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(54) **Title:** 8-AZA-BICYCLO (3.2.1) OCTANE DERIVATIVES AND THEIR USE AS MONOAMINE NEUROTRANSMITTER RE-UPTAKE INHIBITORS

(57) **Abstract:** This invention relates to novel 8-aza-bicyclop[3.2. 1]octane derivatives useful as monoamine neurotransmitter re-uptake inhibitors. In other aspects the invention relates to the use of these compounds in a method for therapy and to pharmaceutical compositions comprising the compounds of the invention.

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8-AZA-BICYCLO[3.2.1]OCTANE DERIVATIVES AND THEIR USE AS MONOAMINE NEUROTRANSMITTER RE-UPTAKE INHIBITORS

TECHNICAL FIELD

This invention relates to novel 8-aza-bicyclo[3.2.1]octane derivatives useful as monoamine neurotransmitter re-uptake inhibitors.

In other aspects the invention relates to the use of these compounds in a method for therapy and to pharmaceutical compositions comprising the compounds of the invention.

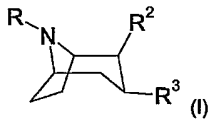
BACKGROUND ART

WO 97/30997 (NeuroSearch A/S) describes tropane derivatives active as neurotransmitter re-uptake inhibitors.

However, there is a continued strong need to find compounds with an optimised biochemical profile as regards the activity on reuptake of the monoamine neurotransmitters serotonin, dopamine and noradrenaline, such as the ratio of the serotonin reuptake versus the noradrenaline and dopamine activity.

SUMMARY OF THE INVENTION

In its first aspect, the invention provides a 8-aza-bicyclo[3.2.1]octane derivative of the Formula I:



(I)

or any of its isomers or any mixture of its isomers, or a pharmaceutically acceptable salt thereof,

wherein R, R^2 and R^3 are as defined below.

In its second aspect, the invention provides a pharmaceutical composition, comprising a therapeutically effective amount of a compound of the invention, or any of its isomers or any mixture of its isomers, or a pharmaceutically acceptable salt thereof, together with at least one pharmaceutically acceptable carrier, excipient or diluent.

In a further aspect, the invention provides the use of a compound of the invention, or any of its isomers or any mixture of its isomers, or a pharmaceutically acceptable salt thereof, for the manufacture of a pharmaceutical composition for the treatment, prevention or alleviation of a disease or a disorder or a condition of a mammal, including a human, which disease, disorder or condition is responsive to inhibition of monoamine neurotransmitter re-uptake in the central nervous system.

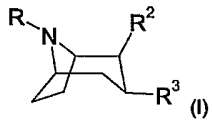
In a still further aspect, the invention relates to a method for treatment, prevention or alleviation of a disease or a disorder or a condition of a living animal body, including a human, which disorder, disease or condition is responsive to responsive to inhibition of monoamine neurotransmitter re-uptake in the central nervous system, which method comprises the step of administering to such a living animal body in need thereof a therapeutically effective amount of a compound of the invention, or any of its isomers or any mixture of its isomers, or a pharmaceutically acceptable salt thereof.

Other objects of the invention will be apparent to the person skilled in the art from the following detailed description and examples.

DETAILED DISCLOSURE OF THE INVENTION

Tropane derivatives

In its first aspect the present invention provides a 8-aza-bicyclo[3.2.1]octane derivative of formula I:



(I)

or any of its isomers or any mixture of its isomers, or a pharmaceutically acceptable salt thereof,

wherein

R represents hydrogen or alkyl;

R^2 represents $-CH_2-X-R^a$;

wherein X represents -O- or -S-;

R^a represents phenyl or naphthyl,

which phenyl or naphthyl is optionally substituted with substituted with one or more substituents selected from the group consisting of:

halo, hydroxy, amino, cyano, nitro, trifluoromethyl, trifluoromethoxy, alkoxy, cycloalkoxy, alkyl, cycloalkyl, cycloalkylalkyl, alkenyl, and alkynyl;

R^3 represents heteroaryl;

which heteroaryl is optionally substituted with substituted with one or more substituents selected from the group consisting of:

halo, hydroxy, amino, cyano, nitro, trifluoromethyl, trifluoromethoxy, alkoxy, cycloalkoxy, alkyl, cycloalkyl, cycloalkylalkyl, alkenyl, and alkynyl.

In one embodiment, R represents hydrogen. In a further embodiment, R represents alkyl, such as methyl. In a still further embodiment, R represents hydrogen or methyl.

In a further embodiment, X represents -O-. In a still further embodiment, X represents -S-.

In a further embodiment, R^a represents optionally substituted phenyl. In a special embodiment, R^a represents phenyl optionally substituted with one or more halo or one or more alkoxy. In a further embodiment, R^a represents phenyl optionally substituted with two halo, such as two chloro. In a further embodiment, R^a represents phenyl substituted with two fluoro. In a still further embodiment, R^a represents phenyl substituted with two alkoxy, such as two methoxy. In a further embodiment, R^a represents 2,3-dichlorophenyl or 3,4-dichlorophenyl. In a still further embodiment, R^a represents 2,3-difluorophenyl. In a further embodiment, R^a represents 2,3-dimethoxyphenyl.

In a still further embodiment, R^a represents optionally substituted naphthyl. In a special embodiment, R^a represents naphthyl, such as naphthalen-1-yl or naphthalen-2-yl.

In a special embodiment, R^2 represents 2,3-dichlorophenoxymethyl, 2,3-difluorophenoxymethyl, 2,3-dimethoxyphenoxymethyl, naphthalen-1-yloxymethyl or naphthalen-2-yloxymethyl. In a further special embodiment, R^2 represents 2,3-dichlorophenoxymethyl or naphthalen-1-yloxymethyl.

In a further embodiment, R^3 represents thienyl optionally substituted with one or more halo or alkoxy. In a special embodiment, R^3 represents chlorothienyl, such as 5-chloro-thiophen-2-yl. In a further special embodiment, R^3 represents methoxythienyl, such as 5-methoxy-thiophen-2-yl. In a still further embodiment, R^3 represents thienyl, such as thiophen-2-yl or thiophen-3-yl. In a further embodiment, R^3 represents furyl, optionally substituted with one or more halo, such as one or more chloro. In a special embodiment, R^3 represents chlorofuryl, such as 5-chloro-furan-2-yl. In a still further embodiment R^3 represents furyl, such as furan-2-yl or furan-3-yl.

In a further embodiment of the compound of formula I,

R represents hydrogen or methyl;

X represents -O-;

R^a represents 2,3-dichlorophenyl, 2,3-difluorophenyl, 2,3-dimethoxyphenyl or naphthyl; and

R^3 represents thienyl or furyl, optionally substituted with one or more halo or alkoxy.

In a still further embodiment of the compound of formula I,

R represents hydrogen or methyl;

X represents -O-;

R^a represents 2,3-dichlorophenyl or naphthyl; and

R^3 represents thienyl or furyl.

In a special embodiment the chemical compound of the invention is

(*2R,3S*)-2-(2,3-Dichlorophenoxymethyl)-8-methyl-3-(2-thienyl-8-aza-bicyclo[3.2.1]octane;

(*2R,3S*)-2-(1-Naphthyloxymethyl)-8-methyl-3-(2-thienyl)-8-aza-bicyclo[3.2.1]octane;

(*2R,3S*)-2-(2,3-Dichlorophenoxymethyl)-8-methyl-3-(3-thienyl)-8-aza-bicyclo[3.2.1]octane;

(*2R,3S*)-2-(1-Naphthyloxymethyl)-8-methyl-3-(3-thienyl)-8-aza-bicyclo[3.2.1]octane;

(*2R,3S*)-2-(2,3-Dichlorophenoxymethyl)-8-methyl-3-(2-furanyl)-8-aza-bicyclo[3.2.1]octane;

(*2R,3S*)-2-(1-Naphthyloxymethyl)-8-methyl-3-(2-furanyl)-8-aza-bicyclo[3.2.1]octane;

(*2R,3S*)-2-(2,3-Dichlorophenoxymethyl)-8-methyl-3-(3-furanyl)-8-aza-bicyclo[3.2.1]octane;

(*2R,3S*)-2-(1-Naphthyloxymethyl)-8-methyl-3-(3-furanyl)-8-aza-bicyclo[3.2.1]octane;

(*2S,3R*)-2-(2,3-Dichlorophenoxymethyl)-8-methyl-3-(2-thienyl)-8-aza-bicyclo[3.2.1]octane;

(*2S,3R*)-2-(1-Naphthyloxymethyl)-8-methyl-3-(2-thienyl)-8-aza-bicyclo[3.2.1]octane;

(*2S,3R*)-2-(2,3-Dichlorophenoxymethyl)-8-methyl-3-(3-thienyl)-8-aza-bicyclo[3.2.1]octane;

(*2S,3R*)-2-(1-Naphthyloxymethyl)-8-methyl-3-(3-thienyl)-8-aza-bicyclo[3.2.1]octane;

(*2S,3R*)-2-(2,3-Dichlorophenoxymethyl)-8-methyl-3-(2-furanyl)-8-aza-bicyclo[3.2.1]octane;

(*2S,3R*)-2-(1-Naphthyloxymethyl)-8-methyl-3-(2-furanyl)-8-aza-bicyclo[3.2.1]octane;

(*2S,3R*)-2-(2,3-Dichlorophenoxymethyl)-8-methyl-3-(3-furanyl)-8-aza-bicyclo[3.2.1]octane;

(*2S,3R*)-2-(1-Naphthyloxymethyl)-8-methyl-3-(3-furanyl)-8-aza-bicyclo[3.2.1]octane;

(*2R,3S*)-2-(2,3-Dichlorophenoxymethyl)-8-methyl-3-(5-chloro-thien-2-yl)-8-aza-bicyclo[3.2.1]octane;

(*2R,3S*)-2-(1-naphthyl)-8-methyl-3-(5-chloro-thien-2-yl)-8-aza-bicyclo[3.2.1]octane;

(*2R,3S*)-2-(2,3-Difluorophenoxymethyl)-8-methyl-3-(5-chloro-furan-2-yl)-8-aza-bicyclo[3.2.1]octane;

(*2R,3S*)-2-(2,3-Difluorophenoxymethyl)-8-methyl-3-(5-methoxy-thien-2-yl)-8-aza-bicyclo[3.2.1]octane;

(2*R*,3*S*)-2-(2,3-Dimethoxyphenoxymethyl)-8-methyl-3-(2-furanyl)-8-aza-bicyclo[3.2.1]octane;
(2*R*,3*S*)-2-(2,3-Dichlorophenoxymethyl)-8-methyl-3-(5-methoxy-thien-2-yl)-8-aza-bicyclo[3.2.1]octane;
(2*R*,3*S*)-2-(2-naphthyl)-8-methyl-3-(5-chloro-thien-2-yl)-8-aza-bicyclo[3.2.1]octane;
(2*R*,3*S*)-2-(2,3-Difluorophenoxymethyl)-8-methyl-3-(2-furanyl)-8-aza-bicyclo[3.2.1]octane;
(2*R*,3*S*)-2-(2,3-Dichlorophenoxymethyl)-8-H -3-(2-thienyl)-8-aza-bicyclo[3.2.1]octane;
(2*R*,3*S*)-2-(1-Naphthyloxymethyl)-8-H-3-(2-thienyl)-8-aza-bicyclo[3.2.1]octane;
(2*R*,3*S*)-2-(2,3-Dichlorophenoxymethyl)-8-H-3-(3-thienyl)-8-aza-bicyclo[3.2.1]octane;
(2*R*,3*S*)-2-(1-Naphthyloxymethyl)-8-H-3-(3-thienyl)-8-aza-bicyclo[3.2.1]octane;
(2*R*,3*S*)-2-(2,3-Dichlorophenoxymethyl)-8-H-3-(2-furanyl)-8-aza-bicyclo[3.2.1]octane;
(2*R*,3*S*)-2-(1-Naphthyloxymethyl)-8-H-3-(2-furanyl)-8-aza-bicyclo[3.2.1]octane;
(2*R*,3*S*)-2-(2,3-Dichlorophenoxymethyl)-8-H-3-(3-furanyl)-8-aza-bicyclo[3.2.1]octane;
(2*R*,3*S*)-2-(1-Naphthyloxymethyl)-8-H-3-(3-furanyl)-8-aza-bicyclo[3.2.1]octane;
(2*S*,3*R*)-2-(2,3-Dichlorophenoxymethyl)-8-H-3-(2-thienyl)-8-aza-bicyclo[3.2.1]octane;
(2*S*,3*R*)-2-(1-Naphthyloxymethyl)-8-H-3-(2-thienyl)-8-aza-bicyclo[3.2.1]octane;
(2*S*,3*R*)-2-(2,3-Dichlorophenoxymethyl)-8-H-3-(3-thienyl)-8-aza-bicyclo[3.2.1]octane;
(2*S*,3*R*)-2-(1-Naphthyloxymethyl)-8-H-3-(3-thienyl)-8-aza-bicyclo[3.2.1]octane;
(2*S*,3*R*)-2-(2,3-Dichlorophenoxymethyl)-8-H-3-(2-furanyl)-8-aza-bicyclo[3.2.1]octane;
(2*S*,3*R*)-2-(1-Naphthyloxymethyl)-8-H-3-(2-furanyl)-8-aza-bicyclo[3.2.1]octane;
(2*S*,3*R*)-2-(2,3-Dichlorophenoxymethyl)-8-H-3-(3-furanyl)-8-aza-bicyclo[3.2.1]octane;
(2*S*,3*R*)-2-(1-Naphthyloxymethyl)-8-H-3-(3-furanyl)-8-aza-bicyclo[3.2.1]octane;
or any of its isomers or any mixture of its isomers, or a pharmaceutically acceptable salt thereof.

Any combination of two or more of the embodiments as described above is considered within the scope of the present invention.

Definition of Substituents

In the context of this invention halo represents fluoro, chloro, bromo or iodo.

In the context of this invention an alkyl group designates a univalent saturated, straight or branched hydrocarbon chain. The hydrocarbon chain preferably contain of from one to six carbon atoms (C_{1-6}-alkyl), including pentyl, isopentyl, neopentyl, tertiary pentyl, hexyl and isohexyl. In a preferred embodiment alkyl represents a C_{1-4}-alkyl group, including butyl, isobutyl, secondary butyl, and tertiary butyl. In another preferred embodiment of this invention alkyl represents a C_{1-3}-alkyl group, which may in particular be methyl, ethyl, propyl or isopropyl.

In the context of this invention an alkenyl group designates a carbon chain containing one or more double bonds, including di-enes, tri-enes and poly-enes. In a preferred embodiment the alkenyl group of the invention comprises of from two to six carbon atoms (C_{2-6}-alkenyl), including at least one double bond. In a most preferred embodiment the alkenyl group of the invention is ethenyl; 1- or 2-propenyl; 1-, 2- or 3-butenyl, or 1,3-butdienyl; 1-, 2-, 3-, 4- or 5-hexenyl, or 1,3-hexdienyl, or 1,3,5-hextrienyl.

In the context of this invention an alkynyl group designates a carbon chain containing one or more triple bonds, including di-ynes, tri-ynes and poly-ynes. In a preferred embodiment the alkynyl group of the invention comprises of from two to six carbon atoms (C_{2-6}-alkynyl), including at least one triple bond. In its most preferred embodiment the alkynyl group of the invention is ethynyl; 1-, or 2-propynyl; 1-, 2-, or 3-butynyl, or 1,3-butdiynyl; 1-, 2-, 3-, 4-pentynyl, or 1,3-pentdiynyl; 1-, 2-, 3-, 4-, or 5-henynyl, or 1,3-hexdiynyl or 1,3,5-hextriynyl.

In the context of this invention a cycloalkyl group designates a cyclic alkyl group, preferably containing of from three to seven carbon atoms (C_{3-7}-cycloalkyl), including cyclopropyl, cyclobutyl, cyclopentyl, cyclohexyl and cycloheptyl.

Alkoxy is O-alkyl, wherein alkyl is as defined above.

Cycloalkoxy means O-cycloalkyl, wherein cycloalkyl is as defined above.

Cycloalkylalkyl means cycloalkyl as above and alkyl as above, meaning for example, cyclopropylmethyl.

Amino is NH_2 or NH-alkyl or N-$(alkyl)_2$, wherein alkyl is as defined above.

Heteroaryl is an aromatic mono-, bi- or poly-heterocyclic group, which holds one or more heteroatoms in its ring structure. Preferred heteroatoms include nitrogen (N), oxygen (O), and sulphur (S).

Preferred monocyclic heteroaryl groups of the invention include aromatic 5- and 6 membered heterocyclic monocyclic groups, including for example, but not limited to, oxazol-2-yl, oxazol-4-yl, oxazol-5-yl, isoxazol-3-yl, isoxazol-4-yl, isoxazol-5-yl, thiazol-2-yl, thiazol-4-yl, thiazol-5-yl, isothiazol-3-yl, isothiazol-4-yl, isothiazol-5-yl, 1,2,4-oxadiazol-3-yl, 1,2,4-oxadiazol-5-yl, 1,2,4-thiadiazol-3-yl, 1,2,4-thiadiazol-5-yl, 1,2,5-oxadiazol-3-yl, 1,2,5-oxadiazol-4-yl, 1,2,5-thiadiazol-3-yl, 1,2,5-thiadiazol-4-yl, 2-imidazolyl, 4-imidazolyl, 5-imidazolyl, 2-pyrrolyl, 3-pyrrolyl, 2-furanyl, 3-furanyl, 2-thienyl, 3-thienyl, 2-pyridyl, 3-pyridyl, 4-pyridyl, 2-pyrimidyl, 4-pyrimidyl, 5-pyrimidyl or 6-pyrimidyl.

Preferred bicyclic heteroaryl groups of the invention include indolizinyl, in particular 2-, 5- or 6-indolizinyl; indolyl, in particular 2-, 5- or 6-indolyl; isoindolyl, in particular 2-, 5- or 6-isoindolyl; benzo[b]furanyl, in particular 2-, 5- or 6-benzofuranyl; benzo[b]thienyl, in particular 2-, 5- or 6-benzothienyl; benzimidazolyl, in particular 2-, 5- or 6-benzimidazolyl; benzothiazolyl, in particular 5- or 6-benzothiazolyl; purinyl, in

particular 2- or 8-purinyl; quinolinyl, in particular 2-, 3-, 6- or 7-quinolinyl; isoquinolinyl, in particular 3-, 6- or 7-isoquinolinyl; cinnolinyl, in particular 6- or 7-cinnolinyl; phthalazinyl, in particular 6- or 7-phthalazinyl; quinazolinyl, in particular 2-, 6- or 7-quinazolinyl; quinoxalinyl, in particular 2- or 6-quinoxalinyl; 1,8-naphthyridinyl, in particular 1,8-naphthyridin-2-, 3-, 6- or 7-yl; pteridinyl, in particular 2-, 6- or 7-pteridinyl; and indenyl, in particular 1-, 2-, 3-, 5- or 5-indenyl.

Pharmaceutically Acceptable Salts

The chemical compound of the invention may be provided in any form suitable for the intended administration. Suitable forms include pharmaceutically (i.e. physiologically) acceptable salts, and pre- or prodrug forms of the chemical compound of the invention.

Examples of pharmaceutically acceptable addition salts include, without limitation, the non-toxic inorganic and organic acid addition salts such as the hydrochloride derived from hydrochloric acid, the hydrobromide derived from hydrobromic acid, the nitrate derived from nitric acid, the perchlorate derived from perchloric acid, the phosphate derived from phosphoric acid, the sulphate derived from sulphuric acid, the formate derived from formic acid, the acetate derived from acetic acid, the aconate derived from aconitic acid, the ascorbate derived from ascorbic acid, the benzenesulphonate derived from benzensulphonic acid, the benzoate derived from benzoic acid, the cinnamate derived from cinnamic acid, the citrate derived from citric acid, the embonate derived from embonic acid, the enantate derived from enanthic acid, the fumarate derived from fumaric acid, the glutamate derived from glutamic acid, the glycolate derived from glycolic acid, the lactate derived from lactic acid, the maleate derived from maleic acid, the malonate derived from malonic acid, the mandelate derived from mandelic acid, the methanesulphonate derived from methane sulphonic acid, the naphthalene-2-sulphonate derived from naphtalene-2-sulphonic acid, the phthalate derived from phthalic acid, the salicylate derived from salicylic acid, the sorbate derived from sorbic acid, the stearate derived from stearic acid, the succinate derived from succinic acid, the tartrate derived from tartaric acid, the toluene-p-sulphonate derived from p-toluene sulphonic acid, and the like. Such salts may be formed by procedures well known and described in the art.Other acids such as oxalic acid, which may not be considered pharmaceutically acceptable, may be useful in the preparation of salts useful as intermediates in obtaining a chemical compound of the invention and its pharmaceutically acceptable acid addition salt.

Metal salts of a chemical compound of the invention include alkali metal salts such as the sodium salt of a chemical compound of the invention containing a carboxy group.

In the context of this invention the "onium salts" of N-containing compounds are also contemplated as pharmaceutically acceptable salts. Preferred "onium salts" include the alkyl-onium salts, the cycloalkyl-onium salts, and the cycloalkylalkyl-onium salts.

Examples of pre- or prodrug forms of the chemical compound of the invention include examples of suitable prodrugs of the substances according to the invention include compounds modified at one or more reactive or derivatizable groups of the parent compound. Of particular interest are compounds modified at a carboxyl group, a hydroxyl group, or an amino group. Examples of suitable derivatives are esters or amides.

The chemical compound of the invention may be provided in dissoluble or indissoluble forms together with a pharmaceutically acceptable solvent such as water, ethanol, and the like. Dissoluble forms may also include hydrated forms such as the monohydrate, the dihydrate, the hemihydrate, the trihydrate, the tetrahydrate, and the like. In general, the dissoluble forms are considered equivalent to indissoluble forms for the purposes of this invention.

Steric Isomers

It will be appreciated by those skilled in the art that the compounds of the present invention may contain one or more chiral centers, and that such compounds exist in the form of isomers, i.e. 1R/S, 2R/S, 3R/S and 5R/S.

Moreover, the substituent $-CH_2-X-R^a$ on position 2 and the substituent R^3 on position 3 of the 8-aza-bicyclo[3.2.1]octane skeleton of formula I may in particular be in cis or trans configuration relative to each another. In one embodiment of the invention the substituents at positions 2 and 3 are in trans configuration. In another embodiment of the invention the substituents at positions 2 and 3 are in cis configuration.

The invention includes all such isomers and any mixtures thereof including racemic mixtures.

Racemic forms can be resolved into the optical antipodes by known methods and techniques. One way of separating the isomeric salts is by use of an optically active acid, and liberating the optically active amine compound by treatment with a base. Another method for resolving racemates into the optical antipodes is based upon chromatography on an optical active matrix. Racemic compounds of the present invention can thus be resolved into their optical antipodes, e.g., by fractional crystallisation of d- or l- (tartrates, mandelates, or camphorsulphonate) salts for example.

The chemical compounds of the present invention may also be resolved by the formation of diastereomeric amides by reaction of the chemical compounds of the present invention with an optically active activated carboxylic acid such as that derived from (+) or (-) phenylalanine, (+) or (-) phenylglycine, (+) or (-) camphanic acid

or by the formation of diastereomeric carbamates by reaction of the chemical compound of the present invention with an optically active chloroformate or the like.

Additional methods for the resolving the optical isomers are known in the art. Such methods include those described by *Jaques J, Collet A, & Wilen S* in "Enantiomers, Racemates, and Resolutions", John Wiley and Sons, New York (1981).

Optical active compounds can also be prepared from optical active starting materials.

Labelled Compounds

The compounds of the invention may be used in their labelled or unlabelled form. In the context of this invention "label" stands for the binding of a marker to the compound of interest that will allow easy quantitative detection of said compound.

The labelled compounds of the invention may be useful as diagnostic tools, radio tracers, or monitoring agents in various diagnostic methods, and for *in vivo* receptor imaging.

The labelled isomer of the invention preferably contains at least one radionuclide as a label. Positron emitting radionuclides are all candidates for usage. In the context of this invention the radionuclide is preferably selected from ^{2}H (deuterium), ^{3}H (tritium), ^{13}C, ^{14}C, ^{131}I, ^{125}I, ^{123}I, and ^{18}F.

The physical method for detecting the labelled isomer of the present invention may be selected from Position Emission Tomography (PET), Single Photon Imaging Computed Tomography (SPECT), Magnetic Resonance Spectroscopy (MRS), Magnetic Resonance Imaging (MRI), and Computed Axial X-ray Tomography (CAT), or combinations thereof.

Methods of Preparation

The chemical compounds of the invention may be prepared by conventional methods for chemical synthesis, e.g. those described in the working examples. The starting materials for the processes described in the present application are known or may readily be prepared by conventional methods from commercially available chemicals.

Also one compound of the invention can be converted to another compound of the invention using conventional methods.

The end products of the reactions described herein may be isolated by conventional techniques, e.g. by extraction, crystallisation, distillation, chromatography, etc.

Biological Activity

Compounds of the invention may be tested for their ability to inhibit reuptake of the monoamines dopamine, noradrenaline and serotonin in synaptosomes eg such as described in WO 97/30997. Based on the balanced activity observed in these tests the compound of the invention is considered useful for the treatment the treatment, prevention or alleviation of a disease or a disorder or a condition of a mammal, including a human, which disease, disorder or condition is responsive to inhibition of monoamine neurotransmitter re-uptake in the central nervous system.

In a special embodiment, the compounds of the invention are considered useful for the treatment, prevention or alleviation of: mood disorder, depression, atypical depression, major depressive disorder, dysthymic disorder, bipolar disorder, bipolar I disorder, bipolar II disorder, cyclothymic disorder, mood disorder due to a general medical condition, substance-induced mood disorder, pseudodementia, Ganser's syndrome, obsessive compulsive disorder, panic disorder, panic disorder without agoraphobia, panic disorder with agoraphobia, agoraphobia without history of panic disorder, panic attack, memory deficits, memory loss, attention deficit hyperactivity disorder, obesity, anxiety, generalized anxiety disorder, eating disorder, Parkinson's disease, parkinsonism, dementia, dementia of ageing, senile dementia, Alzheimer's disease, acquired immunodeficiency syndrome dementia complex, memory dysfunction in ageing, specific phobia, social phobia, post-traumatic stress disorder, acute stress disorder, drug addiction, drug misuse, cocaine abuse, nicotine abuse, tobacco abuse, alcohol addiction, alcoholism, pain, inflammatory pain, neuropathic pan, migraine pain, tension-type headache, chronic tension-type headache, pain associated with depression, fibromyalgia, arthritis, osteoarthritis, rheumatoid arthritis, back pain, cancer pain, irritable bowel pain, irritable bowel syndrome, post-operative pain, post-stroke pain, drug-induced neuropathy, diabetic neuropathy, sympathetically-maintained pain, trigeminal neuralgia, dental pain, myofacial pain, phantom-limb pain, bulimia, premenstrual syndrome, late luteal phase syndrome, post-traumatic syndrome, chronic fatigue syndrome, urinary incontinence, stress incontinence, urge incontinence, nocturnal incontinence, premature ejaculation, erectile difficulty, anorexia nervosa, sleep disorders, autism, mutism, trichotillomania, narcolepsy, post-stroke depression, stroke-induced brain damage, stroke-induced neuronal damage or Gilles de la Tourettes disease. In a preferred embodiment, the compounds are considered useful for the treatment, prevention or alleviation of depression.

It is at present contemplated that a suitable dosage of the active pharmaceutical ingredient (API) is within the range of from about 0.1 to about 1000 mg API per day, more preferred of from about 10 to about 500 mg API per day, most preferred of from about 30 to about 100 mg API per day, dependent, however, upon the exact mode of

administration, the form in which it is administered, the indication considered, the subject and in particular the body weight of the subject involved, and further the preference and experience of the physician or veterinarian in charge.

Preferred compounds of the invention show a biological activity in the sub-micromolar and micromolar range, i.e. of from below 1 to about 100 μM.

Pharmaceutical Compositions

In another aspect the invention provides novel pharmaceutical compositions comprising a therapeutically effective amount of the chemical compound of the invention.

While a chemical compound of the invention for use in therapy may be administered in the form of the raw chemical compound, it is preferred to introduce the active ingredient, optionally in the form of a physiologically acceptable salt, in a pharmaceutical composition together with one or more adjuvants, excipients, carriers, buffers, diluents, and/or other customary pharmaceutical auxiliaries.

In a preferred embodiment, the invention provides pharmaceutical compositions comprising the chemical compound of the invention, or a pharmaceutically acceptable salt or derivative thereof, together with one or more pharmaceutically acceptable carriers therefore, and, optionally, other therapeutic and/or prophylactic ingredients, know and used in the art. The carrier(s) must be "acceptable" in the sense of being compatible with the other ingredients of the formulation and not harmful to the recipient thereof.

Pharmaceutical compositions of the invention may be those suitable for oral, rectal, bronchial, nasal, pulmonal, topical (including buccal and sub-lingual), transdermal, vaginal or parenteral (including cutaneous, subcutaneous, intramuscular, intraperitoneal, intravenous, intraarterial, intracerebral, intraocular injection or infusion) administration, or those in a form suitable for administration by inhalation or insufflation, including powders and liquid aerosol administration, or by sustained release systems. Suitable examples of sustained release systems include semipermeable matrices of solid hydrophobic polymers containing the compound of the invention, which matrices may be in form of shaped articles, e.g. films or microcapsules.

The chemical compound of the invention, together with a conventional adjuvant, carrier, or diluent, may thus be placed into the form of pharmaceutical compositions and unit dosages thereof. Such forms include solids, and in particular tablets, filled capsules, powder and pellet forms, and liquids, in particular aqueous or non-aqueous solutions, suspensions, emulsions, elixirs, and capsules filled with the same, all for oral use, suppositories for rectal administration, and sterile injectable solutions for parenteral use. Such pharmaceutical compositions and unit dosage forms thereof may comprise conventional ingredients in conventional proportions, with or without additional active compounds or principles,

and such unit dosage forms may contain any suitable effective amount of the active ingredient commensurate with the intended daily dosage range to be employed.

The chemical compound of the present invention can be administered in a wide variety of oral and parenteral dosage forms. It will be obvious to those skilled in the art that the following dosage forms may comprise, as the active component, either a chemical compound of the invention or a pharmaceutically acceptable salt of a chemical compound of the invention.

For preparing pharmaceutical compositions from a chemical compound of the present invention, pharmaceutically acceptable carriers can be either solid or liquid. Solid form preparations include powders, tablets, pills, capsules, cachets, suppositories, and dispersible granules. A solid carrier can be one or more substances which may also act as diluents, flavouring agents, solubilizers, lubricants, suspending agents, binders, preservatives, tablet disintegrating agents, or an encapsulating material.

In powders, the carrier is a finely divided solid, which is in a mixture with the finely divided active component.

In tablets, the active component is mixed with the carrier having the necessary binding capacity in suitable proportions and compacted in the shape and size desired.

The powders and tablets preferably contain from five or ten to about seventy percent of the active compound. Suitable carriers are magnesium carbonate, magnesium stearate, talc, sugar, lactose, pectin, dextrin, starch, gelatin, tragacanth, methylcellulose, sodium carboxymethylcellulose, a low melting wax, cocoa butter, and the like. The term "preparation" is intended to include the formulation of the active compound with encapsulating material as carrier providing a capsule in which the active component, with or without carriers, is surrounded by a carrier, which is thus in association with it. Similarly, cachets and lozenges are included. Tablets, powders, capsules, pills, cachets, and lozenges can be used as solid forms suitable for oral administration.

For preparing suppositories, a low melting wax, such as a mixture of fatty acid glyceride or cocoa butter, is first melted and the active component is dispersed homogeneously therein, as by stirring. The molten homogenous mixture is then poured into convenient sized moulds, allowed to cool, and thereby to solidify.

Compositions suitable for vaginal administration may be presented as pessaries, tampons, creams, gels, pastes, foams or sprays containing in addition to the active ingredient such carriers as are known in the art to be appropriate.

Liquid preparations include solutions, suspensions, and emulsions, for example, water or water-propylene glycol solutions. For example, parenteral injection liquid preparations can be formulated as solutions in aqueous polyethylene glycol solution.

The chemical compound according to the present invention may thus be formulated for parenteral administration (e.g. by injection, for example bolus injection or continuous infusion) and may be presented in unit dose form in ampoules, pre-filled syringes, small

volume infusion or in multi-dose containers with an added preservative. The compositions may take such forms as suspensions, solutions, or emulsions in oily or aqueous vehicles, and may contain formulation agents such as suspending, stabilising and/or dispersing agents. Alternatively, the active ingredient may be in powder form, obtained by aseptic isolation of sterile solid or by lyophilization from solution, for constitution with a suitable vehicle, e.g. sterile, pyrogen-free water, before use.

Aqueous solutions suitable for oral use can be prepared by dissolving the active component in water and adding suitable colorants, flavours, stabilising and thickening agents, as desired.

Aqueous suspensions suitable for oral use can be made by dispersing the finely divided active component in water with viscous material, such as natural or synthetic gums, resins, methylcellulose, sodium carboxymethylcellulose, or other well known suspending agents.

Also included are solid form preparations, intended for conversion shortly before use to liquid form preparations for oral administration. Such liquid forms include solutions, suspensions, and emulsions. In addition to the active component such preparations may comprise colorants, flavours, stabilisers, buffers, artificial and natural sweeteners, dispersants, thickeners, solubilizing agents, and the like.

For topical administration to the epidermis the chemical compound of the invention may be formulated as ointments, creams or lotions, or as a transdermal patch. Ointments and creams may, for example, be formulated with an aqueous or oily base with the addition of suitable thickening and/or gelling agents. Lotions may be formulated with an aqueous or oily base and will in general also contain one or more emulsifying agents, stabilising agents, dispersing agents, suspending agents, thickening agents, or colouring agents.

Compositions suitable for topical administration in the mouth include lozenges comprising the active agent in a flavoured base, usually sucrose and acacia or tragacanth; pastilles comprising the active ingredient in an inert base such as gelatin and glycerine or sucrose and acacia; and mouthwashes comprising the active ingredient in a suitable liquid carrier.

Solutions or suspensions are applied directly to the nasal cavity by conventional means, for example with a dropper, pipette or spray. The compositions may be provided in single or multi-dose form.

Administration to the respiratory tract may also be achieved by means of an aerosol formulation in which the active ingredient is provided in a pressurised pack with a suitable propellant such as a chlorofluorocarbon (CFC) for example dichlorodifluoromethane, trichlorofluoromethane, or dichlorotetrafluoroethane, carbon dioxide, or other suitable gas. The aerosol may conveniently also contain a surfactant such as lecithin. The dose of drug may be controlled by provision of a metered valve.

Alternatively the active ingredients may be provided in the form of a dry powder, for example a powder mix of the compound in a suitable powder base such as lactose, starch, starch derivatives such as hydroxypropylmethyl cellulose and polyvinylpyrrolidone (PVP). Conveniently the powder carrier will form a gel in the nasal cavity. The powder composition may be presented in unit dose form for example in capsules or cartridges of, e.g., gelatin, or blister packs from which the powder may be administered by means of an inhaler.

In compositions intended for administration to the respiratory tract, including intranasal compositions, the compound will generally have a small particle size for example of the order of 5 microns or less. Such a particle size may be obtained by means known in the art, for example by micronization.

When desired, compositions adapted to give sustained release of the active ingredient may be employed.

The pharmaceutical preparations are preferably in unit dosage forms. In such form, the preparation is subdivided into unit doses containing appropriate quantities of the active component. The unit dosage form can be a packaged preparation, the package containing discrete quantities of preparation, such as packaged tablets, capsules, and powders in vials or ampoules. Also, the unit dosage form can be a capsule, tablet, cachet, or lozenge itself, or it can be the appropriate number of any of these in packaged form.

Tablets or capsules for oral administration and liquids for intravenous administration and continuous infusion are preferred compositions.

Further details on techniques for formulation and administration may be found in the latest edition of Remington's Pharmaceutical Sciences (Maack Publishing Co., Easton, PA).

A therapeutically effective dose refers to that amount of active ingredient, which ameliorates the symptoms or condition. Therapeutic efficacy and toxicity, e.g. ED_{50} and LD_{50}, may be determined by standard pharmacological procedures in cell cultures or experimental animals. The dose ratio between therapeutic and toxic effects is the therapeutic index and may be expressed by the ratio LD_{50}/ED_{50}. Pharmaceutical compositions exhibiting large therapeutic indexes are preferred.

The dose administered must of course be carefully adjusted to the age, weight and condition of the individual being treated, as well as the route of administration, dosage form and regimen, and the result desired, and the exact dosage should of course be determined by the practitioner.

The actual dosage depend on the nature and severity of the disease being treated, and is within the discretion of the physician, and may be varied by titration of the dosage to the particular circumstances of this invention to produce the desired therapeutic effect. However, it is presently contemplated that pharmaceutical compositions containing of from about 0.1 to about 500 mg of active ingredient per

individual dose, preferably of from about 1 to about 100 mg, most preferred of from about 1 to about 10 mg, are suitable for therapeutic treatments.

The active ingredient may be administered in one or several doses per day. A satisfactory result can, in certain instances, be obtained at a dosage as low as 0.1 µg/kg i.v. and 1 µg/kg p.o. The upper limit of the dosage range is presently considered to be about 10 mg/kg i.v. and 100 mg/kg p.o. Preferred ranges are from about 0.1 µg/kg to about 10 mg/kg/day i.v., and from about 1 µg/kg to about 100 mg/kg/day p.o.

Methods of Therapy

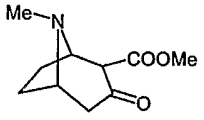
In another aspect the invention provides a method for the treatment, prevention or alleviation of a disease or a disorder or a condition of a living animal body, including a human, which disease, disorder or condition is responsive to inhibition of monoamine neurotransmitter re-uptake in the central nervous system, and which method comprises administering to such a living animal body, including a human, in need thereof an effective amount of a chemical compound of the invention.

It is at present contemplated that suitable dosage ranges are 0.1 to 1000 milligrams daily, 10-500 milligrams daily, and especially 30-100 milligrams daily, dependent as usual upon the exact mode of administration, form in which administered, the indication toward which the administration is directed, the subject involved and the body weight of the subject involved, and further the preference and experience of the physician or veterinarian in charge.

EXAMPLES

The invention is further illustrated with reference to the following examples, which are not intended to be in any way limiting to the scope of the invention as claimed.

Starting materials



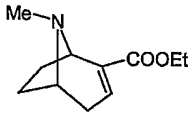
(+)-2-Carbomethoxytropinone

Was prepared by a known procedure (J. F. Casale, Forensic Science International, 33 (1987) 275-298).

(-)-2-Carbomethoxytropinone

Was synthesised similarly.

Method A



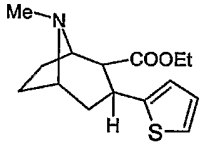
(-)-Ecgonine ethylester

To a stirred solution of (+)-2-carbomethoxytropinone (37.4 g) in methyl alcohol (1.5L) at –45°C, was added sodium borohydride (37g) in small portions, such that the internal temperature was kept between -45°C and -35°C. The reaction mixture was stirred at -45°C for 2 hours, and quenched by drop wise addition of hydrochloric acid (120mL), while keeping the temperature at -45°C. The reaction mixture was allowed to warm to room temperature and stirred overnight. The reaction mixture was concentrated to a volume of approximately 120mL, added water (500mL) and washed with diethyl ether (3X100mL). The aqueous phase was added 25% ammonia (aq.) until pH 10-11, and extracted with dichloromethane (4X200mL). The combined organic phases were dried (sodium sulfate) and evaporated to an oil. The oil was dissolved in ethyl acetate (370mL) and a solution of sodium ethoxide (from 7g of sodium) was added. The resulting solution was heated at reflux for 3 hours, cooled to r.t. and evaporated to an oil. The residue was added toluene (0.5L) and evaporated to an oil, this was repeated. The product 30 g (79%) is an oil.

(+)-Ecgonine ethylester

Was synthesised similarly from (-)-2-carbomethoxytropinone.

Method B



(*2R,3S*)-8-Methyl-3-(2-thienyl)-8-azabicyclo[3.2.1]octane-2-carboxylic acid ethyl ester

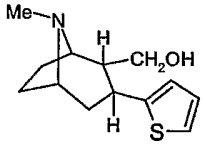
A solution of (-)-ecgonine ethylester (4.9 g; 25 mmol) in anhydrous toluene (60 mL) was added to a stirred solution of 2-thienylmagnesiumbromide (48 mmol) in anhydrous Et_2O (100 mL) at -40°C, such that the internal temperature was kept between -20°C and -40°C. The reaction mixture was stirred at -20°C to -40°C for 90 min, or until TLC indicated complete transformation of starting material. The reaction mixture was poured onto a mixture of conc. HCl (20 mL) and ice (200 mL) and stirred for 20 min. The aqueous phase was washed with Et_2O (2x 30mL), and made alkaline to pH 10-11

using 4 M NaOH. The aqueous phase was extracted using CH_2Cl_2 (4x 100 mL) and the combined organic fractions dried ($MgSO_4$), filtered and evaporated to dryness to yield 5.36 g (80%) of an oil. A mixture of the crude oil, NaOMe (4 ml, 2 M) and anhydrous MeOH (100 mL) was refluxed for 40 h and then evaporated to dryness. Water (50 mL) was added, and extracted using CH_2Cl_2 (3x 50 mL). The combined organic fractions were dried ($MgSO_4$), filtered and evaporated to dryness to yield 4.2 g (63%) as an oil.

(2*S*,3*R*)-8-Methyl-3-(2-thienyl)-8-azabicyclo[3.2.1]octane-2-carboxylic acid ethyl ester

Was synthesised similarly from (+)-ecgonine ethylester.

Method C



(2*R*,3*S*)-(8-Methyl-3-(2-thienyl)-8-aza-bicyclo[3.2.1]oct-2-yl)-methanol

To a mixture of (2*R*,3*S*)-8-methyl-3-(2-thienyl)-8-azabicyclo[3.2.1]octane-2-carboxylic acid ethyl ester (3.65 g, 13.75 mmol) and toluene (75 ml), Red-Al (6 ml, 65%, 20 mmol) was added at 0°C. The mixture was stirred at 0°C for 1 h. A solution of aqueous sodium hydroxide (20 ml, 4 M) was added dropwise followed by warm water (50°C, 150 ml). The mixture was extracted with toluene (2 x 100 ml). The mixture was dried ($MgSO_4$) and evaporated. The product was isolated as crystals. Mp: 153.7-157.5°C. Yield 2.04 g (63%).

(2*S*,3*R*)-(8-Methyl-3-(2-thienyl)-8-aza-bicyclo[3.2.1]oct-2-yl)-methanol

Was synthesised similarly from (2*S*,3*R*)-8-methyl-3-(2-thienyl)-8-azabicyclo[3.2.1]octane-2-carboxylic acid ethyl ester.

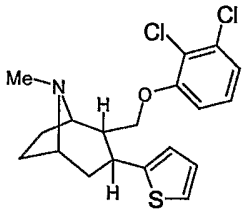
The following compounds were prepared analogously using the above-described methods:

(2*R*,3*S*)-(8-methyl-3-(5-chloro-thien-2-yl)-8-aza-bicyclo[3.2.1]oct-2-yl)-methanol. Mp 172-176°C.

(2*R*,3*S*)-(8-methyl-3-(5-chloro-furan-2-yl)-8-aza-bicyclo[3.2.1]oct-2-yl)-methanol. Mp 88-145°C.

(*2R,3S*)-(8-methyl-3-(5-methoxy-thien-2-yl)-8-aza-bicyclo[3.2.1]oct-2-yl)-methanol. Mp 164.5-167°C.

Method D



(*2R,3S*)-2-(2,3-Dichlorophenoxymethyl)-8-methyl-3-(2-thienyl)-8-aza-bicyclo[3.2.1]octane fumaric acid salt A mixture of (*2R,3S*)-(8-Methyl-3-(2-thienyl)-8-aza-bicyclo[3.2.1]oct-2-yl)-methanol (1.74 g; 7.36 mmol), *p*-toluenesulfonylchloride (1.75 mg; 9.2 mmol) and pyridine (10 ml) in anhydrous CH_2Cl_2 (15 mL) was stirred for 1h at 0°C. The reaction mixture was added H_2O (50 mL) and aqueous sodium hydroxide (5 ml, 4 M). The crystalline *O*-tosylated intermediate was isolated by filtration. Mp: 115.4-120.3 °C. Yield 2.42 g (84%). To a stirred mixture of 2,3-dichlorophenol (820 mg; 5.0 mmol) and *O*-tosylated intermediate (1.17 g, 3.0 mmol) in DMF (15 mL) was added NaH (200 mg, 60%, 5.2 mmol). The reaction mixture was heated to 100°C for 2.5 h. The reaction mixture was cooled to rt, and water (50 ml) was added. The mixture was extracted with Et_2O (2x 50 mL). The combined organic fractions were dried ($MgSO_4$), filtered and evaporated to dryness. Column chromatography (acetone : MeOH : NH_3 (1% aq.) = 9 : 1 : 1) yielded 940 mg (82%) product. The free base was converted to the fumaric acid salt. Mp: 151.5°C.

(*2R,3S*)-2-(1-Naphthyloxymethyl)-8-methyl-3-(2-thienyl)-8-aza-bicyclo[3.2.1]octane fumaric acid salt
Was prepared according to method D from (*2R,3S*)-(8-Methyl-3-(2-thienyl)-8-aza-bicyclo[3.2.1]oct-2-yl)-methanol. Mp 203.1°C.

(*2R,3S*)-2-(2,3-Dichlorophenoxymethyl)-8-methyl-3-(3-thienyl)-8-aza-bicyclo[3.2.1]octane
Is synthesised similarly from (*2R,3S*)-(8-methyl-3-(3-thienyl)-8-aza-bicyclo[3.2.1]oct-2-yl)-methanol.

(*2R,3S*)-2-(1-Naphthyloxymethyl)-8-methyl-3-(3-thienyl)-8-aza-bicyclo[3.2.1]octane
Is synthesised similarly from (*2R,3S*)-(8-methyl-3-(3-thienyl)-8-aza-bicyclo[3.2.1]oct-2-yl)-methanol.

(2*R*,3*S*)-2-(2,3-Dichlorophenoxymethyl)-8-methyl-3-(2-furanyl)-8-aza-bicyclo[3.2.1]octane fumaric acid salt

Was prepared according to method D from (2*R*,3*S*)-(8-methyl-3-(2-furanyl)-8-aza-bicyclo[3.2.1]oct-2-yl)-methanol. Mp 156.4-205.9°C.

(2*R*,3*S*)-2-(1-Naphthyloxymethyl)-8-methyl-3-(2-furanyl)-8-aza-bicyclo[3.2.1]octane fumaric acid salt

Was prepared according to method D from (2*R*,3*S*)-(8-methyl-3-(2-furanyl)-8-aza-bicyclo[3.2.1]oct-2-yl)-methanol. Mp 189.7-214.1°C.

(2*R*,3*S*)-2-(2,3-Dichlorophenoxymethyl)-8-methyl-3-(3-furanyl)-8-aza-bicyclo[3.2.1]octane

Is synthesised similarly from (2*R*,3*S*)-(8-methyl-3-(3-furanyl)-8-aza-bicyclo[3.2.1]oct-2-yl)-methanol.

(2*R*,3*S*)-2-(1-Naphthyloxymethyl)-8-methyl-3-(3-furanyl)-8-aza-bicyclo[3.2.1]octane

Is synthesised similarly from (2*R*,3*S*)-(8-methyl-3-(3-furanyl)-8-aza-bicyclo[3.2.1]oct-2-yl)-methanol.

(2*S*,3*R*)-2-(2,3-Dichlorophenoxymethyl)-8-methyl-3-(2-thienyl)-8-aza-bicyclo[3.2.1]octane

Is synthesised similarly from (2*S*,3*R*)-(8-methyl-3-(2-thienyl)-8-aza-bicyclo[3.2.1]oct-2-yl)-methanol.

(2*S*,3*R*)-2-(1-Naphthyloxymethyl)-8-methyl-3-(2-thienyl)-8-aza-bicyclo[3.2.1]octane

Is synthesised similarly from (2*S*,3*R*)-(8-methyl-3-(2-thienyl)-8-aza-bicyclo[3.2.1]oct-2-yl)-methanol.

(2*S*,3*R*)-2-(2,3-Dichlorophenoxymethyl)-8-methyl-3-(3-thienyl)-8-aza-bicyclo[3.2.1]octane

Is synthesised similarly from (2*S*,3*R*)-(8-methyl-3-(3-thienyl)-8-aza-bicyclo[3.2.1]oct-2-yl)-methanol.

(2*S*,3*R*)-2-(1-Naphthyloxymethyl)-8-methyl-3-(3-thienyl)-8-aza-bicyclo[3.2.1]octane

Is synthesised similarly from (2*S*,3*R*)-(8-methyl-3-(3-thienyl)-8-aza-bicyclo[3.2.1]oct-2-yl)-methanol.

(2*S*,3*R*)-2-(2,3-Dichlorophenoxymethyl)-8-methyl-3-(2-furanyl)-8-aza-bicyclo[3.2.1]octane

Is synthesised similarly from (2*S*,3*R*)-(8-methyl-3-(2-furanyl)-8-aza-bicyclo[3.2.1]oct-2-yl)-methanol.

(2*S*,3*R*)-2-(1-Naphthyloxymethyl)-8-methyl-3-(2-furanyl)-8-aza-bicyclo[3.2.1]octane

Is synthesised similarly from (2*S*,3*R*)-(8-methyl-3-(2-furanyl)-8-aza-bicyclo[3.2.1]oct-2-yl)-methanol.

(2*S*,3*R*)-2-(2,3-Dichlorophenoxymethyl)-8-methyl-3-(3-furanyl)-8-aza-bicyclo[3.2.1]octane

Is synthesised similarly from (2*S*,3*R*)-(8-methyl-3-(3-furanyl)-8-aza-bicyclo[3.2.1]oct-2-yl)-methanol.

(2*S*,3*R*)-2-(1-Naphthyloxymethyl)-8-methyl-3-(3-furanyl)-8-aza-bicyclo[3.2.1]octane

Is synthesised similarly from (2*S*,3*R*)-(8-methyl-3-(3-furanyl)-8-aza-bicyclo[3.2.1]oct-2-yl)-methanol.

(2*R*,3*S*)-2-(2,3-Dichlorophenoxymethyl)-8-methyl-3-(5-chloro-thien-2-yl)-8-aza-bicyclo[3.2.1]octane fumaric acid salt

Was prepared according to method D from (2*R*,3*S*)-(8-methyl-3-(5-chloro-thien-2-yl)-8-aza-bicyclo[3.2.1]oct-2-yl)-methanol. Mp 125.9 – 128.0°C.

(2*R*,3*S*)-2-(1-naphthyl)-8-methyl-3-(5-chloro-thien-2-yl)-8-aza-bicyclo[3.2.1]octane fumaric acid salt

Was prepared according to method D from (2*R*,3*S*)-(8-methyl-3-(5-chloro-thien-2-yl)-8-aza-bicyclo[3.2.1]oct-2-yl)-methanol. Mp 154 – 155 °C.

(2*R*,3*S*)-2-(2,3-Difluorophenoxymethyl)-8-methyl-3-(5-chloro-furan-2-yl)-8-aza-bicyclo[3.2.1]octane citric acid salt

Is synthesised similarly from (2*R*,3*S*)-(8-methyl-3-(5-chloro-furan-2-yl)-8-aza-bicyclo[3.2.1]oct-2-yl)-methanol. Mp 145°C.

(2*R*,3*S*)-2-(2,3-Difluorophenoxymethyl)-8-methyl-3-(5-methoxy-thien-2-yl)-8-aza-bicyclo[3.2.1]octane free base

Was prepared according to method D from (2*R*,3*S*)-(8-methyl-3-(5-methoxy-thien-2-yl)-8-aza-bicyclo[3.2.1]oct-2-yl)-methanol. Mp oil.

(2*R*,3*S*)-2-(2,3-Dimethoxyphenoxymethyl)-8-methyl-3-(2-furanyl)-8-aza-bicyclo[3.2.1]octane fumaric acid salt

Was prepared according to method D from (2*R*,3*S*)-(8-methyl-3-(2-furanyl)-8-aza-bicyclo[3.2.1]oct-2-yl)-methanol. Mp 151.4 – 156.3°C.

(2*R*,3*S*)-2-(2,3-Dichlorophenoxymethyl)-8-methyl-3-(5-methoxy-thien-2-yl)-8-aza-bicyclo[3.2.1]octane free base

Was prepared according to method D from (2*R*,3*S*)-(8-methyl-3-(5-chloro-thien-2-yl)-8-aza-bicyclo[3.2.1]oct-2-yl)-methanol. Mp 61 – 67°C.

(2*R*,3*S*)-2-(2-naphthyl)-8-methyl-3-(5-chloro-thien-2-yl)-8-aza-bicyclo[3.2.1]octane fumaric acid salt

Was prepared according to method D from (2*R*,3*S*)-(8-methyl-3-(5-chloro-thien-2-yl)-8-aza-bicyclo[3.2.1]oct-2-yl)-methanol. Mp 215 – 217°C.

(2*R*,3*S*)-2-(2,3-Difluorophenoxymethyl)-8-methyl-3-(2-furanyl)-8-aza-bicyclo[3.2.1]octane citric acid salt

Was prepared according to method D from (2*R*,3*S*)-(8-methyl-3-(2-furanyl)-8-aza-bicyclo[3.2.1]oct-2-yl)-methanol. Mp 94.8 – 129°C.

Method E

(2*R*,3*S*)-2-(2,3-Dichlorophenoxymethyl)-8-H-3-(2-thienyl)-8-aza-bicyclo[3.2.1]octane fumaric acid salt

A mixture of (2*R*,3*S*)-2-(2,3-dichlorophenoxymethyl)-8-methyl-3-(2-thienyl-8-aza-bicyclo[3.2.1]octane fumaric acid salt (0.69 g, 1.8 mmol), 1-chloroethylchloroformate (1 ml) and toluene (25 ml) was stirred for 0.5 h at room temperature. The mixture was stirred at 100°C for 70 h. Water (20 ml) was added and the mixture was stirred at reflux for 5 h. The mixture was allowed to reach room temperature and ammonia (50 ml, 1 M) was added followed by extraction with diethylether (3 x 50 ml). The crude product was purified by column chromatography using silica gel and a mixture of dichloromethane : methanol : aqueous ammonia (90 : 9 : 1) as liquid phase. The resulting oil (0.49 g, 1.33 mmol) was converted to the fumaric acid salt by stirring in ethanol (25 ml) and fumaric acid (175 mg, 1.5 mmol), followed cooling and filtration. Mp 201.2°C.

(2*R*,3*S*)-2-(1-Naphthyloxymethyl)-8-H-3-(2-thienyl)-8-aza-bicyclo[3.2.1]octane fumaric acid salt

Was prepared according to method E from (2*R*,3*S*)-2-(1-naphthyloxymethyl)-8-methyl-3-(2-thienyl)-8-aza-bicyclo[3.2.1]octane. Mp 199.1°C.

(*2R,3S*)-2-(2,3-Dichlorophenoxymethyl)-8-H-3-(3-thienyl)-8-aza-bicyclo[3.2.1]octane
Is synthesised similarly from (*2R,3S*)-2-(2,3-Dichlorophenoxymethyl)-8-methyl-3-(3-thienyl)-8-aza-bicyclo[3.2.1]octane.

(*2R,3S*)-2-(1-naphthyloxymethyl)-8-H-3-(3-thienyl)-8-aza-bicyclo[3.2.1]octane
Is synthesised similarly from (*2R,3S*)-2-(1-naphthyloxymethyl)-8-methyl-3-(3-thienyl)-8-aza-bicyclo[3.2.1]octane.

(*2R,3S*)-2-(2,3-Dichlorophenoxymethyl)-8-H-3-(2-furanyl)-8-aza-bicyclo[3.2.1]octane
Is synthesised similarly from (*2R,3S*)-2-(2,3-Dichlorophenoxymethyl)-8-methyl-3-(2-furanyl)-8-aza-bicyclo[3.2.1]octane.

(*2R,3S*)-2-(1-naphthyloxymethyl)-8-H-3-(2-furanyl)-8-aza-bicyclo[3.2.1]octane
Is synthesised similarly from (*2R,3S*)-2-(1-naphthyloxymethyl)-8-methyl-3-(2-furanyl)-8-aza-bicyclo[3.2.1]octane.

(*2R,3S*)-2-(2,3-Dichlorophenoxymethyl)-8-H-3-(3-furanyl)-8-aza-bicyclo[3.2.1]octane
Is synthesised similarly from (*2R,3S*)-2-(2,3-Dichlorophenoxymethyl)-8-methyl-3-(3-furanyl)-8-aza-bicyclo[3.2.1]octane.

(*2R,3S*)-2-(1-naphthyloxymethyl)-8-H-3-(3-furanyl)-8-aza-bicyclo[3.2.1]octane
Is synthesised similarly from (*2R,3S*)-2-(1-naphthyloxymethyl)-8-methyl-3-(3-furanyl)-8-aza-bicyclo[3.2.1]octane.

(*2S,3R*)-2-(2,3-Dichlorophenoxymethyl)-8-H-3-(2-thienyl)-8-aza-bicyclo[3.2.1]octane
Is synthesised similarly from (*2S,3R*)-2-(2,3-Dichlorophenoxymethyl)-8-methyl-3-(2-thienyl)-8-aza-bicyclo[3.2.1]octane.

(*2S,3R*)-2-(1-naphthyloxymethyl)-8-H-3-(2-thienyl)-8-aza-bicyclo[3.2.1]octane
Is synthesised similarly from (*2S,3R*)-2-(1-naphthyloxymethyl)-8-H-3-(2-thienyl)-8-aza-bicyclo[3.2.1]octane.

(*2S,3R*)-2-(2,3-Dichlorophenoxymethyl)-8-H-3-(3-thienyl)-8-aza-bicyclo[3.2.1]octane
Is synthesised similarly from (*2S,3R*)-2-(2,3-Dichlorophenoxymethyl)-8-methyl-3-(3-thienyl)-8-aza-bicyclo[3.2.1]octane.

(2*S*,3*R*)-2-(1-naphthyloxymethyl)-8-H-3-(3-thienyl)-8-aza-bicyclo[3.2.1]octane
Is synthesised similarly from (2*S*,3*R*)-2-(1-naphthyloxymethyl)-8-methyl-3-(3-thienyl)-8-aza-bicyclo[3.2.1]octane.

(2*S*,3*R*)-2-(2,3-Dichlorophenoxymethyl)-8-H-3-(2-furanyl)-8-aza-bicyclo[3.2.1]octane
Is synthesised similarly from (2*S*,3*R*)-2-(2,3-Dichlorophenoxymethyl)-8-methyl-3-(2-furanyl)-8-aza-bicyclo[3.2.1]octane.

(2*S*,3*R*)-2-(1-naphthyloxymethyl)-8-H-3-(2-furanyl)-8-aza-bicyclo[3.2.1]octane
Is synthesised similarly from (2*S*,3*R*)-2-(1-naphthyloxymethyl)-8-methyl-3-(2-furanyl)-8-aza-bicyclo[3.2.1]octane.

(2*S*,3*R*)-2-(2,3-Dichlorophenoxymethyl)-8-H-3-(3-furanyl)-8-aza-bicyclo[3.2.1]octane
Is synthesised similarly from (2*S*,3*R*)-2-(2,3-Dichlorophenoxymethyl)-8-methyl-3-(3-furanyl)-8-aza-bicyclo[3.2.1]octane.

(2*S*,3*R*)-2-(1-naphthyloxymethyl)-8-H-3-(3-furanyl)-8-aza-bicyclo[3.2.1]octane
Is synthesised similarly from (2*S*,3*R*)-2-(1-naphthyloxymethyl)-8-methyl-3-(3-furanyl)-8-aza-bicyclo[3.2.1]octane.

Test Examples

In vitro inhibition activity

A number of compounds were tested for their ability to inhibit the reuptake of the monoamine neurotransmitters dopamine (DA) noradrenaline(NA) and serotonin (5-HT) in synaptosomes as described in WO 97/16451.

The test values are given as IC_{50} (the concentration (μM) of the test substance which inhibits the specific binding of ^{3}H-DA, ^{3}H-NA, or ^{3}H-5-HT by 50%).

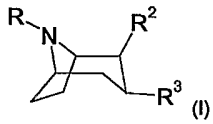
Test results obtained by testing selected compounds of the present invention appear from the below table:

Table 1

Test compound	DA-uptake $IC_{50}(\mu M)$	NA-uptake $IC_{50}(\mu M)$	5-HT-uptake $IC_{50}(\mu M)$
1st compound of method D; (*2R,3S*)-2-(2,3-Dichlorophenoxymethyl)-8-methyl-3-(2-thienyl)-8-aza-bicyclo[3.2.1]octane fumaric acid salt	0.30	0.0019	0.00052
2nd compound of method D; (*2R,3S*)-2-(1-Naphthyloxymethyl)-8-methyl-3-(2-thienyl)-8-aza-bicyclo[3.2.1]octane fumaric acid salt	0.36	0.0036	0.00042
5th compound of method D; (*2R,3S*)-2-(2,3-Dichlorophenoxymethyl)-8-methyl-3-(2-furanyl)-8-aza-bicyclo[3.2.1]octane fumaric acid salt	0.31	0.00090	0.00036
6th compound of method D; (*2R,3S*)-2-(1-Naphthyloxymethyl)-8-methyl-3-(2-furanyl)-8-aza-bicyclo[3.2.1]octane fumaric acid salt	0.92	0.0030	0.00053
1st compound of method E; (*2R,3S*)-2-(2,3-Dichlorophenoxymethyl)-8-H-3-(2-thienyl)-8-aza-bicyclo[3.2.1]octane fumaric acid salt	0.074	0.0018	0.00074
2nd compound of method E; (*2R,3S*)-2-(1-Naphthyloxymethyl)-8-H-3-(2-thienyl)-8-aza-bicyclo[3.2.1]octane fumaric acid salt	0.19	0.0016	0.00054

CLAIMS

1. An 8-aza-bicyclo[3.2.1]octane derivative of the Formula I:



(I)

or any of its isomers or any mixture of its isomers, or a pharmaceutically acceptable salt thereof,
wherein
R represents hydrogen or alkyl;
R^2 represents $-CH_2-X-R^a$;
wherein X represents -O- or -S-;
R^a represents phenyl or naphthyl,
which phenyl or naphthyl is optionally substituted with substituted with one or more substituents selected from the group consisting of:
halo, hydroxy, amino, cyano, nitro, trifluoromethyl, trifluoromethoxy, alkoxy, cycloalkoxy, alkyl, cycloalkyl, cycloalkylalkyl, alkenyl, and alkynyl;
R^3 represents heteroaryl;
which heteroaryl is optionally substituted with substituted with one or more substituents selected from the group consisting of:
halo, hydroxy, amino, cyano, nitro, trifluoromethyl, trifluoromethoxy, alkoxy, cycloalkoxy, alkyl, cycloalkyl, cycloalkylalkyl, alkenyl, and alkynyl.

2. The chemical compound of claim 1, wherein
R represents hydrogen or methyl.

3. The chemical compound of either of claims 1-2, wherein
R^a represents phenyl optionally substituted with one or more halo or one or more alkoxy.

4. The chemical compound of either of claims 1-2, wherein
R^a represents naphthyl.

5. The chemical compounds of any one of claims 1-4, wherein
R^3 represents thienyl optionally substituted with one or more halo or alkoxy.

6. The chemical compounds of any one of claims 1-4, wherein
R^3 represents furyl optionally substituted with one or more halo.

7. The chemical compound of claim 1, wherein
R represents hydrogen or methyl;
X represents -O-;
R^a represents 2,3-dichlorophenyl, 2,3-difluorophenyl, 2,3-dimethoxyphenyl or naphthyl; and
R^3 represents thienyl or furyl,
optionally substituted with one or more halo or alkoxy.

8. The chemical compound of claim 1, which is
(*2R,3S*)-2-(2,3-Dichlorophenoxymethyl)-8-methyl-3-(2-thienyl-8-aza-bicyclo[3.2.1]octane;
(*2R,3S*)-2-(1-Naphthyloxymethyl)-8-methyl-3-(2-thienyl)-8-aza-bicyclo[3.2.1]octane;
(*2R,3S*)-2-(2,3-Dichlorophenoxymethyl)-8-methyl-3-(3-thienyl)-8-aza-bicyclo[3.2.1]octane;
(*2R,3S*)-2-(1-Naphthyloxymethyl)-8-methyl-3-(3-thienyl)-8-aza-bicyclo[3.2.1]octane;
(*2R,3S*)-2-(2,3-Dichlorophenoxymethyl)-8-methyl-3-(2-furanyl)-8-aza-bicyclo[3.2.1]octane;
(*2R,3S*)-2-(1-Naphthyloxymethyl)-8-methyl-3-(2-furanyl)-8-aza-bicyclo[3.2.1]octane;
(*2R,3S*)-2-(2,3-Dichlorophenoxymethyl)-8-methyl-3-(3-furanyl)-8-aza-bicyclo[3.2.1]octane;
(*2R,3S*)-2-(1-Naphthyloxymethyl)-8-methyl-3-(3-furanyl)-8-aza-bicyclo[3.2.1]octane;
(*2S,3R*)-2-(2,3-Dichlorophenoxymethyl)-8-methyl-3-(2-thienyl)-8-aza-bicyclo[3.2.1]octane;
(*2S,3R*)-2-(1-Naphthyloxymethyl)-8-methyl-3-(2-thienyl)-8-aza-bicyclo[3.2.1]octane;
(*2S,3R*)-2-(2,3-Dichlorophenoxymethyl)-8-methyl-3-(3-thienyl)-8-aza-bicyclo[3.2.1]octane;
(*2S,3R*)-2-(1-Naphthyloxymethyl)-8-methyl-3-(3-thienyl)-8-aza-bicyclo[3.2.1]octane;
(*2S,3R*)-2-(2,3-Dichlorophenoxymethyl)-8-methyl-3-(2-furanyl)-8-aza-bicyclo[3.2.1]octane;

(*2S,3R*)-2-(1-Naphthyloxymethyl)-8-methyl-3-(2-furanyl)-8-aza-bicyclo[3.2.1]octane;
(*2S,3R*)-2-(2,3-Dichlorophenoxymethyl)-8-methyl-3-(3-furanyl)-8-aza-bicyclo[3.2.1]octane;
(*2S,3R*)-2-(1-Naphthyloxymethyl)-8-methyl-3-(3-furanyl)-8-aza-bicyclo[3.2.1]octane;
(*2R,3S*)-2-(2,3-Dichlorophenoxymethyl)-8-methyl-3-(5-chloro-thien-2-yl)-8-aza-bicyclo[3.2.1]octane;
(*2R,3S*)-2-(1-naphthyl)-8-methyl-3-(5-chloro-thien-2-yl)-8-aza-bicyclo[3.2.1]octane;
(*2R,3S*)-2-(2,3-Difluorophenoxymethyl)-8-methyl-3-(5-chloro-furan-2-yl)-8-aza-bicyclo[3.2.1]octane;
(*2R,3S*)-2-(2,3-Difluorophenoxymethyl)-8-methyl-3-(5-methoxy-thien-2-yl)-8-aza-bicyclo[3.2.1]octane;
(*2R,3S*)-2-(2,3-Dimethoxyphenoxymethyl)-8-methyl-3-(2-furanyl)-8-aza-bicyclo[3.2.1]octane;
(*2R,3S*)-2-(2,3-Dichlorophenoxymethyl)-8-methyl-3-(5-methoxy-thien-2-yl)-8-aza-bicyclo[3.2.1]octane;
(*2R,3S*)-2-(2-naphthyl)-8-methyl-3-(5-chloro-thien-2-yl)-8-aza-bicyclo[3.2.1]octane;
(*2R,3S*)-2-(2,3-Difluorophenoxymethyl)-8-methyl-3-(2-furanyl)-8-aza-bicyclo[3.2.1]octane;
(*2R,3S*)-2-(2,3-Dichlorophenoxymethyl)-8-H-3-(2-thienyl)-8-aza-bicyclo[3.2.1]octane;
(*2R,3S*)-2-(1-Naphthyloxymethyl)-8-H-3-(2-thienyl)-8-aza-bicyclo[3.2.1]octane;
(*2R,3S*)-2-(2,3-Dichlorophenoxymethyl)-8-H-3-(3-thienyl)-8-aza-bicyclo[3.2.1]octane;
(*2R,3S*)-2-(1-Naphthyloxymethyl)-8-H-3-(3-thienyl)-8-aza-bicyclo[3.2.1]octane;
(*2R,3S*)-2-(2,3-Dichlorophenoxymethyl)-8-H-3-(2-furanyl)-8-aza-bicyclo[3.2.1]octane;
(*2R,3S*)-2-(1-Naphthyloxymethyl)-8-H-3-(2-furanyl)-8-aza-bicyclo[3.2.1]octane;
(*2R,3S*)-2-(2,3-Dichlorophenoxymethyl)-8-H-3-(3-furanyl)-8-aza-bicyclo[3.2.1]octane;
(*2R,3S*)-2-(1-Naphthyloxymethyl)-8-H-3-(3-furanyl)-8-aza-bicyclo[3.2.1]octane;
(*2S,3R*)-2-(2,3-Dichlorophenoxymethyl)-8-H-3-(2-thienyl)-8-aza-bicyclo[3.2.1]octane;
(*2S,3R*)-2-(1-Naphthyloxymethyl)-8-H-3-(2-thienyl)-8-aza-bicyclo[3.2.1]octane;
(*2S,3R*)-2-(2,3-Dichlorophenoxymethyl)-8-H-3-(3-thienyl)-8-aza-bicyclo[3.2.1]octane;

(2*S*,3*R*)-2-(1-Naphthyloxymethyl)-8-H-3-(3-thienyl)-8-aza-bicyclo[3.2.1]octane;
(2*S*,3*R*)-2-(2,3-Dichlorophenoxymethyl)-8-H-3-(2-furanyl)-8-aza-bicyclo[3.2.1]octane;
(2*S*,3*R*)-2-(1-Naphthyloxymethyl)-8-H-3-(2-furanyl)-8-aza-bicyclo[3.2.1]octane;
(2*S*,3*R*)-2-(2,3-Dichlorophenoxymethyl)-8-H-3-(3-furanyl)-8-aza-bicyclo[3.2.1]octane;
(2*S*,3*R*)-2-(1-Naphthyloxymethyl)-8-H-3-(3-furanyl)-8-aza-bicyclo[3.2.1]octane;
or any of its isomers or any mixture of its isomers, or a pharmaceutically acceptable salt thereof.

9. A pharmaceutical composition, comprising a therapeutically effective amount of a compound of any one of claims 1-8, or any of its isomers or any mixture of its isomers, or a pharmaceutically acceptable salt thereof, together with at least one pharmaceutically acceptable carrier, excipient or diluent.

10. Use of the chemical compound of any of claims 1-8, or any of its isomers or any mixture of its isomers, or a pharmaceutically acceptable salt thereof, for the manufacture of a medicament.

11. The use according to claim 10, for the manufacture of a pharmaceutical pharmaceutical composition for the treatment, prevention or alleviation of a disease or a disorder or a condition of a mammal, including a human, which disease, disorder or condition is responsive to inhibition of monoamine neurotransmitter re-uptake in the central nervous system.

12. The use according to claim 11, wherein the disease, disorder or condition is mood disorder, depression, atypical depression, major depressive disorder, dysthymic disorder, bipolar disorder, bipolar I disorder, bipolar II disorder, cyclothymic disorder, mood disorder due to a general medical condition, substance-induced mood disorder, pseudodementia, Ganser's syndrome, obsessive compulsive disorder, panic disorder, panic disorder without agoraphobia, panic disorder with agoraphobia, agoraphobia without history of panic disorder, panic attack, memory deficits, memory loss, attention deficit hyperactivity disorder, obesity, anxiety, generalized anxiety disorder, eating disorder, Parkinson's disease, parkinsonism, dementia, dementia of ageing, senile dementia, Alzheimer's disease, acquired immunodeficiency syndrome dementia complex, memory dysfunction in ageing, specific phobia, social phobia, post-traumatic stress disorder, acute stress disorder, drug addiction, drug misuse, cocaine abuse, nicotine abuse, tobacco abuse, alcohol addiction,

alcoholism, pain, inflammatory pain, neuropathic pan, migraine pain, tension-type headache, chronic tension-type headache, pain associated with depression, fibromyalgia, arthritis, osteoarthritis, rheumatoid arthritis, back pain, cancer pain, irritable bowel pain, irritable bowel syndrome, post-operative pain, post-stroke pain, drug-induced neuropathy, diabetic neuropathy, sympathetically-maintained pain, trigeminal neuralgia, dental pain, myofacial pain, phantom-limb pain, bulimia, premenstrual syndrome, late luteal phase syndrome, post-traumatic syndrome, chronic fatigue syndrome, urinary incontinence, stress incontinence, urge incontinence, nocturnal incontinence, premature ejaculation, erectile difficulty, anorexia nervosa, sleep disorders, autism, mutism, trichotillomania, narcolepsy, post-stroke depression, stroke-induced brain damage, stroke-induced neuronal damage or Gilles de la Tourettes disease.

13. A method for treatment, prevention or alleviation of a disease or a disorder or a condition of a living animal body, including a human, which disorder, disease or condition is responsive to inhibition of monoamine neurotransmitter re-uptake in the central nervous system, which method comprises the step of administering to such a living animal body in need thereof a therapeutically effective amount of a compound according to any one of the claims 1-8, or any of its isomers or any mixture of its isomers, or a pharmaceutically acceptable salt thereof.

INTERNATIONAL SEARCH REPORT

International Application No
PCT/EP2004/050107

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 C07D451/02 A61K31/46 A61P25/00

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 C07D A61K A61P

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)
EPO-Internal, WPI Data, PAJ, BEILSTEIN Data, CHEM ABS Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
P,X	WO 03/014114 A (GOULIAEV ALEX HAAHR ; NEUROSEARCH AS (DK); PETERS DAN (DK)) 20 February 2003 (2003-02-20) page 9; example 7	1-13
Y	WO 02/102801 A (GOULIAEV ALEX HAAHR ; DAHL BJARNE H (DK); NEUROSEARCH AS (DK); PETERS) 27 December 2002 (2002-12-27) pages 2-3; examples	1-13
Y	EP 0 969 005 A (LILLY CO ELI) 5 January 2000 (2000-01-05) page 2	1-13
Y	EP 0 604 354 A (NEUROSEARCH AS) 29 June 1994 (1994-06-29) page 3	1-13

☐ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

° Special categories of cited documents :

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"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
21 June 2004	06 08. 2004

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INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No
PCT/EP2004/050107

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
WO 03014114 A	20-02-2003	WO 03014114 A2	20-02-2003
		EP 1417174 A2	12-05-2004
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INTERNATIONAL SEARCH REPORT

International application No.
PCT/EP2004/050107

Box II Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)

This International Search Report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. [X] Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:

Although claim 13 is directed to a method of treatment of the human/animal body, the search has been carried out and based on the alleged effects of the compound/composition.

2. [ ] Claims Nos.:
because they relate to parts of the International Application that do not comply with the prescribed requirements to such an extent that no meaningful International Search can be carried out, specifically:

3. [ ] Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box III Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

1. [ ] As all required additional search fees were timely paid by the applicant, this International Search Report covers all searchable claims.

2. [ ] As all searchable claims could be searched without effort justifying an additional fee, this Authority did not invite payment of any additional fee.

3. [ ] As only some of the required additional search fees were timely paid by the applicant, this International Search Report covers only those claims for which fees were paid, specifically claims Nos.:

4. [ ] No required additional search fees were timely paid by the applicant. Consequently, this International Search Report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

Remark on Protest

[ ] The additional search fees were accompanied by the applicant's protest.

[ ] No protest accompanied the payment of additional search fees.