ABBREVIATIONS IN ASPET JOURNALS

Rules and Guidelines

The abbreviations for units of measurement given in the list below are used in the text only when following values. They may also be used in figure legends and tables. Otherwise, they should be spelled out.

Title. Nonstandard abbreviations are permitted in the title if used two times. Write it out the first time followed by the abbreviation in parentheses. Write out the full chemical name for numbered compounds (e.g., PD98059); Place the designation in parentheses after the written-out version even if it is used only once in the title.

Abstract. In general, nonstandard abbreviations are allowed in the abstract if used twice or more. Write out the definition the first time. Write out the full chemical name for numbered compounds (e.g., PD98059); Place the designation in parentheses after the written-out version even if it is used only once in the abstract.

Headings. Nonstandard abbreviations may be used in headings. Uses in headings should be counted among the other in-text uses. However, do not define abbreviations in headings. Leave spelled-out form and move definition to first text appearance. In *Pharmacological Reviews*, nonstandard abbreviations are not allowed in headings or in the outline contents.

Text. In general, nonstandard abbreviations are allowed if used three times. All nonstandard abbreviations *must be defined* in the abbreviation footnote. However, they need not be defined in the text unless the author desires. If the abbreviation is used one or more times before it is defined, move the definition to the first use. If the abbreviation is defined more than once, delete the definitions after the first one and retain the abbreviation. The author may alternate between an abbreviation and its definition (written-out form) as long as the abbreviated form is used three times..

Buffers or Solvents. Permissible with contents and concentrations in parentheses: buffer A (3 mg XX, 4 mg YY).

Plurals. Do not use apostrophes (e.g., DNAs).

Schemes/Equations. Abbreviations used only in schemes or equations may be defined in text immediately before or after they appear, without being added to the abbreviation footnote. Abbreviations used in schemes may also be defined in scheme legends.

States/Provinces/Territories. Always abbreviate except in affiliation line. Use two-letter postal code.

Table 1. State Abbreviations

Alabama	AL	Idaho	ID	New Jersey	NJ	Texas	TX
Alaska	AK	Kansas	KS	Montana	MT	Utah	UT
Arizona	AZ	Kentucky	KY	New Mexico	NM	Vermont	VT
Arkansas	AR	Louisiana	LA	New York	NY	Virginia	VA
California	CA	Maine	ME	North Carolina	NC	Washington	WA
Colorado	CO	Maryland	MD	North Dakota	ND	West Virginia	WV
Connecticut	CT	Massachusetts	MA	Ohio	OH	Wisconsin	WI
Delaware	DE	Michigan	MI	Oklahoma	OK	Wyoming	WY
Florida	FL	Minnesota	MN	Oregon	OR		
Georgia	GA	Mississippi	MS	Pennsylvania	PA		
Hawaii	HI	Missouri	MO	Rhode Island	RI		
Illinois	IL	Nebraska	NE	South Carolina	SC		
Indiana	IN	Nevada	NV	South Dakota	SD		
Iowa	IA	New Hampshire	NH	Tennessee	TN		

Table 2. Province Abbreviations

Canada				Australia	
Alberta	AB	Nova Scotia	NS	New South Wales	NSW
British Columbia	BC	Ontario	ON	Northern Territory	NT
Labrador	LB	Prince Edward Island	PE	Queensland	QLD
Manitoba	MB	Quebec	QC	South Australia	SA
New Brunswick	NB	Saskatchewan	SK	Victoria	VIC
Newfoundland	NF	Yukon Territory	YT	Tasmania	TAS
Northwest Territories	NT			Western Australia	WA

Standard Abbreviations

Table 3. Powers of 10 and SI Unit Prefixes

		Prefix (Abbrev)
10^{18}	1,000,000,000,000,000,000	exa (E)
10^{17}	100,000,000,000,000,000	
10^{16}	10,000,000,000,000,000	
10^{15}	1,000,000,000,000,000	peta (P)
10^{14}	100,000,000,000,000	
10^{13}	10,000,000,000,000	
10^{12}	1,000,000,000,000	tera (T)
10^{11}	100,000,000,000	
10^{10}	10,000,000,000	
10^{9}	1,000,000,000	giga (G)
10^{8}	100,000,000	
10^{7}	10,000,000	
10^{6}	1,000,000	mega (M)
10^{5}	100,000	
10^{4}	10,000	
10^{3}	1,000	kilo (k)
10^{2}	100	hecto (h)
10^{1}	10	deka (D)

		Prefix (Abbrev)
10^{-1}	0.1	deci (d)
10^{-2}	0.01	centi (c)
10^{-3}	0.001	milli (m)
10^{-4}	0.000 1	
10^{-5}	0.000 01	
10^{-6}	0.000 001	micro (μ)
10^{-7}	0.000 000 1	
10^{-8}	0.000 000 01	
10^{-9}	0.000 000 001	nano (n)
10^{-10}	0.000 000 000 1	
10^{-11}	0.000 000 000 01	
10^{-12}	0.000 000 000 001	pico (p)
10^{-13}	0.000 000 000 000 1	
10^{-14}	0.000 000 000 000 01	
10^{-15}	0.000 000 000 000 001	femto (f)
10^{-16}	0.000 000 000 000 000 1	
10^{-17}	0.000 000 000 000 000 01	
10^{-18}	0.000 000 000 000 000 001	atto (a)

Note that many standard and nonstandard abbreviations use these prefixes. Only the root forms are shown in Tables 4 and 5 unless there is a need to call attention to a particular usage.

Units

Table 4. Standard Units of Measure

Ω	ohm
μat	microatom(s)
A	absorbance (A_{260} means absorbance at 260 nm)
A	ampere
Å	Ångstrom
Bq	becquerel
cal	calorie
Ci	curie
cm^3	cubic centimeter
cpm	counts per minute
cps	counts per second
Da	dalton
db	decibel
dpm	disintegrations per minute
Eq	equivalent (e.g., 2 Eq, 3 molar Eq, or 6 reducing Eq)
eV	electron volt
g	gram
GPU	guinea pig unit
h	hour
Hz	Hertz
IU	international unit
l	liter (spell out when used alone: “1 liter”)
m	meter
M	molar (no “of”)
min	minute
mol	mole
mol Eq	molar equivalent
Osm	osmolal (no “of”)
OsM	osmolar (no “of”)
Osmol	osmole
s	second
S	siemens (siemens is correct for singular form, too)
S	Svedberg unit (40 S RNA or 40S RNA)
V	volt

Table 5. Nonstandard Units of Measure

Note that units should not be repeated. For example, "10 and 20 μg," not "10 μg and 20 μg." This is true for all units, including % and °C.

μ	Micron; with values, change to μm, for "micrometer" μ = 0.025 M (ionic strength; is OK);
μμ	do not use as prefix; change to p for pico
μm	do not use as prefix; change to n for nano. Otherwise, means micrometer.
bp	base pair (treat as any nonstandard abbreviation)
cc	cubic centimeter; change to ml
cM	centimorgan (treat as any nonstandard abbreviation)
EU	enzyme unit (treat as any nonstandard abbreviation) endotoxin unit (treat as any nonstandard abbreviation)
kb	kilobase (treat as any nonstandard abbreviation)
kbp	kilobase pair (treat as any nonstandard abbreviation)
mμ	millimicron; change to "nm" for nanometers (see μ, above) do not use as prefix; change to n for nano
mcg	microgram (change to μg)
mg%	change to mg/100 ml and query
mol/l	change to M
N	newton (write out if not used three times; note lower case "n" in newton)

Abbreviations

Table 6. Standard Abbreviations

×	multiplication or magnification
°C	degrees Centigrade (close up to numbers, e.g., 20°C)
°F	degrees Fahrenheit (close up to numbers, e.g., 20°C)
^{14}C, ^{3}H, ^{125}I, ^{32}P	radioactive elements (e.g.,^{14}C-labeled digitoxin, [^{14}C]digitoxin)
a.c.	alternating current
ADP	adenosine 5′-diphosphate
AIDS	acquired immunodeficiency syndrome
AM	morning (ante meridian)
AMP	adenosine 5′-monophosphate
AT_{50}	median atomic dose
ATP	adenosine 5′-triphosphate
Ave.	avenue
avg.	average (in tables or parentheses)
b.i.d.	*bis in die*; twice daily
b.p.	boiling point
B_{max}	maximal binding
cAMP	cyclic AMP
CD	circular dichroism

CD40	name of a molecule
CD_{50}	lethal concentration, 50% by volume
cDNA	complementary DNA
CDP	cytidine 5'-diphosphate
cGMP	cyclic GMP
Cm-cellulose	*O*-(carboxymethyl)cellulose
CMP	cytidine 5'-monophosphate
CMP-NeuAc	cytidine monophosphate N-acetylneuraminic acid
CoA	coenzyme A
CoASAc	acetyl coenzyme A
conc.	concentration (use in tables only)
ct	product of concentration
CTP	cytidine 5'-triphosphate
CV	coefficient of variation
D-	dextro (prefix indicating spatial configuration)
d-	dextrorotatory
d.c.	direct current
d.wt.	dry weight
DDT	dichlorodiphenyltrichloroethane
DEAE	diethylaminoethyl
dec	decompose (melting point)
df	degrees of freedom
dl- or DL-	dextro-levo (to express racemic mixtures; no comma, hyphenated to the compound, e.g., DL-lactic acid)
DNA	deoxyribonucleic acid
DOPA	3,4-dihydroxyphenylalanine (prefer DOPA to dopa)
dTDP	thymidine 5′-diphosphate
dTMP	thymidine 5′-monophosphate
dTTP	thymidine 5′-triphosphate
EC_{50}	50% effective concentration; use "EC_{50} values" instead of "EC_{50}s"
ECG	electrocardiogram (or EKG) (author may use either, but be consistent)
ED_{50}	median effective dose
EDTA	see *Buffers* (Table 9, below)
EGTA	see *Buffers* (Table 9, below)
EPR	electron paramagnetic resonance
expt.	experiment (use only in tables)
F	*F* = 17.9; df = 2,40; can also appear as F(2,40) or $F_{2,40}$
f.p.	focal point
FAD	flavin-adenine dinucleotide
$FADH_2$	flavin-adenine dinucleotide, fully reduced form
FMN	riboflavin 5′-phosphate

g	acceleration caused by gravity (3000*g*); close up, no times symbol
GABA	γ-aminobutyric acid
GDP	guanosine diphosphate
GMP	guanosine monophosphate
GSH	glutathione
GSSG	glutathione disulfide
GTP	guanosine 5′-triphosphate
GTPase	guanosine 5′-triphosphatase
H test	Kruskal-Wallis II test
Hb	hemoglobin
HbCO	carbon monoxide hemoglobin
HbO_2	oxyhemoglobin
HEPES	see *Buffers* (Table 9, below)
HIV	human immunodeficiency virus
Hwy.	Highway
HMG	3-hydroxy-3-methylglutaryl
i.a.	intra-arterial (when used with value)
i.c.v.	intracerebroventricular (when used with value)
i.d.	inside diameter (when used with value)
i.m.	intramuscular (when used with value)
i.p.	intraperitoneal (when used with value)
i.t.	intrathecal (when used with value)
ID_{50}	median inhibitory concentration
IDP	inosine 5′-diphosphate
Ig	immunoglobulin (also IgG, IgA, etc.)
I_{max}	maximal current
IMP	inosine 5′-monophosphate
IR	infrared
ITP	inosine 5′-triphosphate
K or *k*	chemical equilibrium, constant ion concentration (subscripts are roman and can be upper or lower case)
K_{aff}	affinity coefficient
L-	levo (prefix indicating spatial configuration)
l-	levorotatory (polarization to the left)
LD_{50}	median lethal dose
ln	logarithm (normal or natural)
MES	see *Buffers* (Table 9, below)
m-, *meta*-	follow copy; both are OK
m.p.	melting point
metHb	methemoglobin
mol. wt.	molecular weight

mRNA	messenger RNA
N	normal concentration
n	normal configuration
N.S.	not significant
NAD	nicotinamide-adenine dinucleotide
NAD^+	nicotinamide-adenine dinucleotide, oxidized form
NADH	nicotinamide-adenine dinucleotide, reduced form
NADP	nicotinamide-adenine dinucleotide phosphate
$NADP^+$	nicotinamide-adenine dinucleotide phosphate, oxidized form
NADPH	nicotinamide-adenine dinucleotide phosphate, reduced form
NMR	nuclear magnetic resonance
no.	number (use only in tables)
NTP	nucleotide triphosphate
o-, *ortho-*	follow copy; both are OK
o.d.	outside diameter
P or *p*	probability (written $P = 0.05$, $p < 0.05$); be consistent within an article for cap or lower case
p-, *para-*	follow copy; both are OK
p.o.	*per os*; by mouth
pA_2	a kinetic parameter similar to K_i
$pACO_2$	arterial CO_2 pressure
pCa	a way of reporting calcium ion levels; equal to $-\log[Ca^{2+}]$. OK without definition.
pCO_2	partial CO_2 pressure in blood or gas
PD_{50}	median protecting (or paralyzing) dose
Pfu	standard form *Pfu* is italic and is derived from *Pyrococcus furiosus*; sold by Stratagene
P_i	inorganic phosphate
pI	isoelectric point
p*K*	dissociation constant; also written $pK^1{}_a$ or pK_a
Pkwy.	Parkway
PM	Postmeridian (afternoon); 12:00 PM should be referred to as “noon” and 12:00 AM as “midnight” (Do not use military time, e.g., 23:00 hours, etc.)
P_o	open probability
PP_i	inorganic pyrophosphate
ppm	parts per million
psi	pounds per square inch
Q, QRS, Q-T, QT	electrocardiogram wave designates; follow copy
q.i.d.	*quater in die*; four times a day
Q_{10}	temperature coefficient
r	ratio (correlation coefficient)

RNA	ribonucleic acid
rpm	revolutions per minute
s.c.	subcutaneous
S.D.	standard deviation; mean ± S.D.
S.E.	standard error; mean ± S.E.
S.E.M.	standard error of the mean; mean ± S.E.M.
SDS	sodium dodecyl sulfate
t test	Student's *t* test or Fisher's *t* test (*t* for time)
t.i.d.	*ter in die*; three times per day
$t_{1/2}$	half-time
TD_{50}	median toxic dose
TDP	ribosylthymine 5′-diphosphate
TEA	tetraethylammonium
TEAE	triethylaminoethyl
TMP	ribosylthymine 5′-monophosphate
Tris	see *Buffers* (Table 9, below)
TTP	ribosylthymine 5′-triphosphate
U or unit	either is OK
U test	Mann-Whitney *U* test
UDP	uridine 5′-diphosphate
UDP-Gal	uridine diphosphogalactose
UDP-GalNAc	uridine diphospho *N*-acetylgalactosamine
UDP-Glc	uridine diphosphoglucose
UDP-GlcNAc	uridine diphospho *N*-acetylglucosamine
UDP-GlcUA	uridine diphosphoglucuronic acide
UDP-Xyl	uridine diphosphoxylose
UMP	uridine 5′-monophosphate
USP	United States Pharmacopeia
UTP	uridine 5′-triphosphate
UV	ultraviolet
v	velocity
v/v	volume per volume
V_{max}; V_{min}	velocity, voltage, or volume
W	watt
w/v	weight per volume
wk	week (use only in tables)
wt.	weight
yr	year (use only in tables)

Table 7. Latin Abbreviations

Abbreviation	Latin	English	Change to English?
ca.	circa	approximately	Yes
cf.	confer	compare (often used to mean "see")	Yes
e.g.	exempli gratia	for example	Maybe
et al.	et alii	and the others	No
etc.	et cetera	and so on	Maybe
i.e.	id est	that is	Maybe
N.B.	nota bene	note well	Maybe
v.i.	vide infra	see below	Yes
v.s.	vide supra	see above	Yes
viz.	videlicet	namely	Yes

Table 8. Amino Acid Abbreviations

Use three-letter code or spell out in text; both forms can be used interchangeably. Use three-letter code with single amino acids (e.g., Pro421), ***but*** if another amino acid is specified, as in mutants or substitutions, use one-letter code (P421A). In strings ≥2 amino acids, either form can be used (e.g., Pro-Ala-Arg-Lys or PARK).

alanine	Ala	A	leucine	Leu	L
arginine	Arg	R	lysine	Lys	K
asparagine	Asn	N	methionine	Met	M
aspartic acid	Asp	D	phenylalanine	Phe	F
cysteine	Cys	C	proline	Pro	P
glutamic acid	Glu	E	serine	Ser	S
glutamine	Gln	Q	threonine	Thr	T
glycine	Gly	G	tryptophan	Trp	W
histidine	His	H	tyrosine	Tyr	Y
isoleucine	Ile	I	valine	Val	V

Buffers. Check Table 9 for specific buffer names. If the buffer appears in the table, only the buffer name should appear in text (not the definition), and the full chemical name should be added to the abbreviations list. EDTA, EGTA, HEPES/Hepes, and Tris (in boldface) are standard buffers and do not have to be defined.

Buffers that are a mixture of chemicals need not be defined in the footnote, and abbreviations, once defined, may be used throughout. These buffers may also be designated buffer A, buffer B, etc., and those designations, once defined, may be used throughout. Example: "A preincubation buffer containing 140 mM KCl and 10 mM Tris-HCl (buffer A) was used." That buffer may be referred to as buffer A throughout without being defined in the footnote. Buffer A may also precede the definition, which should be in parens: "buffer A (140 mM KCl and 10 mM Tris-HCl)."

All definitions that follow are correct. Definitions preceded by an asterisk (*) are preferred if author does not supply one. All abbreviations here can be added to the abbreviations list after one use, except EDTA, EGTA, Hepes, HEPES, and Tris, which are OK without definition. Na_2EDTA, NaEDTA, sodium EDTA, and Na-EDTA are all correct.

Table 9. Buffers

ACES	* 2-[(2-amino-2-oxoethyl)amino]ethanesulfonic acid (systematic name) *N*-(2-acetamido)-2-aminoethanesulfonic acid (manufacturer name)
ADA	* [(carbamoylmethyl)imino]diacetic acid (systematic) *N*-(2-acetamido)-2-iminodiacetic acid (manufacturer)
BES	* 2-[bis(2-hydroxyethyl)amino]ethanesulfonic acid (systematic) *N*,*N*-bis(2-hydroxyethyl)-2-aminoethanesulfonic acid (manufacturer)
Bicine	* *N*,*N*-bis(2-hydroxyethyl)glycine (systematic)
bis-Tris, Bistris, BisTris, or bis-tris	* 2-[bis(2-hydroxyethyl)amino]-2-(hydroxymethyl)propane-1,3-diol (systematic) bis(2-hydroxyethyl)iminotris(hydroxymethyl)methane (manufacturer)
CAPS	3-(cyclohexylamino)propanesulfonic acid
CHAPS	3-[(3-cholamidopropyl)dimethylammonio]-1-propanesulfonic acid
CHAPSO	3-[(3-cholamidopropyl)dimethylammonio]-2-hydroxy-1-propanesulfonic acid
CHES	2-(cyclohexylamino)ethanesulfonic acid
CDTA	1,2-cyclohexylenedinitrilotetraacetic acid
EDTA	* ethylenediaminetetraacetic acid (ethylenedinitrilo)tetraacetic acid *N*,*N*′-1,2-ethanediylbis[*N*-(carboxymethyl)glycine]
EGTA	* [ethylenebis(oxyethylenenitrilo)]tetraacetic acid 3,12-bis(carboxymethyl)-6,9-dioxa-3,12-diazatetradecanedioic acid
EPPS	Acceptable abbrev. for HEPPS; use definition for HEPPS below
HEPES	* 4-(2-hydroxyethyl)-1-piperazineethanesulfonic acid (systematic) *N*-2-hydroxyethylpiperazine-*N*[prime]-2-ethanesulfonic acid (manufacturer)
HEPPS (EPPS is also OK)	* 4-(2-hydroxyethyl)-1-piperazinepropanesulfonic acid (systematic) *N*-2-hydroxyethylpiperazine-*N*′-3-propanesulfonic acid (manufacturer)
MES	* 4-morpholineethanesulfonic acid (systematic) use 4-morpholinoethanesulfonic only if au. insists) 2-(*N*-morpholino)ethanesulfonic acid (manufacturer)
MOPS	* 4-morpholinepropanesulfonic acid (systematic) use 4-morpholinopropanesulfonic only if au. insists) 3-(*N*-morpholino)propanesulfonic acid (manufacturer)
PIPES	* 1,4-piperazinediethanesulfonic acid (systematic) piperazine-*N*,*N*[prime]-bis(2-ethanesulfonic acid) (manufacturer)
TAPS	* 3-{[2-hydroxy-1,1-bis(hydroxymethyl)ethyl]amino}-1-propanesulfonic acid (systematic) 3-[tris(hydroxymethyl)methyl]aminopropanesulfonic acid (manufacturer)
TEMED	* *N*,*N*,*N*′,*N*′-tetramethylethylenediamine
TES	* 2-{[2-hydroxy-1,1-bis(hydroxymethyl)ethyl]amino}ethanesulfonic acid (systematic)

	N-tris(hydroxymethyl)methyl-2-aminoethanesulfonic acid (manufacturer) (use parentheses *not* brackets)
Tricine	* *N*-[2-hydroxy-1,1-bis(hydroxymethyl)ethyl]glycine (systematic) *N*-tris(hydroxymethyl)methylglycine (manufacturer)
Tris	* 2-amino-2-hydroxymethylpropane-1,3-diol (systematic) tris(hydroxymethyl)aminomethane (manufacturer)

Numbered Compounds. All numbered compounds (such as LY294002, MG132, WY-14,643, and PD98059) should be treated like buffers. That is, they should be defined in the abbreviation list but not in the text, and they need be used only once to be added to the list. If author provides full name in text, move to abbreviation list.