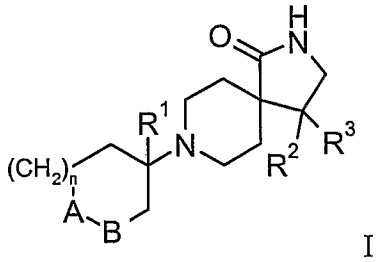
DIAZA-SPIROPIPERIDINE DERIVATIVES AS INHIBITORS OF GLYCINE TRANSPORTER 1 AND GLYCINE TRANSPORTER 2

The present invention relates to compounds of formula



I

wherein

A-B is CH_2-CH_2, -CH_2-O-, -O-CH_2-, -CH_2-S-, -S-CH_2-, -CH_2-C(O)-, -C(O)-CH_2-, -N(R^4)-CH_2- or -CH_2-N(R^4)-;

R^1 is lower alkyl, lower alkenyl, cycloalkyl, or is aryl, optionally substituted by one or two substituents, selected from the group consisting of halogen, cyano, lower alkyl, CF_3, OCF_3 or lower alkoxy, or is heteroaryl, optionally substituted by one or two substituents selected from the group consisting of halogen, lower alkyl, CF_3 or lower alkoxy;

R^2 is lower alkyl, cycloalkyl, or is aryl, optionally substituted by one or two substituents, selected from the group consisting of halogen, lower alkyl, CF_3, lower alkoxy, or
is heteroaryl, optionally substituted by one or two substituents, selected from the group consisting of halogen, lower alkyl, CF_3 or lower alkoxy;

R^3 is hydrogen, lower alkyl or benzyl;

R^4 is hydrogen or benzyl;

n is 0, 1 or 2;

and to pharmaceutically available salts thereof.

The present invention relates to compounds of general formula I, to pharmaceutical compositions containing them and their use in the treatment of neurological and neuropsychiatric disorders.

It has surprisingly been found that the compounds of general formula I are good inhibitors of the glycine transporter 1 (GlyT-1), and that they have a good selectivity to glycine transporter 2 (GlyT-2) inhibitors.

Schizophrenia is a progressive and devastating neurological disease characterized by episodic positive symptoms such as delusions, hallucinations, thought disorders and psychosis and persistent negative symptoms such as flattened affect, impaired attention and social withdrawal, and cognitive impairments (Lewis DA and Lieberman JA, *Neuron,* 2000, 28:325-33). For decades research has focused on the "dopaminergic hyperactivity" hypothesis which has led to therapeutic interventions involving blockade of the dopaminergic system (Vandenberg RJ and Aubrey KR., *Exp. Opin. Ther. Targets*, 2001, 5(4): 507-518; Nakazato A and Okuyama S, et al., 2000, *Exp. Opin. Ther. Patents*, 10(1): 75-98). This pharmacological approach poorly address negative and cognitive symptoms which are the best predictors of functional outcome (Sharma T., *Br.J. Psychiatry*, 1999, 174(suppl. 28): 44-51).

A complementary model of schizophrenia was proposed in the mid-1960' based upon the psychotomimetic action caused by the blockade of the glutamate system by compounds like phencyclidine (PCP) and related agents (ketamine) which are non-competitive NMDA receptor antagonists. Interestingly in healthy volunteers, PCP-induced psychotomimetic action incorporates positive and negative symptoms as well as cognitive dysfunction, thus closely resembling schizophrenia in patients (Javitt DC et al., 1999, *Biol. Psychiatry*, 45: 668-679 and refs. herein). Furthermore transgenic mice expressing reduced levels of the NMDAR1 subunit displays behavioral abnormalities similar to those observed in pharmacologically induced models of schizophrenia, supporting a model in which reduced NMDA receptor activity results in schizophrenia-like behavior (Mohn AR et al., 1999, *Cell*, 98: 427-236).

Glutamate neurotransmission, in particular NMDA receptor activity, plays a critical role in synaptic plasticity, learning and memory, such as the NMDA receptors appears to serve as a graded switch for gating the threshold of synaptic plasticity and memory formation (Hebb DO, 1949, *The organization of behavior*, Wiley, NY; Bliss TV and Collingridge GL, 1993, *Nature*, 361: 31-39). Transgenic mice overexpressing the NMDA NR2B subunit exhibit enhanced synaptic plasticity and superior ability in learning and memory (Tang JP et al., 1999, *Nature*: 401- 63-69).

Thus, if a glutamate deficit is implicate in the pathophysiology of schizophrenia, enhancing glutamate transmission, in particular via NMDA receptor activation, would be predicted to produce both anti-psychotic and cognitive enhancing effects.

The amino acid glycine is known to have at least two important functions in the CNS. It acts as an inhibitory amino acid, binding to strychnine sensitive glycine receptors, and it also influences excitatory activity, acting as an essential co-agonist with glutamate for N-methyl-D-aspartate (NMDA) receptor function. While glutamate is released in an activity-dependent manner from synaptic terminals, glycine is apparently present at a more constant level and seems to modulate/control the receptor for its response to glutamate.

One of the most effective ways to control synaptic concentrations of neurotransmitter is to influence their re-uptake at the synapses. Neurotransmitter transporters by removing neurotransmitters from the extracellular space, can control their extracellular lifetime and thereby modulate the magnitude of the synaptic transmission (Gainetdinov RR et al, 2002, Trends in Pharm. Sci., 23(8): 367-373) .

Glycine transporters, which form part of the sodium and chloride family of neurotransmitter transporters, play an important role in the termination of post-synaptic glycinergic actions and maintenance of low extracellular glycine concentration by re-uptake of glycine into presynaptic nerve terminals and surrounding fine glial processes.

Two distinct glycine transporter genes have been cloned (GlyT-1 and GlyT-2) from mammalian brain, which give rise to two transporters with ~50 % amino acid sequence homology. GlyT-1 presents four isoforms arising from alternative splicing and alternative promoter usage (1a, 1b, 1c and 1d). Only two of these isoforms have been found in rodent brain (GlyT-1a and GlyT-1b). GlyT-2 also presents some degree of heterogeneity. Two GlyT-2 isoforms (2a and 2b) have been identified in rodent brains. GlyT-1 is known to be located in CNS and in peripheral tissues, whereas GlyT-2 is specific to the CNS. GlyT-1 has a predominantly glial distribution and is found not only in areas corresponding to strychnine sensitive glycine receptors but also outside these areas, where it has been postulated to be involved in modulation of NMDA receptor function (Lopez-Corcuera B et al., 2001, *Mol. Mem. Biol.*, 18: 13-20). Thus, one strategy to enhance NMDA receptor activity is to elevate the glycine concentration in the local microenvironment of synaptic NMDA receptors by inhibition of GlyT-1 transporter (Bergereon R. Et al., 1998, *Proc. Natl. Acad. Sci. USA*, 95: 15730-15734; Chen L et al., 2003, *J. Neurophysiol.*, 89 (2): 691-703).

Glycine transporters inhibitors are suitable for the treatment of neuroligical and neuropsychiatric disorders.The majority of diseases states implicated are psychoses, schizophrenia (Armer RE and Miller DJ, 2001, *Exp. Opin. Ther. Patents,* 11 (4): 563-572), psychotic mood disorders such as severe major depressive disorder, mood disorders associated with psychotic disorders such as acute mania or depression associated with bipolar disorders and mood disorders associated with schizophrenia, (Pralong ET et al., 2002, *Prog. Neurobiol.*, 67: 173-202), autistic disorders (Carlsson ML, 1998, *J. Neural Transm.* 105: 525-535), cognitive disorders such as dementias, including age related dementia and senile dementia of the Alzheimer type, memory disorders in a mammal, including a human, attention deficit disorders and pain (Armer RE and Miller DJ, 2001, *Exp. Opin. Ther. Patents,* 11 (4): 563-572).

Thus, increasing activation of NMDA receptors via GlyT-1 inhibition may lead to agents that treat psychosis, schizophrenia, dementia and other diseases in which cognitive processes are impaired, such as attention deficit disorders or Alzheimer's disease.

Objects of the present invention are the compounds of formula I per se, the use of compounds of formula I and their pharmaceutically acceptable salts for the manufacture of medicaments for the treatment of diseases related to activation of NMDA receptors via Glyt-1 inhibition, their manufacture, medicaments based on a compound in accordance with the invention and their production as well as the use of compounds of formula I in the control or prevention of illnesses such as psychoses, disfunction in memory and learning, schizophrenia, dementia and other diseases in which cognitive processes are impaired, such as attention deficit disorders or Alzheimer's disease.

The preferred indications using the compounds of the present invention are schizophrenia, cognitive impairment and Alzheimer's disease.

Furthermore, the invention includes all racemic mixtures, all their corresponding enantiomers and/or optical isomers.

As used herein, the term "lower alkyl" denotes a saturated straight- or branched-chain group containing from 1 to 7 carbon atoms, for example, methyl, ethyl, propyl, isopropyl, n-butyl, i-butyl, 2-butyl, t-butyl and the like. Preferred alkyl groups are groups with 1 - 4 carbon atoms.

As used herein, the term "alkenyl" denotes an unsaturated straight- or branched-chain group containing from 2 to 7 carbon atoms with at least one double bond.

The term "cycloalkyl" denotes a saturated or partially saturated ring containing from 3 to 7 carbon atoms, for example cyclopropyl, cyclopentyl, cyclopentenyl, cyclohexyl, cyclohexenyl, cycloheptyl or cycloheptenyl.

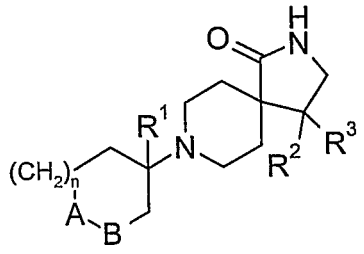
The term "halogen" denotes chlorine, iodine, fluorine and bromine.

The term "aryl" denotes a monovalent cyclic aromatic hydrocarbon radical consisting of one or more fused rings in which at least one ring is aromatic in nature, for example phenyl or naphthyl.

The term "heteroaryl" denotes a cyclic aromatic hydrocarbon radical, containing one, two or three heteroatoms, selected from the group consisting of oxygen, sulphur or nitrogen, for example pyridyl, pyrazinyl, pyrimidinyl, pyridazinyl, triazinyl, thiazolyl, thienyl, furyl, pyrrolyl, imidazolyl, pyrazolyl, oxazolyl, isothiazolyl or isoxazolyl.

The term "pharmaceutically acceptable acid addition salts" embraces salts with inorganic and organic acids, such as hydrochloric acid, nitric acid, sulfuric acid, phosphoric acid, citric acid, formic acid, fumaric acid, maleic acid, acetic acid, succinic acid, tartaric acid, methane-sulfonic acid, p-toluenesulfonic acid and the like.

Especially preferred are those compounds of formula I,



I

wherein

A-B is $-CH_2-CH_2-$, $-CH_2-O-$, $-O-CH_2-$, $-S-CH_2-$ or $-N(R^4)-CH_2-$;

R^1 is lower alkyl, lower alkenyl, cycloalkyl, or is phenyl, optionally substituted by one or two substituent, selected from the group consisting of halogen, cyano, lower alkyl, CF_3, OCF_3 or lower alkoxy, or is heteroaryl, optionally substituted by lower alkyl;

R^2 is lower alkyl, or is phenyl, optionally substituted by one substituent, selected from the group consisting of halogen, lower alkyl, CF_3, lower alkoxy, or is heteroaryl;

R^3 is hydrogen;

R^4 is benzyl; and

n is 1 or 2;

and pharmaceutically available salts thereof.

Further preferred are compounds, wherein –A-B- is $–CH_2-CH_2-$ and n is 1.

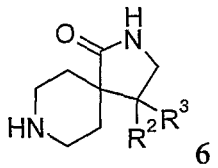
Especially preferred from this group are compounds, wherein R^1 and R^2 are phenyl, optionally substituted by halogen or lower alkyl, for example the following compounds
rac-4-phenyl-8-(1-phenyl-cyclohexyl)-2,8-diaza-spiro[4.5]decan-1-one,
rac-4-(4-fluoro-phenyl)-8-[1-(4-fluoro-phenyl)-cyclohexyl]-2,8-diaza-spiro[4.5]decan-1-one or
rac 8-[1-(4-fluoro-phenyl)-cyclohexyl]-4-*p*-tolyl-2,8-diaza-spiro[4.5]decan-1-one,
or wherein R^1 is thiophenyl and R^2 is phenyl, substituted by halogen, for example the following compounds
rac-4-(4-fluoro-phenyl)-8-(1-thiophen-2-yl-cyclohexyl)-2,8-diaza-spiro[4.5]decan-1-one or
rac-4-(4-fluoro-phenyl)-8-(1-thiophen-3-yl-cyclohexyl)-2,8-diaza-spiro[4.5]decan-1-one,
or wherein R^1 is phenyl, optionally substituted by halogen and R^2 is lower alkyl, for example the following compounds
rac 8-(1-phenyl-cyclohexyl)-4-propyl-2,8-diaza-spiro[4.5]decan-1-one or
rac 8-[1-(4-fluoro-phenyl)-cyclohexyl]-4-propyl-2,8-diaza-spiro[4.5]decan-1-one.

Further preferred are compounds, wherein –A-B- is $–O-CH_2-$, $–CH_2O-$, $–S-CH_2-$ or $–N(benzyl)-CH_2-$ and n is 1.

A further object of the present invention are compounds of formula I, wherein n is 2. An example from this group is the compound
rac-4-(4-fluoro-phenyl)-8-[1-(4-fluoro-phenyl)-cycloheptyl]-2,8-diaza-spiro[4.5]decan-1-one.

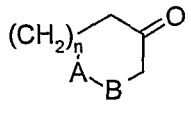
The present compounds of formula I and their pharmaceutically acceptable salts can be prepared by methods known in the art, for example, by processes described below, which process comprises

a) reacting a compound of formula



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with a compound of formula

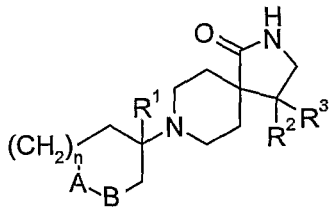


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in the presence of AcOH and TMSCN and then with a corresponding Grignard reagent of formula

R^1Mghal 9

to a compound of formula



I

wherein the substituents are as described above and hal is Cl, Br or I, and

b) if desired, separating the obtained racemic forms into corresponding enantiomers, and

if desired, converting the compounds obtained into pharmaceutically acceptable acid addition salts.

The acid addition salts of the basic compounds of formula I may be converted to the corresponding free bases by treatment with at least a stoichiometric equivalent of a suitable base such as sodium or potassium hydroxide, potassium carbonate, sodium bicarbonate, ammonia, and the like.

The compounds of formula I may be prepared in accordance with process variants a) and b) and with the following schemes 1 and 2.

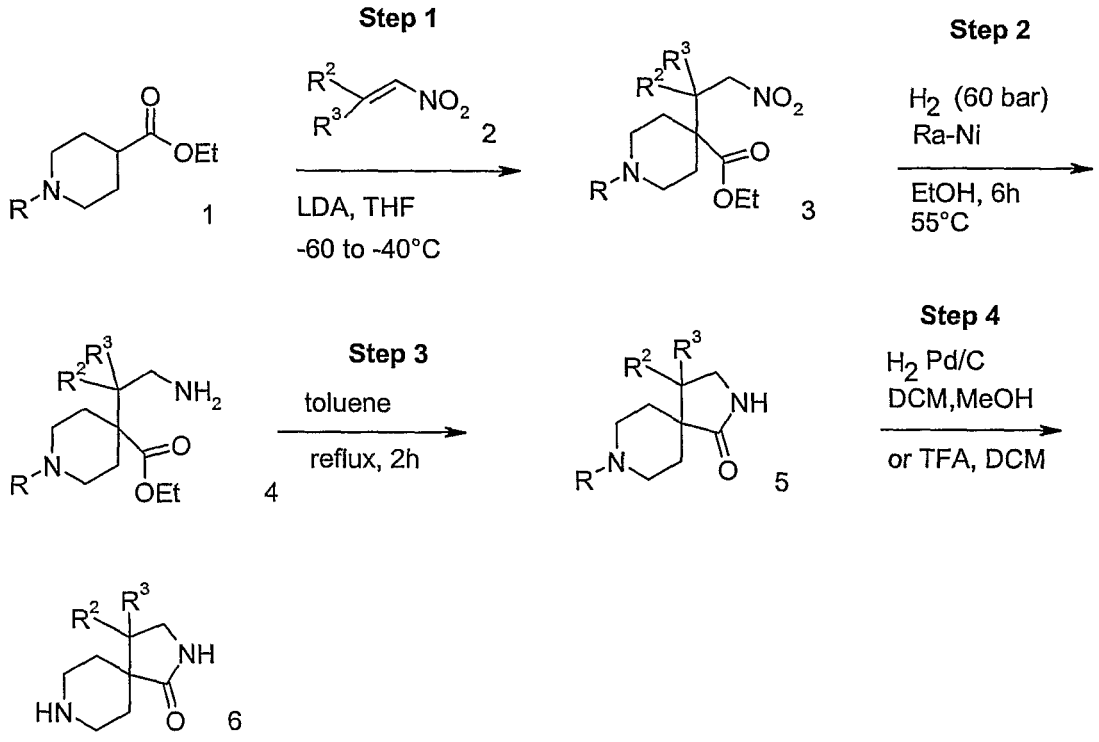
The starting material is commercially available or may be prepared in accordance with known methods.

The following abbreviations have been used:

LDA = lithiumdiisopropylamide
TMSCN = trimethylthiocyanat
DCM = dichloromethane
TFA = trifluoroacetic acid
THF = tetrahydrofuran

Starting from an appropriately 1-protected-piperidine-4-ethylcarboxylate 1, treatment with an appropriate base, usually LDA, followed by treatment with an appropriately substituted nitro alkene 2 results in formation of the nitro alkane 3. Reduction to the amino group facilitated by Raney-Ni and hydrogen, usually at 60 bar pressure and at 55 °C in EtOH as solvent results in the formation of 4. Subsequent cyclisation by heating in toluene under reflux affords the amide 5. Removal of the protecting group under standard conditions (TFA treatment in DCM for R = Boc; or hydrogenolysis with Pd/C in DCM, MeOH for R = Bn) affords the diazaspiropiperidines 6 (Scheme 1).

Scheme 1

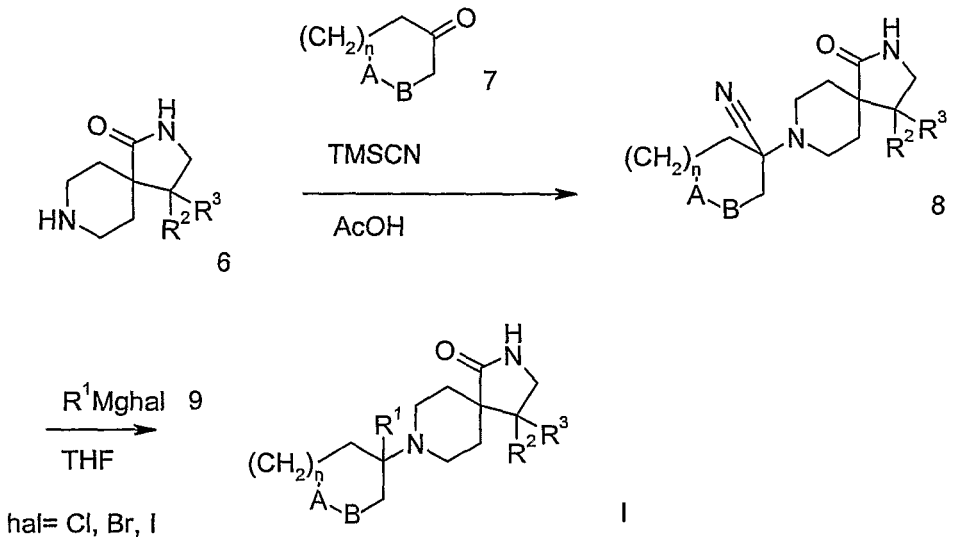


wherein R is a N-protecting group, such as BOC or benzyl, and the other substituents are as described above.

Compounds of formula 6 are treated, under Strecker reaction conditions, with a compound of formula 7 in the presence of AcOH and a cyanide source (preferably TMSCN) to give a compound of formula 8, which are then treated, under Bruylant reaction conditions, with a corresponding Grignard reagent 9 to give compounds of formula 1 (Scheme 2). Strecker synthesis can also be carried out using suitable cyanating reagents (KCN, acetonecyanohydrin) according to known procedures at temperature ranges from

0 to 100 °C with reaction times between 30 min and 7 days. Bruylant reactions can be carried out using Grignard reagents prepared from Mg(0) or from i-PrMgCl or other known reagents in a suitable solvent such as tetrahydrofuran (THF). Suitable Grignard reagents are represented by formula R^1-Mghal 9.

Scheme 2



All compounds of formulas I, 3, 4, 5, 6 and 8 can be prepared in racemic form following the procedures described below and separated into chiral non-racemic enantiomers by preparative HPLC using either a Chiralpak OD or AD column (5 x 50 cm) at room temperature using an ethanol : heptane mobile phase with UV detection at 220 nM.

The compounds of formula I and their pharmaceutically usable addition salts possess valuable pharmacological properties. Specifically, it has been found that the compounds of the present invention are good inhibitors of the glycine transporter I (GlyT-1).

The compounds were investigated in accordance with the test given hereinafter.

Solutions and materials

DMEM complete medium: Nutrient mixture F-12 (Gibco Life-technologies), fetal bovine serum (FBS) 5 %, (Gibco life technologies), Penicillin/Streptomycin1 % (Gibco life technologies), Hygromycin 0.6 mg/ml (Gibco life technologies), Glutamine 1 mM Gibco life technologies)

Uptake buffer (UB): 150 mM NaCl, 10 mM Hepes-Tris, pH 7.4, 1 mM $CaCl_2$, 2.5 mM KCl, 2.5 mM $MgSO_4$, 10 mM (+) D-glucose.
Flp-in™-CHO (Invitrogen Cat n° R758-07)cells stably transfected with mGlyT1b cDNA.

Glycine uptake inhibition assay (mGlyT-1b)

On day 1 mammalian cells, (Flp-in™-CHO), transfected with mGlyT-1b cDNA , were plated at the density of 40,000 cells/well in complete F-12 medium, without hygromycin in 96-well culture plates. On day 2, the medium was aspirated and the cells were washed twice with uptake buffer (UB). The cells were then incubated for 20 min at 22°C with either (i) no potential competitor, (ii) 10 mM non-radioactive glycine , (iii) a concentration of a potential inhibitor. A range of concentrations of the potential inhibitor was used to generate data for calculating the concentration of inhibitor resulting in 50 % of the effect (e.g. IC_{50}, the concentration of the competitor inhibiting glycine uptake of 50 %). A solution was then immediately added containing [^{3}H]-glycine 60 nM (11-16 Ci/mmol) and 25 µM non-radioactive glycine. The plates were incubated with gentle shaking and the reaction was stopped by aspiration of the mixture and washing (three times) with ice-cold UB. The cells were lysed with scintillation liquid, shaken 3 hours and the radioactivity in the cells was counted using a scintillation counter.

The following activity can be shown in mouse and human:

Example No.	GlyT-1 Racemat Mouse/human (nMol)	GlyT-1 Enant. Mouse/human (nMol)
1	115/118	115,160/77,107
25	103/95	56,73/nd,97
36	67/-	75,nd/281,381

38	99/-	99,213/-
50	-/132	81,153/-
52	-/73	
56	-/161	-/62,82
57	-/93	

The compounds of formula I and the pharmaceutically acceptable salts of the compounds of formula I can be used as medicaments, e.g. in the form of pharmaceutical preparations. The pharmaceutical preparations can be administered orally, e.g. in the form of tablets, coated tablets, dragées, hard and soft gelatine capsules, solutions, emulsions or suspensions. The administration can, however, also be effected rectally, e.g. in the form of suppositories, parenterally, e.g. in the form of injection solutions.

The compounds of formula I can be processed with pharmaceutically inert, inorganic or organic carriers for the production of pharmaceutical preparations. Lactose,corn starch or derivatives thereof, talc, stearic acids or its salts and the like can be used, for example, as such carriers for tablets, coated tablets, dragées and hard gelatine capsules. Suitable carriers for soft gelatine capsules are, for example, vegetable oils, waxes, fats, semi-solid and liquid polyols and the like. Depending on the nature of the active substance no carriers are however usually required in the case of soft gelatine capsules. Suitable carriers for the production of solutions and syrups are, for example, water, polyols, glycerol, vegetable oil and the like. Suitable carriers for suppositories are, for example, natural or hardened oils, waxes, fats, semi-liquid or liquid polyols and the like.

The pharmaceutical preparations can, moreover, contain preservatives, solubilizers, stabilizers, wetting agents, emulsifiers, sweeteners, colorants, flavorants, salts for varying the osmotic pressure, buffers, masking agents or antioxidants. They can also contain still other therapeutically valuable substances.

Medicaments containing a compound of formula I or a pharmaceutically acceptable salt thereof and a therapeutically inert carrier are also an object of the present invention, as is a process for their production, which comprises bringing one or more compounds of formula I and/or pharmaceutically acceptable acid addition salts and, if

desired, one or more other therapeutically valuable substances into a galenical administration form together with one or more therapeutically inert carriers.

The most preferred indications in accordance with the present invention are those, which include disorders of the central nervous system, for example the treatment or prevention of schizophrenia, cognitive impairment and Alzheimer's disease.

The dosage can vary within wide limits and will, of course, have to be adjusted to the individual requirements in each particular case. In the case of oral administration the dosage for adults can vary from about 0.01 mg to about 1000 mg per day of a compound of general formula I or of the corresponding amount of a pharmaceutically acceptable salt thereof. The daily dosage may be administered as single dose or in divided doses and, in addition, the upper limit can also be exceeded when this is found to be indicated.

The following examples illustrate the present invention without limiting it. All temperatures are given in degree Celsius.

Preparation of Building blocks 6

rac-4-Phenyl-2,8-diaza-spiro[4.5]decan-1-one

rac-1-Benzyl-4-(2-nitro-1-phenyl-ethyl)-piperidine-4-carboxylic acid ethyl ester

a) An LDA (14 mmol) solution was prepared by treating diisopropylamine (1.37 g, 14 mmol) with BuLi (1.6 M, 8.5 mL, 14 mmol) at -78 °C in dry THF (10 mL) under Argon and allowing to warm up to -20 °C. This solution was then cooled to -60 °C added to a solution of 1-benzyl-piperidine-4-ethyl carboxylate (3.05 g, 12 mmol) at -60 °C and allowed to warm up to -40 °C over 1 h whereupon a solution of *trans*-beta-nitrostyrene (1.93 g, 13 mmol) was added dropwise. The reaction mixture was allowed to warm up to room temperature over 1 h and then quenched with ammonium chloride (saturated, 40 mL) and the product extracted with ethyl acetate (2 x 40 mL). The combined organic extracts were then washed with brine, dried over sodium sulfate, filtered and evaporated. Purification by chromatography on silica gel eluting with DCM : MeOH (9 : 1) afforded the title compound (4.1 g, 84 %) as a light yellow gum. MS : m/e = 397.4 (M+H).

rac-4-(2-Amino-1-phenyl-ethyl)-1-benzyl-piperidine-4-carboxylic acid ethyl ester

b) A solution of rac-1-benzyl-4-(2-nitro-1-phenyl-ethyl)-piperidine-4-carboxylic acid ethyl ester (3.18 g, 8 mmol) in dry EtOH (240 mL) was hydrogenated in the presence of Ra-Ni (3 g) at 60 bar at 55 °C for 3 h. After cooling and decompression of the reaction

vessel, the mixture was filtered over celite and the filtrate evaporated to leave the title compound (2.9 g, 99 %) as a clear oil. MS : m/e = 367.4 (M+H).

rac-8-Benzyl-4-phenyl-2,8-diaza-spiro[4.5]decan-1-one

c) A solution of rac-4-(2-amino-1-phenyl-ethyl)-1-benzyl-piperidine-4-carboxylic acid ethyl ester (2.9 g, 8 mmol) in toluene (30 mL) was heated under reflux for 4 h. After cooling to room temperature and evaporation the mixture was purified by chromatography on silica gel eluting with DCM : MeOH : NH_4OH (95 : 4.5: 0.5) to afford the title compound (1.47 g, 58 %) as a white solid. MS : m/e = 321.4 (M+H).

rac-4-Phenyl-2,8-diaza-spiro[4.5]decan-1-one

d) A suspension of rac-8-benzyl-4-phenyl-2,8-diaza-spiro[4.5]decan-1-one (28.8 g, 90 mmol) in MeOH : DCM (4 : 1, 500 mL) was hydrogenated in the presence of Pd (10% on C, 14 g, 132 mmol) at 2 bar for 48 h at room temperature. After filtration over celite, the reaction mixture was evaporated and the residue dissolved in NaOH (2 N, 200 mL). The product was extracted with DCM (3 x 150 mL) and the combined organic extracts dried over sodium sulfate. Filtration and evaporation afforded the title compound (13.1 g, 63 %) as a white solid after trituration from diethylether. MS : m/e = 231.4 (M+H).

Scheme 1, Step 1: F-derivative from Boc protecting group

rac-4-(4-Fluoro-phenyl)-2,8-diaza-spiro[4.5]decan-1-one

Piperidine-1,4-dicarboxylic acid 1-tert-butyl ester 4-ethyl ester

a) To a solution of ethyl isonipecotate (20 g, 127 mmol) in dioxane : water (1 : 1, 120 mL) was added triethylamine (12.87 g, 127 mmol) at 0 °C followed by di-tert-butylcarbonate (35.2 g, 161 mmol) and the resulting mixture maintained at this temperature for 2 h. The product was then extracted with ethyl acetate (3 x 100 mL) and the combined organic extracts washed with HCl (1 N, 100 mL), brine (100 mL), dried over sodium sulfate, filtered and evaporated. Purification by Kugelrohr distillation afforded the title compound (29.0 g, 89 %) as a colourless liquid, bp 140 °C at 0.13 mbar. MS : m/e = 275.2 ($M+NH_4$).

rac-4-[1-(4-Fluoro-phenyl)-2-nitro-ethyl]-piperidine-1,4-dicarboxylic acid 1-tert-butyl ester 4-ethyl ester

b) An LDA solution was prepared by treating diisopropylamine (6.98 g, 69 mmol) with BuLi (1.6 M, 41.3 mL, 66 mmol) at -78 °C in dry THF (45 mL) under Argon and allowing to warm up to -20 °C. This solution was then cooled to -60 °C added to a solution of piperidine-1,4-dicarboxylic acid 1-tert-butyl ester 4-ethyl ester (15.44 g, 60 mmol) in dry THF (45 mL) at -60 °C and allowed to warm up to -40 °C over 1 h whereupon a solution of 4-fluoro-*trans*-beta-nitrostyrene (10.02 g, 60 mmol) in dry THF (40 mL) was added dropwise. The reaction mixture was allowed to warm up to room temperature over 1 h and then quenched with ammonium chloride (saturated, 250 mL) and the product extracted with diethylether (3 x 100 mL). The combined organic extracts were then washed with brine, dried over sodium sulfate, filtered and evaporated to afford the title compound (26.7 g, 99 %) as a light yellow gum. MS : m/e = 442.4 ($M+NH_4$).

rac-4-(2-Amino-1-phenyl-ethyl)-1-tert-butyl-piperidine-1,4-dicarboxylic acid ethyl ester

c) A solution of rac-4-[1-(4-fluoro-phenyl)-2-nitro-ethyl]-piperidine-1,4-dicarboxylic acid 1-tert-butyl ester 4-ethyl ester (26.6 g, 60 mmol) in dry EtOH (600 mL) was hydrogenated in the presence of Ra-Ni (25 g) at 50 bar at 50 °C for 20 h. After cooling and decompression of the reaction vessel, the mixture was filtered over celite and the filtrate evaporated to leave the title compound (23.4 g, 99 %) as a clear oil which was used directly in the next step.

rac-4-(4-Fluoro-phenyl)-1-oxo-2,8-diaza-spiro[4.5]decane-8-carboxylic acid tert-butyl ester

d) A solution of rac-4-(2-amino-1-phenyl-ethyl)-1-tert-butyl-piperidine-1,4-dicarboxylic acid ethyl ester (23.4 g, 60 mmol) in toluene (200 mL) was heated under reflux for 18 h. After cooling to room temperature, evaporation afforded the title compound (17.17 g,
83 %) as a white solid after trituration from hot pentane. MS : m/e = 349.3 (M+H).

rac-4-(4-Fluoro-phenyl)-2,8-diaza-spiro[4.5]decan-1-one

e) A solution of rac-4-(4-fluoro-phenyl)-1-oxo-2,8-diaza-spiro[4.5]decane-8-carboxylic acid tert-butyl ester (46.0 g, 132 mmol) in DCM (260 mL) containing TFA (150 mL, 1.32 mol) was stirred vigorously at 0 °C for 15 min. The reaction mixture was then poured into NaOH (3 N, 200 mL) and the product extracted with DCM (3 x 100 mL). The combined organic extracts were then washed with water (100 mL) and brine (100 mL) and then dried over sodium sulfate. Filtration and evaporation afforded the title

compound (22.14 g,
68 %) as a white solid after trituration from ethyl acetate. MS : m/e = 249.2 (M+H).

(R)- 4-(4-Fluoro-phenyl)-2,8-diaza-spiro[4.5]decan-1-one and (S)- 4-(4-Fluoro-phenyl)-2,8-diaza-spiro[4.5]decan-1-one

The enantiomers of rac-4-(4-fluoro-phenyl)-2,8-diaza-spiro[4.5]decan-1-one were separated using a 5 x 50 cm Chiralpak AD column at room temperature using a 15 % ethanol : 85 % heptane mobile phase with UV detection at 220 nM. Less polar component (Peak 1) corresponds to the (R)-enantiomer (see below).

Elucidation of absolute stereochemistry: To a solution of 4-(4-fluoro-phenyl)-2,8-diaza-spiro[4.5]decan-1-one (Peak A, 50 mg, 0.2 mmol) in methanol (10 mL) was added 1R-(-)-camphorsulfonic acid (46.8 mg, 0.2 mmol) and the solution stirred for 10 min at room temperature. The resulting mixture was evaporated and the residue crystallized from ethyl acetate. A single crystal X-ray structural analysis determined the absolute configuration was (R)- as 1R-(-)-camphorsulfonic acid salt.

Preparation of Building blocks 8

rac-1-(1-Oxo-4-phenyl-2,8-diaza-spiro[4.5]dec-8-yl)-cyclohexanecarbonitrile

To a mixture of rac-4-phenyl-2,8-diaza-spiro[4.5]decan-1-one (8.0 g, 34.7 mmol) in AcOH (80 mL) was added cyclohexanone (3-4 g, 34.7 mmol) followed by the dropwise addition of TMSCN (10.4 g, 104.2 mmol) and the resulting mixture stirred at room temperature for 5 days. The resulting mixture was poured onto ice – sodium hydroxide (25 %, 200 mL) and the resulting white solid filtered off. The solid was dissolved in DCM (50 mL) and washed with water (40 mL) and dried over sodium sulfate. Filtration and evaporation afforded the title compound (7.25 g, 62 %) as a white solid after purification by silica gel chromatography eluting with DCM : MeOH (9 : 1). MS : m/e = 338.3 (M+H).

rac-1-[4-(4-Fluoro-phenyl)-1-oxo-2,8-diaza-spiro[4.5]dec-8-yl]-cyclohexanecarbonitrile

As described above, rac-4-(4-fluoro-phenyl)-2,8-diaza-spiro[4.5]decan-1-one (10.0 g, 40.3 mmol) was converted to the title compound (8.0 g, 56 %) which was obtained as a white solid. MS : m/e = 356.5 (M+H).

(R)-1-[4-(4-Fluoro-phenyl)-1-oxo-2,8-diaza-spiro[4.5]dec-8-yl]-cyclohexanecarbonitrile

As described above, (R)-4-(4-fluoro-phenyl)-2,8-diaza-spiro[4.5]decan-1-one (Peak A, 150 mg, 0.4 mmol) was converted to the title compound (116 mg, 54 %) which was obtained as a white solid. MS : m/e = 356.5 (M+H).

(S)-1-[4-(4-Fluoro-phenyl)-1-oxo-2,8-diaza-spiro[4.5]dec-8-yl]-cyclohexanecarbonitrile

As described above, (S)-4-(4-fluoro-phenyl)-2,8-diaza-spiro[4.5]decan-1-one (Peak B, 150 mg, 0.4 mmol) was converted to the title compound (116 mg, 54 %) which was obtained as a white solid. MS : m/e = 356.5 (M+H).

Example 1

rac-4-Phenyl-8-(1-phenyl-cyclohexyl)-2,8-diaza-spiro[4.5]decan-1-one

To a solution of rac-1-(1-oxo-4-phenyl-2,8-diaza-spiro[4.5]dec-8-yl)-cyclohexanecarbonitrile (400 mg, 1.2 mmol) in dry THF (12 mL) under argon at 0 °C was added phenylmagnesium bromide (1 M in THF, 3.5 mL, 3.6 mmol) and the resulting mixture allowed to warm up to room temperature overnight. The reaction was quenched by the addition of ammonium chloride solution (sat., 20 mL) and the product extracted with ethyl acetate (2 x 50 mL). The combined organic extracts were then washed with brine (50 mL), dried over sodium sulfate, filtered and evaporated. The residue was purified by chromatography on silica gel eluting with DCM : MeOH : NH_4OH (95 : 4.5: 0.5) to afford the title compound (430 mg, 94 %) as a white solid.
MS : m/e = 389.3 (M+H).

Example 2

rac-4-Phenyl-8-(1-p-tolyl-cyclohexyl)-2,8-diaza-spiro[4.5]decan-1-one

As described for example 1, rac-1-(1-oxo-4-phenyl-2,8-diaza-spiro[4.5]dec-8-yl)-cyclohexanecarbonitrile (200 mg, 0.6 mmol) was converted to the title compound (186 mg, 78 %) (using p-tolylmagnesium bromide instead of phenylmagnesium bromide) which was obtained as a white solid. MS : m/e = 403.6 (M+H).

Example 3

rac-4-Phenyl-8-(1-m-tolyl-cyclohexyl)-2,8-diaza-spiro[4.5]decan-1-one

To a solution of 3-iodotoluene (388 mg, 1.8 mmol) in dry THF (6 mL) under argon at -60 °C was added isopropylmagnesium chloride (2 M solution in THF, 977 uL, 2.0 mmol) and the resulting solution allowed to warm up to 0 °C over 1 h and then to room temperature over 10 min. The resulting solution was then added dropwise to a solution of rac-1-(1-oxo-4-phenyl-2,8-diaza-spiro[4.5]dec-8-yl)-cyclohexanecarbonitrile (200 mg, 0.6 mmol) in dry THF (3 mL) and the solution stirred overnight at room temperature. The reaction was quenched by the addition of ammonium chloride solution (sat., 10 mL) and the product extracted with ethyl acetate (2 x 20 mL). The combined organic extracts were then washed with brine (20 mL), dried over sodium sulfate, filtered and evaporated. The residue was purified by chromatography on silica gel eluting with DCM : MeOH : NH_4OH (95 : 4.5: 0.5) to afford the title compound (170 mg, 71 %) as a white solid.

MS : m/e = 403.6 (M+H).

Example 4

rac-4-Phenyl-8-(1-o-tolyl-cyclohexyl)-2,8-diaza-spiro[4.5]decan-1-one

As described for example 3, rac-1-(1-oxo-4-phenyl-2,8-diaza-spiro[4.5]dec-8-yl)-cyclohexanecarbonitrile (200 mg, 0.6 mmol) was converted to the title compound (11 mg, 5 %) (using 2-iodotoluene instead of 3-iodotoluene) which was obtained as a white solid. MS : m/e = 403.6 (M+H).

Example 5

rac-8-[1-(3-Fluoro-phenyl)-cyclohexyl]-4-phenyl-2,8-diaza-spiro[4.5]decan-1-one

As described for example 3, rac-1-(1-oxo-4-phenyl-2,8-diaza-spiro[4.5]dec-8-yl)-cyclohexanecarbonitrile (200 mg, 0.6 mmol) was converted to the title compound (146 mg, 61 %) (using 1-fluoro-3-iodobenzene instead of 3-iodotoluene) which was obtained as a white solid. MS : m/e = 407.5 (M+H).

Example 6

rac-8-[1-(3,4-Difluoro-phenyl)-cyclohexyl]-4-phenyl-2,8-diaza-spiro[4.5]decan-1-one

As described for example 3, rac-1-(1-oxo-4-phenyl-2,8-diaza-spiro[4.5]dec-8-yl)-cyclohexanecarbonitrile (200 mg, 0.6 mmol) was converted to the title compound (96 mg, 38 %) (using 1,2-difluoro-4-iodobenzene instead of 3-iodotoluene) which was obtained as a white solid. MS : m/e = 425.6 (M+H).

Example 7

rac-8-[1-(4-Chloro-phenyl)-cyclohexyl]-4-phenyl-2,8-diaza-spiro[4.5]decan-1-one

As described for example 3, rac-1-(1-oxo-4-phenyl-2,8-diaza-spiro[4.5]dec-8-yl)-cyclohexanecarbonitrile (200 mg, 0.6 mmol) was converted to the title compound (96 mg, 38 %) (using 1-chloro-4-iodobenzene instead of 3-iodotoluene) which was obtained as a white solid. MS : m/e = 423.4 (M).

Example 8

rac-4-Phenyl-8-[1-(4-trifluoromethyl-phenyl)-cyclohexyl]-2,8-diaza-spiro[4.5]decan-1-one

As described for example 3, rac-1-(1-oxo-4-phenyl-2,8-diaza-spiro[4.5]dec-8-yl)-cyclohexanecarbonitrile (200 mg, 0.6 mmol) was converted to the title compound (169 mg, 63 %) (using 4-iodobenzotrifluoride instead of 3-iodotoluene) which was obtained as a white solid. MS : m/e = 457.6 (M+H).

Example 9

rac-4-[1-(1-Oxo-4-phenyl-2,8-diaza-spiro[4.5]dec-8-yl)-cyclohexyl]-benzonitrile

As described for example 3, rac-1-(1-oxo-4-phenyl-2,8-diaza-spiro[4.5]dec-8-yl)-cyclohexanecarbonitrile (200 mg, 0.6 mmol) was converted to the title compound (81 mg, 33 %) (using 4-iodobenzonitrile instead of 3-iodotoluene) which was obtained as a white solid. MS : m/e = 414.5 (M+H).

Example 10

rac-3-[1-(1-Oxo-4-phenyl-2,8-diaza-spiro[4.5]dec-8-yl)-cyclohexyl]-benzonitrile

As described for example 3, rac-1-(1-oxo-4-phenyl-2,8-diaza-spiro[4.5]dec-8-yl)-cyclohexanecarbonitrile (200 mg, 0.6 mmol) was converted to the title compound (77 mg, 31 %) (using 3-iodobenzonitrile instead of 3-iodotoluene) which was obtained as a white solid. MS : m/e = 414.5 (M+H).

Example 11

rac-8-[1-(4-Methoxy-phenyl)-cyclohexyl]-4-phenyl-2,8-diaza-spiro[4.5]decan-1-one

As described for example 1, rac-1-(1-oxo-4-phenyl-2,8-diaza-spiro[4.5]dec-8-yl)-cyclohexanecarbonitrile (200 mg, 0.6 mmol) was converted to the title compound (68 mg, 27 %) (using 4-methoxyphenylmagnesium bromide instead of phenylmagnesium bromide) which was obtained as a white solid. MS : m/e = 437.5 (M+H).

Example 12

rac-8-[1-(3-Methoxy-phenyl)-cyclohexyl]-4-phenyl-2,8-diaza-spiro[4.5]decan-1-one

As described for example 3, rac-1-(1-oxo-4-phenyl-2,8-diaza-spiro[4.5]dec-8-yl)-cyclohexanecarbonitrile (200 mg, 0.6 mmol) was converted to the title compound (150 mg, 61 %) (using 3-iodoanisole instead of 3-iodotoluene) which was obtained as a white solid. MS : m/e = 419.5 (M+H).

Example 13

rac-8-[1-(2-Methoxy-phenyl)-cyclohexyl]-4-phenyl-2,8-diaza-spiro[4.5]decan-1-one

As described for example 3, rac-1-(1-oxo-4-phenyl-2,8-diaza-spiro[4.5]dec-8-yl)-cyclohexanecarbonitrile (200 mg, 0.6 mmol) was converted to the title compound (37 mg, 15 %) (using 2-iodoanisole instead of 3-iodotoluene) which was obtained as a white solid. MS : m/e = 419.5 (M+H).

Example 14

rac-4-Phenyl-8-[1-(4-trifluoromethoxy-phenyl)-cyclohexyl]-2,8-diaza-spiro[4.5]decan-1-one

As described for example 3, rac-1-(1-oxo-4-phenyl-2,8-diaza-spiro[4.5]dec-8-yl)-cyclohexanecarbonitrile (200 mg, 0.6 mmol) was converted to the title compound (19 mg, 7 %) (using 1-bromo-4-(trifluoromethoxy)benzene instead of 3-iodotoluene) which was obtained as a white solid. MS : m/e = 473.5 (M+H).

Example 15

rac-4-Phenyl-8-[1-(3-trifluoromethoxy-phenyl)-cyclohexyl]-2,8-diaza-spiro[4.5]decan-1-one

As described for example 3, rac-1-(1-oxo-4-phenyl-2,8-diaza-spiro[4.5]dec-8-yl)-cyclohexanecarbonitrile (200 mg, 0.6 mmol) was converted to the title compound (115

mg, 41 %) (using 3-(trifluoromethoxy)iodobenzene instead of 3-iodotoluene) which was obtained as a white solid. MS : m/e = 473.5 (M+H).

Example 16

rac-4-Phenyl-8-(1-thiophen-3-yl-cyclohexyl)-2,8-diaza-spiro[4.5]decan-1-one

As described for example 3, rac-1-(1-oxo-4-phenyl-2,8-diaza-spiro[4.5]dec-8-yl)-cyclohexanecarbonitrile (300 mg, 0.9 mmol) was converted to the title compound (77 mg, 22 %) (using 3-bromothiophene instead of 3-iodotoluene) which was obtained as a brown oil. MS : m/e = 395.4 (M+H).

Example 17

rac-8-Bicyclohexyl-1-yl-4-phenyl-2,8-diaza-spiro[4.5]decan-1-one

As described for example 1, rac-1-(1-oxo-4-phenyl-2,8-diaza-spiro[4.5]dec-8-yl)-cyclohexanecarbonitrile (160 mg, 0.5 mmol) was converted to the title compound (26 mg, 14 %) (using cyclohexylmagnesium chloride instead of phenylmagnesium bromide) which was obtained as a white solid. MS : m/e = 395.4 (M+H).

Example 18

rac-8-(1-Cyclopentyl-cyclohexyl)-4-phenyl-2,8-diaza-spiro[4.5]decan-1-one

As described for example 1, rac-1-(1-oxo-4-phenyl-2,8-diaza-spiro[4.5]dec-8-yl)-cyclohexanecarbonitrile (160 mg, 0.5 mmol) was converted to the title compound (46 mg, 26 %) (using cyclopentylmagnesium chloride instead of phenylmagnesium bromide) which was obtained as a white solid. MS : m/e = 381.5 (M+H).

Example 19

rac-8-(1-Cyclopropyl-cyclohexyl)-4-phenyl-2,8-diaza-spiro[4.5]decan-1-one

As described for example 1, rac-1-(1-oxo-4-phenyl-2,8-diaza-spiro[4.5]dec-8-yl)-cyclohexanecarbonitrile (150 mg, 0.44 mmol) was converted to the title compound (21 mg, 12 %) (using cyclopropylmagnesium bromide instead of phenylmagnesium bromide) which was obtained as a white solid. MS : m/e = 353.4 (M+H).

Example 20

rac-8-(1-Isopropyl-cyclohexyl)-4-phenyl-2,8-diaza-spiro[4.5]decan-1-one

As described for example 14, rac-1-(1-oxo-4-phenyl-2,8-diaza-spiro[4.5]dec-8-yl)-cyclohexanecarbonitrile (200 mg, 0.6 mmol) was converted to the title compound (12 mg, 6 %) which was obtained as a white solid. MS : m/e = 355.5 (M+H).

Example 21

rac 8-[1-(2-Methyl-propenyl)-cyclohexyl]-4-phenyl-2,8-diaza-spiro[4.5]decan-1-one

As described for example 1, rac-1-(1-oxo-4-phenyl-2,8-diaza-spiro[4.5]dec-8-yl)-cyclohexanecarbonitrile (160 mg, 0.47 mmol) was converted to the title compound (55 mg, 32 %) (using 2-methyl-1-propenylmagnesium bromide instead of phenylmagnesium bromide) which was obtained as a white solid. MS : m/e = 367.3 (M+H).

Example 22

rac-4-(4-Fluoro-phenyl)-8-(1-p-tolyl-cyclohexyl)-2,8-diaza-spiro[4.5]decan-1-one

As described for example 2, rac-4-(4-fluoro-phenyl)-2,8-diaza-spiro[4.5]decan-1-one (200 mg, 0.6 mmol) was converted to the title compound (173 mg, 73 %) which was obtained as a white solid. MS : m/e = 421.4 (M+H).

Example 23

rac-4-(4-Fluoro-phenyl)-8-(1-m-tolyl-cyclohexyl)-2,8-diaza-spiro[4.5]decan-1-one

As described for example 3, rac-4-(4-fluoro-phenyl)-2,8-diaza-spiro[4.5]decan-1-one (200 mg, 0.6 mmol) was converted to the title compound (100 mg, 42 %) which was obtained as a white solid. MS : m/e = 421.5 (M+H).

Example 24

rac-4-(4-Fluoro-phenyl)-8-(1-o-tolyl-cyclohexyl)-2,8-diaza-spiro[4.5]decan-1-one

As described for example 4, rac-4-(4-fluoro-phenyl)-2,8-diaza-spiro[4.5]decan-1-one (200 mg, 0.6 mmol) was converted to the title compound (36 mg, 15 %) which was obtained as a white solid. MS : m/e = 421.5 (M+H).

Example 25

rac-4-(4-Fluoro-phenyl)-8-[1-(4-fluoro-phenyl)-cyclohexyl]-2,8-diaza-spiro[4.5]decan-1-one

As described for example 1, rac-4-(4-fluoro-phenyl)-2,8-diaza-spiro[4.5]decan-1-one (1.0 g, 2.8 mmol) was converted to the title compound (891 mg, 75 %) (using 4-fluorophenylmagnesium bromide instead of phenylmagnesium bromide) which was obtained as a white solid. MS : m/e = 425.5 (M+H).

(R)-4-(4-Fluoro-phenyl)-8-[1-(4-fluoro-phenyl)-cyclohexyl]-2,8-diaza-spiro[4.5]decan-1-one

As described for example 24-rac, (R)-4-(4-fluoro-phenyl)-2,8-diaza-spiro[4.5]decan-1-one (103 mg, 0.3 mmol) was converted to the title compound (29 mg, 24 %)which was obtained as a white solid. MS : m/e = 425.5 (M+H).

(S)-4-(4-Fluoro-phenyl)-8-[1-(4-fluoro-phenyl)-cyclohexyl]-2,8-diaza-spiro[4.5]decan-1-one

As described for example 24-rac, (S)-4-(4-fluoro-phenyl)-2,8-diaza-spiro[4.5]decan-1-one (97 mg, 0.3 mmol) was converted to the title compound (35 mg, 30 %)which was obtained as a white solid. MS : m/e = 425.5 (M+H).

Example 26

rac-4-(4-Fluoro-phenyl)-8-[1-(3-fluoro-phenyl)-cyclohexyl]-2,8-diaza-spiro[4.5]decan-1-one

As described for example 5, rac-4-(4-fluoro-phenyl)-2,8-diaza-spiro[4.5]decan-1-one (200 mg, 0.6 mmol) was converted to the title compound (180 mg, 75 %) which was obtained as a white solid. MS : m/e = 425.4 (M+H).

Example 27

rac-8-[1-(3,4-Difluoro-phenyl)-cyclohexyl]-4-(4-fluoro-phenyl)-2,8-diaza-spiro[4.5]decan-1-one

As described for example 6, rac-4-(4-fluoro-phenyl)-2,8-diaza-spiro[4.5]decan-1-one (200 mg, 0.6 mmol) was converted to the title compound (85 mg, 34 %) which was obtained as a white solid. MS : m/e = 443.5 (M+H).

Example 28

rac-8-[1-(4-Chloro-phenyl)-cyclohexyl]-4-(4-fluoro-phenyl)-2,8-diaza-spiro[4.5]decan-1-one

As described for example 7, rac-4-(4-fluoro-phenyl)-2,8-diaza-spiro[4.5]decan-1-one (200 mg, 0.6 mmol) was converted to the title compound (12 mg, 5 %) which was obtained as a white solid. MS : m/e = 441.5 (M).

Example 29

rac-4-(4-Fluoro-phenyl)-8-[1-(4-trifluoromethyl-phenyl)-cyclohexyl]-2,8-diaza-spiro[4.5]decan-1-one

As described for example 8, rac-4-(4-fluoro-phenyl)-2,8-diaza-spiro[4.5]decan-1-one (200 mg, 0.6 mmol) was converted to the title compound (114 mg, 42 %) which was obtained as a white solid. MS : m/e = 475.6 (M+H).

Example 30

rac-4-{1-[4-(4-Fluoro-phenyl)-1-oxo-2,8-diaza-spiro[4.5]dec-8-yl]-cyclohexyl}-benzonitrile

As described for example 9, rac-4-(4-fluoro-phenyl)-2,8-diaza-spiro[4.5]decan-1-one (200 mg, 0.6 mmol) was converted to the title compound (88 mg, 36 %) which was obtained as a white solid. MS : m/e = 432.6 (M+H).

Example 31

rac-3-{1-[4-(4-Fluoro-phenyl)-1-oxo-2,8-diaza-spiro[4.5]dec-8-yl]-cyclohexyl}-benzonitrile

As described for example 10, rac-4-(4-fluoro-phenyl)-2,8-diaza-spiro[4.5]decan-1-one (200 mg, 0.6 mmol) was converted to the title compound (16 mg, 7 %) which was obtained as a white solid. MS : m/e = 432.3 (M+H).

Example 32

rac-4-(4-Fluoro-phenyl)-8-[1-(4-methoxy-phenyl)-cyclohexyl]-2,8-diaza-spiro[4.5]decan-1-one

As described for example 11, rac-4-(4-fluoro-phenyl)-2,8-diaza-spiro[4.5]decan-1-one (250 mg, 0.7 mmol) was converted to the title compound (95 mg, 31 %) which was obtained as a white solid. MS : m/e = 437.5 (M+H).

Example 33

rac-4-(4-Fluoro-phenyl)-8-[1-(3-methoxy-phenyl)-cyclohexyl]-2,8-diaza-spiro[4.5]decan-1-one

As described for example 12, rac-4-(4-fluoro-phenyl)-2,8-diaza-spiro[4.5]decan-1-one (250 mg, 0.7 mmol) was converted to the title compound (95 mg, 39 %) which was obtained as a white solid. MS : m/e = 437.5 (M+H).

Example 34

rac-4-(4-Fluoro-phenyl)-8-[1-(4-trifluoromethoxy-phenyl)-cyclohexyl]-2,8-diaza-spiro[4.5]decan-1-one

As described for example 14, rac-4-(4-fluoro-phenyl)-2,8-diaza-spiro[4.5]decan-1-one (200 mg, 0.6 mmol) was converted to the title compound (10 mg, 4 %) which was obtained as a white solid. MS : m/e = 491.5 (M+H).

Example 35

rac-4-(4-Fluoro-phenyl)-8-[1-(3-trifluoromethoxy-phenyl)-cyclohexyl]-2,8-diaza-spiro[4.5]decan-1-one

As described for example 15, rac-4-(4-fluoro-phenyl)-2,8-diaza-spiro[4.5]decan-1-one (200 mg, 0.6 mmol) was converted to the title compound (88 mg, 32 %) which was obtained as a white solid. MS : m/e = 491.5 (M+H).

Example 36

rac-4-(4-Fluoro-phenyl)-8-(1-thiophen-2-yl-cyclohexyl)-2,8-diaza-spiro[4.5]decan-1-one

As described for example 3, rac-4-(4-fluoro-phenyl)-2,8-diaza-spiro[4.5]decan-1-one (150 mg, 0.4 mmol) was converted to the title compound (93 mg, 53 %) (using 2-iodothiophene instead of 3-iodotoluene)) which was obtained as a white solid. MS : m/e = 413.4 (M+H).

Example 37

rac-4-(4-Fluoro-phenyl)-8-[1-(5-methyl-thiophen-2-yl)-cyclohexyl]-2,8-diaza-spiro[4.5]decan-1-one

As described for example 3, rac-4-(4-fluoro-phenyl)-2,8-diaza-spiro[4.5]decan-1-one (100 mg, 0.28 mmol) was converted to the title compound (50 mg, 42%) (using 2-bromo-5-methylthiophene instead of 3-iodotoluene)) which was obtained as a white solid.

MS : m/e = 427.6 (M+H).

Example 38

rac-4-(4-Fluoro-phenyl)-8-(1-thiophen-3-yl-cyclohexyl)-2,8-diaza-spiro[4.5]decan-1-one

As described for example 16, rac-4-(4-fluoro-phenyl)-2,8-diaza-spiro[4.5]decan-1-one (150 mg, 0.4 mmol) was converted to the title compound (108 mg, 62 %) which was obtained as a white solid. MS : m/e = 413.4 (M+H).

Example 39

rac-4-(4-Fluoro-phenyl)-8-(1-thiazol-2-yl-cyclohexyl)-2,8-diaza-spiro[4.5]decan-1-one

As described for example 3, rac-4-(4-fluoro-phenyl)-2,8-diaza-spiro[4.5]decan-1-one (100 mg, 0.28 mmol) was converted to the title compound (26 mg, 15 %) (using 2-bromothiazole instead of 3-iodotoluene) which was obtained as a white solid. MS : m/e = 414.4 (M+H).

Example 40

rac-8-(1-Cyclopropyl-cyclohexyl)-4-(4-fluoro-phenyl)-2,8-diaza-spiro[4.5]decan-1-one

As described for example 19, rac-4-(4-fluoro-phenyl)-2,8-diaza-spiro[4.5]decan-1-one (125 mg, 0.35 mmol) was converted to the title compound (11 mg, 8 %) which was obtained as a light yellow solid. MS : m/e = 371.3 (M+H).

Example 41

rac-8-(1-Cyclopropyl-cyclohexyl)-4-(4-fluoro-phenyl)-2,8-diaza-spiro[4.5]decan-1-one

As described for example 34, rac-4-(4-fluoro-phenyl)-2,8-diaza-spiro[4.5]decan-1-one (200 mg, 0.6 mmol) was converted to the title compound (13 mg, 6 %) which was obtained as a white solid. MS : m/e = 373.6 (M+H).

Example 42

rac-8-(1-Ethyl-cyclohexyl)-4-(4-fluoro-phenyl)-2,8-diaza-spiro[4.5]decan-1-one

As described for example 3, rac-4-(4-fluoro-phenyl)-2,8-diaza-spiro[4.5]decan-1-one (200 mg, 0.6 mmol) was converted to the title compound (29 mg, 14 %) (using 2-iodopyridine and ethylmagnesium bromide instead of 3-iodotoluene and isopropylmagnesium chloride) which was obtained as a light brown solid. MS : m/e = 359.3 (M+H).

Example 43

rac-4-Phenyl-8-(4-phenyl-tetrahydro-pyran-4-yl)-2,8-diaza-spiro[4.5]decan-1-one

rac-4-(1-Oxo-4-phenyl-2,8-diaza-spiro[4.5]dec-8-yl)-tetrahydro-pyran-4-carbonitrile

a) As described for building block 8, rac-4-phenyl-2,8-diaza-spiro[4.5]decan-1-one (150 mg, 0.65 mmol) was converted to the title compound (70 mg, 32 %) (using tetrahydro-4*H*-pyran-4-one instead of cyclohexanone) which was obtained as a yellow foam. MS : m/e = 340.3 (M+H).

rac-4-Phenyl-8-(4-phenyl-tetrahydro-pyran-4-yl)-2,8-diaza-spiro[4.5]decan-1-one

b) As described for example 1, rac-4-(1-oxo-4-phenyl-2,8-diaza-spiro[4.5]dec-8-yl)-tetrahydro-pyran-4-carbonitrile (70 mg, 0.2 mmol) was converted to the title compound (24 mg, 30 %) which was obtained as an orange solid. MS : m/e = 391.3 (M+H).

Example 44

4-Phenyl-8-(3-phenyl-tetrahydro-pyran-3-yl)-2,8-diaza-spiro[4.5]decan-1-one

rac 3-(1-Oxo-4-phenyl-2,8-diaza-spiro[4.5]dec-8-yl)-tetrahydro-pyran-3-carbonitrile

a) As described for example 43a, rac-4-phenyl-2,8-diaza-spiro[4.5]decan-1-one (150 mg, 0.65 mmol) was converted to the title compound (55 mg, 25 %) (using dihydro-pyran-3-one instead of tetrahydro-4*H*-pyran-4-one) which was obtained as a white solid. MS : m/e = 340.3 (M+H).

rac4-Phenyl-8-(3-phenyl-tetrahydro-pyran-3-yl)-2,8-diaza-spiro[4.5]decan-1-one

b) As described for example 1, rac 3-(1-oxo-4-phenyl-2,8-diaza-spiro[4.5]dec-8-yl)-tetrahydro-pyran-3-carbonitrile (54 mg, 0.16 mmol) was converted to the title

compound (20 mg, 30 %) which was obtained as an orange solid. MS : m/e = 391.3 (M+H).

Example 45

rac-4-(4-Fluoro-phenyl)-8-(4-phenyl-tetrahydro-thiopyran-4-yl)-2,8-diaza-spiro[4.5]decan-1-one

rac-4-[4-(4-Fluoro-phenyl)-1-oxo-2,8-diaza-spiro[4.5]dec-8-yl]-tetrahydro-thiopyran-4-carbonitrile

a) To a stirred mixture of rac-4-(4-fluoro-phenyl)-2,8-diaza-spiro[4.5]decan-1-one hydrochloride (500 mg, 2.0 mmol) and tetrahydro-4*H*-thiopyran-4-one (300 mg, 2.6 mmol) was added a solution of KCN (168 mg, 2.6 mmol) in water (30 mL). The resulting mixture was vigorously stirred at room temperature overnight and the resulting precipiate filtered off, washed with water and hexane and dried to afford the title compound (424 mg, 44 %). MS : m/e = 374.5 (M+H).

rac-4-(4-Fluoro-phenyl)-8-(4-phenyl-tetrahydro-thiopyran-4-yl)-2,8-diaza-spiro[4.5]decan-1-one

b) As described for example 1, rac-4-[4-(4-fluoro-phenyl)-1-oxo-2,8-diaza-spiro[4.5]dec-8-yl]-tetrahydro-thiopyran-4-carbonitrile (150 mg, 0.4 mmol) was converted to the title compound (50 mg, 29 %) which was obtained as a white solid. MS : m/e = 425.5 (M+H).

Example 46

rac-4-(4-Fluoro-phenyl)-8-[4-(4-fluoro-phenyl)-tetrahydro-thiopyran-4-yl]-2,8-diaza-spiro[4.5]decan-1-one

As described for example 25, rac-4-[4-(4-fluoro-phenyl)-1-oxo-2,8-diaza-spiro[4.5]dec-8-yl]-tetrahydro-thiopyran-4-carbonitrile (520 mg, 1.4 mmol) was converted to the title compound (94 mg, 15 %) which was obtained as a white solid. MS : m/e = 443.5 (M+H).

Example 47

rac-8-[1-Benzyl-4-(4-fluoro-phenyl)-piperidin-4-yl]-4-(4-fluoro-phenyl)-2,8-diaza-spiro[4.5]decan-1-one

rac-1-Benzyl-4-[4-(4-fluoro-phenyl)-1-oxo-2,8-diaza-spiro[4.5]dec-8-yl]-piperidine-4-carbonitrile

a) As described for example 43a, rac-4-(4-fluoro-phenyl)-2,8-diaza-spiro[4.5]decan-1-one (300 mg, 1.6 mmol) was converted to the title compound (650 mg, 92 %) (using 1-benzyl-4-piperidone instead of cyclohexanone) which was obtained as a white solid.
MS : m/e = 447.6 (M+H).

rac-8-[1-Benzyl-4-(4-fluoro-phenyl)-piperidin-4-yl]-4-(4-fluoro-phenyl)-2,8-diaza-spiro[4.5]decan-1-one

b) As described for example 25, rac-1-benzyl-4-[4-(4-fluoro-phenyl)-1-oxo-2,8-diaza-spiro[4.5]dec-8-yl]-piperidine-4-carbonitrile (500 mg, 1.1 mmol) was converted to the title compound (33 mg, 6 %) which was obtained as a white solid.
MS : m/e = 516.5 (M+H).

Example 48

rac-4-Phenyl-8-(1-phenyl-cycloheptyl)-2,8-diaza-spiro[4.5]decan-1-one

rac-1-[4-(Phenyl)-1-oxo-2,8-diaza-spiro[4.5]dec-8-yl]-cycloheptanecarbonitrile

a) As described for example 45a, rac-4-phenyl-2,8-diaza-spiro[4.5]decan-1-one (60 mg, 0.5 mmol) was converted to the title compound (120 mg, 64 %) (using cycloheptanone instead of cyclohexanone) which was obtained as a white solid. MS : m/e = 352.1 (M+H).

rac-4-Phenyl-8-(1-phenyl-cycloheptyl)-2,8-diaza-spiro[4.5]decan-1-one

b) As described for example 1, rac-1-[4-(phenyl)-1-oxo-2,8-diaza-spiro[4.5]dec-8-yl]-cycloheptanecarbonitrile (100 mg, 0.28 mmol) was converted to the title compound (41 mg, 36 %) which was obtained as a white solid. MS : m/e = 403.6 (M+H).

Example 49

rac-4-(4-Fluoro-phenyl)-8-(1-phenyl-cycloheptyl)-2,8-diaza-spiro[4.5]decan-1-one

rac-1-[4-(4-Fluoro-phenyl)-1-oxo-2,8-diaza-spiro[4.5]dec-8-yl]-cycloheptanecarbonitrile

a) As described for example 48a, rac-4-(4-fluoro-phenyl)-2,8-diaza-spiro[4.5]decan-1-one (300 mg, 2.7 mmol) was converted to the title compound (488 mg, 49 %) which was obtained as a white solid. MS : m/e = 370.4 (M+H).

rac-4-(4-Fluoro-phenyl)-8-(1-phenyl-cycloheptyl)-2,8-diaza-spiro[4.5]decan-1-one

b) As described for example 1, rac-1-[4-(4-fluoro-phenyl)-1-oxo-2,8-diaza-spiro[4.5]dec-8-yl]-cycloheptanecarbonitrile (200 mg, 0.54 mmol) was converted to the title compound (110 mg, 48 %) which was obtained as a white solid. MS : m/e = 421.5 (M+H).

Example 50

rac-4-(4-Fluoro-phenyl)-8-[1-(4-fluoro-phenyl)-cycloheptyl]-2,8-diaza-spiro[4.5]decan-1-one

As described for example 25, rac-1-[4-(4-fluoro-phenyl)-1-oxo-2,8-diaza-spiro[4.5]dec-8-yl]-cycloheptanecarbonitrile (300 mg, 0.7 mmol) was converted to the title compound (182 mg, 77 %) which was obtained as a white solid. MS : m/e = 439.5 (M+H).

Example 51

rac 8-(1-Phenyl-cyclohexyl)-4-*p*-tolyl-2,8-diaza-spiro[4.5]decan-1-one

rac 4-(2-Nitro-1-p-tolyl-ethyl)-piperidine-1,4-dicarboxylic acid 1-tert-butyl ester 4-ethyl ester

a) As described for building block 7, piperidine-1,4-dicarboxylic acid 1-tert-butyl ester 4-ethyl ester (3.15 g, 12.3 mmol) was converted to the title compound (4.86 g, 94 %) (using *trans*-4-methyl-beta-nitrostyrene instead of 4-fluoro-*trans*-beta-nitrostyrene) which was obtained as a light brown foam. MS : m/e 419.4 (M-H).

rac 1-Oxo-4-p-tolyl-2,8-diaza-spiro[4.5]decane-8-carboxylic acid tert-butyl ester

b) As described for for building block 7, rac 4-(2-nitro-1-p-tolyl-ethyl)-piperidine-1,4-dicarboxylic acid 1-tert-butyl ester 4-ethyl ester (4.85 g, 11.5 mmol) was converted to the title compound (2.46 g, 62 %) after the two-step procedure of Ra-Ni hydrogenation and heating under reflux in toluene solution. The title compound was obtained as a white solid after tritutation from pentane. MS : m/e 345.4 (M + H).

rac 4-p-Tolyl-2,8-diaza-spiro[4.5]decan-1-one

c) As described for building block 7, rac 1-oxo-4-p-tolyl-2,8-diaza-spiro[4.5]decane-8-carboxylic acid tert-butyl ester (2.45 g, 7.1 mmol) was converted to the title compound (1.1 g, 63 %), after treatment with TFA in DCM, which was obtained as a brown solid. MS : m/e 245.5 (M + H).

rac 8-(1-Phenyl-cyclohexyl)-4-*p*-tolyl-2,8-diaza-spiro[4.5]decan-1-one

d) As described for building block 7, rac 4-p-tolyl-2,8-diaza-spiro[4.5]decan-1-one (350 mg, 0.1 mmol) was converted to the title compound (68 mg, 17 %) which was obtained as an off-white solid. MS : m/e 403.5 (M + H) after the two-step procedure involving the Strecker and Bruylant reactions.

Example 52

rac 8-[1-(4-Fluoro-phenyl)-cyclohexyl]-4-*p*-tolyl-2,8-diaza-spiro[4.5]decan-1-one

As described for example 51, 7, rac 4-p-tolyl-2,8-diaza-spiro[4.5]decan-1-one (350 mg, 0.1 mmol) was converted to the title compound (93 mg, 22 %) which was obtained as an off-white solid. MS : m/e 421.3 (M + H) after the two-step procedure involving the Strecker and Bruylant (using 4-fluorophenylmagnesium bromide instead of phenylmagnesium bromide) reactions.

Example 53

rac 8-[1-(4-Fluoro-phenyl)-cyclohexyl]-4-(4-trifluoromethyl-phenyl)-2,8-diaza-spiro[4.5]decan-1-one

rac 4-[2-Nitro-1-(4-trifluoromethyl-phenyl)-ethyl]-piperidine-1,4-dicarboxylic acid 1-*tert*-butyl ester 4-ethyl ester

a) As described for example 51a, piperidine-1,4-dicarboxylic acid 1-tert-butyl ester 4-ethyl ester (1.71 g, 6.6 mmol) was converted to the title compound (2.05 g, 65 %) (using *trans*-4-trifluoromethyl-beta-nitrostyrene instead of 4-fluoro-*trans*-beta-nitrostyrene) which was obtained as a yellow oil.

rac 1-Oxo-4-(4-trifluoromethyl-phenyl)-2,8-diaza-spiro[4.5]decane-8-carboxylic acid *tert*-butyl ester

b) As described for example 51b, rac 4-[2-nitro-1-(4-trifluoromethyl-phenyl)-ethyl]-piperidine-1,4-dicarboxylic acid 1-*tert*-butyl ester 4-ethyl ester (2.04 g, 4.3 mmol) was converted to the title compound (1.22 g, 71 %) after the two-step procedure of Ra-Ni

hydrogenation and heating under reflux in toluene solution containing triethylamine. The title compound was obtained as a white foam. MS : m/e 399.3 (M + H).

rac 4-(4-Trifluoromethyl-phenyl)-2,8-diaza-spiro[4.5]decan-1-one 1: 1 hydrochloride

c) Rac 1-oxo-4-(4-trifluoromethyl-phenyl)-2,8-diaza-spiro[4.5]decane-8-carboxylic acid *tert*-butyl ester (1.22 g, 3.1 mmol) was converted to the title compound (1.03 g, 100 %), after treatment with HCl in dioxane, which was obtained as a white solid.
MS : m/e 299.3 (M + H).

rac 1-[1-Oxo-4-(4-trifluoromethyl-phenyl)-2,8-diaza-spiro[4.5]dec-8-yl]-cyclohexanecarbonitrile

d) As described for example 45a, 4-(4-trifluoromethyl-phenyl)-2,8-diaza-spiro[4.5]decan-1-one 1: 1 hydrochloride (974 mg, 2.9 mmol) was converted to the title compound (863 mg, 73 %) which was obtained as a white solid. MS : m/e 406.3 (M + H).

rac 8-[1-(4-Fluoro-phenyl)-cyclohexyl]-4-(4-trifluoromethyl-phenyl)-2,8-diaza-spiro[4.5]decan-1-one

e) As described for example 25, 7, rac 1-[1-oxo-4-(4-trifluoromethyl-phenyl)-2,8-diaza-spiro[4.5]dec-8-yl]-cyclohexanecarbonitrile (250 mg, 0.62 mmol) was converted to the title compound (34 mg, 12 %) which was obtained as a white solid.
MS : m/e 475.1 (M + H).

Example 54

rac 8-[1-(4-Fluoro-phenyl)-cyclohexyl]-4-(4-methoxy-phenyl)-2,8-diaza-spiro[4.5]decan-1-one

rac 4-[1-(4-Methoxy-phenyl)-2-nitro-ethyl]-piperidine-1,4-dicarboxylic acid 1-tert-butyl ester 4-ethyl ester

a) As described for example 51a, piperidine-1,4-dicarboxylic acid 1-tert-butyl ester 4-ethyl ester (2.87 g, 78 mmol) was converted to the title compound (3.8 g, 78 %) (using 1-(4-methoxyphenyl)-2 nitroethene instead of 4-fluoro-*trans*-beta-nitrostyrene) which was obtained as a light brown foam. MS : m/e 437.6 (M + H).

rac 4-(4-Methoxy-phenyl)-1-oxo-2,8-diaza-spiro[4.5]decane-8-carboxylic acid tert-butyl ester

b) As described for example 51b, 4-[1-(4-methoxy-phenyl)-2-nitro-ethyl]-piperidine-1,4-dicarboxylic acid 1-tert-butyl ester 4-ethyl ester (3.8 g, 8.7 mmol) was converted to the title compound (750 mg, 21 %) after the two-step procedure of Ra-Ni hydrogenation and heating under reflux in toluene solution containing triethylamine. The title compound was obtained as a white foam. MS : m/e 361.6 (M + H).

rac 4-(4-Methoxy-phenyl)-2,8-diaza-spiro[4.5]decan-1-one

c) As described for example 51c, rac 4-(4-methoxy-phenyl)-1-oxo-2,8-diaza-spiro[4.5]decane-8-carboxylic acid tert-butyl ester (0.74 g, 2.1 mmol) was converted to the title compound (328 mg, 61 %), after treatment with TFA in DCM, which was obtained as a white solid. MS : m/e 261.3 (M + H).

rac 1-[4-(4-Methoxy-phenyl)-1-oxo-2,8-diaza-spiro[4.5]dec-8-yl]-cyclohexanecarbonitrile

d) As described for example 45a, 4-(4-methoxy-phenyl)-2,8-diaza-spiro[4.5]decan-1-one (300 mg, 1.2 mmol) was converted to the title compound (270 mg, 64 %) which was obtained as a white solid. MS : m/e 368.4 (M + H).

rac 8-[1-(4-Fluoro-phenyl)-cyclohexyl]-4-(4-methoxy-phenyl)-2,8-diaza-spiro[4.5]decan-1-one

e) As described for example 25, rac 1-[4-(4-methoxy-phenyl)-1-oxo-2,8-diaza-spiro[4.5]dec-8-yl]-cyclohexanecarbonitrile (250 mg, 0.68 mmol) was converted to the title compound (104 mg, 35 %) which was obtained as a white solid.
MS : m/e 437.4 (M + H).

Example 55

rac 8-(1-Phenyl-cyclohexyl)-4-thiophen-2-yl-2,8-diaza-spiro[4.5]decan-1-one

rac 4-(2-Nitro-1-thiophen-2-yl-ethyl)-piperidine-1,4-dicarboxylic acid 1-tert-butyl ester 4-ethyl ester

a) As described for example 51a, piperidine-1,4-dicarboxylic acid 1-tert-butyl ester 4-ethyl ester (1.66 g, 10.7 mmol) was converted to the title compound (1.62 g, 61 %) (using 2-(2-nitrovinyl)thiophene instead of 4-fluoro-*trans*-beta-nitrostyrene) which was obtained as a dark brown solid. MS : m/e 413.4 (M + H).

rac 4-(2-Amino-1-thiophen-2-yl-ethyl)-piperidine-1,4-dicarboxylic acid 1-tert-butyl ester 4-ethyl ester

b) To a solution of 4-(2-nitro-1-thiophen-2-yl-ethyl)-piperidine-1,4-dicarboxylic acid 1-tert-butyl ester 4-ethyl ester (1.5 g, 3.6 mmol) in acetic acid (15 mL) was added Zinc dust (2 g, 30.6 mmol) and the resulting mixture stirred at room temperature for 3 h. The mixture was then diluted with water and basufied with sodium carbonate. The product was extracted with ethyl acetate and the combined organic extracts were then washed with brine, dried over sodium sulfate, filtered and evaporated. Purification by chromatography on silica gel eluting with DCM : MeOH (98 : 2) afforded the title compound
(403 mg, 29 %) as a light brown foam. MS : m/e = 399.5 ($M+NH_4$).

rac 8-(1-Phenyl-cyclohexyl)-4-thiophen-2-yl-2,8-diaza-spiro[4.5]decan-1-one

c) A mixture of 4-(2-amino-1-thiophen-2-yl-ethyl)-piperidine-1,4-dicarboxylic acid 1-tert-butyl ester 4-ethyl ester (400 mg, 0.97 mmol) in toluene (3 mL) containing triethylamine (0.2 mL) was heated under reflux for 5 h. After cooling to room temperature the mixture was evaporated to afford the cyclic amide
[MS : m/e 337.3 (M + H)] which was was then dissolved in dicloromethane (4 mL) and trifluoro acetic acid (0.8 mL, 1.1 mmol) was added and the resulting mixture stirred at room temperature for 30 min. The mixture was then basified with NaOH (2 N) dn the product extracted with dicloromethane to affor the amine (76 mg, 30 %) as a brown foam. This product was then treated in an analogous manner to example 45a to afford the Strecker product (75 mg, 69 %) as a brown oil. MS : m/e = 344.3 (M+H). This product was then treated as described for example 1, to afford the title compound (42 mg, 52 %) which was obtained as a light yellow oil. MS : m/e 395.3 (M + H).

Example 56

rac 8-(1-Phenyl-cyclohexyl)-4-propyl-2,8-diaza-spiro[4.5]decan-1-one

1-Nitro-pent-1-ene

a) To a solution of butyraldehyde (90.1 mL, 1 mol) in aquesous $NaHSO_3$ (38%, 207.5 mL, 1 mol) and water (293 mL) was added a solution of nitromethane (54.1 mL, 1 mol) dissolved in NaOH (2 N, 150 mL, 300 mmol) and water (50 mL) and the resulting mixture stirred at 43 °C for 3 h and then heated under reflux for 30 min. The mixture was then cooled to room temperature overnight and adjusted to pH~4 with HCl (6 N). The

product was extracted with diethyl ether (3 x 500 mL) and the combined organic layers where then washed with H_2O and brine, dried over sodium sulfate and evaporated to leave a brown liquid (37.6 g, 282 mmol). This product was then dissolved in chloroform (100 mL) and treated with acetyl chloride (23 mL, 325 mmol) and the resulting mixture stirred at room temperature for 3 h and then heated under reflux for 30 min. After cooling to room temperature the mixture was poured onto ice and neutralized with solid $NaHCO_3$. The product was extracted with chloroform (2 x 200 mL) and the combined organic layers where then washed with H_2O and brine, dried over sodium sulfate and evaporated to leave a brown liquid (46.1 g, 263 mmol). This product was then dissolved in ethyl acetate (1 L) and then sodium acetate (69.1 g, 842 mmol) added and the resulting mixture stirred at room temperature for 48 h. The mixture was then filtered and the solution evaporated. The residue was then partioned between diethyl ether and water and the water layer extracted with diethyl ether. The combined organic layers where then washed with H_2O and brine, dried over sodium sulfate and evaporated to leave a brown liquid (46 g). The title compound (6.8 g, 23 %) was purified by steam distillation (bp 70 °C at 8 torr).

rac 4-(1-Nitromethyl-butyl)-piperidine-1,4-dicarboxylic acid 1-tert-butyl ester 4-ethyl ester

b) As described for building block 7, piperidine-1,4-dicarboxylic acid 1-tert-butyl ester 4-ethyl ester (15.3 g, 59 mmol) was converted to the title compound (21.2 g, 96 %) (using 1-nitro-pent-1-ene instead of 4-fluoro-*trans*-beta-nitrostyrene) which was obtained as a yellow oil. MS : m/e 371.2 (M - H).

rac 1-Oxo-4-propyl-2,8-diaza-spiro[4.5]decane-8-carboxylic acid tert-butyl ester

c) As described for for building block 7, rac 4-(1-nitromethyl-butyl)-piperidine-1,4-dicarboxylic acid 1-tert-butyl ester 4-ethyl ester (21.2 g, 57 mmol) was converted to the title compound (11.2 g, 66 %) after the two-step procedure of Ra-Ni hydrogenation and heating under reflux in toluene solution. The title compound was obtained as a white solid after tritutation from hot pentane. MS : m/e 297.5 (M + H).

rac 4-Propyl-2,8-diaza-spiro[4.5]decan-1-one

d) As described for building block 7, 1-oxo-4-propyl-2,8-diaza-spiro[4.5]decane-8-carboxylic acid tert-butyl ester (11.2 g, 38 mmol) was converted to the title compound (6.3 g, 85 %) which was obtained as a light yellow liquid. MS : m/e 197.4 (M + H).

rac 1-(1-Oxo-4-propyl-2,8-diaza-spiro[4.5]dec-8-yl)-cyclohexanecarbonitrile

e) As described for building block 8, rac 4-propyl-2,8-diaza-spiro[4.5]decan-1-one (4.0 g, 20 mmol) was converted to the title compound (718 mg, 12 %) which was obtained as a white solid. MS : m/e 304.4 (M + H).

rac 8-(1-Phenyl-cyclohexyl)-4-propyl-2,8-diaza-spiro[4.5]decan-1-one

As described for example 1, 1-(1-oxo-4-propyl-2,8-diaza-spiro[4.5]dec-8-yl)-cyclohexanecarbonitrile (200 mg, 0.66 mmol) was converted to the title compound (122 mg, 52 %) which was obtained as a white solid. MS : m/e 355.5 (M + H).

Example 57

rac 8-[1-(4-Fluoro-phenyl)-cyclohexyl]-4-propyl-2,8-diaza-spiro[4.5]decan-1-one

As described for example 25, rac 1-(1-oxo-4-propyl-2,8-diaza-spiro[4.5]dec-8-yl)-cyclohexanecarbonitrile (200 mg, 0.66 mmol) was converted to the title compound (87 mg, 35 %) which was obtained as a white solid. MS : m/e 373.5 (M + H).

Example 58

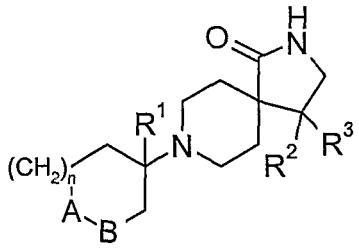
rac 4-Propyl-8-(1-thiophen-2-yl-cyclohexyl)-2,8-diaza-spiro[4.5]decan-1-one

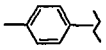
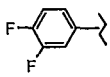
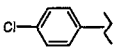
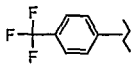
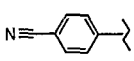
As described for example 36, rac 1-(1-oxo-4-propyl-2,8-diaza-spiro[4.5]dec-8-yl)-cyclohexanecarbonitrile (75 mg, 0.3 mmol) was converted to the title compound (40 mg, 45 %) which was obtained as a white solid. MS : m/e 361.5 (M + H).

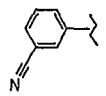
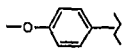
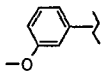
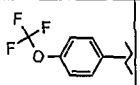
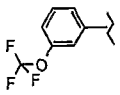
Example 59

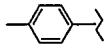
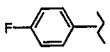
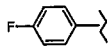
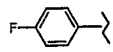
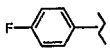
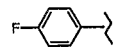
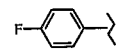
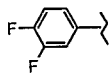
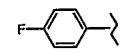
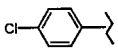
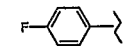
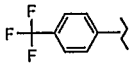
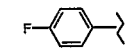
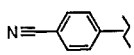
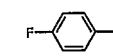
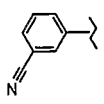
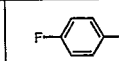
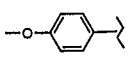
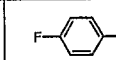
rac 8-[1-(5-Methyl-thiophen-2-yl)-cyclohexyl]-4-propyl-2,8-diaza-spiro[4.5]decan-1-one

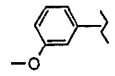
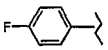
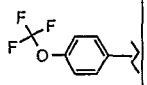
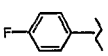
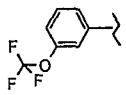
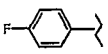
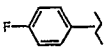
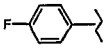
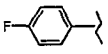
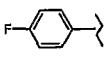
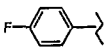
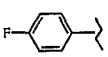
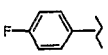
As described for example 37, rac 1-(1-oxo-4-propyl-2,8-diaza-spiro[4.5]dec-8-yl)-cyclohexanecarbonitrile (77 mg, 0.3 mmol) was converted to the title compound (29 mg, 31 %) which was obtained as a white solid. MS : m/e 375.4 (M + H).

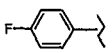
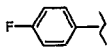
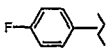
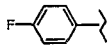
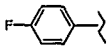
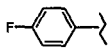
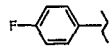
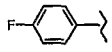
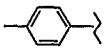
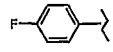
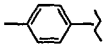
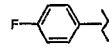
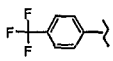
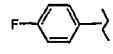
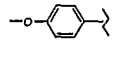


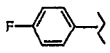
n	A-B	R^1	R^3	R^2	Example
1	CH_2CH_2		H		1
1	CH_2CH_2		H		2
1	CH_2CH_2		H		3
1	CH_2CH_2		H		4
1	CH_2CH_2		H		5
1	CH_2CH_2		H		6
1	CH_2CH_2		H		7
1	CH_2CH_2		H		8
1	CH_2CH_2		H		9

1	CH_2CH_2		H		10
1	CH_2CH_2		H		11
1	CH_2CH_2		H		12
1	CH_2CH_2		H		13
1	CH_2CH_2		H		14
1	CH_2CH_2		H		15
1	CH_2CH_2		H		16
1	CH_2CH_2		H		17
1	CH_2CH_2		H		18
1	CH_2CH_2		H		19
1	CH_2CH_2		H		20
1	CH_2CH_2		H		21

1	CH_2CH_2		H		22
1	CH_2CH_2		H		23
1	CH_2CH_2		H		24
1	CH_2CH_2		H		25
1	CH_2CH_2		H		26
1	CH_2CH_2		H		27
1	CH_2CH_2		H		28
1	CH_2CH_2		H		29
1	CH_2CH_2		H		30
1	CH_2CH_2		H		31
1	CH_2CH_2		H		32

1	CH_2CH_2		H		33
1	CH_2CH_2		H		34
1	CH_2CH_2		H		35
1	CH_2CH_2		H		36
1	CH_2CH_2		H		37
1	CH_2CH_2		H		38
1	CH_2CH_2		H		39
1	CH_2CH_2		H		40
1	CH_2CH_2		H		41
1	CH_2CH_2		H		42
1	OCH_2		H		43

1	CH_2O		H		44
1	SCH_2		H		45
1	SCH_2		H		46
1	$BnNCH_2$		H		47
2	CH_2CH_2		H		48
2	CH_2CH_2		H		49
2	CH_2CH_2		H		50
1	CH_2CH_2		H		51
1	CH_2CH_2		H		52
1	CH_2CH_2		H		53
1	CH_2CH_2		H		54
1	CH_2CH_2		H		55

1	CH_2CH_2		H		56
1	CH_2CH_2		H		57
1	CH_2CH_2		H		58
1	CH_2CH_2		H		59

Tablet Formulation (Wet Granulation)

Item	Ingredients	mg/tablet			
		5 mg	25 mg	100 mg	500 mg
1.	Compound of formula I	5	25	100	500
2.	Lactose Anhydrous DTG	125	105	30	150
3.	Sta-Rx 1500	6	6	6	30
4.	Microcrystalline Cellulose	30	30	30	150
5.	Magnesium Stearate	1	1	1	1
	Total	167	167	167	831

Manufacturing Procedure

1. Mix items 1, 2, 3 and 4 and granulate with purified water.
2. Dry the granules at 50°C.
3. Pass the granules through suitable milling equipment.
4. Add item 5 and mix for three minutes; compress on a suitable press.

Capsule Formulation

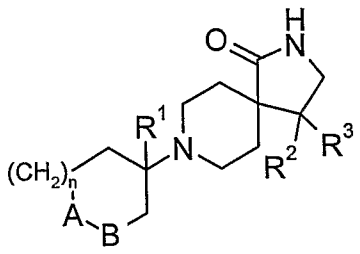
Item	Ingredients	mg/capsule			
		5 mg	25 mg	100 mg	500 mg
1.	Compound of formula I	5	25	100	500
2.	Hydrous Lactose	159	123	148	---
3.	Corn Starch	25	35	40	70
4.	Talc	10	15	10	25
5.	Magnesium Stearate	1	2	2	5
	Total	200	200	300	600

Manufacturing Procedure

1. Mix items 1, 2 and 3 in a suitable mixer for 30 minutes.
2. Add items 4 and 5 and mix for 3 minutes.
3. Fill into a suitable capsule.

Claims

1. Compounds of the general formula



I

wherein

A-B is CH_2-CH_2, -CH_2-O-, -O-CH_2-, -CH_2-S-, -S-CH_2-, -CH_2-C(O)-, -C(O)-CH_2-, -N(R^4)-CH_2- or -CH_2-N(R^4)-;

R^1 is lower alkyl, lower alkenyl, cycloalkyl, or is aryl, optionally substituted by one or two substituents, selected from the group consisting of halogen, cyano, lower alkyl, CF_3, OCF_3 or lower alkoxy, or is heteroaryl, optionally substituted by one or two substituents selected from the group consisting of halogen, lower alkyl, CF_3 or lower alkoxy;

R^2 is lower alkyl, cycloalkyl, or is aryl, optionally substituted by one or two substituents, selected from the group consisting of halogen, lower alkyl, CF_3, lower alkoxy, or
is heteroaryl, optionally substituted by one or two substituents, selected from the group consisting of halogen, lower alkyl, CF_3 or lower alkoxy;

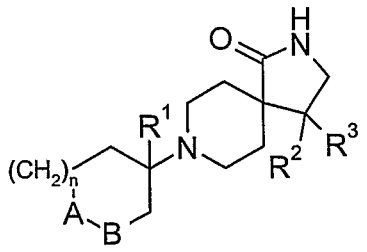
R^3 is hydrogen, lower alkyl or benzyl;

R^4 is hydrogen or benzyl;

n is 0, 1 or 2;

and pharmaceutically available salts thereof.

2. Compounds of formula I according to claim 1



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wherein

A-B is $-CH_2-CH_2-$, $-CH_2-O-$, $-O-CH_2-$, $-S-CH_2-$ or $-N(R^4)-CH_2-$;

R^1 is lower alkyl, lower alkenyl, cycloalkyl, or is phenyl, optionally substituted by one or two substituent, selected from the group consisting of halogen, cyano, lower alkyl, CF_3, OCF_3 or lower alkoxy, or is heteroaryl, optionally substituted by lower alkyl;

R^2 is lower alkyl, or is phenyl, optionally substituted by one substituent, selected from the group consisting of halogen, lower alkyl, CF_3, lower alkoxy, or is heteroaryl;

R^3 is hydrogen;

R^4 is benzyl; and

n is 1 or 2;

and pharmaceutically available salts thereof.

3. Compounds of formula I according to claim 2, wherein n is 1.

4. Compounds of formula I according to claim 3, wherein –A-B- is $-CH_2-CH_2-$.

5. Compounds of formula I according to claim 4, wherein R^1 and R^2 are phenyl, optionally substituted by halogen or lower alkyl.

6. Compounds of formula I according to claim 5, wherein the compounds are rac-4-phenyl-8-(1-phenyl-cyclohexyl)-2,8-diaza-spiro[4.5]decan-1-one, rac-4-(4-fluoro-phenyl)-8-[1-(4-fluoro-phenyl)-cyclohexyl]-2,8-diaza-spiro[4.5]decan-1-one or rac 8-[1-(4-fluoro-phenyl)-cyclohexyl]-4-*p*-tolyl-2,8-diaza-spiro[4.5]decan-1-one.

7. Compounds of formula I according to claim 4, wherein R^1 is thiophenyl and R^2 is phenyl, substituted by halogen.

8. Compounds of formula I according to claim 7, wherein the compounds are rac-4-(4-fluoro-phenyl)-8-(1-thiophen-2-yl-cyclohexyl)-2,8-diaza-spiro[4.5]decan-1-one or
rac-4-(4-fluoro-phenyl)-8-(1-thiophen-3-yl-cyclohexyl)-2,8-diaza-spiro[4.5]decan-1-one.

9. Compounds of formula I according to claim 4, wherein R^1 is phenyl, optionally substituted by halogen and R^2 is lower alkyl.

10. Compounds of formula I according to claim 9, wherein the compounds are rac 8-(1-phenyl-cyclohexyl)-4-propyl-2,8-diaza-spiro[4.5]decan-1-one or
rac 8-[1-(4-fluoro-phenyl)-cyclohexyl]-4-propyl-2,8-diaza-spiro[4.5]decan-1-one.

11. Compounds of formula I according to claim 3, wherein –A-B- is $-O-CH_2-$.

12. Compounds of formula I according to claim 3, wherein –A-B- is $-CH_2-O-$.

13. Compounds of formula I according to claim 3, wherein –A-B- is $-S-CH_2-$

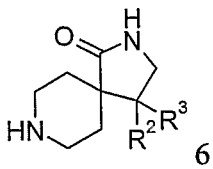
14. Compounds of formula I according to claim 3, wherein –A-B- is –N(benzyl)-CH_2-.

15. Compounds of formula I according to claim 2, wherein n is 2.

16. Compounds of formula I according to claim 15, wherein the compound is rac-4-(4-fluoro-phenyl)-8-[1-(4-fluoro-phenyl)-cycloheptyl]-2,8-diaza-spiro[4.5]decan-1-one.

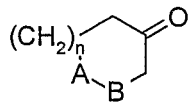
17. Processes for preparation of compounds of formula I and their pharmaceutically acceptable salts, which processes comprise

a) reacting a compound of formula



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with a compound of formula

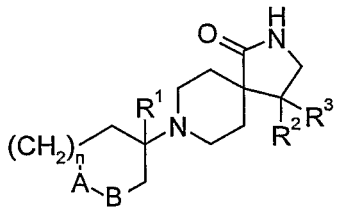


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in the presence of AcOH and TMSCN and then with a corresponding Grignard reagent of formula

R^1Mghal 9

to a compound of formula



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wherein the substituents are as described above and hal is Cl, Br or I, and

b) if desired, separating the obtained racemic forms into corresponding enantiomers, and

if desired, converting the compounds obtained into pharmaceutically acceptable acid addition salts.

18. A compound according to claim 1, whenever prepared by a process as claimed in claim 17 or by an equivalent method.

19. A medicament containing one or more compounds as claimed in claim 1 and pharmaceutically acceptable excipients.

20. A medicament according to claim 19 for the treatment of illnesses based on the glycine uptake inhibitor.

21. A medicament according to claims 19 and 20, wherein the illnesses are psychoses, pain, disfunction in memory and learning, schizophrenia, dementia and other diseases in which cognitive processes are impaired, such as attention deficit disorders or Alzheimer's disease.

22. The use of a compound as claimed in claim 1 for the manufacture of medicaments for the treatment of psychoses, pain, neurodegenerative disfunction in memory and learning, schizophrenia, dementia and other diseases in which cognitive processes are impaired, such as attention deficit disorders or Alzheimer's disease.

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23. The invention as herein before described.

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