic table always start with a capital letter; if there is a second letter, it is always lowercase.

For example,

N Nitrogen
O Oxygen
Na Sodium
Zn Zinc

- Do not divide abbreviations, or a numerical value followed by a unit of measure, between lines on a page.

……AIDS	……10 mg
not……AI	*not*……10
DS	mg

Table 1. List of abbreviations and Latin expressions used in scientific writing

Abbreviation	Expression	Translation
c. *or* ca.	Circa	About (in reference to approximate date or time)
c.f.	Con fero	Compare, consult
–	Et	And
et al.	Et alii	And others (in reference to people)
etc.	Et cetera	And so forth, and so on
et seq.	Et sequentes	And the following
e.g.	Exempli gratia	For example
Ibid.	Ibidem	The same place
i.e.	Id est	That is
l.c. *or* loc. cit.	Loco citato	At the place already cited
N.B.	Nota bene	Note well (to draw attention to something)
op. cit.	Opere citato	In the work cited
P.S.	Post scriptum	After writing (in reference to additions to a letter after the signature)
q.v.	Quod vide	Which see (in reference to a term/sentence to be looked up elsewhere
sc.	Scilicet	Namely, to wit
-	Sic	As such, thus, so, just as that
vs.	Versus	Against
Viz.	Videlicet	Namely, to wit

General Abbreviations and Acronyms Used in Biomedical Research

Abbreviation	Definition
A	
A	Adenine *or* alanine
aa	Amino acid *or* aminoacyl
Ab	Antibody
ABU	L-a-Aminobutyric acid
ABZ	2-Aminobenzoyl
AC	Accession number
ac	Acetyl
Ac	Actinium
Ac-CO A	Acetyl-coenzyme A
AChE	Acetylcholinesterase

Acm	Acetamidomethyl
ADH	Alcohol dehydrogenase
ADP	Adenosine diphosphate
AFC	7-Amino-4-trifloromethyl-coumaride
Ag	Antigen *or* silver
Aha	7-Aminoheptanoic acid
Al	Aluminum
Ala	Alanine
Am	Americium
AMP	Adenosine monophosphate
Amp	Ampicillin
an	Anisoyl
ANOVA	Analysis of variance
AP	Anteroposterior *or* action potential *or* alkaline phosphatase
APC	Antigen presenting cells
apoE	Apolipoprotein E
APP	Amyloid Precursor Protein
APS	Ammonium persulfate
Ar	Argon
Arg	Arginine
As	Arsenic
ASA	Acetyl salicylic acid
Asn	Asparagine
Asp	Aspartic acid
At	Astatine
ATP	Adenosine 5'- triphosphate
ATPase	Adenosine triphosphatase
Au	gold

B

B	Boron *or* bromouridine
Ba	Barium
BAC	Bacterial artificial chromosome
BAP	Bacterial alkaline phosphatase
BCIP	5-Bromo-4-chloro-3-indolyl phosphate
Be	Beryllium
bh	Benzhydryl
Bh	Bohrium
Bi	Bismuth
Bio-dNTP	Biotin-deoxynucleoside triphosphate
Bk	Berkelium
BLAST	Basic Local Alignment Search Tool
BME	Beta-mercaptoethanol
BMT	Bone marrow (or blood and marrow) transplant
Bp	Base pair

Br	Bromine
BrUrd	Bromouridine
BSA	Bovine serum albumin
bz	Benzoyl
bzy	Benzyl

C

C	Carbon *or* cytosine *or* cysteine
Ca	Calcium
CA	Casamino acids
CAT	Chloramphenicol acetyl
CD	Central domain
Cd	Cadmium
cDNA	Complementary deoxyribonucleic acid
Ce	Cerium
Cf	Californium
CFU	Colony-forming units
CIAP	Calf intestinal alkaline phosphatase
cl	Chloro
Cl	Chlorine
Cm	Curium
Co	Cobalt
Cr	Chromium
Cs	Cesium
CSF	Cerebrospinal fluid
CTP	Cytidine 5'-triphosphate
Cu	Copper
Cyd	Cytidine
Cys	Cysteine

D

D	Aspartic acid
dAMP	Deoxyadenosine monophosphate
dATP	Deoxyadenosine triphosphate
DAG	Diacylglycerol
Db	Dubnium
dCTP	Deoxycytidine triphosphate
ddATP	Dideoxycytidine triphosphate
ddCTP	Dideoxyadenosine triphosphate
ddGTP	Dideoxyguanosine triphosphate
ddNTP	Dideoxynucleoside triphosphate
DEAE	Diethylaminoethyl
DEPC	Diethyl Pyrocarbonate
dGTP	Deoxyguanosine triphosphate
DIDS	4,4′-di-isothiocyanato-2,2′-disulfostilbene

DIG	Digoxigenin
DIV	Days In Vitro
DMF	N,N-Dimethylformamide
DMS	Dimethylsulfide
DMSO	Dimethyl sulfoxide
DMT	Dimethyltryptamine
DNA	Deoxyribonucleic acid
DNase	Deoxyribonuclease
dns	Dansyl
Dnp	2,4-Dinitrophenyl
dNTP	Deoxyribonucleotide triphosphate
DPI	Diphenylene iodonium
Dpr	2,3-Diaminopropionic acid
Ds	Darmstadtium
ds	Double stranded
DT	Diphtheria toxin
DTA	Diphtheria toxin A chain
DTE	Dithienylethene
DTT	Dithiothreitol
dTTP	Deoxythymidine triphosphate
dUTP	Deoxyuridine triphosphate
DV	Dorsoventral
Dy	Dysprosium

E

E	Glutamic acid
EDT	1,2-Ethanedithiol
EDTA	Ethylenediaminetetraacetic acid
EGTA	Ethylene glycol tetraacetic acid
ER	Endoplasmic reticulum
Er	Erbium
Es	Einsteinium
EtBr	Ethidium Bromide
EtOH	Ethanol
Eu	Europium
exo	Exonuclease

F

F	Fluorine *or* phenylalanine
fa	Formylaminoacyl
FBS	Fetal bovine serum
FCS	Fetal calf serum
Fe	Iron
FITC	Fluorescein isothiocyanate

Fm	Fermium
FOA	5-Fluoroacetic acid
Fr	Francium
FSH	Follicle-stimulating hormone

G

g	Gram
g	Gravitational force
G	Glycine
Ga	Gallium
Gd	Gadolinium
Ge	Germanium
GFP	Green Fluorescent Protein
Gln	Glutamine
Glu	Glutamic acid
Gly	Glycine
GM	Genetically Modified
GMO	Genetically Modified Organisms
GUS	Beta-D-glucuronidase

H

H	Hydrogen *or* histidine
Hb	Hemoglobin
HBSS	Hank's Buffered Salt Solution
HCl	Hydrochloric acid
H&E	Hematoxylin and Eosin
He	Helium
HEPES	4-(2-hydroxyethyl)-1-piperazineethanesulfonic acid)
Hf	Hafnium
Hg	Mercury
His	Histidine
HLA	Histocompatibility Leukocyte Antigen
hm	Hydroxymethyl
Ho	Holmium
HPRT	Hypoxanthine phosphoribosyltransferase
HRP	Horseradish peroxidase
Hs	Hassium
Hsp	Heat Shock Protein
HT	High temperature
hU	Dihydrouridine
humi.	Humidity
Hyl	Hydroxylysine
Hyp	Hypoxanthine

I

I	Iodine or isoleucine
Ig	Immunoglobulin
IgA	Immunoglobulin A (gamma A immunoglobulin)
IgD	Immunoglobulin D (gamma D immunoglobulin)
IgE	Immunoglobulin E (gamma E immunoglobulin)
IgG	Immunoglobulin G (gamma G immunoglobulin)
IgM	Immunoglobulin M (gamma M immunoglobulin)
IIe	Isoleucine
In	Indium
Ino	Inosine
IPP	Isopentenyl diphosphate
IPTG	Isopropyl-beta-D-thiogalactopyranoside
IR	Infrared
Ir	Iridium

K

K	Potassium *or* lysine
Kr	Krypton

L

L	Leucine
La	Lanthanum
LB	Luria-Bertani medium *or* Luria broth
Leu	Leucine
Li	Lithium
Lr	Lawrencium
LTA	Lipoteichoic Acid
Lu	Lutetium
Lys	Lysine

M

M	Methionine
mAb	Monoclonal antibodies
MCS	Multiple cloning site
Md	Mendelevium
MeOH	Methanol
Met	Methionine
Mg	Magnesium
MgCl	Magnesium chloride
MMLV	Moloney murine leukemia virus
mmt	Monomethoxytrityl

Mn	Manganese
Mo	Molybdenum
MOPS	4-Morpholinepropanesulfonic acid
mRNA	Messenger Ribonucleic Acid
Mt	Meitnerium
MTS	3-(4,5dimethylthiazol-2-yl)-5-(3-carboxymethozyphenyl-2-(4-sulfophenyl)-2H-tetrazolium
mtDNA	Mitochondrial DNA

N

N	asparagine *or* nitrogen
Na	Sodium
NaF	Sodium fluoride
NAD	Nicotinamide adenine dinucleotide
NADH	Nicotinamide adenine dinucleotide (reduced form)
NADP	Nicotinamide adenine dinucleotide phosphate
NADPH	Nicotinamide adenine dinucleotide phosphate (reduced form)
Nb	Niobium
NBT	Nitroblue tetrazolium
Nd	Neodymium
Ne	Neon
Ni	Nickel
NMDA	N-methyl-D-aspartic acid
No	Nobelium
Np	Neptunium
nRNA	Nuclear RNA
NT	Nucleotides *or* nuclear transfer or null type
NTP	Nucleoside triphosphate
NZCYM	Casein hydrolysate casamino acids yeast extract magnesium medium

O

O	Oxygen *or* orotidine
OD	Optical Density
Oilgo(dT)	Oligodeoxythymidylic acid
OMP	Orotidine monophosphate
o/n	Over night
Ord	Orotidine
ORF	Open reading frame
Oro	Orotate
Os	Osmium

P

P	Phosphorus or praline
Pa	Protactinium
PAC	P1 artificial chromosome
Pb	Lead
PBMC	Peripheral blood mononuclear cells
PBS	Phosphate Buffer Saline
Pd	Palladium
PEI	Polyethylenimine
PEG	Polyethylene glycol
PFU	Plaque-forming units
Phe	Phenylalanine
PK	Protein kinase
PIPES	Piperazine-N,N'-bis(2-ethanesulfonic acid)
Pm	Promethium
PMSF	Phenylmethylsulfonyl fluoride
PNK	Polynucleotide kinase
Po	Polonium
Poly(A)	Polyadenylic acid
Poly(A)+	Polyadenylated messenger Ribonucleic Acid
Poly(U)	Polyuridylic acid
Pr	Praseodymium
Pro	Proline
Pt	Platinum
PTX	Pertussis toxin
Pu	Plutonium
Puo	Purine nucleoside
Pur	Purine
PVC	Polyvinyl chloride
Pyd	Pyrimidine nucleoside
Pyr	Pyrimidine

Q

Q	Glutamine or ubiquinone (coenzyme Q)

R

R	Arginine
Ra	Radium
Rb	Rubidium
Re	Rhenium
Rf	Rutherfordium
Rg	Roentgenium
Rh	Rhodium

Rn	Radon
RNA	Ribonucleic acid
RNase	Ribonuclease
RNP	Ribonucleoprotein
RRM	RNA recognition motif
rRNA	Ribosomal ribonucleic acid
RT	Room temperature *or* reverse transcriptase
Ru	Ruthenium
Rxn	Reaction

S

S	Sulphur *or* serine
Sb	Antimony
Sc	Scandium
SDS	Sodium Dodecyl Sulfate
Se	Selenium
Ser	Serine
Sg	Seaborgium
Si	Silicon
Sm	Samarium
Sn	Tin
SR	Sarcoplasmic reticulum
Sr	Strontium
ss	Single stranded
SSC	Sodium citrate buffer
STR	Short tandem repeats

T

T	Threonine
Ta	Tantalum
TAE	Tris-acetate buffer
Taq	Thermus aquatic DNA polymerase
Tb	Terbium
TBE	Tris/Borate/EDTA buffer
TBS	Tris-Buffered Saline
TBST	Tris-Buffered Saline Tween-20
Tc	Technetium
TCA	Trichloroacetic acid
TdT	Terminal deoxynucleotidyl transferase
Te	Tellurium
TE	Tris/EDTA buffer
TEA	Triethanolamine
TEMED	N,N,N′,N′-Tetramethylethylenediamine

TES	N-Tris(hydroxymethyl)methyl-2- minoethanesulfonic acid
Tg	Transgenic
TGB	Tris/Glycine buffer
Th	Thorium
Thr	Threonine
Ti	Titanium
Tl	Thallium
Tm	Thulium
TP	Thymidine phosphorylase
TRIS	Tris-hydroxymethyl-aminomethanel
tRNA	Transfer RNA
Trp	Tryptophan
Tyr	Tyrosine

U

U	Uranium *or* uridine
UP	Uridine phosphorylase
Ura	Uracil
Urd	Uridine
UTP	Uridine triphosphate
UTR	Untranslated region
Uub	Ununbium
Uuh	Ununhexium
Uun	Ununnilium
Uuo	Ununoctium
Uup	Ununpentium
Uuq	Ununquadium
Uus	Ununseptium
Uut	Ununtrium
Uuu	Unununium
UV	Ultraviolet

V

V	Vanadium *or* valine
Val	Valine

W

W	Tungsten *or* tryptophan
WT	Wild-type

X

Xan	Xanthine
Xe	Xenon

X-Gal	5-bromo-4-chloro-3-indolyl-beta-D-galactopyranoside
X-Gluc	5-bromo-4-chloro-3-indolyl-beta-D-glucuronic acid

Y

Y	Yttrium *or* tyrosine
YAC	Yeast Artificial Chromosome
Yb	Ytterbium
YMG	Yeast and malt extract with glucose media
YPD	Yeast extract/peptone/dextrose bacterial media
YPG	Yeast extract/peptone/galactose bacterial media
YT	Yeast extract/tryptone bacterial media

Z

Zn	Zinc
Zr	Zirconium

Please note that amino acids are given three-letter and one-letter abbreviations (e.g. A or Ala for Alanine).

Methods and Techniques Used in Biomedical Research

CHEF	Contour-clamped homogeneous electric field gel electrophoresis
CSGE	Conformation-sensitive gel electrophoresis
DFP	DNA finger printing
DGGE	Denaturing gradient gel electrophoresis
ELISA	Enzyme-linked immunosorbent assay
EMSA	Electrophoresis mobility shift assay
ENDO	Endodeoxyribonuclease assay
EXO	5' and 3' exodeoxyribonuclease assay
FACS	Fluorescence-activated cell sorting
FIGE	Field inversion gel electrophoresis
FISH	Fluorescent in situ hybridization
GC	Gas chromatography
HPLC	High performance liquid chromatography
HTRF	Homogeneous time-resolved fluorescence assay
IEF	Isoelectric focusing
IHC	Immunohistochemistry
IP	Immunoprecipitation
ISH	In situ hybridization
LCR	Ligase chain reaction
MNR	Nuclear magnetic resonance
MS	Mass Spec
MZE	Multiphasic zone electrophoresis

NAAT	Nucleic acid amplification technique
NB	Northern blot
PAGE	Polyacrylamide gel electrophoresis
PCR	Polymerase chain reaction
PFGE	Pulsed-field gel electrophoresis
PRINS	Primed in situ labeling
qPCR	Quantitative PCR
RDA	Representational difference analysis
REMI	Restriction enzyme mediated integration
RFLP	Restriction fragment length polymorphism
RGE	Rotating gel electrophoresis
RPA	Ribonuclease protection assay
SB	Southern blot
SCGE	Single cell gel electrophoresis
SDA	Strand displacement amplification
TAFE	Transverse alternating-field electrophoresis
TAP	Tandem affinity purification
TGGE	Temperature gradient gel electrophoresis
TLC	Thin layer chromatography
WB	Western blot

Radioactive Isotopes

^{14}C	Carbon-14
^{3}H	Tritium-3
^{131}I	Iodine-131
^{32}P	Phosphorus-32
^{33}P	Phosphorus-33
^{35}S	Sulfate-35

Cell Lines

3T3	Mouse embryo fibroblast cell line
9L	Rat glioma
A549	Human lung cancer cell line
B104	Rat neuroblastoma
BHK	Baby hamster kidney cells
B-LCL	B-lymphoblastoid cell line
C6	Rat glioma
CHO	Chinese hamster ovary
CLL	Carcinoma cell line
CMT	Canine mammary tumor

COS	(monkey kidney)
CV-C	African green monkey kidney cell line
EC	Embryonal carcinoma (human)
EJ	Human bladder cancer cell line
GH3	Rat pituitary tumor cell line
HaCaT	Human keratinocyte cell line
HEK	Human embryonic kidney
HeLa	Henrietta Lacks (human cervical cell line)
HL-60	Human leukemia cell line
MCF-7	Human breast cancer cell line
MDCK	Madin-Darby canine kidney
NS0	Mouse myeloma cell line
PC12	Chromaffin cell line (rat)
SCLC	Small cell lung cancer cell line
SPEV	Swine kidney cell line
SW480	Human colon cancer cell line
U87	Human glioblastoma-astrocytoma cell line
U343	Human astrocytoma cell line

Units of Measurement

Always abbreviate units when reporting numerical information. However, if you write the number out in full, you must spell out the unit of measurement. Always put a space between the number and the unit. When starting a sentence with a number and unit, both must be spelled out as words. Abbreviations for most units of measurement use small letters. The following abbreviations of units of measurement are frequently used in biomedical research.

A	Ampere
a	Area
A_{260}	Absorbance measured at 260 nm
Bq	Becquerel
C	Coulomb
°C	Degree Celsius
cal	Calorie
Ci	Curie
cm	Centimeter
cpm	Counts per minute
d	Day
Da	Dalton
DIV	Days in vitro
dpm	Disintegrations per minute
F	Fahrenheit
g, gr	Gram (g is commonly used)

h	Hour
Hz	Hertz
J	Joule
k	Kilo (10^3)
kb	Kilobases
kDa	Kilodalton
L	Liter
lb	Pounds
M	Molar
m	Meter
mA	Milliamps
Mb	Megabase
mg	Milligram
min	Minute
mL	Milliliter
mM	Millimolar
mmol	Millimole
mo	Month
mol	Mole
ms, msec	Milliseconds (ms is generally used)
mV	Millivolt
MW	Molecular weight
N	Newton
n	Nano or sample size
ng	Nanogram
nm	Nanometer
OD	Optical density
oz	Ounces
pH	Power of hydrogen
r	Revolution
rpm	Revolutions per minute
S	Svedberg units
s, sec	Seconds (s is generally used)
T_m	Melting temperature
U	Unit
µ	Micron
µM	Micromolar
µm	Micrometer
w, W	Watt (W is commonly used)
wk	Week
wt	Weight
w/v	Weight to volume
y	Year
V_{max}	Maximum velocity
v/v	Volume to volume