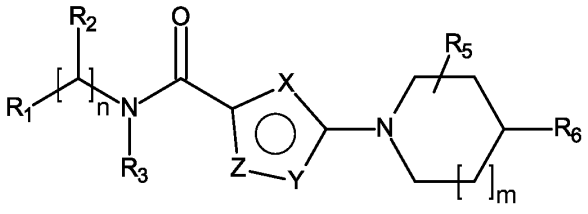
Claims

1. A compound of the general formula (I)



(I)

in which

X represents S, N or O;

Y represents N, S or O,

where, if X represents S, then Y represents N;

where, if X represents O, then Y represents N;

Z represents CR_4, O or NR_4,

where, if X represents N and Y represents N, then Z represents O;

where, if X represents S, then Z represents CR_4 or NR_4

R_1 represents 5- or 6-membered heteroaryl, phenyl,

where 5- to 6-membered heteroaryl may be substituted by 1 to 2 substituents independently of one another selected from the group of $(C_1$-$C_4)$-alkyl, $(C_1$-$C_4)$-alkoxy, halogen;

where $(C_1$-$C_4)$-alkyl may be up to trisubstituted by halogen,

where $(C_1$-$C_4)$-alkoxy may be up to trisubstituted by halogen,

where phenyl may be substituted by 1 to 2 substituents independently of one another selected from the group of $(C_1$-$C_4)$-alkyl, $(C_3$-$C_5)$-cycloalkyl, $(C_1$-$C_4)$-alkoxy, cyano, hydroxy, halogen;

where $(C_1$-$C_4)$-alkyl may be up to trisubstituted by halogen,

R_2 represents hydrogen, $(C_1$-$C_4)$-alkyl;

where (C_1-C_4)-alkyl may be up to trisubstituted by halogen,

or

together with the carbon atom to which R_2 is attached forms a (C_3-C_4)-cycloalkyl ring,

R_3 represents hydrogen, (C_1-C_4)-alkyl,

where (C_1-C_4)-alkyl may be up to trisubstituted by halogen,

R_4 in CR_4 represents hydrogen, (C_1-C_4)-alkyl, (C_3-C_4)-cycloalkyl, phenyl, halogen;

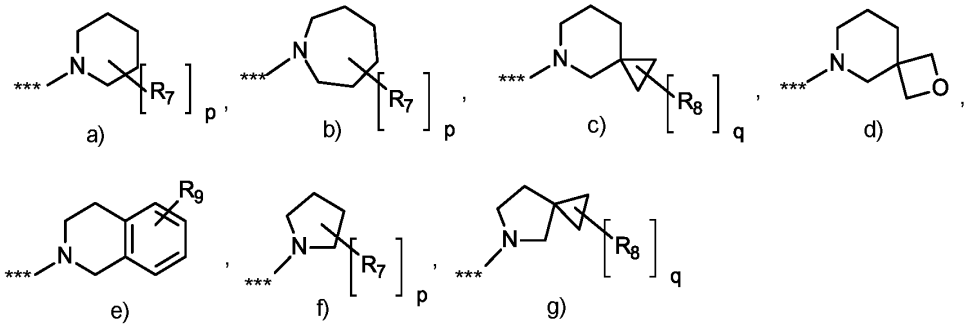
where (C_1-C_4)-alkyl may be up to trisubstituted by halogen and phenyl may be substituted by halogen,

in NR_4 represents hydrogen, (C_1-C_4)-alkyl, (C_3-C_4)-cycloalkyl, phenyl;

where (C_1-C_4)-alkyl may be up to trisubstituted by halogen and phenyl may be substituted by halogen,

R_5 represents hydrogen, (C_1-C_4)-alkyl, (C_1-C_4)-alkoxy, halogen,

R_6 represents a group of formula a), b), c), d), e), f) or g)



,

where *** marks the attachment to the adjacent piperidine ring,

where R_7 represents hydrogen, (C_1-C_4)-alkyl, (C_3-C_4)-cycloalkyl, (C_1-C_4)-alkoxy, (C_3-C_4)-cycloalkoxy, phenyl,

where (C_1-C_4)-alkyl may be substituted by (C_3-C_4)-cycloalkyl, (C_1-C_4)-alkoxy, (C_3-C_4)-cycloalkoxy and up to trisubstituted by halogen,

where (C_1-C_4)-alkoxy may be substituted by (C_3-C_4)-cycloalkyl and up to trisubstituted by halogen,

where (C_3-C_4)-cycloalkyl may be substituted by monofluoromethyl, difluoromethyl or trifluoromethyl and up to disubstituted by halogen,

where (C_1-C_4)-alkoxy may be substituted by (C_3-C_4)-cycloalkyl and up to trisubstituted by halogen,

where (C_3-C_4)-cycloalkyl may be mono- or disubstituted by halogen,

where (C_3-C_4)-cycloalkoxy may be up to disubstituted by halogen,

where R_8 represents hydrogen or fluorine,

where R_9 represents hydrogen, (C_1-C_4)-alkyl, (C_1-C_4)-alkoxy, halogen;

where (C_1-C_4)-alkyl may be substituted by (C_1-C_4)-alkoxy,

n represents 0 or 1,

m represents 0, 1 or 2,

p represents 0, 1 or 2 and

q represents 0, 1 or 2,

and the salts, solvates and solvates of the salts thereof.

2. Compounds of the formula (I) according to Claim 1, in which

X represents S or N;

Y represents N, S or O,

where, if X represents S, then Y represents N;

Z represents CR_4, N or O,

where, if X represents N and Y represents N, then Z represents O;

where, if X represents S, then Z represents N or CR_4

R_1 represents pyridinyl, pyrazolyl, thiazolyl, thienyl, phenyl,

where pyridinyl may be substituted by 1 to 2 substituents independently of one another selected from the group of (C_1-C_2)-alkyl, fluorine, chlorine, trifluoromethyl, trifluoromethoxy,

where pyrazolyl may be substituted by 1 to 2 substituents independently of one another selected from the group of (C_1-C_2)-alkyl, fluorine, chlorine, trifluoromethyl,

where thiazolyl may be substituted by 1 to 2 substituents independently of one another selected from the group of fluorine, chlorine,

where thienyl may be substituted by 1 to 2 substituents independently of one another selected from the group of fluorine, chlorine,

where phenyl may be substituted by 1 to 2 substituents independently of one another selected from the group of (C_1-C_2)-alkyl, (C_3-C_4)-cycloalkyl, methoxy, cyano, hydroxy, fluorine, chlorine, trifluoromethyl;

R_2 represents hydrogen, (C_1-C_2)-alkyl,

or

together with the carbon atom to which R_2 is attached forms a cyclopropyl ring,

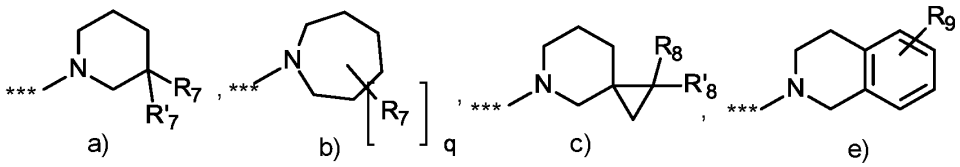
R_3 represents hydrogen, (C_1-C_2)-alkyl;

R_4 represents hydrogen, (C_1-C_2)-alkyl, (C_3-C_4)-cycloalkyl, trifluoromethyl, bromine, chlorine, phenyl;

where phenyl may be substituted by halogen,

R_5 represents hydrogen, (C_1-C_2)-alkyl, methoxy, fluorine;

R_6 represents a group of the formula a), b), c) or e),



where *** marks the attachment to the adjacent piperidine ring,

where R_7 or R'_7 independently of one another represent hydrogen, $(C_1$-$C_4)$-alkyl, $(C_3$-$C_4)$-cycloalkyl, $(C_1$-$C_2)$-alkoxy, $(C_3$-$C_4)$-cycloalkoxy, monofluoromethyl, difluoromethyl, trifluoromethyl, difluoromethoxy, phenyl,

where $(C_1$-$C_4)$-alkyl may be substituted by methoxy, n-butoxy, cyclopropyl, cyclobutoxy and up to disubstituted by fluorine,

where methoxy may be substituted by cyclopropyl, cyclobutyl, trifluoromethyl,

where cyclopropyl may be substituted by monofluoromethyl, difluoromethyl, trifluoromethyl,

where cyclobutyl may be up to disubstituted by fluorine,

where n-butoxy may be up to disubstituted by fluorine,

where $(C_1$-$C_2)$-alkoxy may be substituted by cyclopropyl, cyclobutyl, cyclobutoxy, trifluoromethyl and

where cyclopropyl and cyclobutyl may be up to disubstituted by fluorine,

where $(C_3$-$C_4)$-cycloalkoxy may be up to disubstituted by fluorine,

where R_8 or R'_8 independently of one another represent hydrogen or fluorine,

where R_9 represents hydrogen, $(C_1$-$C_4)$-alkyl, $(C_1$-$C_2)$-alkoxy, methoxyethyl, fluorine, chlorine;

n represents 0 or 1 and

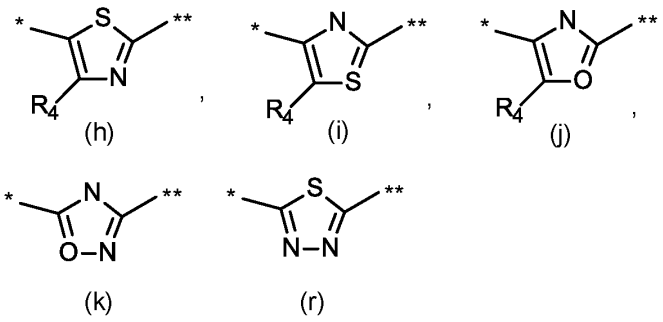
m represents 1 or 2,

q represents 0 or 2,

and the salts, solvates and solvates of the salts thereof.

3. Compounds of the formula (I) according to Claim 1, in which

X, Y and Z are selected such that the aromatic 5-memebered ring has the structural formula h), i), j), k) or (r),



where * marks the attachment to the carbonyl group and ** marks the attachment to the nitrogen atom of the adjacent piperidine ring and

R_1 represents pyridinyl, pyrazolyl, thiazolyl, thienyl, phenyl,

where pyridinyl may be substituted by 1 to 2 substituents independently of one another selected from the group of (C_1-C_2)-alkyl, fluorine, chlorine, trifluoromethyl, trifluoromethoxy,

where pyrazolyl may be substituted by 1 to 2 substituents independently of one another selected from the group of (C_1-C_2)-alkyl, fluorine, chlorine, trifluoromethyl,

where thiazolyl may be substituted by chlorine,

where thienyl may be substituted by fluorine,

where phenyl may be substituted by 1 to 2 substituents independently of one another selected from the group of (C_1-C_2)-alkyl, (C_3-C_4)-cycloalkyl, methoxy, cyano, hydroxy, fluorine, chlorine, trifluoromethyl;

R_2 represents hydrogen, methyl,

or

together with the carbon atom to which R_2 is attached forms a cyclopropyl ring,

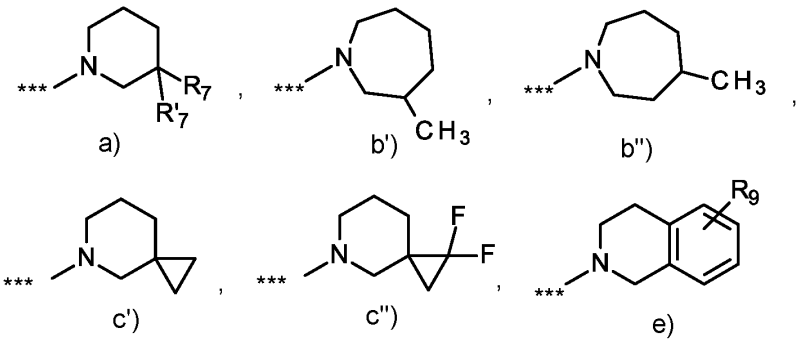
R_3 represents hydrogen, (C_1-C_2)-alkyl;

R_4 represents hydrogen, methyl, ethyl, cyclopropyl, trifluoromethyl, bromine, chlorine, phenyl;

where phenyl may be substituted by chlorine,

R_5 represents hydrogen, fluorine;

R_6 represents a group of the formula a), b‘), b‘‘), c‘), c‘‘) or e),



where *** marks the attachment to the adjacent piperidine ring,

where R_7 or $R‘_7$ independently of one another represent hydrogen, (C_1-C_4)-alkyl, (C_3-C_4)-cycloalkyl, (C_1-C_2)-alkoxy, (C_3-C_4)-cycloalkoxy, monofluoromethyl, difluoromethyl, trifluoromethyl, difluoromethoxy, phenyl,

where (C_1-C_4)-alkyl may be substituted by methoxy, n-butoxy, cyclopropyl, cyclobutoxy and up to disubstituted by fluorine,

where methoxy may be substituted by cyclopropyl, cyclobutyl, trifluoromethyl,

where cyclopropyl may be substituted by monofluoromethyl, difluoromethyl, trifluoromethyl,

where cyclobutyl may be up to disubstituted by fluorine,

where n-butoxy may be up to disubstituted by fluorine,

where (C_1-C_2)-alkoxy may be substituted by cyclopropyl, cyclobutyl, cyclobutoxy, trifluoromethyl and

where cyclopropyl and cyclobutyl may be up to disubstituted by fluorine,

where (C_3-C_4)-cycloalkoxy may be up to disubstituted by fluorine,

where R_9 represents hydrogen, methyl, tert-butyl, methoxy, methoxymethyl, fluorine, chlorine;

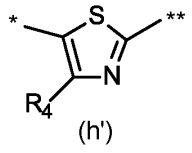
n represents 0 or 1 and

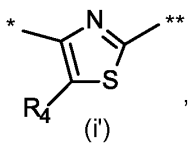
m represents 1 or 2,

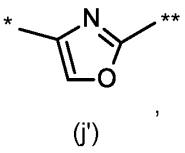
and the salts, solvates and solvates of the salts thereof.

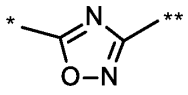
4. Compounds of the formula (I) according to Claim 1, in which

X, Y and Z are selected such that the aromatic 5-memebered ring has the structural formula h'), i'), j') or k),


(h')


(i')


(j')


(k)

R_1 represents pyridinyl, 2-ethylpyridinyl, 4,6-dimethylpyridinyl, 3,5-difluoropyridinyl, 3-fluoropyridinyl, 4-trifluoromethylpyridinyl, 6-trifluoromethylpyridinyl, 5-chloro-3-fluoropyridinyl, 3-chloro-5-fluoropyridinyl, 3-methylpyridinyl, 4-methylpyridinyl, 6-methylpyridinyl, 3-chloropyridinyl, 5-chloropyridinyl, 6-trifluoromethoxypyridinyl, phenyl, 2-methylphenyl, 3-methylphenyl, 4-methylphenyl, 3-methoxyphenyl, 4-trifluoromethylphenyl, 2-chlorophenyl, 3-chlorophenyl, 4-chlorophenyl, 2-fluorophenyl, 3-fluorophenyl, 4-fluorophenyl, 3-hydroxyphenyl, 2,5-difluorophenyl, 5-chloro-2-hydroxyphenyl, 5-fluoro-2-methoxyphenyl, 5-chloro-2-fluorophenyl, 2-chloro-5-fluorophenyl, 2-chloro-4-fluorophenyl, 3-cyano-4-fluorophenyl, 2-cyclopropylphenyl, 4-chloro-1-methyl-1H-pyrazolyl, 5-chloro-1,3-thiazolyl, 5-fluoro-2-thienyl;

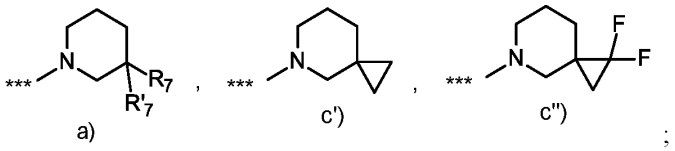
R_2 represents hydrogen or methyl;

R_3 represents hydrogen, methyl;

R_4 represents hydrogen, ethyl, trifluoromethyl;

R_5 represents hydrogen, fluorine;

R_6 represents a group of the formula a), c') or c'')



;

where *** marks the attachment to the adjacent piperidine ring,

where R_7 and R'_7 independently of one another represent hydrogen, methyl, ethyl, n-propyl, isopropyl, tert-butyl, 2-fluoroethyl, cyclopropyl, cyclobutyl, cyclopropylmethyl, methoxy, ethoxy, methoxymethyl, monofluoromethyl, difluoromethyl, trifluoromethyl, difluoromethoxy, 3,3-difluorocyclobutylmethoxy, cyclobutylmethoxy, cyclopropylmethoxy, cyclopropylmethoxymethyl, cyclobutyloxymethyl, 3-fluorobutyloxymethyl, 3,3-difluorocyclobutylmethoxymethyl, 2,2,2-trifluoroethoxy, 2,2,2-trifluoroethoxymethyl, 2,2-difluorocyclopropylmethoxy, cyclobutyloxy, 3,3-difluorocyclobutyloxy, fluoromethylcyclopropylmethoxy, difluoromethylcyclopropylmethoxy, trifluoromethylcyclopropylmethoxy, fluorine;

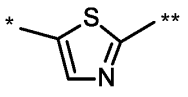
n represents 0 or 1 and

m represents 1,

and the salts, solvates and solvates of the salts thereof.

5. Compounds of the formula (I) according to Claim 1, in which

X, Y and Z are selected such that the aromatic 5-membered ring has the structural formula h')



,

(h')

R_1 represents pyridinyl, 2-ethylpyridinyl, 4,6-dimethylpyridinyl, 3,5-difluoropyridinyl, 3-fluoropyridinyl, 4-trifluoromethylpyridinyl, 6-trifluoromethylpyridinyl, 5-chloro-3-fluoropyridinyl, 3-chloro-5-fluoropyridinyl, 3-methylpyridinyl, 4-methylpyridinyl, 6-methylpyridinyl, 3-chloropyridinyl, 5-chloropyridinyl, 6-trifluoromethoxypyridinyl, phenyl, 2-methylphenyl, 3-methylphenyl, 4-

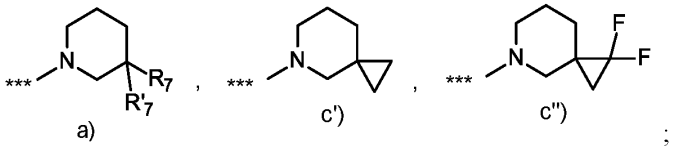
methylphenyl, 3-methoxyphenyl, 4-trifluoromethylphenyl, 2-chlorophenyl, 3-chlorophenyl, 4-chlorophenyl, 2-fluorophenyl, 3-fluorophenyl, 4-fluorophenyl, 3-hydroxyphenyl, 2,5-difluorophenyl, 5-chloro-2-hydroxyphenyl, 5-fluoro-2-methoxyphenyl, 5-chloro-2-fluorophenyl, 2-chloro-5-fluorophenyl, 2-chloro-4-fluorophenyl, 3-cyano-4-fluorophenyl, 2-cyclopropylphenyl, 4-chloro-1-methyl-1H-pyrazolyl, 5-chloro-1,3-thiazolyl, 5-fluoro-2-thienyl;

R_2 represents hydrogen or methyl;

R_3 represents hydrogen;

R_5 represents hydrogen, fluorine;

R_6 represents a group of the formula a), c') or c'')



;

where *** marks the attachment to the adjacent piperidine ring,

where R_7 and R'_7 independently of one another represent hydrogen, methyl, ethyl, n-propyl, isopropyl, tert-butyl, 2-fluoroethyl, cyclopropyl, cyclobutyl, cyclopropylmethyl, methoxy, ethoxy, methoxymethyl, monofluoromethyl, difluoromethyl, trifluoromethyl, difluoromethoxy, 3,3-difluorocyclobutylmethoxy, cyclobutylmethoxy, cyclopropylmethoxy, cyclopropylmethoxymethyl, cyclobutyloxymethyl, 3-fluorobutyloxymethyl, 3,3-difluorocyclobutylmethoxymethyl, 2,2,2-trifluoroethoxy, 2,2,2-trifluoroethoxymethyl, 2,2-difluorocyclopropylmethoxy, cyclobutyloxy, 3,3-difluorocyclobutyloxy, fluoromethylcyclopropylmethoxy, difluoromethylcyclopropylmethoxy, trifluoromethylcyclopropylmethoxy, fluorine;

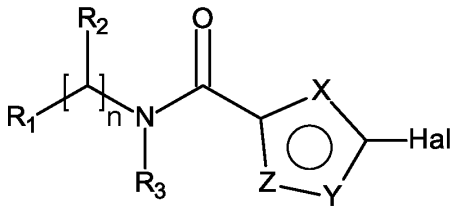
n represents 0 or 1 and

m represents 1,

and the salts, solvates and solvates of the salts thereof.

6. Process for preparing the compounds of the formula (I) or salts thereof, solvates thereof or solvates of the salts thereof, where

[A] compounds of the formula (II)



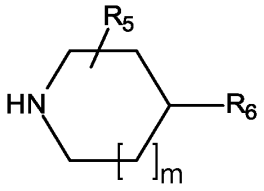
(II)

in which

X, Y, Z, R_1, R_2, R_3 and R_4 and n have the meanings given above,

Hal represents a leaving group,

are reacted in the presence of a base with compounds of the formula (III)

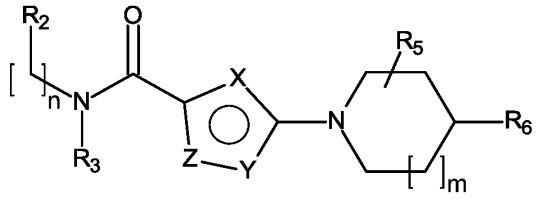


(III),

in which

R_5 and R_6 and m have the meanings given above,

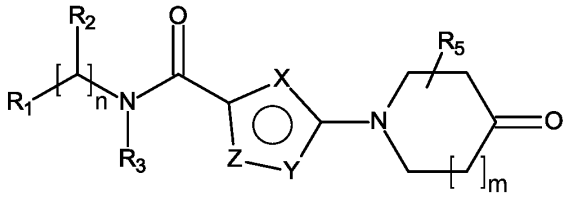
to give compounds of the formula (I-A)



(I-A),

or

[B] compounds of the formula (IV)

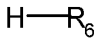


(IV),

in which

X, Y, Z, R_1, R_2, R_3, R_4 and R_5 and n and m have the meanings given above,

are reacted with compounds of the formula (V)

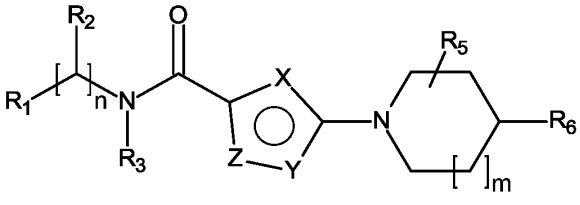


(V),

in which

R_6 has the meaning given above,

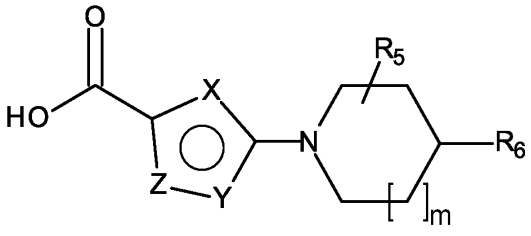
in the presence of a reducing agent and optionally an acid to give compounds of the formula (I-B)



(I-B),

or

[C] compounds of the formula (VI)

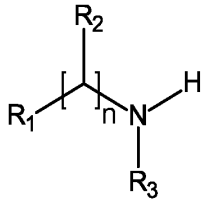


(VI),

in which

X, Y, Z, R_4, R_5 and R_6 and n and m have the meanings given above,

are reacted with compounds of the formula (VII)

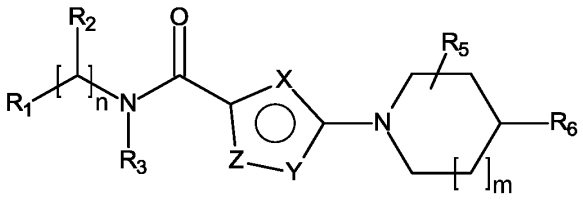


(VII),

in which

R_1, R_2 and R_3 and n have the meanings given above,

in the presence of a condensating or activating agent to give compounds of the formula (I-C)



(I-C),

and the compounds of the formulae (I-A), (I-B), (I-C) thus obtained are optionally separated into their enantiomers and/or diastereomers and/or optionally converted with the appropriate (*i*) solvents and/or (*ii*) acids to the solvates, salts and/or solvates of the salts thereof.

7. Compound as defined in any of Claims 1 to 5 for treatment and/or prevention of diseases.

8. Compound as defined in any of Claims 1 to 5 for use in a method for the treatment and/or prevention of breathing difficulties, dysphagia, peripheral and cardiac vascular disorders and disorders of the peripheral and central nervous system.

9. Compound as defined in any of Claims 1 to 5 for use in a method for the treatment and/or prevention of breathing difficulties including sleep-induced breathing difficulties such as central and obstructive sleep apnoea, snoring (primary and obstructive snoring), dysphagia, peripheral and cardiac vascular disorders including diabetic microangiopathies and disorders of the peripheral and central nervous system including neurodegenerative and neuroinflammatory disorders.

10. Compound as defined in any of Claims 1 to 5 for use in a method for the treatment and/or prevention of breathing difficulties including sleep-induced breathing difficulties such as,

inter alia, obstructive sleep apnoea (in adults and children), primary snoring, obstructive snoring (upper airway resistance syndrome, heavy snoring, hypopnoea syndrome), central sleep apnoea, Cheyne-Stokes respiration, primary sleep apnoea of infancy, apparent life-threatening event, central sleep apnoea as a result of the use of medicaments or the use of other substances, obesity hypoventilation syndrome, disrupted central respiratory drive, sudden infant death, primary alveolar hypoventilation syndrome, postoperative hypoxia and apnoea, muscular respiratory disorders, respiratory disorders following long-term ventilation, respiratory disorders during adaptation in high mountains, acute and chronic pulmonary diseases with hypoxia and hypercapnia, sleep-related non-obstructive alveolar hypoventilation and the congenital central alveolar hypoventilation syndrome and dysphagia.

11. Compound as defined in any of Claims 1 to 5 for use in a method for the treatment and/or prevention of peripheral and cardiac vascular disorders including diabetic microangiopathies, diabetic ulcers at the extremities, in particular for promoting wound healing of diabetic foot ulcers, diabetic heart failure, diabetic coronary microvascular cardiac disorders, peripheral and cardiac vascular disorders, thromboembolic disorders and ischaemias, peripheral circulatory disorders, Raynaud's phenomenon, systemic scleroderma, CREST syndrome, microcirculation disorders and intermittent claudication.

12. Compound as defined in any of Claims 1 to 5 for use in a method for the treatment and/or prevention of disorders of the peripheral and central nervous system, including dementia, depression, schizophrenia, attention deficit disorder with or without hyperaktivity (ADHS), Tourette syndrome, post-traumatic stress disorder, obsessive-compulsive disorder, blepharospasm or other focal dystonias, drug-induced psychosis, temporal lobe epilepsy with psychosis, panic disorder, disorders caused by changes in sexual hormones, multiple sclerosis, Alzheimer's disease, Parkinson's disease, Huntington's disease.

13. Medicament comprising a compound as defined in any of Claims 1 to 5 in combination with one or more inert, nontoxic, pharmaceutically suitable excipients.

14. Medicament, comprising a compound as defined in any of Claims 1 to 5 in combination with one or more further active compounds selected from the group consisting of respiratory stimulants, psychostimulating compounds, serotonin reuptake inhibitors, noradrenergic, serotonergic and tricyclic antidepressants, P2X3 antagonists, sGC stimulators, mineralocorticoid receptor antagonists, antiinflammatory drugs, immunomodulators, immunosuppressives and cytotoxic drugs.

15. Medicament according to Claim 13 or 14 for the treatment and/or prevention of breathing difficulties including sleep-induced breathing difficulties such as central and obstructive

sleep apnoea, snoring (primary and obstructive snoring), dysphagia, peripheral and cardiac vascular disorders including diabetic microangiopathies and disorders of the peripheral and central nervous system including neurodegenerative and neuroinflammatory disorders.

16. Method for the treatment and/or prevention of breathing difficulties including sleep-induced breathing difficulties such as central and obstructive sleep apnoea, snoring (primary and obstructive snoring), dysphagia, peripheral and cardiac vascular disorders including diabetic microangiopathies and disorders of the peripheral and central nervous system including neurodegenerative and neuroinflammatory disorders in humans and animals by administration of an effective amount of at least one compound as defined in any of Claims 1 to 5, or of a medicament as defined in any of Claims 13 to 15.