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International Nonproprietary Names Modified

***Programme on International Nonproprietary Names
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I. General

1. The INN Programme was established by World Health Organization (WHO) to facilitate communication among health professionals in relation to pharmaceutical products used for therapeutic and prophylactic purposes. To serve this purpose, International Nonproprietary Names (INNs) are selected as single designations for individual pharmaceutical substances. As substances used in medicine and pharmacy are of highly diverse nature, individual classes of such substances require specific rules of nomenclature for creation of pertinent INNs.
2. Special situations mentioned above comprise creation of names of individual members belonging to a group of closely related substances. When the INN Programme was initiated, it was decided that in such situations, in order to limit the number of published INNs, an INN should be selected for one member of such a group only. This approach, which concerns especially substance sets formed by salts or esters of the same active moiety was validated in the 20th report of the WHO Expert Committee on Nonproprietary Names for Pharmaceutical Substances (Technical Report Series No. 581). It has been left for the users of INNs (pharmacopoeia commissions, regulatory bodies, pharmaceutical manufacturers) to create the actual name of any individual substance that turns up in practical use, this to be done in conformity with the usual practice of naming chemical compounds. INNs created in this manner are referred to as INNMs (International Nonproprietary Names Modified).
3. Present review is addressed to those users of the INN system who have a need to create an INNМ based on an existing INN. The review describes the approaches to be applied for the purpose and illustrates several frequent situations. When an INN is representing an acid, an INNМ may sometimes be needed to designate a salt or an ester, when an INN has been selected for a base, an INNМ may be necessary to designate a salt. In the case of an INN representing an alcohol, an INNМ may be needed to designate an ester. Other situations when the INNМ approach may be used include naming of quaternary salts differing in the anionic substituent. INNMs may be also needed for naming of combination products/complexes composed of substances for which an INN was selected. In presenting the INNМ approach in the review, appropriate use was made of the "General principles for guidance in devising international nonproprietary names for pharmaceutical substances" (see Annex 2 to resolution EB 115//2005/REC/1), referred to in following as "General principles".
4. Names that are used to designate pharmaceutical substances should convey information about the properties of that substance. This is of value for health professionals involved in drug delivery, especially for medical practitioners who are prescribing medicinal products, as the lack of such information may, in some cases, lead to errors in prescribing or even in drug dispensation. The use of the INNМ approach has an advantage of permitting to include in the name, in a logical way, some additional elements of information. However, the INNМ approach is not without its inconvenience, as

names that are created have to be composed at least of two or, sometimes, of three distinct words.

5. The use of INN approach requires sometimes utilization of chemical designations for radicals or groups of complex composition for which no trivial names exist in chemical nomenclature. To make substance names coined according to the INN approach more user-friendly, the INN Programme has created a number of shortened designations for such radicals and groups. This avoids the use of specific features of systematic organic chemical nomenclature, like the use as locants of numerals or single letters, a feature that is highly inconvenient for prescribers. The INN Programme has also created such shortened designations to describe simultaneous substitution of a parent molecule by two different radicals. A complete list of such radicals and groups is published in a document WHO/EDM/QSM/2004.6 "Names for radicals & groups - comprehensive list (2004)". Some examples of such abbreviated designations are given in the following parts of the document, but are limited chiefly to designations describing a single substituent.

6. The rules described in the present document are intended primarily for creation of INNs in Latin and in English. The examples selected to illustrate the INN approach for naming different groups of pharmaceutical substances are therefore given in Latin and English only. When other linguistic versions of INNs are to be created, the advice given in the document should be used together with the rules on transposition of INNs into the relevant language and taking also into account the usual practice of presenting chemical names in that language.

II. INNs for salts of basic compounds

7. When an INN is given for a substance that is a base, the INN of a salt is created by adding, as a second word, an appropriate designation of the acidic part of the molecule. For this part of the INN, usual names of acids are used. Abbreviated designations for complicated anions included in the list indicated in para. 5. may also be used, if appropriate. Some examples of those shortened designations are given below:

INN abbreviation Latin	INN abbreviation English	structure
besilas	besilate	benzenesulfonate
edisilas	edisilate	ethane-1,2-disulfonate
embonas	embonate	4,4'-methylenebis(3-hydroxynaphthalene-2-carboxylate)
mesilas	mesilate	methanesulfonate

8. When creating an INN for a salt of an inorganic acid, the usual rules of inorganic nomenclature are followed.

When creating an INN for a salt of an organic acid the following approach is usually used:

In the Latin version, a modified INN of the base is followed by the name of the anion. The name of the base is given in the genitive case and the name of the acidic component (anion) in the nominative case (either second declension neuter or third declension masculine). To form the name of an anion derived of a carboxylic acid, the suffix *-oicum* (or *-icum*) in the acid name is replaced with *-oas* (or *-as*).

In the English version, the INN of the base remains unchanged and is followed by the name of the anion. To form the name of an anion derived of a carboxylic acid, the suffix *-oic* (or *-ic*) in the acid name is replaced with *-oate* (or *-ate*).

INN Latin	INN English	INN Latin	INN English
abanoquillum	abanoquil	abanoquili mesilas	abanoquil mesilate
amlodipinum	amlodipine	amlodipini besilas	amlodipine besilate
chlorphenaminum	chlorphen-amine	- chlorphenamini hydrogenomaleas - chlorphenamini maleas	- chlorphenamine hydrogenomaleate - chlorphenamine maleate
clindamycinum	clindamycin	- clindamycini hydrochloridum - clindamycini phosphas	- clindamycin hydrochloride - clindamycin phosphate
clomethiazolum	clomethiazole	clomethiazoli edisilas	clomethiazole edisilate
fenoterolum	fenoterol	fenoteroli hydrobromidum	fenoterol hydrobromide
mebeverinum	mebeverine	mebeverini embonas	mebeverine embonate
prednisolonum	prednisolone	prednisoloni natrii phosphas	prednisolone sodium phosphate
timololum	timolol	timololi maleas	timolol maleate

III. INNs for salts of acidic compounds

9. The majority of organic compounds characterized as acids contain in their structure a carboxylic group (-COOH), a sulphonic group (-SO₃H) or a phosphonic group (-PO₃H₂). Also substances of other structure may show acid character and are classified as pseudo-acids. In all those cases, as indicated in para. 7., INNs created for salts would consist of two words, one designating the acidic component, and another one indicating the basic component (the cation). The sequences in which these two words are placed and the form used for the acidic component depend on the mode used for presentation of INN for the acid as shown in paras 10 - 12. When the basic

part of a salt is a simple cation, its usual chemical name is used. For basic components of a complex structure shortened designations included in the list mentioned in para 5, may also be used, if appropriate. Some examples of relevant abbreviated designations are given below:

INN abbreviation Latin	INN abbreviation English	structure
erbuminum	erbumine	2-methylpropan-2-amine
olaminum	olamine	2-aminoethanol

10. In the INN for a salt, in the case when INN for an acid is a two-word name containing the word "acid", an element describing acid component is formed from the name of the acid in the way described in para. 8. In the Latin version the suffix *-oicum* (or *-icum*) in the acid name is replaced with *-oas* (or *-as*). In the English version, the suffix *-oic* (or *-ic*) is replaced with *-oate* (or *-ate*).

INN Latin	INN English	INN Latin	INN English
acidum clavulanicum	clavulanic acid	kalii clavulanas	potassium clavulanate
acidum piridronicum	piridronic acid	natrii piridronas	sodium piridronate
acidum tiludronicum	tiludronic acid	- natrii tiludronas - dinatrii tiludronas	- sodium tiludronate - disodium tiludronate
acidum valproicum	valproic acid	- magnesii valproas - natrii valproas	- magnesium valproate - sodium valproate

11. In the case of complexes formed of a basic component and an acidic one, when the INN for the acid element is a two-word name containing the word "acid" but an INN exists also for the basic component, the procedure to create an INN is as follows: for the name of the acidic component the approach described in para. 10. is used, while the name of the base remains unchanged (see also para. 24).

INN Latin	INN English	INN Latin	INN English
acidum gadopenteticum	gadopentetic acid	gadopentas megluminum	gadopentate meglumine
acidum iodoxamicum	iodoxamic acid	iodoxamas megluminum	iodoxamate meglumine

12. When, in accordance with item 4 of the "General principles", the INN for an acid is formed as a one-word name, the name of the acid remains unchanged when creating an INN for a salt, both in the Latin and the English versions.

INN Latin	INN English	INN Latin	INN English
acamprosatum	acamprosate	acamprosatum calcium	acamprosate calcium
ciclopiroxum	ciclopirox	ciclopiroxum olaminum	ciclopirox olamine
dinoprostum	dinoprost	dinoprostum trometamolum	dinoprost trometamol
fostriecinum	fostriecin	fostriecinum natrium	fostriecin sodium
ibuprofenum	ibuprofen	ibuprofenum natrium	ibuprofen sodium
perindoprilum	perindopril	perindoprilum erbuminum	perindopril erbumine
zofenoprilum	zofenopril	zofenoprilum calcium	zofenopril calcium

13. When creating an INN for a salt of a compound that is not a true acid (a pseudo-acid), a two-word approach is also used. In the Latin version the INN of the acid remains in the nominative case (i.e. unchanged), treating it as a neuter substantive. The complementary component (the cation) is given in an adjectival form in agreement with the substantive. Consequently, "natricus" as the adjectival form of "natrium" has to be turned to "natricum". In the English version both the name of the acid and the name of the cation remain unchanged.

INN Latin	INN English	INN Latin	INN English
acesulfamum	acesulfam	acesulfamum kalicum	acesulfam potassium
amobarbitalum	amobarbital	amobarbitalum natricum	amobarbital natrium
carmellosum	carmellose	carmellosum natricum	carmellose sodium
cefalotinum	cefalotin	cefalotinum natricum	cefalotin sodium
flucloxacillinum	flucloxacillin	flucloxacillinum natricum	flucloxacillin sodium
liothyroninum	liothyronine	liothyroninum natricum	liothyronine sodium
mupirocinum	mupirocin	mupirocinum calcicum	mupirocin calcium

IV. INNMs for hydrates and other solvates

14. The occurrence of water in the composition of the substance is indicated by attaching the word hydrate to an INN, sometimes with a Latin or Greek prefix to indicate the number of molecules present. A shortened designation for a combination of the acid element and the degree of hydration/solvation included in the list indicated in para 5. may also be used, when appropriate.

INN abbreviation Latin	INN abbreviation English	composition
hyclas	hyclate	EtOH - HCl - H ₂ O (0.5/1/0.5)

15. When creating an INN for a hydrate, the INN remains unchanged.

INN Latin	INN English	INN Latin	INN English
estradiolum	estradiol	estradiolum hemihydricum	estradiol hemihydrate
niclosamidum	niclosamide	niclosamidum monohydricum	niclosamide monohydrate
oxytetracyclinum	oxytetracycline	oxytetracyclinum dihydricum	oxytetracycline dihydrate

16. When creating an INN for a compound which is a hydrate of a salt, the word *hydrate* follows the designation of the salt, unless an abbreviated designation is used.

INN Latin	INN English	INN Latin	INN English
doxycyclinum	doxycycline	doxycyclini hyclas	doxycycline hyclate
ethacridinum	ethacridine	ethacridini lactas monohydricus	ethacridine lactate monohydrate
ondansetronum	ondansetron	ondansetroni hydrochloridum dihydricum	ondansetron hydrochloride dihydrate

V. INNMs for esters - INN with an acid function

17. INNMs that are created for esters consist of two words, one corresponding to the acid component, and another designating the radical derived of the alcohol component. When creating an INN for an ester in the situation when the INN for the parent substance contains the acid function, the manner used to render the acid component in the ester name depends on the mode used for the presentation of the INN for acid, as described in paras. 10 and 12. The form in which the acidic component is presented, and the sequences in which the two words are placed, is different in the case when the INN for the acid is a two-word name (see para 18) or when it is a one-word name (see para 19). Abbreviated designations for complex radicals included in the list indicated in para 5. may also be used, if appropriate. Examples of those shortened designations are given below. When the molecule contains two radicals, a prefix *di-* is placed before radical name.

INN radical Latin	INN radical English	composition
axetilum	axetil	<i>rac</i> -1-(acetyloxy)ethyl
cilexetilum	cilexetil	<i>rac</i> -1-[[cyclohexyloxy]carbonyl]oxy}ethyl
mofetilum	mofetil	2-(morpholinyl-4-yl)ethyl
pivoxetilum	pivoxetil	<i>rac</i> -1-[(2-methoxy-2-methyl-propanyl)oxy]ethyl]
proxetilum	proxetil	<i>rac</i> -1-[[propan-2-yloxy]carbonyl]oxy}ethyl
soproxilum	soproxil	[[propan-2-yloxy]carbonyl]oxy}methyl

18. In the case when the INN for the acid is represented as a two-word name containing the word "acid", the procedure to create an INN for an ester is similar to that described already for salts in para 10. In the INN, the part describing the acid is formed in the Latin version by replacing the suffix *-oicum* (or *-icum*) in the name of the acid with *-oas* (or *-as*), while in the English version it is formed by replacing the suffix *-oic* (or *-ic*) with *-oate* (or *-ate*).

INN Latin	INN English	INN Latin	INN English
acidum flufenamicum	flufenamic acid	butylis flufenamas	butyl flufenamate
acidum mycophenolicum	mycophenolic acid	mofetilis mycophenolas	mofetil mycophenolate
acidum palmoxiricum	palmoxiric acid	methyilis palmoxiras	methyl palmoxirate

19. When, in accordance with item 4 of the "General principles" the INN for an acid is formed as a one-word name, the name of the acid remains unchanged when creating an INN for an ester, both in the Latin and the English versions. The procedure is thus similar to that described for salts in para 12.

INN Latin	INN English	INN Latin	INN English
cefuroximum	cefuroxim	- cefuroximum axetilum - cefuroximum pivoxilum	- cefuroxim axetil - cefuroxim pivoxetil
cefpodoximum	cefpodoxim	cefpodoximum proxetilum	cefpodoxim proxetil
sanfetrinemum	sanfetrinem	sanfetrinemum cilexetilum	sanfetrinem cilexetil
tenofovirum	tenofovir	tenofovirum disoproxilum	tenofovir disoproxil

VI. INNs for esters - INN with an alcohol function

20. When creating an INN for an ester in the situation when the INN is designating the alcohol component, the name of the INN is modified in the Latin version, but remains unchanged in the English version. The name of the acid part is suitably modified in both versions. Appropriate procedure is described in para. 21. For commonly used organic acids their usual names are employed. For acids of more complex structure, abbreviated carboxylate designations included in the list indicated in para 5. may also be used, when appropriate. Some examples of those shortened designations are given below:

INN abbreviation Latin	INN abbreviation English	structure
ecamas	ecamate	N-ethylcarbamate
enantas	enantate	heptanoate
etabonas	etabonate	ethyl carbonate
laurilsulfas	laurilsulfate	dodecyl sulfate
pivalas	pivalate	2,2-dimethylpropanoate
xinafoas	xinafoate	1-hydroxynaphthalene-2-carboxylate

21. The following approach is usually used when creating an INN for an ester in the situation described in para 20.

In the Latin version, an INN of the component containing the alcohol function is given in the genitive case and the name of the acidic component (anion) in the nominative case. The name of the acid component is formed in a manner similar to that described in para. 8, the suffix *-oicum* (or *-icum*) in the name of the acid being replaced with *-oas* (or *-as*).

In the English version, the INN of the component containing the alcohol function remains unchanged, while the name of the acid component is formed in the same manner as that described in para. 8, the suffix *-oic* (or *-ic*) in the name of the acid being replaced with *-oate* (or *-ate*).

In both linguistic versions the name of the alcohol component is followed by the name of the acid component.

INN Latin	INN English	INN Latin	INN English
asoprisnilum	asoprisnil	asoprisnili ecamas	asoprisnil ecamate
desoxycortonium	desoxycortone	- desoxycortoni acetas - desoxycortoni pivalas	- desoxycortone acetate - desoxycortone pivalate
erythromycinum	erythromycin	- erythromycini ethylsuccinas - erythromycini lactobionas - erythromycini laurisulfas - erythromycini stearas	- erythromycin ethylsuccinate - erythromycin lactobionate - erythromycin laurilsulfate - erythromycin stearate
fluocortolonum	fluocortolone	fluocortoloni pivalas	fluocortolone pivalate
fluphenazinum	fluphenazine	fluphenazini enantas	fluphenazine enantate
loteprednolum	loteprednol	loteprednoli etabonas	loteprednol etabonate
salmeterolum	salmeterol	salmeteroli xinafoas	salmeterol xinafoate
zuclopenthixolum	zuclopenthixol	- zuclopenthixoli acetas - zuclopenthixol decanoas	- zuclopenthixol acetate - zuclopenthixol decanoate

VII. INNs for quaternary substances

23. In accordance with item 5 of the "General principles" the INN for a quaternary substance will consist of two words, the cation and anion (the base) being named as separate components. The arrangements of the name

in Latin and in English are similar to that described for salts in para. 7. Abbreviated designations for complicated anions included in the list indicated in para 5. may also be used, if appropriate. Examples of shortened designations are given below:

INN abbreviation Latin	INN abbreviation English	structure
besilas	besilate	benzenesulfonate
closilas	closilate	4-chlorobenzene-1-sulfonate

24. When creating an INN for a quaternary substance in the Latin version, the name of the cation is given in the genitive case, whereas in the English version the name of the base remains unchanged.

INN Latin	INN English
atracurii besilas	atracurium besilate
benzododecinii bromidum	benzododecinium bromide
benzododecinii chloridum	benzododecinium chloride
gantacurii chloridum	gantacurium chloride
ipratropii bromidum	ipratropium bromide
thenii closilas	thenium closilate

VIII. INNs for combination products/complexes

25. INNs for combination products and for complexes are composed of two (or more) words and are created by placing together appropriate INNs without any modification.

INN Latin	INN English
bendazacum lysinum	bendazac lysine
dexketoprofenum trometamolum	dexketoprofen trometamol
dinoprostum trometamolum	dinoprost trometamol
fosfomicinum trometamolum	fosfomicin trometamol

26. In the case when an INN for a second component of a combination product or a complex does not exist, an established chemical name of that component is used.

INN Latin	INN English	INN Latin	INN English
bacitracinum	bacitracin	bacitracinum zincum	bacitracin zinc
cefatrizinum	cefatrizine	cefatrizinum propylenglycolum	cefatrizine propylene glycol
sulfadiazinum	sulfadiazine	sulfadiazinum argentum	sulfadiazine silver

IX. INNs for members of polymeric series

27. In the case of INNs for synthetic polymeric substances, which are frequently used as excipients, the INN is usually given to a family of polymers with a numerical designator to differentiate individual members of the series.

Such designator may indicate, for example, an average molecular mass. The examples are given below for the naming of polyethylene glycols (macrogols) and their monoesters. Creation of INNMs for esters from INNs for substances with an alcohol function is described in para 21.

INN Latin	INN English	Example of Latin INN	Example of English INN
macrogolum	macrogol	macrogolum 300	macrogol 300
<u>Definition:</u> polyethylene glycol of general formula $H-(OCH_2CH_2)_n-OH$, where n varies from 3 to 225, approximately. Each macrogol name is followed by a number corresponding approximately to its average molecular mass			

INN Latin	INN English	Example of Latin INN	Example of English INN
macrogolum	macrogol	macrogoli stearas 400	macrogol stearate 400
<u>Definition:</u> monoester derived from a polyethylene glycol and a fatty acid of general formula $H-(OCH_2CH_2)_n-OOCR$. Each macrogol ester name is followed by a number corresponding approximately to the average molecular mass of the polyethylene glycol portion.			

X. Improper use of the INN approach

28. As indicated in para 2, it has been left for the users of INNs (pharmacopoeia commissions, regulatory bodies, pharmaceutical manufacturers) to create the actual INN of an individual substance that is found in practical use. Such understanding is restricted to a regular use of the INN approach and should not be considered as a permission for creation of unauthorized versions of INNs. Some examples of situations that are not covered by the INN approach and where modifications of INNs are not authorized are presented in paras. 29 and 30. In all such cases, if a need arises for selection of an INN for a new substance, a regular procedure for the selection of INNs should be initiated and followed by the interested party.

29. An attempt is sometimes made to create names for derivatives of substances for which an INN has been selected. Various chemical prefixes are being attached to the INN to indicate a change in the structure of the molecule. Such names are occasionally referred to as "composite" INNs. This approach is considered inappropriate by the INN Programme, as it may create uncertainty as to the exact structure of the substance thus named, may hinder the regular process of INN selection, but may also create difficulties in the area of INN protection under intellectual property laws.

30. In the case of many INNs that are selected for substances of highly complex structure, like polypeptides or glycopolypeptides obtained by biotechnology, a need exists to differentiate between materials of close structural relationship. This may be done by appending, to the parent INN selected for the whole series, of specific designators, like Greek letters (for changes in the glycosylation pattern) or of single Arabic numerals, sometimes

followed by a small case letter. INNs for epoetins (alfa, beta, gamma, etc.) and for interferons (alfa-2a, alfa-2b, beta 1b, etc.) may be mentioned here as illustrating this approach. The selection of an appropriate designator is done in all those cases through applying a regular INN procedure and is not a part of the INN approach.