Description

Sulfonyl-phenyl-2H-[1,2,4]oxadiazol-5-one derivatives , processes for their preparation and their use as pharmaceuticals

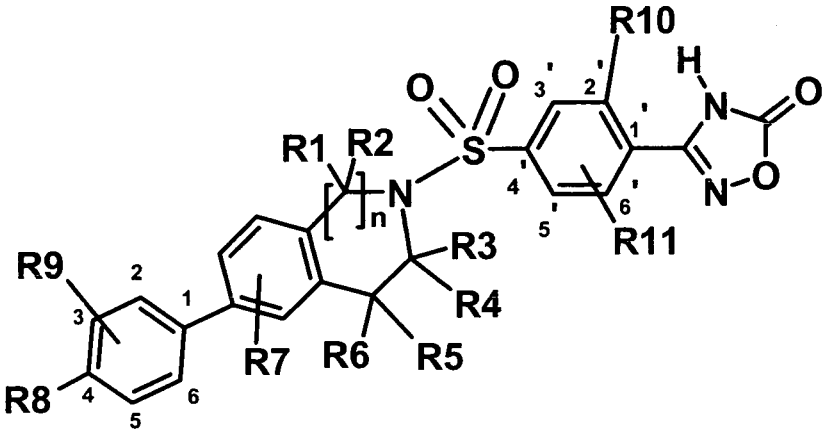
The invention relates to sulfonyl-phenyl-oxadiazolones and to their physiologically acceptable salts and physiologically functional derivatives showing PPARdelta or PPARdelta and PPARalpha agonist activity.

PPARdelta agonists having a sulfonamide group are described in WO 2003/097607, WO 2004/005253 and DE 10335449 as well as in WO 2004/092117. Compounds comprising an oxadiazolone feature are disclosed in WO 2005/097786.

The invention was based on the object of providing compounds which permit therapeutically utilizable modulation of lipid and/or carbohydrate metabolism and are thus suitable for the prevention and/or treatment of diseases such as type 2 diabetes and atherosclerosis and the diverse sequelae thereof. Another purpose of the invention is to treat demyelinating and other neurodegenerative disorders of the central and peripheral nervous systems.

A series of compounds which modulate the activity of PPA receptors has been found. The compounds are suitable in particular for activating PPARdelta or PPARdelta and PPARalpha, however it is possible that the relative activation varies depending on the specific compounds.

Compounds of the present invention are described by formula I:



formula I

wherein

n is 0,1

R1, R2 are independently H, (C1-C8) alkyl, (C0-C4) alkylene -(C3-C7) cycloalkyl, (C0-C4) alkylene -(C6-C10) aryl, wherein alkyl and alkylene are unsubstituted or 1- to 3-fold substitued by F;

R3,R4 are independently H, (C1-C8) alkyl, (C0-C4) alkylene -(C3-C7) cycloalkyl, (C0-C4) alkylene -(C6-C10) ary,l wherein alkyl and alkylene are unsubstituted or 1- to 3-fold substitued by F;

R5,R6 are independently H, (C1-C8) alkyl, (C0-C4) alkylene -(C3-C7) cycloalkyl, (C0-C4) alkylene -(C6-C10) aryl, wherein alkyl and alkylene are unsubstituted or 1- to 3-fold substitued by F; or

R5 and R6 together with the carbon atom carrying them form a (C3-C7) cycloalkylring, wherein one carbon atom can be replaced by one heteroatom O, S, N;

R7 is H, halogen, (C1-C8) alkyl, (C0-C4) alkylene-O-(C0-C4) alkylene-H, (C3-C7) cycloalkyl, wherein alkyl and alkylene are unsubstituted or 1- to 3-fold substitued by F;

R8, R9 are independently H, halogen, (C1-C8) alkyl, (C0-C4) alkylene-O-(C0-C4) alkylene-H, (C3-C7) cycloalkyl, -CO-O-(C0-C4)-alkylene-H, CO-O-phenyl, -CO-NR12R13, wherein alkyl and alkylene are unsubstituted or 1- to 3-fold substitued by F, NR12R13 and phenyl is unsubstituted or 1- to 3-fold substituted by halogen, (C1-C4) alkyl, (C0-C4) alkylene-O-(C0-C4) alkylene-H, or NR12R13; or

R8 and R9 together with the carbon atoms to which they are bonded form a (C5-C7) cycloalkyl ring, wherein one carbon atom can be replaced by one heteroatom O, S, N;

R10, R11 are independently H, halogen, (C1-C8) alkyl, (C0-C4) alkylene-O-(C0-C4) alkylene-H, (C3-C7) cycloalkyl, (C6-C10) aryl, wherein cycloalkyl and aryl are unsubstituted or 1- to 2-fold substituted by (C1-C4) alkyl and wherein alkyl and alkylene are unsubstituted or 1- to 3-fold substitued by F;

R12, R13 are independently H, (C1-C6) alkyl;

in all its stereoisomeric forms and mixtures in any ratio, and its physiologically acceptable salts and tautomeric forms.

Another embodiment according to the invention are compounds of the formula I, wherein

n is 0,1

R1, R2 are independently H, (C1-C8) alkyl, (C0-C4) alkylene -(C3-C7) cycloalkyl, (C0-C4) alkylene -(C6-C10) aryl, wherein alkyl and alkylene are unsubstituted or 1- to 3-fold substitued by F;

R3,R4 are independently H, (C1-C8) alkyl, (C0-C4) alkylene -(C3-C7) cycloalkyl, (C0-C4) alkylene -(C6-C10) aryl, wherein alkyl and alkylene are unsubstituted or 1- to 3-fold substitued by F;

R5,R6 are independently H, (C1-C8) alkyl, (C0-C4) alkylene -(C3-C7) cycloalkyl, (C0-C4) alkylene -(C6-C10) aryl, wherein alkyl and alkylene are unsubstituted or 1- to 3-fold substitued by F;

R7 is H, halogen, (C1-C8) alkyl, (C0-C4) alkylene-O-(C0-C4) alkylene-H, (C3-C7) cycloalkyl, wherein alkyl and alkylene are unsubstituted or 1- to 3-fold substitued by F;

R8, R9 are independently H, halogen, (C1-C8) alkyl, (C0-C4) alkylene-O-(C0-C4) alkylene-H, (C3-C7) cycloalkyl, wherein alkyl and alkylene are unsubstituted or 1- to 3-fold substitued by F;

R10, R11 are independently H, halogen, (C1-C8) alkyl, (C0-C4) alkylene-O-(C0-C4) alkylene-H, (C3-C7) cycloalkyl, wherein alkyl and alkylene are unsubstituted or 1- to 3-fold substitued by F;

Another embodiment according to the invention are compounds of the formula I, wherein

n is 0.

Another embodiment according to the invention are compounds of the formula I, wherein

n is 1.

Another embodiment according to the invention are compounds of the formula I, wherein

R9 is in position 2.

Another embodiment according to the invention are compounds of the formula I, wherein

R9 is in position 3 if R8 and R9 together with the carbon atoms to which they are bonded form a cycloalkyl ring.

Another embodiment according to the invention are compounds of the formula I, wherein

R11 is in position 3'.

Another embodiment according to the invention are compounds of the formula I, wherein

R11 is in position 3' and

R10 is H.

Another embodiment according to the invention are compounds of the formula I, wherein

R8 is CF_3.

Another embodiment according to the invention are compounds of the formula I, wherein

R10 is Cl.

Another embodiment according to the invention are compounds of the formula I, wherein

R5 and R6 together with the carbon atom carrying them form a (C3-C7) cycloalkyl ring, wherein one carbon atom can be replaced by one heteroatom O, S, N, preferably by one heteroatom O.

Another embodiment according to the invention are compounds of the formula I where one or more substituents have the following meaning:

n is 0,1;

R1, R2 are H;

R3, R4 are H;

R5, R6 are independently H, (C1-C6) alkyl, preferably, H, CH_3; or

R5 and R6 together with the carbon atom carrying them form a (C5-C6) cycloalkyl ring wherein one carbon atom can be replaced by one heteroatom O or N, preferably it forms a tetrahydropyran ring;

R7 is H;

R8 is CF_3, Cl;

R9 is in position 2 and

R9 is H, F, O-(C1-C4) alkyl, COOH, CO-O-phenyl, O-(C1-C4) alkyl-NR12R13, CO-O-(C1-C4) alkyl-NR12R13, CO-NH-(C1-C4) alkyl-NR12R13; or

R8 and R9 together with the carbon atoms to which they are bonded form a (C5-C6) cycloalkyl ring, wherein one carbon atom is replaced by one heteroatom O;

R10 is H, Cl, F, CH_3;

R11 is H, Cl, phenyl-CF_3;

R12, R13 are (C1-C4) alkyl.

Another embodiment according to the invention are compounds of the formula I where one or more substituents have the following meaning:

n is 0,1;

R1, R2 are H;

R3, R4 are H;

R5, R6 are independently H, (C1-C6) alkyl, preferably, H, CH_3; or

R5 and R6 together with the carbon atom carrying them form a (C5-C6) cycloalkyl ring wherein one carbon atom is replaced by one heteroatom O, preferably a tetrahydropyran ring;

R7 is H;

R8 is CF_3, Cl;

R9 is H, O-(C1-C4) alkyl, COOH, CO-O-phenyl, preferably H, methoxy, COOH,

CO-O-phenyl; or

R8 and R9 together with the carbon atoms to which they are bonded form a (C5-C6) cycloalkyl ring, wherein one carbon atom is replaced by one heteroatom O;

R10 is H, Cl;

R11 is H, Cl, phenyl-CF_3;

R12, R13 are (C1-C4) alkyl, preferably methyl.

Another embodiment according to the invention are compounds of the formula I where one or more substituents have the following meaning:

n is 0, 1;

R1, R2 are H;

R3, R4 are H;

R5, R6 are independently H, (C1-C6) alkyl, preferably, H, CH_3;

R7 is H;

R8 is CF_3;

R9 is H;

R10 is Cl;

R11 is H.

Another embodiment according to the invention are compounds of the formula I where one or more substituents have the following meaning:

R1, R2 are H;

R3, R4 are H;

R5, R6 are independently H, (C1-C6) alkyl, preferably, H, CH_3;

R7 is H;

R8 is CF_3;

R9 is H, F;

R10 is H, Cl, F, CH_3;

R11 is H.

Another embodiment according to the invention are compounds of the formula I where one or more substituents have the following meaning:

R5 is H and
R6 is H or
R5 is CH_3 and
R6 is CH_3;
R9 is H;
R10 is H, Cl.

Further embodiments according to the invention are the following compounds:

3-{4-[5-(4-Trifluoromethyl-phenyl)-2,3-dihydro-indole-1-sulfonyl]-phenyl}-4H-[1,2,4]oxadiazol-5-one

3-{4-[3,3-Dimethyl-5-(4-trifluoromethyl-phenyl)-2,3-dihydro-indole-1-sulfonyl]-phenyl}-2H-[1,2,4]oxadiazol-5-one

3-{2-Chloro-4-[5-(4-trifluoromethyl-phenyl)-2,3-dihydro-indole-1-sulfonyl]-phenyl}-4H-[1,2,4]oxadiazol-5-one

3-{2-Chloro-4-[3,3-dimethyl-5-(4-trifluoromethyl-phenyl)-2,3-dihydro-indole-1-sulfonyl]-phenyl}-2H-[1,2,4]oxadiazol-5-one

3-{2-Chloro-4-[7-(4-trifluoromethyl-phenyl)-3,4-dihydro-1H-isoquinoline-2-sulfonyl]-phenyl}-2H-[1,2,4]oxadiazol-5-one

3-{3-Chloro-4-[5-(4-trifluoromethyl-phenyl)-2,3-dihydro-indole-1-sulfonyl]-phenyl}-4H-[1,2,4]oxadiazol-5-one

3-{4-[5-(2-Methoxy-4-trifluoromethyl-phenyl)-2,3-dihydro-indole-1-sulfonyl]-phenyl}-4H-[1,2,4]oxadiazol-5-one

5-Chloro-2-{1-[4-(5-oxo-4,5-dihydro-[1,2,4]oxadiazol-3-yl)-benzenesulfonyl]-2,3-dihydro-1H-indol-5-yl}-benzoic acid phenyl ester

5-Chloro-2-{1-[4-(5-oxo-4,5-dihydro-[1,2,4]oxadiazol-3-yl)-benzenesulfonyl]-2,3-dihydro-1H-indol-5-yl}-benzoic acid

3-{4-[5-(2,3-Dihydro-benzofuran-5-yl)-2,3-dihydro-indole-1-sulfonyl]-phenyl}-4H-[1,2,4]oxadiazol-5-one

3-{4-[3,3-(4-Spiro-tetrahydropyran)-5-(4-trifluoromethyl-phenyl)-2,3-dihydro-indole-1-sulfonyl]-phenyl}-4H-[1,2,4]oxadiazol-5-one

3-{4'-Trifluoromethyl-6-[5-(4-trifluoromethyl-phenyl)-2,3-dihydro-indole-1-sulfonyl]-biphenyl-3-yl}-4H-[1,2,4]oxadiazol-5-one

3-(4-{5-[2-(2-Dimethylamino-ethoxy)-4-trifluoromethyl-phenyl]-2,3-dihydro-indole-1-sulfonyl}-phenyl)-4H-[1,2,4]oxadiazol-5-one

2-{1-[4-(5-Oxo-4,5-dihydro-[1,2,4]oxadiazol-3-yl)-benzenesulfonyl]-2,3-dihydro-1H-indol-5-yl}-5-trifluoromethyl-benzoic acid 2-dimethylamino-ethyl ester

N-(2-Dimethylamino-ethyl)-2-{1-[4-(5-oxo-4,5-dihydro-[1,2,4]oxadiazol-3-yl)-benzenesulfonyl]-2,3-dihydro-1H-indol-5-yl}-5-trifluoromethyl-benzamide

This invention also encompasses all combinations of preferred aspects of the invention described herein.

As used herein, the term alkyl is to be understood in the broadest sense to mean saturated hydrocarbon residues which can be linear, i. e. straight-chain, or branched. If not otherwise defined alkyl has 1 to 8 carbon atoms. Examples of „-(C1-C8)-alkyl" are alkyl residues containing 1, 2, 3, 4, 5, 6, 7 or 8 carbon atoms are methyl, ethyl, propyl, butyl, pentyl, hexyl, heptyl or octyl, the n-isomers of all these residues, isopropyl, isobutyl, 1-methylbutyl, isopentyl, neopentyl, 2,2-dimethylbutyl, 2-methylpentyl, 3-methylpentyl, isohexyl, sec-butyl, tert-butyl or tert-pentyl. The term „-(C0-C8)-alkyl" is a hydrocarbon residue containing 1, 2, 3, 4, 5, 6, 7 or 8 carbon atoms, in which the

term „-C0-alkyl" is a covalent bond. All these statements apply also to the term alkylene.

As used herein, the term alkenyl is to be understood in the broadest sense to mean hydrocarbon residues which has 1 to 4 double bonds and can be linear, i. e. straight-chain, or branched. If not otherwise defined alkenyl has 2 to 8 carbon atoms. Examples of „-(C2-C8)-alkenyl" are alkenyl residues containing 2, 3, 4, 5, 6, 7 or 8 carbon atoms are, for example vinyl, 1-propenyl, 2-propenyl (= allyl), 2-butenyl, 3-butenyl, 2-methyl-2-butenyl, 3-methyl-2-butenyl, 5-hexenyl or 1,3-pentadienyl. All these statements apply also to the term alkenylene.

As used herein, the term alkinyl is to be understood in the broadest sense to mean hydrocarbon residues, which has 1 to 4 triple bonds and can be linear, i. e. straight-chain, or branched. If not otherwise defined alkinyl has 2 to 8 carbon atoms. Examples of „-(C2-C8)-alkinyl" are alkinyl residues containing 2, 3, 4, 5, 6, 7 or 8 carbon atoms are, for example ethynyl, 1-propynyl, 2-propynyl (= propargyl) or 2-butynyl. All these statements apply also to the term alkylidene.

All these statements also apply if an alkyl group occurs as a substituent on another residue, for example in an alkyloxy residue, an alkyloxycarbonyl residue or an arylalkyl residue.

If not otherwise defined, alkyl, and alkylene, are unsubstituted or mono, di- or trisubstituted independently of one another by suitable groups such as, for example: F, Cl, Br, I, CF3, NO2, CN, COOH, CO-O-(C0-C4) alkylene-(C6-C10) aryl, CO-O-(C1-C4) alkyl, CO-O-(C0-C4) alkylene-(C3-C13)cycloalkyl, CO-O-(C0-C4) alkylene-(C3-C15)heterocycle, CO-N((C0-C4) alkylene-H)-(C0-C4) alkylene- (C6-C10) aryl, CO-N((C0-C4) alkylene-H)-(C0-C4) alkylene-H, CO-N((C0-C4) alkylene-H)-(C0-C4) alkylene- (C3-C13)cycloalkyl, CO-N((C0-C4) alkylene-H)-(C0-C4) alkylene- (C3-C15) heterocycle, (C0-C4) alkylene-(C3-C6)cycloalkyl, (C0-C4) alkylene-(C6-C10)aryl, (C0-C4) alkylene-(C3-C15)heterocycle, (C2-C6)-alkenyl, (C2-C6)-alkinyl, O-(C0-C6)-alkyl, O-(C0-C4) alkylene-(C6-C10) aryl, O-(C0-C4) alkylene-(C3-C12)cycloalkyl, O-

(C0-C4) alkylene-(C3-C15)heterocycle, O-CO-O-(C0-C4) alkylene-(C6-C10) aryl, O-CO-O-(C1-C4) alkyl, O-CO-O-(C0-C4) alkylene-(C3-C13)cycloalkyl, O-CO-O-(C0-C4) alkylene-(C3-C15)heterocycle, S-(C1-C4)alkyl, S-(C0-C4) alkylene-(C3-C13)cycloalkyl, S-(C0-C4) alkylene-(C6-C10) aryl, S-(C0-C4) alkylene-(C3-C15) heterocycle, SO-(C1-C4)alkyl, SO-(C0-C4) alkylene-(C3-C13)cycloalkyl, SO-(C0-C4) alkylene-(C6-C10) aryl, SO-(C0-C4) alkylene-(C3-C15) heterocycle, SO2-(C1-C4)alkyl, SO2-(C0-C4) alkylene-(C3-C13)cycloalkyl, SO2-(C0-C4) alkylene-(C6-C10) aryl, SO2-(C0-C4) alkylene-(C3-C15) heterocycle, SO2-N((C0-C4)alkylene-H)-(C0-C4)alkylene-(C6-C10)aryl, SO2-N((C0-C4)alkylene-H)-(C0-C4)alkylene-H, SO2-N((C0-C4) alkylene-H)-(C0-C4)alkylene-(C3-C13)cycloalkyl, SO2-N((C0-C4)alkylene-H)-(C0-C4)alkylene-(C3-C15)heterocycle, where the aryl ring or heterocyclic ring is unsubstituted or mono- or disubstituted by F, Cl, Br, OH, CF3, NO2, CN, OCF3, O-(C1-C6)-alkyl, (C1-C6)-alkyl, N((C0-C4)-alkylene-H)-(C0-C4)-alkylene-H;

N((C0-C4)-alkylene-H)-(C0-C4)-alkylene-H, N((C0-C4) alkylene-H)-(C0-C4)alkylene-H)-(C1-C6)cycloalkyl, N((C0-C4)alkylene-H)-(C0-C4)alkylene-(C6-C12)-aryl, N((C0-C4)alkylene-H)-(C0-C4)alkylene-(C3-C15)heterocycle, N((C0-C4) alkylene-H)-CO-(C0-C4)alkylene-(C6-C12)-aryl, N((C0-C4)alkylene-H)-CO-(C0-C4)alkyl, N((C0-C4)alkylene-H)-CO-(C0-C4)alkylene-(C3-C13)cycloalkyl, N((C0-C4)alkylene-H)-CO-(C0-C4)alkylene-(C3-C15)heterocycle, N((C0-C4) alkylene-H)-CO-O-(C0-C4)alkylene-(C6-C12)-aryl, N((C0-C4)alkylene-H)-CO-O-(C0-C4)alkyl, N((C0-C4)alkylene-H)-CO-O-(C0-C4)alkylene-(C3-C13)cycloalkyl, N((C0-C4)alkylene-H)-CO-O-(C0-C4)alkylene-(C3-C15)heterocycle, N((C0-C4) alkylene-H)-CO-N((C0-C4)-alkylene-H)-(C0-C4)alkylene-(C6-C12)-aryl, N((C0-C4)alkylene-H)-CO-N((C0-C4)-alkylene-H)-(C0-C4)alkyl, N((C0-C4)alkylene-H)-CO-N((C0-C4)-alkylene-H)-(C0-C4)alkylene-(C3-C13)cycloalkyl, N((C0-C4)alkylene-H)-CO-N((C0-C4)-alkylene-H)-(C0-C4)alkylene-(C3-C15)heterocycle, where the aryl ring or heterocyclic ring is unsubstituted or mono- or disubstituted by F, Cl, Br, I, OH, CF3, NO2, CN, OCF3, O-(C1-C6)-alkyl, (C1-C6)-alkyl, N((C0-C4)-alkylene-H)-(C0-C4)-alkylene-H, SO2-CH3, COOH, COO-(C1-C6)-alkyl, SF5, CONH2.

If not otherwise specified, the term cycloalkyl is to be understood to mean saturated hydrocarbon cycle containing from 3 to 13 carbon atoms in a mono- or bicyclic, fused,

bridged or spirocyclic ring. Examples of (C3-C13)-cycloalkyl cyclic alkyl residues are cycloalkyl residues containing 3, 4, 5, 6, 7, 8, 9, 10, 11, 12 or 13 ring carbon atoms like cyclopropyl, cyclobutyl, cyclopentyl, cyclohexyl, cycloheptyl, cyclooctyl, cyclononyl, cyclodecyl, cycloundecyl or cyclododecyl. The term cycloalkyl also includes bicyclic groups in which any of the above cycloalkyl ring is fused to a benzene ring, for example indane and 1,2,3,4-tetrahydronaphthalene.

If not otherwise defined cycloalkyl are unsubstituted or mono, di- or trisubstituted independently of one another by suitable groups such as, for example: F, Cl, Br, I, CF3, NO2, CN, COOH, CO-O-(C0-C4) alkylene-(C6-C10) aryl, CO-O-(C1-C4) alkyl, CO-O-(C0-C4) alkylene-(C3-C13)cycloalkyl, CO-O-(C0-C4) alkylene-(C3-C15)heterocycle,, CO-N((C0-C4) alkylene-H)-(C1-C6)alkylene-H, CO-N((C0-C4) alkylene-H)-(C1-C6)cycloalkyl, CON((C0-C4) alkylene-H)-(C0-C4)alkylene-(C6-C12)-aryl, (C0-C4) alkylene-(C3-C6)cycloalkyl, (C3-C6)alkyl, (C2-C6)-alkenyl, (C2-C6)-alkinyl, (C0-C4) alkylene-(C6-C10)aryl, (C0-C4) alkylene-(C3-C15)heterocycle, O-(C0-C6)-alkyl, (C0-C4) alkylene-O-(C0-C4) alkyl, (C0-C4) alkylene-O-(C0-C4) alkylene-(C3-C13)cycloalkyl, (C0-C4) alkylene-O-(C0-C4) alkylene-(C6-C10)aryl, (C0-C4) alkylene-O-(C0-C4) alkylene-(C3-C15)heterocycle, O-CO-O-(C0-C4) alkylene-(C6-C10) aryl, O-CO-O-(C1-C4) alkyl, O-CO-O-(C0-C4) alkylene-(C3-C13)cycloalkyl, O-CO-O-(C0-C4) alkylene-(C3-C15)heterocycle, O-CO-N((C0-C4) alkylene-H)-(C0-C4) alkylene- (C6-C10) aryl, O-CO-N((C0-C4) alkylene-H)-(C0-C4) alkylene-H, O-CO-N((C0-C4) alkylene-H)-(C0-C4) alkylene- (C3-C13)cycloalkyl, O-CO-N((C0-C4) alkylene-H)-(C0-C4) alkylene- (C3-C15) heterocycle,S-(C1-C4)alkyl, S-(C0-C4) alkylene-(C3-C13)cycloalkyl, S-(C0-C4) alkylene-(C6-C10) aryl, S-(C0-C4) alkylene-(C3-C15) heterocycle, SO-(C1-C4)alkyl, SO-(C0-C4) alkylene-(C3-C13)cycloalkyl, SO-(C0-C4) alkylene-(C6-C10) aryl, SO-(C0-C4) alkylene-(C3-C15) heterocycle, SO2-(C1-C4)alkyl, SO2-(C0-C4) alkylene-(C3-C13)cycloalkyl, SO2-(C0-C4) alkylene-(C6-C10) aryl, SO2-(C0-C4) alkylene-(C3-C15) heterocycle, SO2-N((C0-C4)alkylene-H)-(C0-C4)alkylene-(C6-C10)aryl, SO2-N((C0-C4)alkylene-H)-(C0-C4)alkylene-H, SO2-N((C0-C4) alkylene-H)-(C0-C4)alkylene-(C3-C13)cycloalkyl, SO2-N((C0-C4)alkylene-H)-(C0-C4)alkylene-(C3-C15)heterocycle, where the aryl ring or heterocyclic ring is

unsubstituted or mono- or disubstituted by F, Cl, Br, OH, CF3, NO2, CN, OCF3, O-(C1-C6)-alkyl, (C1-C6)-alkyl, N((C0-C4)-alkylene-H)-(C0-C4)-alkylene-H; N((C0-C4)-alkylene-H)-(C0-C4)-alkylene-H, N((C0-C4) alkylene-H)-(C0-C4)alkylene-H)-(C1-C6)cycloalkyl, N((C0-C4)alkylene-H)-(C0-C4)alkylene-(C6-C12)-aryl, N((C0-C4)alkylene-H)-(C0-C4)alkylene-(C3-C15)heterocycle, N((C0-C4) alkylene-H)-CO-(C0-C4)alkylene-(C6-C12)-aryl, N((C0-C4)alkylene-H)-CO-(C0-C4)alkyl, N((C0-C4)alkylene-H)-CO-(C0-C4)alkylene-(C3-C13)cycloalkyl, N((C0-C4)alkylene-H)-CO-(C0-C4)alkylene-(C3-C15)heterocycle, N((C0-C4) alkylene-H)-CO-O-(C0-C4)alkylene-(C6-C12)-aryl, N((C0-C4)alkylene-H)-CO-O-(C0-C4)alkyl, N((C0-C4)alkylene-H)-CO-O-(C0-C4)alkylene-(C3-C13)cycloalkyl, N((C0-C4)alkylene-H)-CO-O-(C0-C4)alkylene-(C3-C15)heterocycle, N((C0-C4) alkylene-H)-CO-N((C0-C4)-alkylene-H)-(C0-C4)alkylene-(C6-C12)-aryl, N((C0-C4)alkylene-H)-CO-N((C0-C4)-alkylene-H)-(C0-C4)alkyl, N((C0-C4)alkylene-H)-CO-N((C0-C4)-alkylene-H)-(C0-C4)alkylene-(C3-C13)cycloalkyl, N((C0-C4)alkylene-H)-CO-N((C0-C4)-alkylene-H)-(C0-C4)alkylene-(C3-C15)heterocycle, where the aryl or heterocyclic ring is unsubstituted or mono- or disubstituted by F, Cl, Br, I, OH, CF3, NO2, CN, OCF3, O-(C1-C6)-alkyl, (C1-C6)-alkyl, N((C0-C4)-alkylene-H)-(C0-C4)-alkylene-H,SO2-CH3, COOH, COO-(C1-C6)-alkyl, SF5, CONH2.

The term “aryl” is understood to mean aromatic hydrocarbon ring containing from 6 to 14 carbon atoms in a mono- or bicyclic ring. Examples of (C6-C14)-aryl rings are phenyl, naphthyl, for example 1-naphthyl and 2-naphthyl, biphenylyl, for example 2-biphenylyl, 3-biphenylyl and 4-biphenylyl, anthryl or fluorenyl. Biphenylyl rings, naphthyl rings and, in particular, phenyl rings are further embodiments of aryl rings.

The terms heterocycle is understood to mean saturated (heterocycloalkyl), partly unsaturated (heterocycloalkenyl) or unsaturated (heteroaryl) hydrocarbon rings containing from 3 to 15 carbon atoms in a mono- or bicyclic , fused, bridged or spirocyclicring in which 1 to 5 carbon atoms of the 3 to 15 ring carbon atoms are replaced by heteroatoms such as nitrogen, oxygen or sulfur in which further the heteroatoms can be oxidized, for example N=O, S=O, SO2. Examples of heterocycles are acridinyl, azaindole (1H-pyrrolopyridinyl), azabenzimidazolyl, azaspirodecanyl,

azepinyl, azetidinyl, aziridinyl, benzimidazolyl, benzofuranyl, dihydrobenzofuranyl, benzothiofuranyl, benzothiophenyl, benzoxazolyl, benzthiazolyl, benztriazolyl, benztetrazolyl, benzisoxazolyl, benzisothiazolyl, carbazolyl, 4aH-carbazolyl, carbolinyl, chromanyl, chromenyl, cinnolinyl, decahydrochinolinyl, 4,5-dihydrooxazolinyl, dioxazolyl, dioxazinyl, 1,3-dioxolanyl, 1,3-dioxolenyl, 3,3-dioxo[1,3,4]oxathiazinyl, 6H-1,5,2-dithiazinyl, dihydrofuro[2,3-b]-tetrahydrofuranyl, furanyl, furazanyl, imidazolidinyl, imidazolinyl, imidazolyl, 1H-indazolyl, indolinyl, indolizinyl, indolyl, 3H-indolyl, isobenzofuranyl, isochromanyl, isoindazolyl, isoindolinyl, isoindolyl, isoquinolinyl (benzimidazolyl), isothiazolyl, isothiazolidinyl, isothiazolinyl, isoxazolyl, isoxazolinyl, isoxazolidinyl, 2-isoxazolinyl, ketopiperazinyl, morpholinyl, naphthyridinyl, octahydroisoquinolinyl, oxadiazolyl, 1,2,3-oxadiazolyl, 1,2,4-oxadiazolyl, 1,2,5-oxadiazolyl, 1,3,4-oxadiazolyl, 1,2-oxa-thiepanyl, 1,2-oxathiolanyl, 1,4-oxazepanyl, 1,4-oxazepinyl, 1,2-oxazinyl, 1,3-oxazinyl, 1,4-oxazinyl, oxazolidinyl, oxazolinyl, oxazolyl, oxetanyl, oxocanyl, phenanthridinyl, phenanthrolinyl, phenazinyl, phenothiazinyl, phenoxathiinyl, phenoxazinyl, phthalazinyl, piperazinyl, piperidinyl, pteridinyl, purinyl, pyranyl, pyrazinyl, pyrazolidinyl, pyrazolinyl, pyrazolyl, pyridazinyl, pyridooxazolyl, pyridoimidazolyl, pyridothiazolyl, pyridinyl, pyridyl, pyrimidinyl, pyrrolidinyl, pyrrolidinonyl, pyrrolinyl, 2H-pyrrolyl, pyrrolyl, quinazolinyl, quinolinyl, 4H-quinolizinyl, quinoxalinyl, quinuclidinyl, tetrahydrofuranyl, tetrahydroisoquinolinyl, tetrahydroquinolinyl, tetrahydrofuranyl, tetrahydropyranyl, tetrahydropyridinyl, tetrahydrothiophenyl, tetrazinyl, tetrazolyl, 6H-1,2,5-thiadiazinyl, 1,2,3-thiadiazolyl, 1,2,4-thiadiazolyl, 1,2,5-thiadiazolyl, 1,3,4-thiadiazolyl, thianthrenyl, 1,2-thiazinyl, 1,3-thiazinyl, 1,4-thiazinyl, 1,3-thiazolyl, thiazolyl, thiazolidinyl, thiazolinyl, thienyl, thietanyl, thienothiazolyl, thienooxazolyl, thienoimidazolyl, thiomorpholinyl, thiophenolyl, thiophenyl, thiopyranyl, 1,2,3-triazinyl, 1,2,4-triazinyl, 1,3,5-triazinyl, 1,2,3-triazolyl, 1,2,3-triazolyl, 1,2,4-triazolyl, 1,2,5-triazolyl, 1,3,4-triazolyl and xanthenyl.

The heterocyclic rings are unsubstituted or mono-, di- or trisubstituted by suitable groups such as, for example: F, Cl, Br, I, CF3, NO2, CN, COOH, CO-O-(C0-C4) alkylene-(C6-C10) aryl, CO-O-(C1-C4) alkyl, CO-O-(C0-C4) alkylene-(C3-C13)cycloalkyl, CO-O-(C0-C4) alkylene-(C3-C15)heterocycle, CO-N((C0-C4) alkylene-H)-(C1-C6)alkylene-H, CO-N((C0-C4) alkylene-H)-(C1-C6)cycloalkyl, CON((C0-C4)

alkylene-H)-(C0-C4)alkylene-(C6-C12)-aryl, (C0-C4) alkylene-(C3-C6)cycloalkyl, (C3-C6)alkyl, (C2-C6)-alkenyl, (C2-C6)-alkinyl, (C0-C4) alkylene-(C6-C10)aryl, (C0-C4) alkylene-(C3-C15)heterocycle, O-(C0-C6)-alkyl, (C0-C4) alkylene-O-(C0-C4) alkyl, (C0-C4) alkylene-O-(C0-C4) alkylene-(C3-C13)cycloalkyl, (C0-C4) alkylene-O-(C0-C4) alkylene-(C6-C10)aryl, (C0-C4) alkylene-O-(C0-C4) alkylene-(C3-C15)heterocycle, O-CO-O-(C0-C4) alkylene-(C6-C10) aryl, O-CO-O-(C1-C4) alkyl, O-CO-O-(C0-C4) alkylene-(C3-C13)cycloalkyl, O-CO-O-(C0-C4) alkylene-(C3-C15)heterocycle, O-CO-N((C0-C4) alkylene-H)-(C0-C4) alkylene- (C6-C10) aryl, O-CO-N((C0-C4) alkylene-H)-(C0-C4) alkylene-H, O-CO-N((C0-C4) alkylene-H)-(C0-C4) alkylene- (C3-C13)cycloalkyl, O-CO-N((C0-C4) alkylene-H)-(C0-C4) alkylene- (C3-C15) heterocycle,S-(C1-C4)alkyl, S-(C0-C4) alkylene-(C3-C13)cycloalkyl, S-(C0-C4) alkylene-(C6-C10) aryl, S-(C0-C4) alkylene-(C3-C15) heterocycle, SO-(C1-C4)alkyl, SO-(C0-C4) alkylene-(C3-C13)cycloalkyl, SO-(C0-C4) alkylene-(C6-C10) aryl, SO-(C0-C4) alkylene-(C3-C15) heterocycle, SO2-(C1-C4)alkyl, SO2-(C0-C4) alkylene-(C3-C13)cycloalkyl, SO2-(C0-C4) alkylene-(C6-C10) aryl, SO2-(C0-C4) alkylene-(C3-C15) heterocycle, SO2-N((C0-C4)alkylene-H)-(C0-C4)alkylene-(C6-C10)aryl, SO2-N((C0-C4)alkylene-H)-(C0-C4)alkylene-H, SO2-N((C0-C4) alkylene-H)-(C0-C4)alkylene-(C3-C13)cycloalkyl, SO2-N((C0-C4)alkylene-H)-(C0-C4)alkylene-(C3-C15)heterocycle, where the aryl ring or heterocyclic ring is unsubstituted or mono- or disubstituted by F, Cl, Br, OH, CF3, NO2, CN, OCF3, O-(C1-C6)-alkyl, (C1-C6)-alkyl, N((C0-C4)-alkylene-H)-(C0-C4)-alkylene-H,;

N((C0-C4)-alkylene-H)-(C0-C4)-alkylene-H, N((C0-C4) alkylene-H)-(C0-C4)alkylene-H)-(C1-C6)cycloalkyl, N((C0-C4)alkylene-H)-(C0-C4)alkylene-(C6-C12)-aryl, N((C0-C4)alkylene-H)-(C0-C4)alkylene-(C3-C15)heterocycle, N((C0-C4) alkylene-H)-CO-(C0-C4)alkylene-(C6-C12)-aryl, N((C0-C4)alkylene-H)-CO-(C0-C4)alkyl, N((C0-C4)alkylene-H)-CO-(C0-C4)alkylene-(C3-C13)cycloalkyl, N((C0-C4)alkylene-H)-CO-(C0-C4)alkylene-(C3-C15)heterocycle, N((C0-C4) alkylene-H)-CO-O-(C0-C4)alkylene-(C6-C12)-aryl, N((C0-C4)alkylene-H)-CO-O-(C0-C4)alkyl, N((C0-C4)alkylene-H)-CO-O-(C0-C4)alkylene-(C3-C13)cycloalkyl, N((C0-C4)alkylene-H)-CO-O-(C0-C4)alkylene-(C3-C15)heterocycle, N((C0-C4) alkylene-H)-CO-N((C0-C4)-alkylene-H)-(C0-C4)alkylene-(C6-C12)-aryl, N((C0-C4)alkylene-H)-CO-N((C0-C4)-alkylene-H)-(C0-C4)alkyl, N((C0-C4)alkylene-H)-CO-N((C0-C4)-alkylene-H)-(C0-C4)alkylene-(C3-

C13)cycloalkyl, N((C0-C4)alkylene-H)-CO-N((C0-C4)-alkylene-H)-(C0-C4)alkylene-(C3-C15)heterocycle, where the aryl or heterocyclic ring is unsubstituted or mono- or disubstituted by F, Cl, Br, I, OH, CF3, NO2, CN, OCF3, O-(C1-C6)-alkyl, (C1-C6)-alkyl, N((C0-C4)-alkylene-H)-(C0-C4)-alkylene-H,SO2-CH3, COOH, COO-(C1-C6)-alkyl, SF5, CONH2.

Halogen is fluorine, chlorine, bromine or iodine.

Optically active carbon atoms present in the compounds of the formula I can independently of each other have R configuration or S configuration. The compounds of the formula I can be present in the form of pure enantiomers or pure diastereomers or in the form of mixtures of enantiomers and/or diastereomers, for example in the form of racemates. The present invention relates to pure enantiomers and mixtures of enantiomers as well as to pure diastereomers and mixtures of diastereomers. The invention comprises mixtures of two or of more than two stereoisomers of the formula I and it comprises all ratios of the stereoisomers in the mixtures. In case the compounds of the formula I can be present as E isomers or Z isomers (or cis isomers or trans isomers) the invention relates both to pure E isomers and pure Z isomers and to E/Z mixtures in all ratios. The invention also comprises all tautomeric forms of the compounds of the formula I.

Diastereomers, including E/Z isomers, can be separated into the individual isomers, for example, by chromatography. Racemates can be separated into the two enantiomers by customary methods, for example by chromatography on chiral phases or by resolution, for example by crystallization of diastereomeric salts obtained with optically active acids or bases. Stereochemically uniform compounds of the formula I can also be obtained by employing stereochemically uniform starting materials or by using stereoselective reactions.

The compounds of the formula I may exist in the form of their racemates, racemic mixtures, pure enantiomers, diastereomers and mixtures of diastereomers as well in their tautomeric forms. The present invention encompasses all these isomeric and

tautomeric forms of the compounds of the formula I. These isomeric forms can be obtained by known methods even if not specifically described in some cases.

Pharmaceutically acceptable salts are, because their solubility in water is greater than that of the initial or basic compounds, particularly suitable for medical applications. These salts must have a pharmaceutically acceptable anion or cation. Suitable pharmaceutically acceptable acid addition salts of the compounds of the invention are salts of inorganic acids such as hydrochloric acid, hydrobromic, phosphoric, metaphosphoric, nitric and sulfuric acid, and of organic acids such as, for example, acetic acid, benzenesulfonic, benzoic, citric, ethanesulfonic, fumaric, gluconic, glycolic, isethionic, lactic, lactobionic, maleic, malic, methanesulfonic, succinic, p-toluenesulfonic and tartaric acid. Suitable pharmaceutically acceptable basic salts are ammonium salts, alkali metal salts (such as sodium and potassium salts), alkaline earth metal salts (such as magnesium and calcium salts), and salts of trometamol (2-amino-2-hydroxymethyl-1,3-propanediol), diethanolamine, lysine or ethylenediamine.

Salts with a pharmaceutically unacceptable anion such as, for example, trifluoroacetate likewise belong within the framework of the invention as useful intermediates for the preparation or purification of pharmaceutically acceptable salts and/or for use in nontherapeutic, for example in vitro, applications.

The term "physiologically functional derivative" used herein refers to any physiologically tolerated derivative of a compound of the formula I of the invention, for example an ester, which on administration to a mammal such as, for example, a human is able to form (directly or indirectly) a compound of the formula I or an active metabolite thereof.

Physiologically functional derivatives also include prodrugs of the compounds of the invention, as described, for example, in H. Okada et al., Chem. Pharm. Bull. 1994, 42, 57-61. Such prodrugs can be metabolized in vivo to a compound of the invention. These prodrugs may themselves be active or not.

The compounds of the invention may also exist in various polymorphous forms, for example as amorphous and crystalline polymorphous forms. All polymorphous forms of the compounds of the invention belong within the framework of the invention and are a further aspect of the invention.

All references to "compound(s) of formula I" hereinafter refer to compound(s) of the formula I as described above, and their salts, solvates and physiologically functional derivatives as described herein.

Use

This invention relates further to the use of compounds of the formula I and their pharmaceutical compositions as PPAR ligands. The PPAR ligands of the invention are suitable as modulators of PPAR activity.

Peroxisome proliferator-activated receptors (PPAR) are transcription factors which can be activated by ligands and belong to the class of nuclear hormone receptors. There are three PPAR isoforms, PPARalpha, PPARgamma and PPARdelta (identical to PPARbeta), which are encoded by different genes (Peroxisome proliferator-activated receptor (PPAR): structure, mechanisms of activation and diverse functions: Motojima K., Cell Struct Funct., 1993, 18(5), 267-77).

In humans, PPARgamma exists in three variants, PPARgamma$_1$, gamma$_2$, and gamma$_3$, which are the result of alternative use of promoters and differential mRNA splicing. Different PPARs have different tissue distribution and modulate different physiological functions. The PPARs play a key role in various aspects of the regulation of a large number of genes, the products of which genes are directly or indirectly crucially involved in lipid and carbohydrate metabolism. Thus, for example, the PPARalpha receptor plays an important part in the regulation of fatty acid catabolism or lipoprotein metabolism in the liver, while PPARgamma is crucially involved for example in regulating adipose cell differentiation. In addition, however, PPARs are also involved in the regulation of many other physiological processes, including those which

are not directly connected with carbohydrate or lipid metabolism. The activity of different PPARs can be modulated by various fatty acids, fatty acid derivatives and synthetic compounds to varying extents. For relevant reviews about functions, physiological effects and pathophysiology, see: Berger, J. et al., Annu. Rev. Med., 2002, 53, 409-435; Wilson, T. et al., J. Med. Chem., 2000, 43 (4), 527-550; Kliewer, S. et al., Recent Prog Horm Res., 2001, 56, 239-63; Moller, D.E. and Berger, J.P., Int J Obes Relat Metab Disord., 2003, 27 Suppl 3, 17-21; Ram, V.J., Drugs Today, 2003, 39(8),609-32).

Among the three PPAR-isoforms the physiological functions of PPARdelta have long remained an enigma. The first proposed pharmacological role for PPARdelta has been the regulation of cholesterol homeostasis. It was shown that the somewhat selective PPARdelta ligand L-165041 raises plasma cholesterol in a diabetic animal model (Berger J. et al., J. Biol. Chem., 1999, 274, 6718-6725; Leibowitz M.D. et al., FEBS Lett., 2000, 473(3), 333-336). In obese, insulin resistant rhesus monkeys, the potent and selective PPARdelta ligand GW501516 raises HDL-cholesterol, decreases plasma LDL-cholesterol, triglycerides and insulin levels (Oliver, W. et al., Proc. Natl. Acad. Sci., 2001, 98, 5306-5311). The dual PPARdelta/PPARalpha agonist YM-16638 significantly lowers plasma lipids in rhesus and cynomolgus monkeys (Goto, S. et al., Br. J. Pharm., 1996, 118, 174-178) and acts in a similar manner in two weeks clinical trials in healthy volunteers (Shimokawa, T. et al., Drug Dev. Res., 1996, 38, 86-92). More recent publications underline that PPARdelta is an important target for the treatment of dyslipidemia, insulin resistance, type 2 diabetes, atherosclerosis and syndrom X (Wang,Y-X. et al., Cell, 2003, 113, 159-170; Luquet, S. et al., FASEB J., 2003, 17, 209-226 ; Tanaka, T. et al., PNAS, 2003, 100, 15924-15929 ; Holst, D. et al., BioChem. Biophys. Acta, 2003, 1633, 43-50; Dressel, U. et al., Mol. Endocrin., 2003, 17, 2477-2493 ; Lee, C.H. et al., Science, 2003, 302, 453-457).
Besides its actions as a regulator of the lipid-, glucose- and cholesterol-metabolism PPARdelta is known to play a role in embryonic development, implantation and bone formation (Lim, H. and Dey, S.K., Trends Endocrinol Metab., 2000, 11(4),137-42; Ding, N.Z. et al., Mol Reprod Dev., 2003, 66(3), 218-24; Mano, H. et al., J Biol Chem., 2000, 275(11), 8126-32).

Numerous publications demonstrate that PPARdelta is triggering proliferation and differentiation of keratinocytes which points to its role in skin disorders and wound healing (Di-Poi, N. et al., J Steroid Biochem Mol Biol., 2003, 85(2-5), 257-65; Tan, N.S. et al., Am J Clin Dermatol., 2003,4(8), 523-30; Wahli, W., Swiss Med Wkly., 2002, 132(7-8),83-91).

PPARdelta appears to be significantly expressed in the CNS; however much of its function there still remains undiscovered. Of singular interest however, is the discovery that PPARdelta was expressed in rodent oligodendrocytes, the major lipid producing cells of the CNS (J. Granneman, et al., J. Neurosci. Res., 1998, 51, 563-573). Moreover, it was also found that a PPARdelta selective agonist was found to significantly increase oligodendroglial myelin gene expression and myelin sheath diameter in mouse cultures (I. Saluja et al., Glia, 2001, 33, 194-204). Thus, PPARdelta activators may be of use for the treatment of demyelinating and dysmyelinating diseases. The use of peroxisome proliferator activated receptor delta agonists for the treatment of MS and other demyelinating diseases can be shown as described in WO2005/097098.

Demyelinating conditions are manifested in loss of myelin - the multiple dense layers of lipids and protein which cover many nerve fibers. These layers are provided by oligodendroglia in the central nervous system (CNS), and Schwann cells in the peripheral nervous system (PNS). In patients with demyelinating conditions, demyelination may be irreversible; it is usually accompanied or followed by axonal degeneration, and often by cellular degeneration. Demyelination can occur as a result of neuronal damage or damage to the myelin itself - whether due to aberrant immune responses, local injury, ischemia, metabolic disorders, toxic agents, or viral infections (Prineas and McDonald, Demyelinating Diseases. In Greenfield's Neuropathology, 6.sup.th ed. (Edward Arnold: New York, 1997) 813-811, Beers and Berkow, eds., The Merck Manual of Diagnosis and Therapy, 17.sup.th ed. (Whitehouse Station, N.J.: Merck Research Laboratories, 1999) 1299, 1437, 1473-76, 1483).

Central demyelination (demyelination of the CNS) occurs in several conditions, often of uncertain etiology, that have come to be known as the primary demyelinating diseases. Of these, multiple sclerosis (MS) is the most prevalent. Other primary demyelinating

diseases include adrenoleukodystrophy (ALD), adrenomyeloneuropathy, AIDS-vacuolar myelopathy, HTLV-associated myelopathy, Leber's hereditary optic atrophy, progressive multifocal leukoencephalopathy (PML), subacute sclerosing panencephalitis, Guillian-Barre syndrome and tropical spastic paraparesis. In addition, there are acute conditions in which demyelination can occur in the CNS, e.g., acute disseminated encephalomyelitis (ADEM) and acute viral encephalitis. Furthermore, acute transverse myelitis, a syndrome in which an acute spinal cord transection of unknown cause affects both gray and white matter in one or more adjacent thoracic segments, can also result in demyelination. Also, disorders in which myelin forming glial cells are damaged including spinal cord injuries, neuropathies and nerve injury.

The present invention relates to compounds of the formula I suitable for modulating the activity of PPARs, especially the activity of PPARdelta and PPARalpha. Depending on the modulation profile, the compounds of the formula I are suitable for the treatment, control and prophylaxis of the indications described hereinafter, and for a number of other pharmaceutical applications connected thereto (see, for example, Berger, J., et al., Annu. Rev. Med., 2002, 53, 409-435; Wilson, T. et al., J. Med. Chem., 2000, 43(4), 527-550; Kliewer, S. et al., Recent Prog Horm Res., 2001, 56, 239-63; Fruchart, J.C. et al., 2001, Pharmacological Research, 44(5), 345-52; Kersten, S. et al., Nature, 2000, 405, 421-424; Torra, I.P. et al., Curr Opin Lipidol, 2001,12, 245-254).

Compounds of this type are particularly suitable for the treatment and/or prevention of:

1. - Disorders of fatty acid metabolism and glucose utilization disorders.
   - Disorders in which insulin resistance is involved

2. Diabetes mellitus, especially type 2 diabetes, including the prevention of the sequelae associated therewith.
   Particular aspects in this connection are
   - hyperglycemia,
   - improvement in insulin resistance,
   - improvement in glucose tolerance,
   - protection of the pancreatic ß cells

- prevention of macro- and microvascular disorders

3. Dyslipidemias and their sequelae such as, for example, atherosclerosis, coronary heart disease, cerebrovascular disorders etc, especially those (but not restricted thereto) which are characterized by one or more of the following factors:
   - high plasma triglyceride concentrations, high postprandial plasma triglyceride concentrations,
   - low HDL cholesterol concentrations
   - low ApoA lipoprotein concentrations
   - high LDL cholesterol concentrations
   - small dense LDL cholesterol particles
   - high ApoB lipoprotein concentrations

4. Various other conditions which may be associated with the metabolic syndrome, such as:
   - obesity (excess weight), including central obesity
   - thromboses, hypercoagulable and prothrombotic states (arterial and venous)
   - high blood pressure
   - heart failure such as, for example (but not restricted thereto), following myocardial infarction, hypertensive heart disease or cardiomyopathy

5. Disorders or conditions in which inflammatory reactions are involved:
   - atherosclerosis such as, for example (but not restricted thereto), coronary sclerosis including angina pectoris or myocardial infarction, stroke
   - vascular restenosis or reocclusion
   - chronic inflammatory bowel diseases such as, for example, Crohn's disease and ulcerative colitis
   - asthma
   - lupus erythematosus (LE) or inflammatory rheumatic disorders such as, for example, rheumatoid arthritis
   - other inflammatory states

6. Disorders of cell cycle or cell differentiation processes:
   - adipose cell tumors
   - lipomatous carcinomas such as, for example, liposarcomas
   - solid tumors and neoplasms such as, for example (but not restricted thereto), carcinomas of the gastrointestinal tract, of the liver, of the biliary tract and of the pancreas, endocrine tumors, carcinomas of the lungs, of the kidneys and the urinary tract, of the genital tract, prostate carcinomas etc
   - acute and chronic myeloproliferative disorders and lymphomas
   - angiogenesis

7. Demyelinating and other neurodegenerative disorders of the central and peripheral nervous systems including:
   - Alzheimer's disease
   - multiple sclerosis
   - Parkinson's disease
   - adrenoleukodystrophy (ALD)
   - adrenomyeloneuropathy
   - AIDS-vacuolar myelopathy
   - HTLV-associated myelopathy
   - Leber's hereditary optic atrophy
   - progressive multifocal leukoencephalopathy (PML)
   - subacute sclerosing panencephalitis
   - Guillian-Barre syndrome
   - tropical spastic paraparesis
   - acute disseminated encephalomyelitis (ADEM)
   - acute viral encephalitis
   - acute transverse myelitis
   - spinal cord and brain trauma
   - Charcot-Marie-Tooth disease

8. Skin disorders and/or disorders of wound healing processes:
   - erythemato-squamous dermatoses such as, for example, psoriasis

- acne vulgaris
- other skin disorders and dermatological conditions which are modulated by PPAR
- eczemas and neurodermitis
- dermatitis such as, for example, seborrheic dermatitis or photodermatitis
- keratitis and keratoses such as, for example, seborrheic keratoses, senile keratoses, actinic keratosis, photo-induced keratoses or keratosis follicularis
- keloids and keloid prophylaxis
- warts, including condylomata or condylomata acuminata
- human papilloma viral (HPV) infections such as, for example, venereal papillomata, viral warts such as, for example, molluscum contagiosum, leukoplakia
- papular dermatoses such as, for example, Lichen planus
- skin cancer such as, for example, basal-cell carcinomas, melanomas or cutaneous T-cell lymphomas
- localized benign epidermal tumors such as, for example, keratoderma, epidermal naevi
- chilblains
- wound healing

9. Other disorders

- high blood pressure
- pancreatitis
- syndrome X
- polycystic ovary syndrome (PCOS)
- asthma
- osteoarthritis
- lupus erythematosus (LE) or inflammatory rheumatic disorders such as, for example, rheumatoid arthritis
- vasculitis
- wasting (cachexia)
- gout

- ischemia/reperfusion syndrome
- acute respiratory distress syndrome (ARDS)

Formulations

The amount of a compound of formula I necessary to achieve the desired biological effect depends on a number of factors, for example the specific compound chosen, the intended use, the mode of administration and the clinical condition of the patient. The daily dose is generally in the range from 0.001 mg to 100 mg (typically from 0.01 mg to 50 mg) per day and per kilogram of bodyweight, for example 0.1-10 mg/kg/day. An intravenous dose may be, for example, in the range from 0.001 mg to 1.0 mg/kg, which can suitably be administered as infusion of 10 ng to 100 ng per kilogram and per minute. Suitable infusion solutions for these purposes may contain, for example, from 0.1 ng to 10 mg, typically from 1 ng to 10 mg, per milliliter. Single doses may contain, for example, from 1 mg to 10 g of the active ingredient. Thus, ampules for injections may contain, for example, from 1 mg to 100 mg, and single-dose formulations which can be administered orally, such as, for example, capsules or tablets, may contain, for example, from 0.05 to 1000 mg, typically from 0.5 to 600 mg. For the therapy of the abovementioned conditions, the compounds of formula I may be used as the compound itself, but they are preferably in the form of a pharmaceutical composition with an acceptable carrier. The carrier must, of course, be acceptable in the sense that it is compatible with the other ingredients of the composition and is not harmful for the patient's health. The carrier may be a solid or a liquid or both and is preferably formulated with the compound as a single dose, for example as a tablet, which may contain from 0.05% to 95% by weight of the active ingredient. Other pharmaceutically active substances may likewise be present, including other compounds of formula I. The pharmaceutical compositions of the invention can be produced by one of the known pharmaceutical methods, which essentially consist of mixing the ingredients with pharmacologically acceptable carriers and/or excipients.

Pharmaceutical compositions of the invention are those suitable for oral, rectal, topical, peroral (for example sublingual) and parenteral (for example subcutaneous,

intramuscular, intradermal or intravenous) administration, although the most suitable mode of administration depends in each individual case on the nature and severity of the condition to be treated and on the nature of the compound of formula I used in each case. Coated formulations and coated slow-release formulations also belong within the framework of the invention. Preference is given to acid- and gastric juice-resistant formulations. Suitable coatings resistant to gastric juice comprise cellulose acetate phthalate, polyvinyl acetate phthalate, hydroxypropylmethylcellulose phthalate and anionic polymers of methacrylic acid and methyl methacrylate.

Suitable pharmaceutical preparations for oral administration may be in the form of separate units such as, for example, capsules, cachets, suckable tablets or tablets, each of which contain a defined amount of the compound of formula I; as powders or granules, as solution or suspension in an aqueous or nonaqueous liquid; or as an oil-in-water or water-in-oil emulsion. These compositions may, as already mentioned, be prepared by any suitable pharmaceutical method which includes a step in which the active ingredient and the carrier (which may consist of one or more additional ingredients) are brought into contact. The compositions are generally produced by uniform and homogeneous mixing of the active ingredient with a liquid and/or finely divided solid carrier, after which the product is shaped if necessary. Thus, for example, a tablet can be produced by compressing or molding a powder or granules of the compound, where appropriate with one or more additional ingredients. Compressed tablets can be produced by tableting the compound in free-flowing form such as, for example, a powder or granules, where appropriate mixed with a binder, glidant, inert diluent and/or one (or more) surface-active/dispersing agent(s) in a suitable machine. Molded tablets can be produced by molding the compound, which is in powder form and is moistened with an inert liquid diluent, in a suitable machine.

Pharmaceutical compositions which are suitable for peroral (sublingual) administration comprise suckable tablets which contain a compound of formula I with a flavoring, normally sucrose and gum arabic or tragacanth, and pastilles which comprise the compound in an inert base such as gelatin and glycerol or sucrose and gum arabic.

Pharmaceutical compositions suitable for parenteral administration comprise preferably sterile aqueous preparations of a compound of formula I, which are preferably isotonic with the blood of the intended recipient. These preparations are preferably administered intravenously, although administration may also take place by subcutaneous, intramuscular or intradermal injection. These preparations can preferably be produced by mixing the compound with water and making the resulting solution sterile and isotonic with blood. Injectable compositions of the invention generally contain from 0.1 to 5% by weight of the active compound.

Pharmaceutical compositions suitable for rectal administration are preferably in the form of single-dose suppositories. These can be produced by mixing a compound of the formula I with one or more conventional solid carriers, for example cocoa butter, and shaping the resulting mixture.

Pharmaceutical compositions suitable for topical use on the skin are preferably in the form of ointment, cream, lotion, paste, spray, aerosol or oil. Carriers which can be used are petrolatum, lanolin, polyethylene glycols, alcohols and combinations of two or more of these substances. The active ingredient is generally present in a concentration of from 0.1 to 15% by weight of the composition, for example from 0.5 to 2%.

Transdermal administration is also possible. Pharmaceutical compositions suitable for transdermal uses can be in the form of single plasters which are suitable for long-term close contact with the patient's epidermis. Such plasters suitably contain the active ingredient in an aqueous solution which is buffered where appropriate, dissolved and/or dispersed in an adhesive or dispersed in a polymer. A suitable active ingredient concentration is about 1% to 35%, preferably about 3% to 15%. A particular possibility is for the active ingredient to be released by electrotransport or iontophoresis as described, for example, in Pharmaceutical Research, 2(6): 318 (1986).

The compounds of the formula I are distinguished by favorable effects on metabolic disorders. They beneficially influence lipid and sugar metabolism, in particular they lower the triglyceride level and are suitable for the prevention and treatment of type II

diabetes and atheriosclerosis and the diverse sequalae thereof.

Combinations with other medicaments

The compounds of the invention can be administered alone or in combination with one or more further pharmacologically active substances. In particular, the compounds of the invention can be administered in combination with active ingredients having a similar pharmacological action. For example, they can be administered in combination with active ingredients which have favorable effects on metabolic disturbances or disorders frequently associated therewith. Examples of such medicaments are

1. medicaments which lower blood glucose, antidiabetics,
2. active ingredients for the treatment of dyslipidemias,
3. antiatherosclerotic medicaments,
4. antiobesity agents,
5. antiinflammatory active ingredients
6. active ingredients for the treatment of malignant tumors
7. antithrombotic active ingredients
8. active ingredients for the treatment of high blood pressure
9. active ingredients for the treatment of heart failure and
10. active ingredients for the treatment and/or prevention of complications caused by diabetes or associated with diabetes.
11. active ingredients for the treatment of neurodegenerative diseases
12. active ingredients for the treatment of disorders of the central nervous system
13. active ingredients for the treatment of drug, nicotine and alcohol addiction
14. analgesics

They can be combined with the compounds of the invention of the formula I in particular for a synergistic enhancement of activity. Administration of the active ingredient combination can take place either by separate administration of the active ingredients to the patient or in the form of combination products in which a plurality of active ingredients are present in one pharmaceutical preparation.

Further active ingredients suitable for combination products are:
All antidiabetics which are mentioned in the Rote Liste 2005, chapter 12; all weight-reducing agents/appetite suppressants which are mentioned in the Rote Liste 2005, chapter 1; all lipid-lowering agents which are mentioned in the Rote Liste 2005, chapter 58. They may be combined with the compound of the invention of the formula I in particular for a synergistic improvement in the effect. The active ingredient combination can be administered either by separate administration of the active ingredients to the patient or in the form of combination products in which a plurality of active ingredients is present in a pharmaceutical preparation. Most of the active ingredients mentioned hereinafter are disclosed in the USP Dictionary of USAN and International Drug Names, US Pharmacopeia, Rockville 2001.

Antidiabetics include insulin and insulin derivatives such as, for example, Lantus® (see www.lantus.com) or HMR 1964 or Levemir® (insulin detemir) or those described in WO2005005477 (Novo Nordisk), fast-acting insulins (see US 6,221,633), inhalable insulins such as, for example, Exubera ® or oral insulins such as, for example, IN-105 (Nobex) or Oral-lyn™ (Generex Biotechnology), GLP-1 derivatives and GLP-1 agonists such as, for example, exenatide, liraglutide or those which have been disclosed in WO98/08871, WO2005027978, WO2006037811 or WO2006037810 of Novo Nordisk A/S, in WO01/04156 of Zealand or in WO00/34331 of Beaufour-Ipsen, pramlintide acetate (Symlin; Amylin Pharmaceuticals), BIM-51077, PC-DAC-exendin-4 (an exendin-4 analog covalently bonded to recombinant human albumin), agonists like those described for example in D. Chen et al., Proc. Natl. Acad. Sci. USA 104 (2007) 943, those as are described in WO2006124529, and orally effective hypoglycemic active ingredients.

Antidiabetics also include agonists of the glucose-dependent insulinotropic polypeptide (GIP) receptor as are described for example in WO2006121860.

The orally effective hypoglycemic active ingredients include preferably
sulfonylureas,
biguanidines,

meglitinides,
oxadiazolidinediones,
thiazolidinediones,
glucosidase inhibitors,
inhibitors of glycogen phosphorylase,
glucagon antagonists,
glucokinase activators,
inhibitors of fructose-1,6-bisphosphatase,
modulators of glucose transporter 4 (GLUT4),
inhibitors of glutamine-fructose-6-phosphate amidotransferase (GFAT),
GLP-1 agonists,
potassium channel openers such as, for example, pinacidil, cromakalim, diazoxide or those described in R.D. Carr et al., Diabetes **52**, *2003*, 2513.2518, in J. B. Hansen et al., Current Medicinal Chemistry **11**, *2004*, 1595-1615, in T.M. Tagmose et al., J. Med. Chem. **47**, *2004*, 3202-3211 or in M. J. Coghlan et al., J. Med. Chem. **44**, *2001*, 1627-1653, or those which have been disclosed in WO 97/26265 and WO 99/03861 of Novo Nordisk A/S,
inhibitors of dipeptidylpeptidase IV (DPP-IV),
insulin sensitizers,
inhibitors of liver enzymes involved in stimulating gluconeogenesis and/or glycogenolysis,
modulators of glucose uptake, of glucose transport and of glucose reabsorption,
inhibitors of 11ß-HSD1,
inhibitors of protein tyrosine phosphatase 1B (PTP1B),
modulators of the sodium-dependent glucose transporter 1 or 2 (SGLT1, SGLT2),
compounds which alter lipid metabolism such as antihyperlipidemic active ingredients and antilipidemic active ingredients,
compounds which reduce food intake,
compounds which increase thermogenesis,
PPAR and RXR modulators and
active ingredients which act on the ATP-dependent potassium channel of the beta cells.

In one embodiment of the invention, the compounds of the formula I is administered in combination with an HMGCoA reductase inhibitor such as simvastatin, fluvastatin, pravastatin, lovastatin, atorvastatin, cerivastatin, rosuvastatin or L-659699.

In one embodiment of the invention, the compound of the formula I is administered in combination with a cholesterol absorption inhibitor such as, for example, ezetimibe, tiqueside, pamaqueside, FM-VP4 (sitostanol/campesterol ascorbyl phosphate; Forbes Medi-Tech, WO2005042692, WO2005005453), MD-0727 (Microbia Inc., WO2005021497, WO2005021495) or with compounds as described in WO2002066464, WO2005000353 (Kotobuki Pharmaceutical Co. Ltd.), or WO2005044256 or WO2005062824 (Merck & Co.) or WO2005061451 and WO2005061452 (AstraZeneca AB), and WO2006017257 (Phenomix) or WO2005033100 (Lipideon Biotechnology AG), or as described in WO2004097655, WO2004000805, WO2004000804, WO2004000803, WO2002050068, WO2002050060, WO2005047248, WO2006086562, WO2006102674, WO2006116499, WO2006121861, WO2006122186, WO2006122216, WO2006127893, WO2006137794, WO2006137796, WO2006137782, WO2006137793, WO2006137797, WO2006137795, WO2006137792, WO2006138163.

In one embodiment of the invention, the compound of the formula I is administered in combination with Vytorin™, a fixed combination of ezetimibe and simvastatin.

In one embodiment of the invention, the compound of the formula I is administered in combination with a fixed combination of ezetimibe with atorvastatin.

In one embodiment of the invention, the compound of the formula I is administered in combination with a fixed combination of ezetimibe with fenofibrate.

In a further embodiment of the invention, the compound of the formula I is administered in combination with a fixed combination of fenofibrate and rosuvastatin.

In one embodiment of the invention, the compound of the formula I is administered in combination with Synordia®, a fixed combination of fenofibrate with metformin.

In one embodiment of the invention, the compound of the formula I is administered in combination with ISIS-301012, an antisense oligonucleotide able to regulate the apolipoprotein B gene.

In one embodiment of the invention, the compound of the formula I is administered in combination with a PPAR gamma agonist such as, for example, rosiglitazone, pioglitazone, JTT-501, GI 262570, R-483, CS-011 (rivoglitazone).

In one embodiment of the invention, the compound of the formula I is administered in combination with Competact™, a fixed combination of pioglitazone hydrochloride with metformin hydrochloride.

In one embodiment of the invention, the compound of the formula I is administered in combination with Tandemact™, a fixed combination of pioglitazone with glimepiride.

In one embodiment of the invention, the compound of the formula I is administered in combination with a fixed combination of pioglitazone hydrochloride with an angiotensin II agonist such as, for example, TAK-536.

In one embodiment of the invention, the compound of the formula I is administered in combination with a PPAR alpha agonist such as, for example, GW9578, GW-590735, K-111, LY-674, KRP-101, DRF-10945, LY-518674 or those as are described in WO2001040207, WO2002096894, WO2005097076.

In one embodiment of the invention, the compound of the formula I is administered in combination with a mixed PPAR alpha/gamma agonist such as, for example, naveglitazar, LY-510929, ONO-5129, E-3030, AVE 8042, AVE 8134, AVE 0847, CKD-501 (lobeglitazone sulfate) or as described in WO 00/64888, WO 00/64876,

WO03/020269 or in J.P. Berger et al., TRENDS in Pharmacological Sciences 28(5), 244-251, 2005.

In one embodiment of the invention, the compound of the formula I is administered in combination with a PPAR delta agonist such as, for example, GW-501516 or as described in WO2006059744, WO2006084176, WO2006029699, WO2007039172-WO2007039178.

In one embodiment, the compound of the formula I is administered in combination with metaglidasen or with MBX-2044 or other partial PPAR gamma agonists/antagonists.

In one embodiment of the invention, the compound of the formula I is administered in combination with a fibrate such as, for example, fenofibrate, clofibrate or bezafibrate.

In one embodiment of the invention, the compound of the formula I is administered in combination with an MTP inhibitor such as, for example, implitapide, BMS-201038, R-103757, AS-1552133 or those described in WO2005085226, WO2005121091, WO2006010423.

In one embodiment of the invention, the compound of the formula I is administered in combination with a CETP inhibitor such as, for example, torcetrapib or JTT-705 or those described in WO2006002342, WO2006010422, WO2006012093, WO2006073973, WO2006072362, WO2006097169, WO2007041494.

In one embodiment of the invention, the compound of the formula I is administered in combination with a bile acid absorption inhibitor (see, for example, US 6,245,744, US 6,221,897 or WO00/61568), such as, for example, HMR 1741 or those as described in DE 10 2005 033099.1 and DE 10 2005 033100.9, WO2007009655-56.

In one embodiment of the invention, the compound of the formula I is administered in combination with a polymeric bile acid adsorbent such as, for example, cholestyramine or colesevelam.

In one embodiment of the invention, the compound of the formula I is administered in combination with an LDL receptor inducer (see US 6,342,512), such as, for example, HMR1171, HMR1586 or those as described in WO2005097738.

In one embodiment of the invention, the compound of the formula I is administered in combination with an ABCA1 expression enhancer as described for example in WO2006072393.

In a further embodiment of the invention, the compound of the formula I is administered in combination with an RNAi therapeutic directed against PCSK9 (proprotein convertase subtilisin/kexin type 9).

In one embodiment, the compound of the formula I is administered in combination with Omacor® (omega-3 fatty acids; highly concentrated ethyl esters of eicosapentaenoic acid and of docosahexaenoic acid).

In one embodiment of the invention, the compound of the formula I is administered in combination with an ACAT inhibitor such as, for example, avasimibe or SMP-797.

In one embodiment of the invention, the compound of the formula I is administered in combination with an antioxidant such as, for example, OPC-14117, probucol, tocopherol, ascorbic acid, β-carotene or selenium.

In one embodiment of the invention, the compound of the formula I is administered in combination with a vitamin such as, for example, vitamin B6 or vitamin B12.

In one embodiment of the invention, the compound of the formula I is administered in combination with a lipoprotein lipase modulator such as, for example, ibrolipim (NO-1886).

In one embodiment of the invention, the compound of the formula I is administered in combination with an ATP citrate lyase inhibitor such as, for example, SB-204990.

In one embodiment of the invention, the compound of the formula I is administered in combination with a squalene synthetase inhibitor such as, for example, BMS-188494, TAK-475 or as described in WO2005077907, JP2007022943.

In one embodiment of the invention, the compound of the formula I is administered in combination with a lipoprotein(a) antagonist such as, for example, gemcabene (CI-1027).

In one embodiment of the invention, the compound of the formula I is administered in combination with an agonist of GPR109A (HM74A receptor agonist; NAR agonist (nicotinic acid receptor agonist) such as, for example, nicotinic acid or extended release niacin in conjunction with MK-0524A or those compounds described in WO2006045565, WO2006045564, WO2006069242, WO2006124490, WO2006113150, WO2007017261, WO2007017262, WO2007017265, WO2007015744, WO2007027532.

In another embodiment of the invention, the compound of the formula I is administered in combination with an agonist of GPR116 as are described for example in WO2006067531, WO2006067532.

In one embodiment of the invention, the compound of the formula I is administered in combination with a lipase inhibitor such as, for example, orlistat or cetilistat (ATL-962).

In one embodiment of the invention, the compound of the formula I is administered in combination with insulin.

In one embodiment, the compound of the formula I is administered in combination with a sulfonylurea such as, for example, tolbutamide, glibenclamide, glipizide, gliclazide or glimepiride.

In one embodiment, the compound of the formula I is administered in combination with a substance which enhances insulin secretion, such as, for example, KCP-265 (WO2003097064) or those described in WO2007026761.

In one embodiment, the compound of the formula I is administered in combination with agonists of the glucose-dependent insulinotropic receptor (GDIR) such as, for example, APD-668.

In one embodiment, the compound of the formula I is administered in combination with a biguanide such as, for example, metformin.

In yet another embodiment, the compound of the formula I is administered in combination with a meglitinide such as, for example, repaglinide, nateglinide or mitiglinide

In a further embodiment, the compound of the formula I is administered with a combination of mitiglinide with a glitazone, e.g. pioglitazone hydrochloride.

In a further embodiment, the compound of the formula I is administered with a combination of mitiglinide with an alpha-glucosidase inhibitor.

In one embodiment, the compound of the formula I is administered in combination with a thiazolidinedione such as, for example, troglitazone, ciglitazone, pioglitazone, rosiglitazone or the compounds disclosed in WO 97/41097 of Dr. Reddy's Research Foundation, in particular 5-[[4-[(3,4-dihydro-3-methyl-4-oxo-2-quinazolinylmethoxy]-phenyl]methyl]-2,4-thiazolidinedione.

In one embodiment, the compound of the formula I is administered in combination with an α-glucosidase inhibitor such as, for example, miglitol or acarbose.

In one embodiment, the compound of the formula I is administered in combination with an active ingredient which acts on the ATP-dependent potassium channel of the beta cells, such as, for example, tolbutamide, glibenclamide, glipizide, glimepiride or

repaglinide.

In one embodiment, the compound of the formula I is administered in combination with more than one of the aforementioned compounds, e.g. in combination with a sulfonylurea and metformin, a sulfonylurea and acarbose, repaglinide and metformin, insulin and a sulfonylurea, insulin and metformin, insulin and troglitazone, insulin and lovastatin, etc.

In one embodiment, the compound of the formula I is administered in combination with an inhibitor of glycogen phosphorylase, such as, for example, PSN-357 or FR-258900 or those as described in WO2003084922, WO2004007455, WO2005073229-31 or WO2005067932.

In one embodiment, the compound of the formula I is administered in combination with glucagon receptor antagonists such as, for example, A-770077, NNC-25-2504 or as described in WO2004100875 or WO2005065680.

In one embodiment, the compound of the formula I is administered in combination with activators of glucokinase, such as, for example, LY-2121260 (WO2004063179), PSN-105, PSN-110, GKA-50 or those as are described for example in WO2004072031, WO2004072066, WO2005080360, WO2005044801, WO2006016194, WO2006058923, WO2006112549, WO2006125972, WO2007017549, WO2007017649, WO2007007910, WO2007007040-42, WO2007006760-61, WO2007006814, WO2007007886, WO2007028135, WO2007031739, WO2007041365, WO2007041366, WO2007037534, WO2007043638, WO2007053345, WO2007051846, WO2007051845, WO2007053765, WO2007051847.

In one embodiment, the compound of the formula I is administered in combination with an inhibitor of gluconeogenesis, such as, for example, FR-225654.

In one embodiment, the compound of the formula I is administered in combination with inhibitors of fructose-1,6-bisphosphatase (FBPase), such as, for example, CS-917

(MB-06322) or MB-07803 or those described in WO2006023515, WO2006104030, WO2007014619.

In one embodiment, the compound of the formula I is administered in combination with modulators of glucose transporter 4 (GLUT4), such as, for example, KST-48 (D.-O. Lee et al.: Arzneim.-Forsch. Drug Res. 54 (12), 835 (2004)).

In one embodiment, the compound of the formula I is administered in combination with inhibitors of glutamine-fructose-6-phosphate amidotransferase (GFAT), as are described for example in WO2004101528.

In one embodiment, the compound of the formula I is administered in combination with inhibitors of dipeptidylpeptidase IV (DPP-IV), such as, for example, vildagliptin (LAF-237), sitagliptin (MK-0431), sitagliptin phosphate, saxagliptin ((BMS-477118), GSK-823093, PSN-9301, SYR-322, SYR-619, TA-6666, TS-021, GRC-8200, GW-825964X, KRP-104, DP-893, ABT-341, ABT-279 or another salt thereof or those compounds as are described in WO2003074500, WO2003106456, WO2004037169, WO200450658, WO2005058901, WO2005012312, WO2005/012308, WO2006039325, WO2006058064, WO2006015691, WO2006015701, WO2006015699, WO2006015700, WO2006018117, WO2006099943, WO2006099941, JP2006160733, WO2006071752, WO2006065826, WO2006078676, WO2006073167, WO2006068163, WO2006090915, WO2006104356, WO2006127530, WO2006111261, WO2007015767, WO2007024993, WO2007029086.

In one embodiment, the compound of the formula I is administered in combination with Janumet™, a fixed combination of sitagliptin phosphate with metformin hydrochloride.

In one embodiment, the compound of the formula I is administered in combination with inhibitors of 11-beta-hydroxysteroid dehydrogenase 1 (11ß-HSD1), such as, for example, BVT-2733, JNJ-25918646, INCB-13739 or those as are described for example in WO200190090-94, WO200343999, WO2004112782, WO200344000, WO200344009, WO2004112779, WO2004113310, WO2004103980, WO2004112784,

WO2003065983, WO2003104207, WO2003104208, WO2004106294, WO2004011410, WO2004033427, WO2004041264, WO2004037251, WO2004056744, WO2004058730, WO2004065351, WO2004089367, WO2004089380, WO2004089470-71, WO2004089896, WO2005016877, WO2005097759, WO2006010546, WO2006012227, WO2006012173, WO2006017542, WO2006034804, WO2006040329, WO2006051662, WO2006048750, WO2006049952, WO2006048331, WO2006050908, WO2006024627, WO2006040329, WO2006066109, WO2006074244, WO2006078006, WO2006106423, WO2006132436, WO2006134481, WO2006134467, WO2006135795, WO2006136502, WO2006138695, WO2006133926, WO2007003521, WO2007007688, US2007066584, WO2007047625, WO2007051811, WO2007051810.

In one embodiment, the compound of the formula I is administered in combination with inhibitors of protein tyrosine phosphatase 1B (PTP1B), as are described for example in WO200119830-31, WO200117516, WO2004506446, WO2005012295, WO2005116003, WO2005116003, WO2006007959, DE 10 2004 060542.4, WO2007009911, WO2007028145, WO2007081755.

In one embodiment, the compound of the formula I is administered in combination with modulators of the sodium-dependent glucose transporter 1 or 2 (SGLT1, SGLT2), such as, for example, KGA-2727, T-1095, SGL-0010, AVE 2268, SAR 7226 and sergliflozin or as described for example in WO2004007517, WO200452903, WO200452902, PCT/EP2005/005959, WO2005085237, JP2004359630, WO2005121161, WO2006018150, WO2006035796, WO2006062224, WO2006058597, WO2006073197, WO2006080577, WO2006087997, WO2006108842, WO2007000445, WO2007014895, WO2007080170 or by A. L. Handlon in Expert Opin. Ther. Patents (2005) 15(11), 1531-1540.

In one embodiment, the compound of the formula I is administered in combination with modulators of GPR40 as are described for example in WO2007013689, WO2007033002.

In one embodiment, the compound of the formula I is administered in combination with modulators of GPR119b as are described for example in WO2004041274.

In one embodiment, the compound of the formula I is administered in combination with modulators of GPR119 as are described for example in WO2005061489 (PSN-632408), WO2004065380, WO2007003960-62 and WO2007003964.

In a further embodiment, the compound of the formula I is administered in combination with modulators of GPR120.

In one embodiment, the compound of the formula I is administered in combination with inhibitors of hormone-sensitive lipase (HSL) and/or phospholipases as described for example in WO2005073199, WO2006074957, WO2006087309, WO2006111321, WO2007042178.

In one embodiment, the compound of the formula I is administered in combination with inhibitors of acetyl-CoA carboxylase (ACC), such as, for example, those as described in WO199946262, WO200372197, WO2003072197, WO2005044814, WO2005108370, JP2006131559, WO2007011809, WO2007011811, WO2007013691.

In a further embodiment, the compound of the formula I is administered in combination with modulators of xanthine oxidoreductase (XOR).

In one embodiment, the compound of the formula I is administered in combination with an inhibitor of phosphoenolpyruvate carboxykinase (PEPCK), such as, for example, those as described in WO2004074288.

In one embodiment, the compound of the formula I is administered in combination with an inhibitor of glycogen synthase kinase 3 beta (GSK-3 beta), as described for example in US2005222220, WO2005085230, WO2005111018, WO2003078403, WO2004022544, WO2003106410, WO2005058908, US2005038023,

WO2005009997, US2005026984, WO2005000836, WO2004106343, EP1460075, WO2004014910, WO2003076442, WO2005087727 or WO2004046117.

In one embodiment, the compound of the formula I is administered in combination with an inhibitor of the serum/glucocorticoid-regulated kinase (SGK) as described for example in WO2006072354.

In one embodiment, the compound of the formula I is administered in combination with an agonist of the RUP3 receptor as described for example in WO2007035355.

In one embodiment, the compound of the formula I is administered in combination with an inhibitor of protein kinase C beta (PKC beta), such as, for example, ruboxistaurin.

In another embodiment, the compound of the formula I is administered in combination with an activator of the gene which codes for the ataxia telangiectasia mutated (ATM) protein kinase, such as, for example, chloroquine.

In one embodiment, the compound of the formula I is administered in combination with an endothelin A receptor antagonist such as, for example, avosentan (SPP-301).

In one embodiment, the compound of the formula I is administered in combination with inhibitors of "I-kappaB kinase" (IKK inhibitors), as are described for example in WO2001000610, WO2001030774, WO2004022553 or WO2005097129.

In one embodiment, the compound of the formula I is administered in combination with modulators of the glucocorticoid receptor (GR), as are described for example in WO2005090336, WO2006071609, WO2006135826.

In a further embodiment, the compound of the formula I is administered in combination with CART modulators (see "Cocaine-amphetamine-regulated transcript influences energy metabolism, anxiety and gastric emptying in mice" Asakawa, A. et al.: Hormone and Metabolic Research (2001), 33(9), 554-558);

NPY antagonists such as, for example, naphthalene-1-sulfonic acid {4-[(4-aminoquinazolin-2-ylamino)methyl]cyclohexylmethyl}amide hydrochloride (CGP 71683A);
NPY-5 receptor antagonists such as L-152804, or as are described for example in WO2006001318;
NPY-4 receptor antagonists as are for example described in WO2007038942;
NPY-2 receptor antagonists as are for example described in WO2007038943;
Peptide YY 3-36 (PYY3-36) or analogous compounds, such as, for example, CJC-1682 (PYY3-36 conjugated with human serum albumin via Cys34), CJC-1643 (derivative of PYY3-36 which conjugates in vivo to serum albumin) or those as are described in WO2005080424, WO2006095166;
derivatives of the peptide obestatin as are described in WO2006096847;
CB1R (cannabinoid receptor 1) antagonists (such as, for example, rimonabant, SR147778, SLV-319, AVE-1625, MK-0364 or salts thereof or those compounds as are described for example in EP 0656354, WO00/15609, WO2001/64632-64634, WO 02/076949, WO2005080345, WO2005080328, WO2005080343, WO2005075450, WO2005080357, WO200170700, WO2003026647-48, WO200302776, WO2003040107, WO2003007887, WO2003027069, US6,509,367, WO200132663, WO2003086288, WO2003087037, WO2004048317, WO2004058145, WO2003084930, WO2003084943, WO2004058744, WO2004013120, WO2004029204, WO2004035566, WO2004058249, WO2004058255, WO2004058727, WO2004069838, US20040214837, US20040214855, US20040214856, WO2004096209, WO2004096763, WO2004096794, WO2005000809, WO2004099157, US20040266845, WO2004110453, WO2004108728, WO2004000817, WO2005000820, US20050009870, WO200500974, WO2004111033-34, WO200411038-39, WO2005016286, WO2005007111, WO2005007628, US20050054679, WO2005027837, WO2005028456, WO2005063761-62, WO2005061509, WO2005077897, WO2006047516, WO2006060461, WO2006067428, WO2006067443, WO2006087480, WO2006087476, WO2006100208, WO2006106054, WO2006111849, WO2006113704, WO2007009705, WO2007017124, WO2007017126, WO2007018459, WO2007016460, WO2007020502,

WO2007026215, WO2007028849, WO2007031720, WO2007031721, WO2007036945, WO2007038045, WO2007039740, US20070015810, WO2007046548, WO2007047737, WO2007084319, WO2007084450);

cannabinoid receptor 1/cannabinoid receptor 2 (CB1/CB2) modulating compounds as described for example in WO2007001939, WO2007044215, WO2007047737;

MC4 agonists (e.g. 1-amino-1,2,3,4-tetrahydronaphthalene-2-carboxylic acid [2-(3a-benzyl-2-methyl-3-oxo-2,3,3a,4,6,7-hexahydropyrazolo[4,3-c]pyridin-5-yl)-1-(4-chlorophenyl)-2-oxoethyl]amide; (WO 01/91752)) or LB53280, LB53279, LB53278 or THIQ, MB243, RY764, CHIR-785, PT-141 or those that are described in WO2005060985, WO2005009950, WO2004087159, WO2004078717, WO2004078716, WO2004024720, US20050124652, WO2005051391, WO2004112793, WOUS20050222014, US20050176728, US20050164914, US20050124636, US20050130988, US20040167201, WO2004005324, WO2004037797, WO2005042516, WO2005040109, WO2005030797, US20040224901, WO200501921, WO200509184, WO2005000339, EP1460069, WO2005047253, WO2005047251, WO2005118573, EP1538159, WO2004072076, WO2004072077, WO2006021655-57, WO2007009894, WO2007015162, WO2007041061, WO2007041052;

orexin receptor antagonists (e.g. 1-(2-methylbenzoxazol-6-yl)-3-[1,5]naphthyridin-4-ylurea hydrochloride (SB-334867-A) or those as are described for example in WO200196302, WO200185693, WO2004085403, WO2005075458 or WO2006067224);

histamine H3 receptor agonists (e.g. 3-cyclohexyl-1-(4,4-dimethyl-1,4,6,7-tetrahydroimidazo[4,5-c]pyridin-5-yl)propan-1-one oxalic acid salt (WO 00/63208) or those as are described in WO200064884, WO2005082893, WO2006107661, WO2007003804, WO2007016496, WO2007020213);

histamine H1/histamine H3 modulators such as for example betahistine and its dihydrochloride;

CRF antagonists (e.g. [2-methyl-9-(2,4,6-trimethylphenyl)-9H-1,3,9-triazafluoren-4-yl]dipropylamine (WO 00/66585));

CRF BP antagonists (e.g. urocortin);

urocortin agonists;

agonists of the beta-3 adrenoceptor such as, for example, 1-(4-chloro-3-methanesulfonylmethylphenyl)-2-[2-(2,3-dimethyl-1H-indol-6-yloxy)ethylamino]ethanol hydrochloride (WO 01/83451); or Solabegron (GW-427353) or N-5984 (KRP-204) or those described in JP2006111553, WO2002038543, WO2007048840-843;

MSH (melanocyte-stimulating hormone) agonists;
MCH (melanin-concentrating hormone) receptor antagonists (such as, for example, NBI-845, A-761, A-665798, A-798, ATC-0175, T-226296, T-71, GW-803430 or compounds such as are described in WO2005085200, WO2005019240, WO2004011438, WO2004012648, WO2003015769, WO2004072025, WO2005070898, WO2005070925, WO2004039780, WO2004092181, WO2003033476, WO2002006245, WO2002089729, WO2002002744, WO2003004027, FR2868780, WO2006010446, WO2006038680, WO2006044293, WO2006044174, JP2006176443, WO2006018280, WO2006018279, WO2006118320, WO2006130075, WO2007018248, WO2007012661, WO2007029847, WO2007024004, WO2007039462, WO2007042660, WO2007042668, WO2007042669, US2007093508, US2007093509, WO2007048802, JP2007091649);

CCK-A agonists (such as, for example, {2-[4-(4-chloro-2,5-dimethoxyphenyl)-5-(2-cyclohexylethyl)thiazol-2-ylcarbamoyl]-5,7-dimethylindol-1-yl}acetic acid trifluoroacetic acid salt (WO 99/15525), SR-146131 (WO 0244150) or SSR-125180 or those as are described in WO2005116034);
serotonin reuptake inhibitors (e.g. dexfenfluramine);
mixed serotonin/dopamine reuptake inhibitors (e.g. bupropion) or fixed combinations of bupropion with naltrexone;
mixed sertoninergic and noradrenergic compounds (e.g. WO 00/71549);
5-HT receptor agonists, e.g. 1-(3-ethylbenzofuran-7-yl)piperazine oxalic acid salt (WO 01/09111);
mixed dopamine/norepinephrine/acetylcholine reuptake inhibitors (e.g. tesofensine);
5-HT2C receptor agonists (such as, for example, lorcaserin hydrochloride (APD-356), BVT-933 or those as are described in WO200077010, WO20077001-02,

WO2005019180, WO2003064423, WO200242304, WO2005035533, WO2005082859, WO2006077025, WO2006103511);
5-HT6 receptor antagonists such as for example E-6837 or BVT-74316 or those as are described for example in WO2005058858, WO2007054257;
bombesin receptor agonists (BRS-3 agonists);
galanin receptor antagonists;
growth hormone (e.g. human growth hormone or AOD-9604);
growth hormone-releasing compounds (tertiary butyl 6-benzyloxy-1-(2-diisopropyl-aminoethylcarbamoyl)-3,4-dihydro-1H-isoquinoline-2-carboxylate (WO 01/85695));
growth hormone secretagogue receptor antagonists (ghrelin antagonists) such as, for example, A-778193 or those as are described in WO2005030734;
TRH agonists (see, for example, EP 0 462 884);
uncoupling protein 2 or 3 modulators;
leptin agonists (see, for example, Lee, Daniel W.; Leinung, Matthew C.; Rozhavskaya-Arena, Marina; Grasso, Patricia. Leptin agonists as a potential approach to the treatment of obesity. Drugs of the Future (2001), 26(9), 873-881);
DA agonists (bromocriptine or Doprexin);
lipase/amylase inhibitors (for example WO 00/40569);
inhibitors of diacylglycerol O-acyltransferases (DGATs) such as, for example, BAY-74-4113 or as described for example in US2004/0224997, WO2004094618, WO200058491, WO2005044250, WO2005072740, JP2005206492, WO2005013907, WO2006004200, WO2006019020, WO2006064189, WO2006082952, WO2006120125, WO2006113919, WO2006134317, WO2007016538;
inhibitors of fatty acid synthase (FAS) such as, for example, C75 or those as described in WO2004005277;
inhibitors of stearoyl-CoA delta9 desaturase (SCD1) as described for example in WO2007009236, WO2007044085, WO2007046867, WO2007046868, WO20070501124;
oxyntomodulin;
oleoyl-estrone
or thyroid hormone receptor agonists or partial agonists such as, for example: KB-2115 or those as described in WO20058279, WO200172692, WO200194293,

WO2003084915, WO2004018421, WO2005092316, WO2007003419, WO2007009913, WO2007039125.

In one embodiment, the further active ingredient is varenicline tartrate, a partial agonist of the alpha 4-beta 2 nicotinic acetylcholine receptor.

In one embodiment, the further active ingredient is trodusquemine.

In one embodiment, the further active ingredient is a modulator of the SIRT1 enzyme.

In one embodiment of the invention, the further active ingredient is leptin; see, for example, "Perspectives in the therapeutic use of leptin", Salvador, Javier; Gomez-Ambrosi, Javier; Fruhbeck, Gema, Expert Opinion on Pharmacotherapy (2001), 2(10), 1615-1622.

In one embodiment, the further active ingredient is dexamphetamine or amphetamine.

In one embodiment, the further active ingredient is fenfluramine or dexfenfluramine.

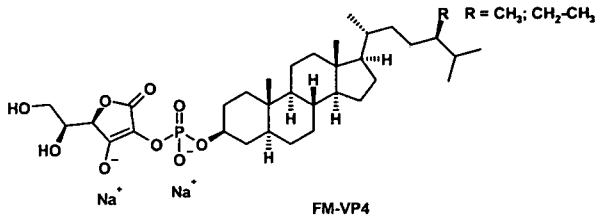
In another embodiment, the further active ingredient is sibutramine.

In one embodiment, the further active ingredient is mazindole or phentermine.

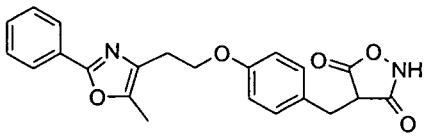
In one embodiment, the compound of the formula I is administered in combination with bulking agents, preferably insoluble bulking agents (see, for example, Carob/Caromax® (Zunft H J; et al., Carob pulp preparation for treatment of hypercholesterolemia, ADVANCES IN THERAPY (2001 Sep-Oct), 18(5), 230-6). Caromax is a carob-containing product from Nutrinova, Nutrition Specialties & Food Ingredients GmbH, Industriepark Höchst, 65926 Frankfurt/Main). Combination with Caromax® is possible in one preparation or by separate administration of compounds of the formula I and Caromax®. Caromax® can in this connection also be

administered in the form of food products such as, for example, in bakery products or muesli bars.

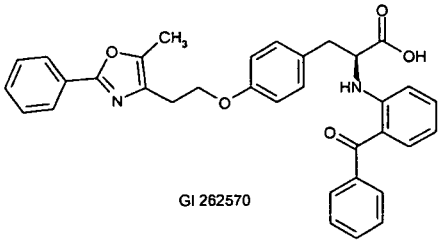
It will be understood that every suitable combination of the compounds of the invention with one or more of the aforementioned compounds and optionally one or more further pharmacologically active substances will be regarded as falling within the protection conferred by the present invention.



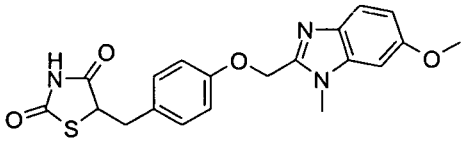
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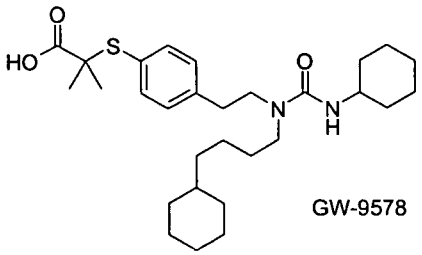
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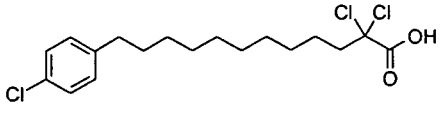
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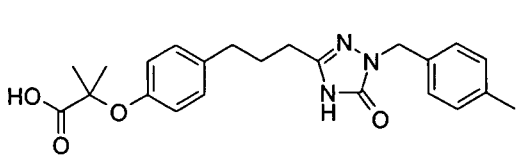
CS-011
Rivoglitazone



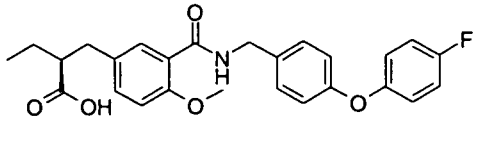
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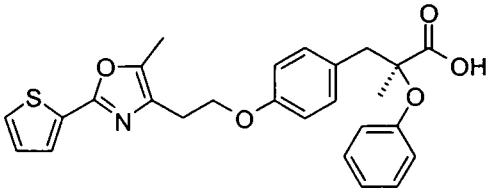
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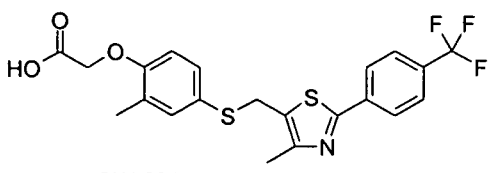
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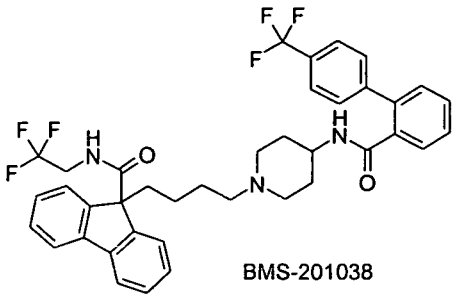
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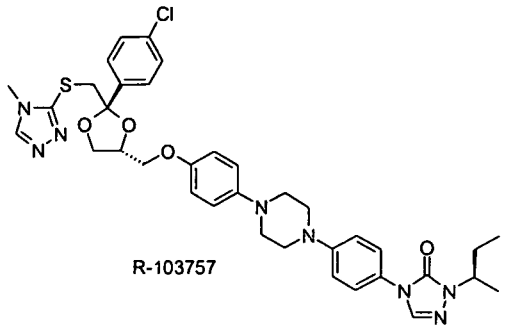
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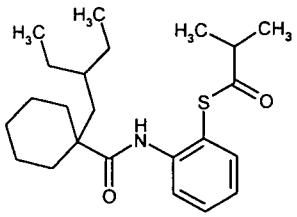
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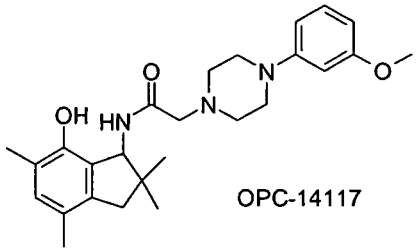
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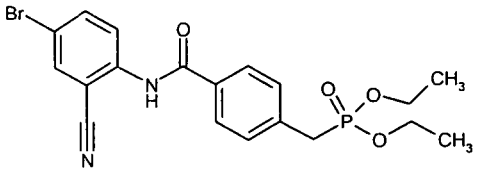
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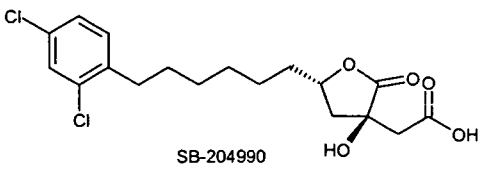
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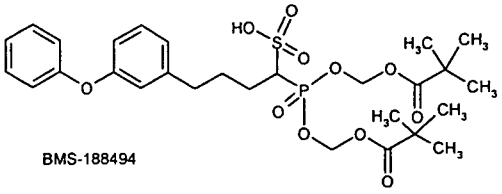
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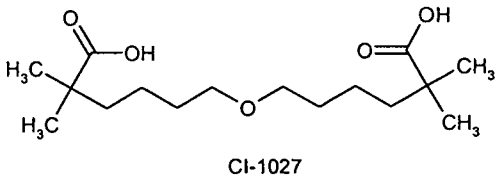
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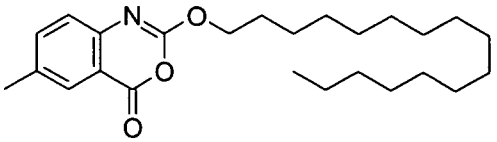
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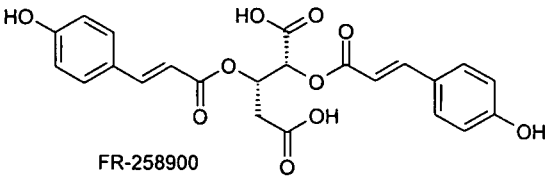
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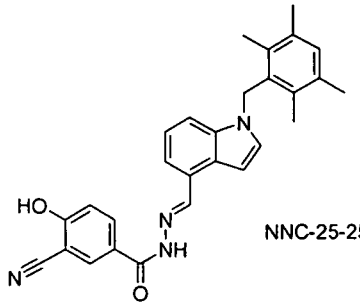
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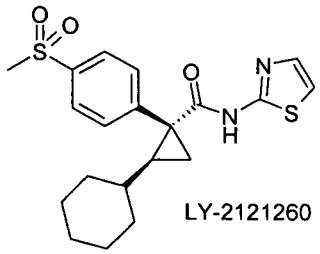
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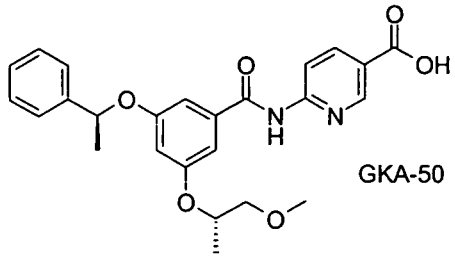
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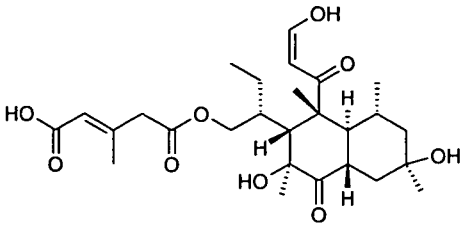
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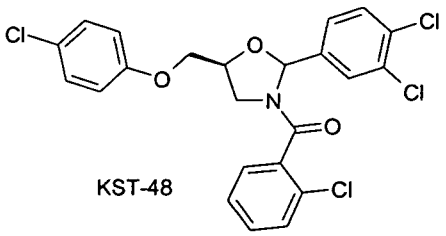
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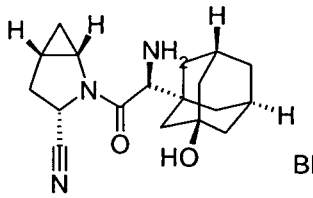
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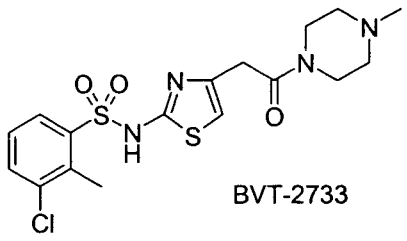
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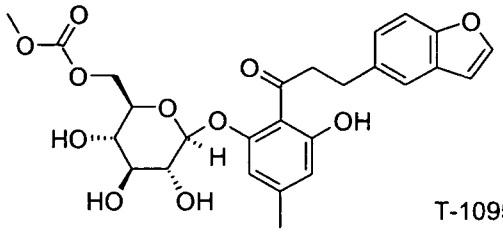


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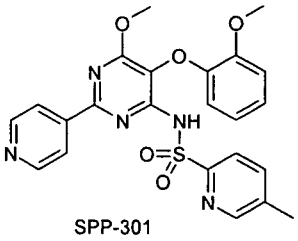
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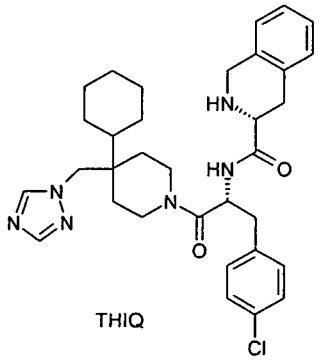


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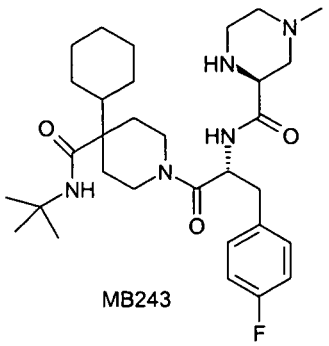
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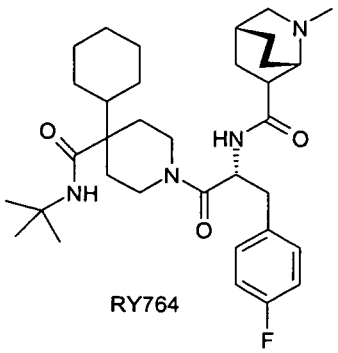
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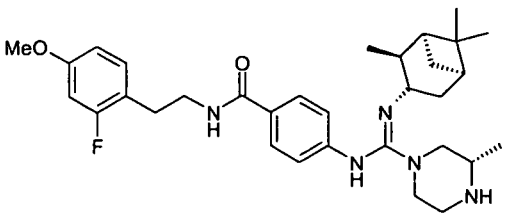
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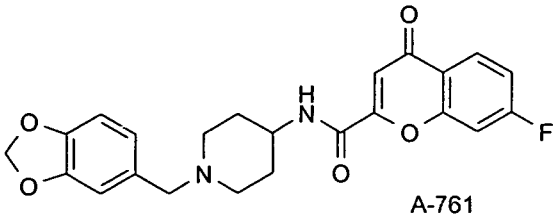
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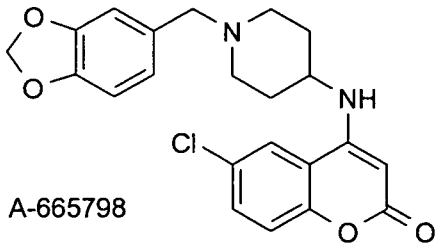
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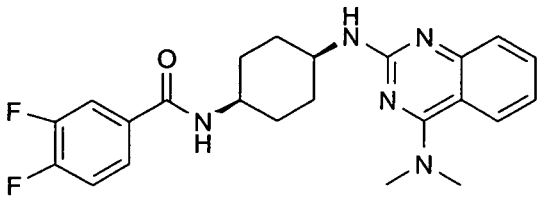
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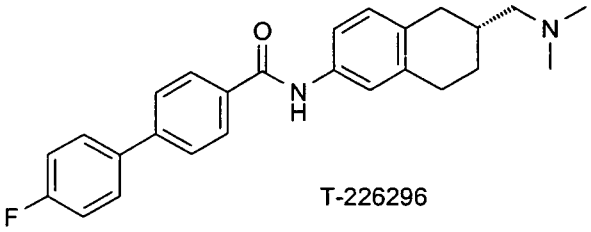
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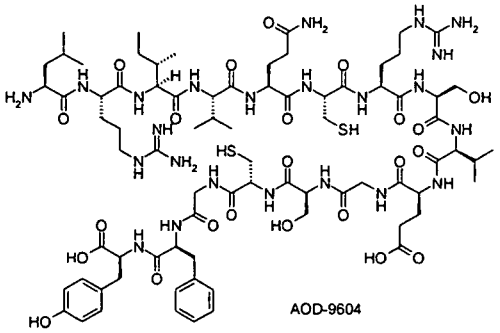


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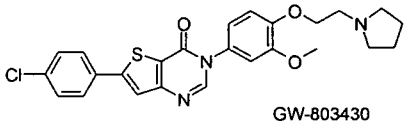


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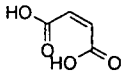
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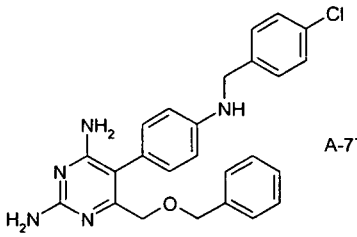


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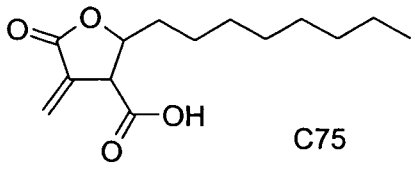


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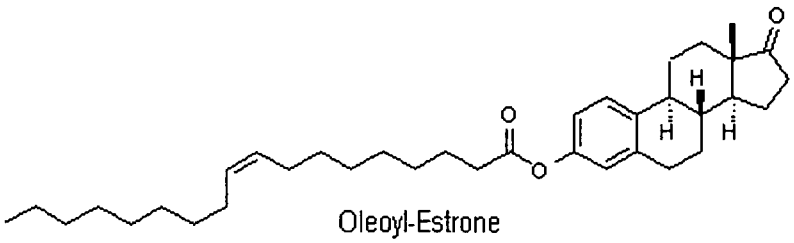




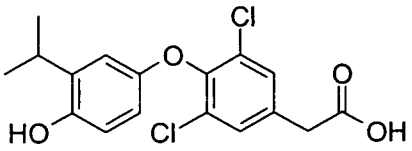
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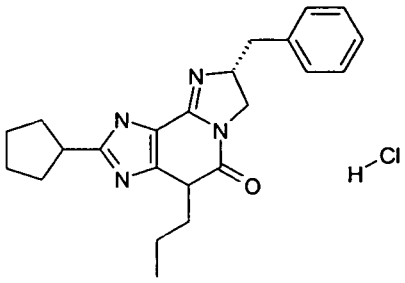
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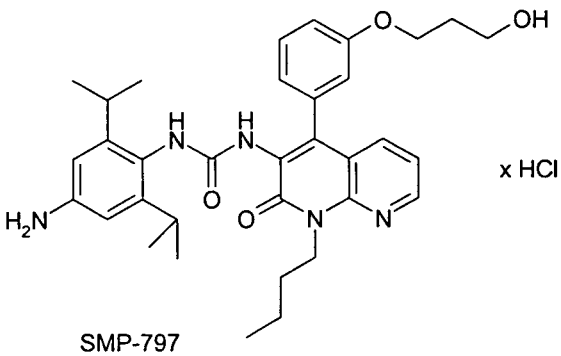
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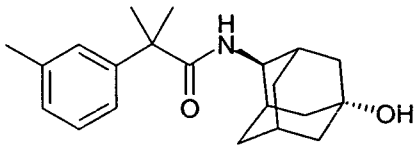
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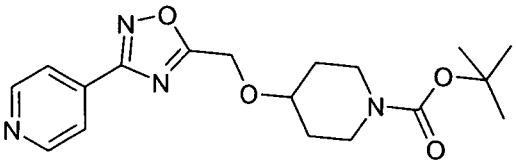
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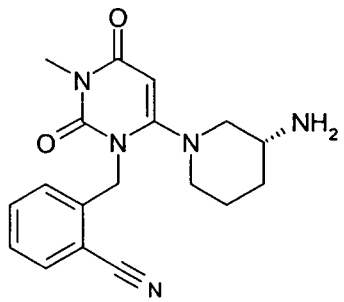
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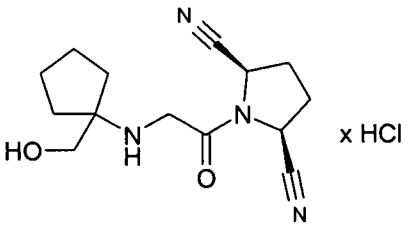
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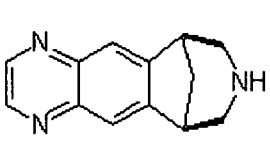
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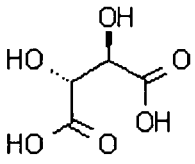


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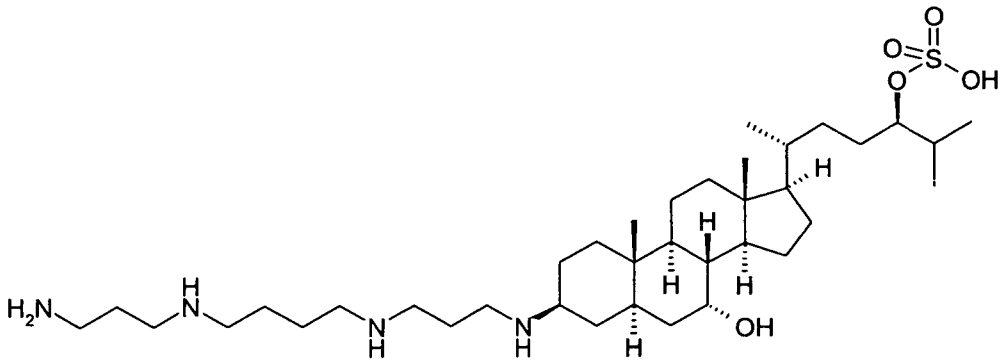


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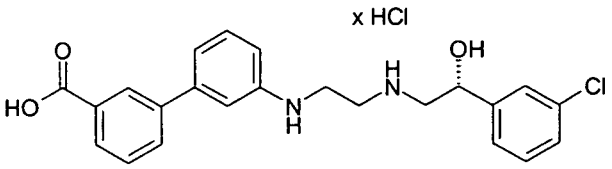




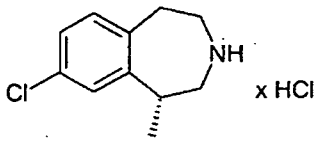
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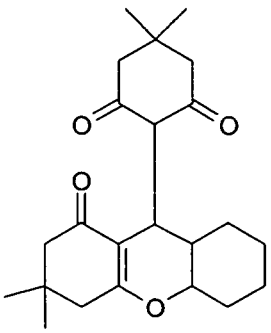
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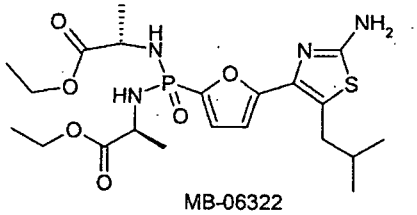
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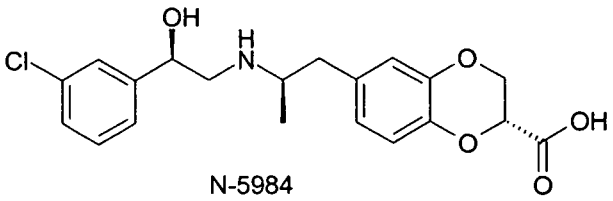
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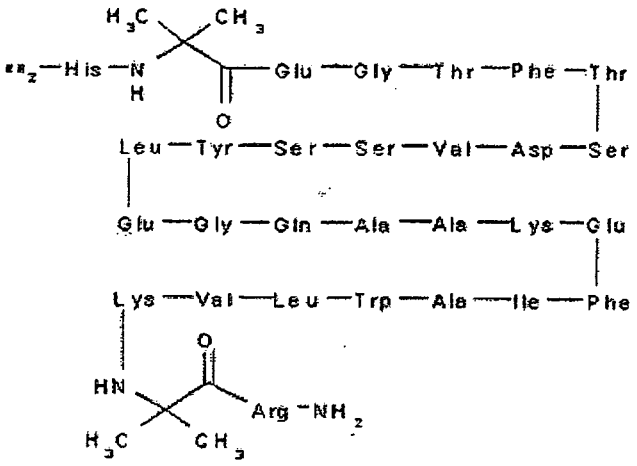


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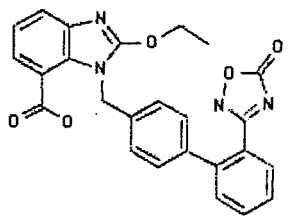


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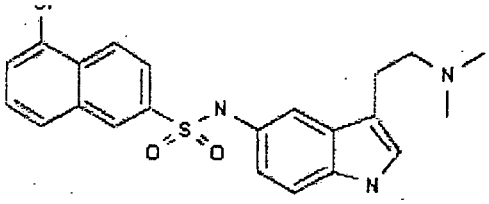
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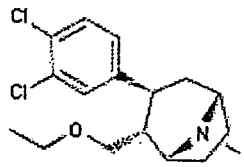
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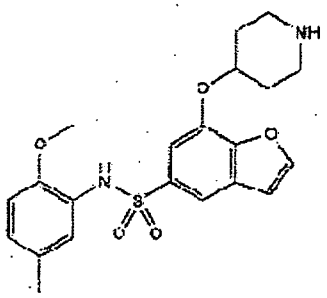
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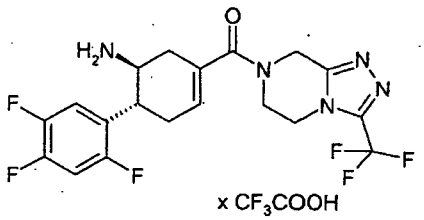
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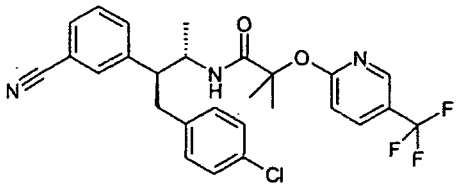
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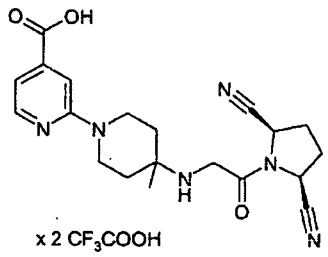
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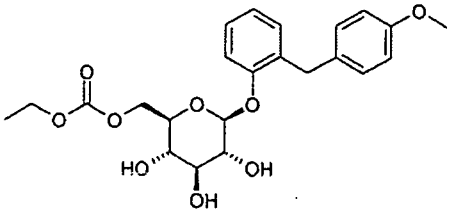
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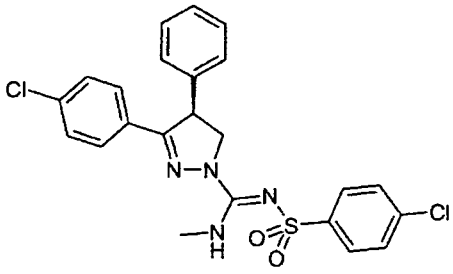
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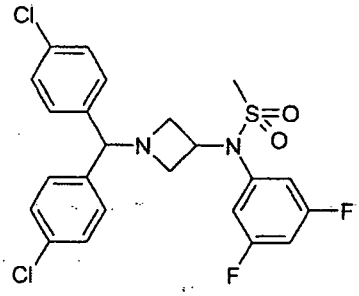
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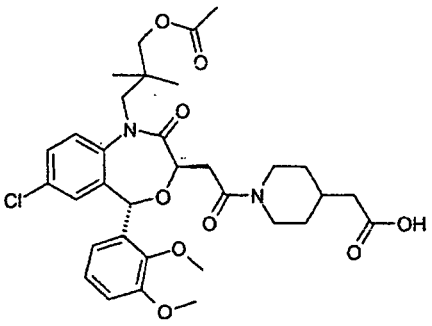
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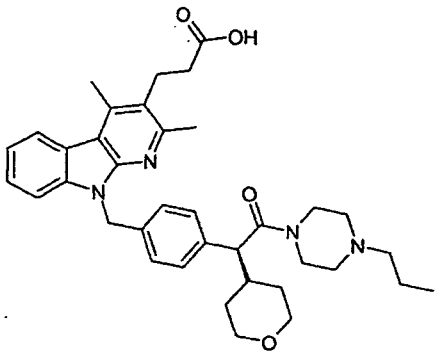
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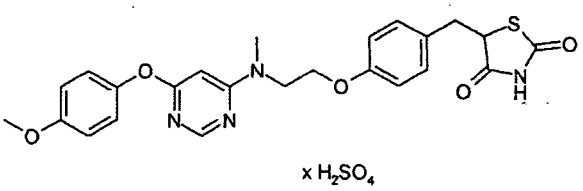
AVE 1625



TAK-475



AS-1552133



CKD-501 **(Lobeglitazone Sulfate)**

The activity of the compounds was tested as follows:

Determination of EC50 values of PPAR agonists in the cellular PPARalpha assay

Principle

The potency of substances which bind to human PPARalpha and activate it in an agonistic manner is analyzed using a stably transfected HEK cell line (HEK= human embryo kidney) which is referred to here as PPARalpha reporter cell line. It contains two genetic elements, a luciferase reporter element (pdeltaM-GAL4-Luc-Zeo) and a PPARalpha fusion protein (GR-GAL4-humanPPARalpha-LBD) which mediates expression of the luciferase reporter element depending on a PPARalpha ligand. The

stably and constitutively expressed fusion protein GR-GAL4-humanPPARalpha-LBD binds in the cell nucleus of the PPARalpha reporter cell line via the GAL4 protein portion to the GAL4 DNA binding motifs 5′-upstream of the luciferase reporter element which is stably integrated in the genome of the cell line. There is only weak expression of the luciferase reporter gene in the absence of a PPARalpha ligand if fatty acid-depleted fetal calf serum (cs-FCS) is used in the assay. PPARalpha ligands bind and activate the PPARalpha fusion protein and thereby stimulate the expression of the luciferase reporter gene. The luciferase which is formed can be detected by means of chemiluminescence via an appropriate substrate.

Construction of the PPARalpha reporter cell line

The PPARalpha reporter cell line was prepared in two stages. Firstly, the luciferase reporter element was constructed and stably transfected into HEK cells. For this purpose, five binding sites of the yeast transcription factor GAL4 (Accession # AF264724) were cloned in 5′-upstream of a 68 bp-long minimal MMTV promoter (Accession # V01175). The minimal MMTV promoter section contains a CCAAT box and a TATA element in order to enable efficient transcription by RNA polymerase II. The cloning and sequencing of the GAL4-MMTV construct took place in analogy to the description of Sambrook J. et. al. (Molecular cloning, Cold Spring Harbor Laboratory Press, 1989). Then the complete Photinus pyralis gene (Accession # M15077) was cloned in 3′-downstream of the GAL4-MMTV element. After sequencing, the luciferase reporter element consisting of five GAL4 binding sites, MMTV promoter and luciferase gene was recloned into a plasmid which confers zeocin resistance in order to obtain the plasmid pdeltaM-GAL4-Luc-Zeo. This vector was transfected into HEK cells in accordance with the statements in Ausubel, F.M. et al. (Current protocols in molecular biology, Vol. 1-3, John Wiley & Sons, Inc., 1995). Then zeocin-containing medium (0.5 mg/ml) was used to select a suitable stable cell clone which showed very low basal expression of the luceriferase gene.

In a second step, the PPARalpha fusion protein (GR-GAL4-humanPPARalpha-LBD was introduced into the stable cell clone described. For this purpose, initially the cDNA coding for the N-terminal 76 amino acids of the glucocorticoid receptor (Accession #

P04150) was linked to the cDNA section coding for amino acids 1-147 of the yeast transcription factor GAL4 (Accession # P04386). The cDNA of the ligand-binding domain of the human PPARalpha receptor (amino acids S167-Y468; Accession # S74349) was cloned in at the 3'-end of this GR-GAL4 construct. The fusion construct prepared in this way (GR-GAL4-humanPPARalpha-LBD) was recloned into the plasmid pcDNA3 (Invitrogen) in order to enable constitutive expression therein by the cytomegalovirus promoter. This plasmid was linearized with a restriction endonuclease and stably transfected into the previously described cell clone containing the luciferase reporter element. The finished PPARalpha reporter cell line which contains a luciferase reporter element and constitutively expresses the PPARalpha fusion protein (GR-GAL4-human PPARalpha-LBD) was isolated by selection with zeocin (0.5 mg/ml) and G418 (0.5 mg/ml).

Assay procedure

The activity of PPARalpha agonists is determined in a 3-day assay which is described below:

Day 1

The PPARalphareporter cell line is cultivated to 80% confluence in DMEM (# 41965-039, Invitrogen) which is mixed with the following additions: 10% cs-FCS (fetal calf serum; #SH-30068.03, Hyclone), 0.5 mg/ml zeocin (#R250-01, Invitrogen), 0.5 mg/ml G418 (#10131-027, Invitrogen), 1% penicillin-streptomycin solution (#15140-122, Invitrogen) and 2 mM L-glutamine (#25030-024, Invitrogen). The cultivation takes place in standard cell culture bottles (# 353112, Becton Dickinson) in a cell culture incubator at 37°C in the presence of 5% CO_2. The 80%-confluent cells are washed once with 15 ml of PBS (#14190-094, Invitrogen), treated with 3 ml of trypsin solution (#25300-054, Invitrogen) at 37°C for 2 min, taken up in 5 ml of the DMEM described and counted in a cell counter. After dilution to 500.000 cells/ml, 35,000 cells are seeded in each well of a 96 well microtiter plate with a clear plastic base (#3610, Corning Costar). The plates are incubated in the cell culture incubator at 37°C and 5% CO_2 for 24 h.

Day 2

PPARalpha agonists to be tested are dissolved in DMSO in a concentration of 10 mM. This stock solution is diluted in DMEM (#41965-039, Invitrogen) which is mixed with 5% cs-FCS (#SH-30068.03, Hyclone), 2 mM L-glutamine (#25030-024, Invitrogen) and the previously described antibiotics (zeocin, G418, penicillin and streptomycin). Test substances are tested in 11 different concentrations in the range from 10 µM to 100 pM. More potent compounds are tested in concentration ranges from 1 µM to 10 pM or between 100 nM and 1 pM.

The medium of the PPARalpha reporter cell line seeded on day 1 is completely removed by aspiration, and the test substances diluted in medium are immediately added to the cells. The dilution and addition of the substances is carried out by a robot (Beckman FX). The final volume of the test substances diluted in medium is 100 µl per well of a 96 well microtiter plate. The DMSO concentration in the assay is less than 0.1 % v/v in order to avoid cytotoxic effects of the solvent.

Each plate was charged with a standard PPARalpha agonist, which was likewise diluted in 11 different concentrations, in order to demonstrate the functioning of the assay in each individual plate. The assay plates are incubated in an incubator at 37°C and 5% CO_2 for 24 h.

Day 3

The PPARalpha reporter cells treated with the test substances are removed from the incubator, and the medium is aspirated off. The cells are lyzed by pipetting 50 µl of Bright Glo reagent (from Promega) into each well of a 96 well microtiter plate. After incubation at room temperature in the dark for 10 minutes, the microtiter plates are measured in the luminometer (Trilux from Wallac). The measuring time for each well of a microtiter plate is 1 sec.

Evaluation

The raw data from the luminometer are transferred into a Microsoft Excel file. Dose-effect plots and EC50 values of PPAR agonists are calculated using the XL.Fit program as specified by the manufacturer (IDBS).

The PPARalpha EC50 values for the compounds of Examples 1 to 5 in this assay are in the range from 1 µM to 5 µM. Compounds of the invention of the formula I activate the PPARalpha receptor.

Determination of EC50 values of PPAR agonists in the cellular PPARdelta assay

Principle

The potency of substances which bind to human PPARdelta and activate it in an agonistic manner is analyzed using a stably transfected HEK cell line (HEK= human embryo kidney) which is referred to here as PPARdelta reporter cell line. In analogy to the assay described for PPARalpha, the PPARdelta reporter cell line also contains two genetic elements, a luciferase reporter element (pdeltaM-GAL4-Luc-Zeo) and a PPARdelta fusion protein (GR-GAL4-humanPPARdelta-LBD) which mediates expression of the luciferase reporter element depending on a PPARdelta ligand. The stably and constitutively expressed fusion protein GR-GAL4-humanPPARdelta-LBD binds in the cell nucleus of the PPARdelta reporter cell line via the GAL4 protein portion to the GAL4 DNA binding motifs 5´-upstream of the luciferase reporter element which is stably integrated in the genome of the cell line. There is only little expression of the luciferase reporter gene in the absence of a PPARdelta ligand if fatty acid-depleted fetal calf serum (cs-FCS) is used in the assay. PPARdelta ligands bind and activate the PPARdelta fusion protein and thereby stimulate expression of the luciferase reporter gene. The luciferase which is formed can be detected by means of chemiluminescence via an appropriate substrate.

Construction of the PPARdelta reporter cell line

The production of the stable PPARdelta reporter cell line is based on a stable HEK-cell clone which was stably transfected with a luciferase reporter element. This step was already described above in the section “construction of the PPARalpha reporter cell line”. In a second step, the PPARdelta fusion protein (GR-GAL4-humanPPARdelta-LBD was stably introduced into this cell clone. For this purpose, the cDNA coding for

the N-terminal 76 amino acids of the glucocorticoid receptor (Accession # P04150) was linked to the cDNA section coding for amino acids 1-147 of the yeast transcription factor GAL4 (Accession # P04386). The cDNA of the ligand-binding domain of the human PPARdelta receptor (amino acids S139-Y441; Accession # L07592) was cloned in at the 3'-end of this GR-GAL4 construct. The fusion construct prepared in this way (GR-GAL4-humanPPARdelta-LBD) was recloned into the plasmid pcDNA3 (Invitrogen) in order to enable constitutive expression by the cytomegalovirus promoter. This plasmid was linearized with a restriction endonuclease and stably transfected into the previously described cell clone containing the luciferase reporter element. The resulting PPARdelta reporter cell line which contains a luciferase reporter element and constitutively expresses the PPARdelta fusion protein (GR-GAL4-human PPARdelta-LBD) was isolated by selection with zeocin (0.5 mg/ml) and G418 (0.5 mg/ml).

Assay procedure and evaluation

The activity of PPARdelta agonists is determined in a 3-day assay in exact analogy to the procedure already described for the PPARalpha reporter cell line except that the PPARdelta reporter cell line and a specific PPARdelta agonist was used as a standard to control test efficacy.

PPARdelta EC50 values in the range from 1 nM to >10 µM were measured for the PPAR agonists of Examples 1 to 12 described in this application. Compounds of the invention of the formula I activate the PPARdelta receptor.

The examples given in Table I serve to illustrate the invention, but without limiting it.

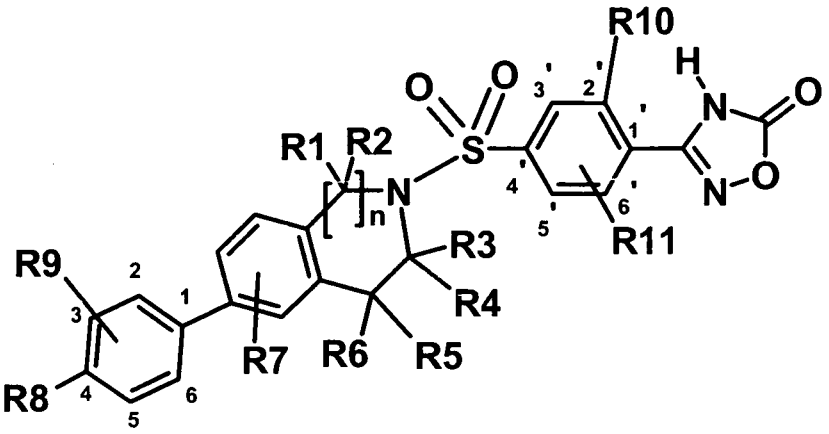


Table I

where R3, R4 and R7 = H.

Example	n	R1	R2	R5	R6	R8	R9	R10	R11
1	0	-	-	H	H	-CF3	H	H	H
2	0	-	-	-CH3	-CH3	CF3	H	H	H
3	0	-	-	H	H	-CF3	H	-Cl	H
4	0	-	-	-CH3	-CH3	-CF3	H	-Cl	H
5	1	H	H	H	H	-CF3	H	-Cl	H
6	0	-	-	H	H	-CF3	H	H	Cl
7	0	-	-	H	H	-CF3	-OCH3	H	H
8	0	-	-	H	H	-Cl	-CO-O-Ph	H	H
9	0	-	-	H	H	-Cl	-CO-OH	H	H
10	0	-	-	H	H	-O-(CH2)2-		H	H
11	0	-	-	-(CH2)2-O-(CH2)2-		-CF3	H	H	H
12	0	-	-	H	H	-CF3	H	H	-Ph-CF3

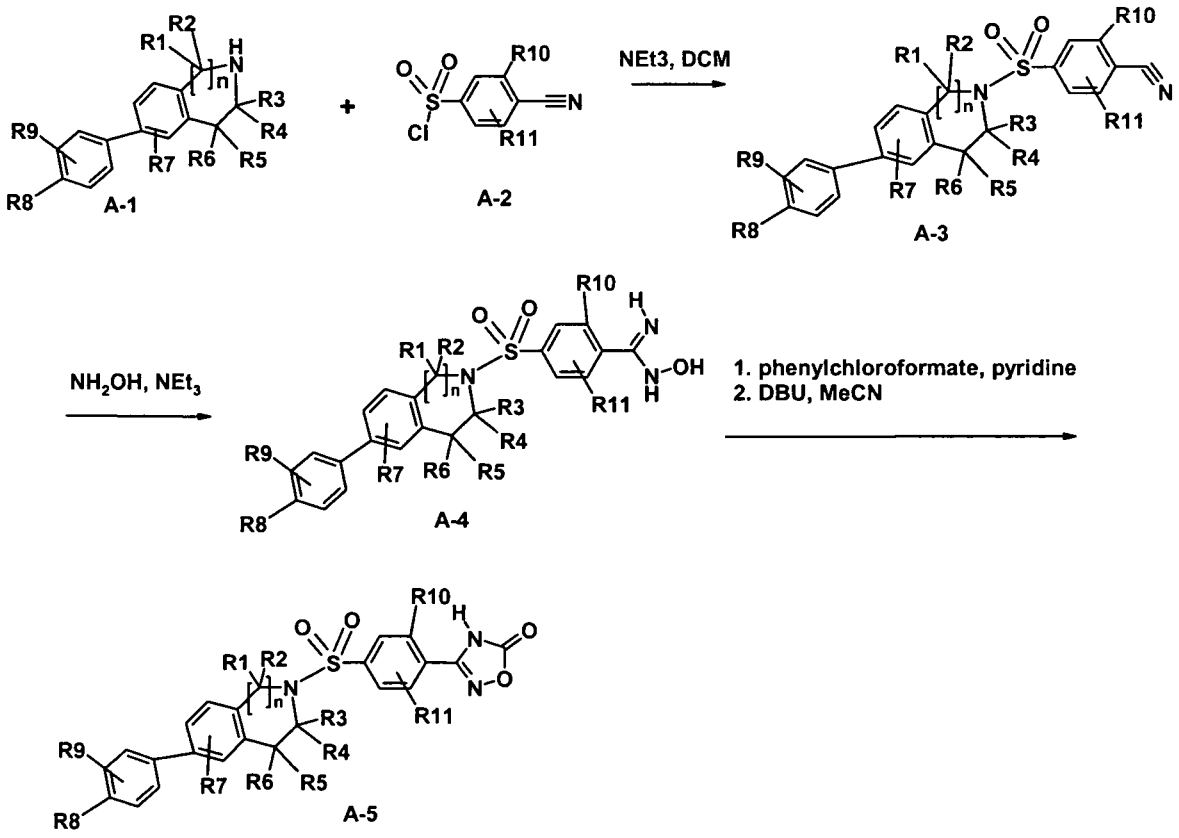
The potency of some of the described examples are indicated in the following table :

Example	PPARdelta EC50 (μM)	PPARalpha EC50 (μM)
2	0,015	3,52
3	0,003	1,11
5	0,035	1,64

Processes

The compounds of the general formula I according to the invention can be obtained as outlined to the reaction schemes below:

Process A

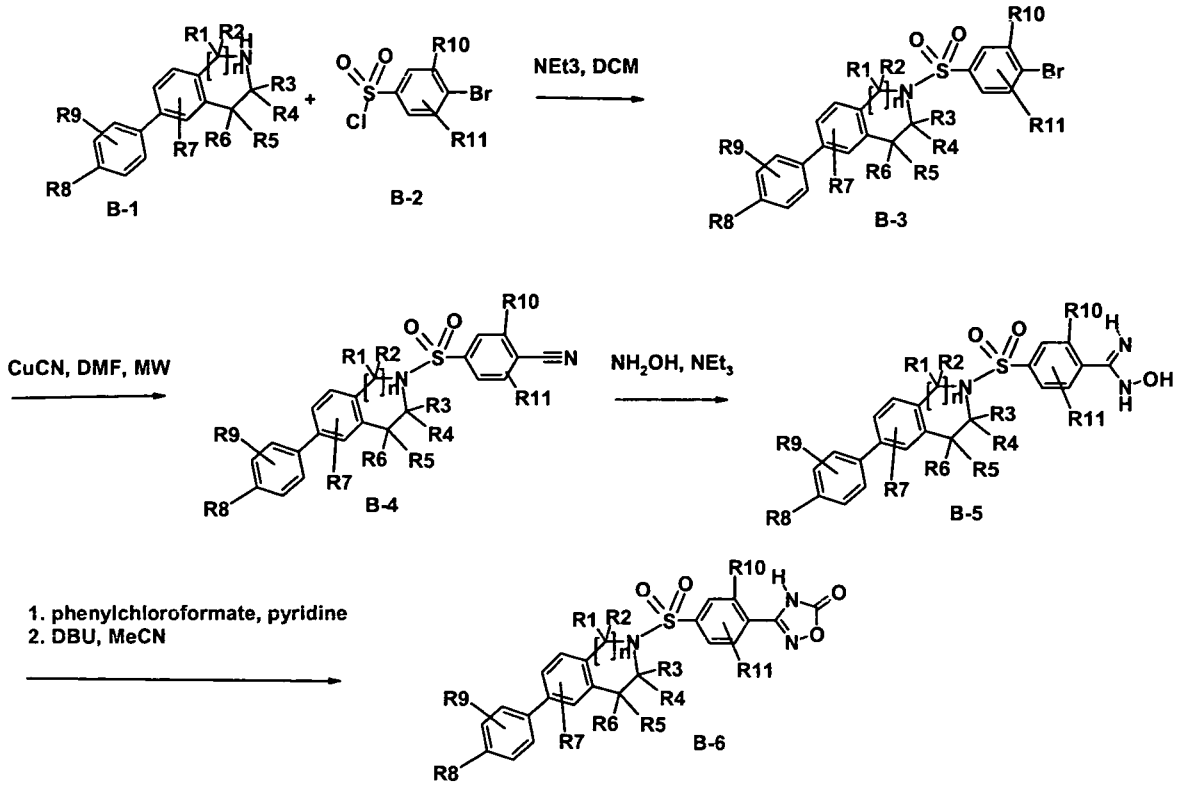


A compound of the general formula A-1 where R1, R2, R3, R4, R5, R6, R7, R8 and R9 are as defined is reacted with a sulfonylchloride of general formula A-2 where R10 and R11 are as defined in the presence of a base as triethylamine in a solvent as dichloromethane to give a compound of the general formula A-3. The compound of the general formula A-3 is reacted with hydroxylamine hydrochloride in the presence of a base as triethylamine in a solvent as tetrahydrofuran and methanol to obtain a compound of the general formula A-4.This reaction can be facilitated by heating the reaction mixture under microwave irradiation. This compound of general formula A-4 is converted to the product of general formula A-5 by reaction with phenylchloroformate in the presence of a base as pyridine or diisopropylethylamine followed by heating the reaction mixture with microwave irradiation to allow cyclization or alternatively isolating the resulting intermediate and treating it with a base as 1,8-diazabicyclo[5.4.0]undec-7-ene in a solvent as acetonitrile.

Examples 1 – 2 were obtained according to process A.

Other compounds can be obtained accordingly or by known processes.

Process B:



A compound of the general formula B-1 where R1, R2, R3, R4, R5, R6, R7, R8 and R9 are as defined is reacted with a sulfonylchloride of general formula B-2 where R10 and R11 are as defined in the presence of a base as triethylamine in a solvent as dichloromethane to give a compound of the general formula A-3. The compound of the general formula A-3 is reacted with copper cyanide in a solvent as dimethylfomamide under microwave irradiation at a temperature e.g. 200°C to give the cyanide of general formula B-4. The compound of the general formula B-4 is reacted with hydroxylamine hydrochloride in the presence of a base as triethylamine in a solvent as tetrahydrofuran and methanol to obtain a compound of the general formula B-5. This reaction can be facilitated by heating the reaction mixture under microwave irradiation. This compound of general formula B-5 is converted to the product of general formula B-6 by reaction with phenylchloroformate in the presence of a base as pyridine or diisopropylethylamine followed by heating the reaction mixture with microwave irradiation to allow cyclization or alternatively isolating the resulting intermediate and

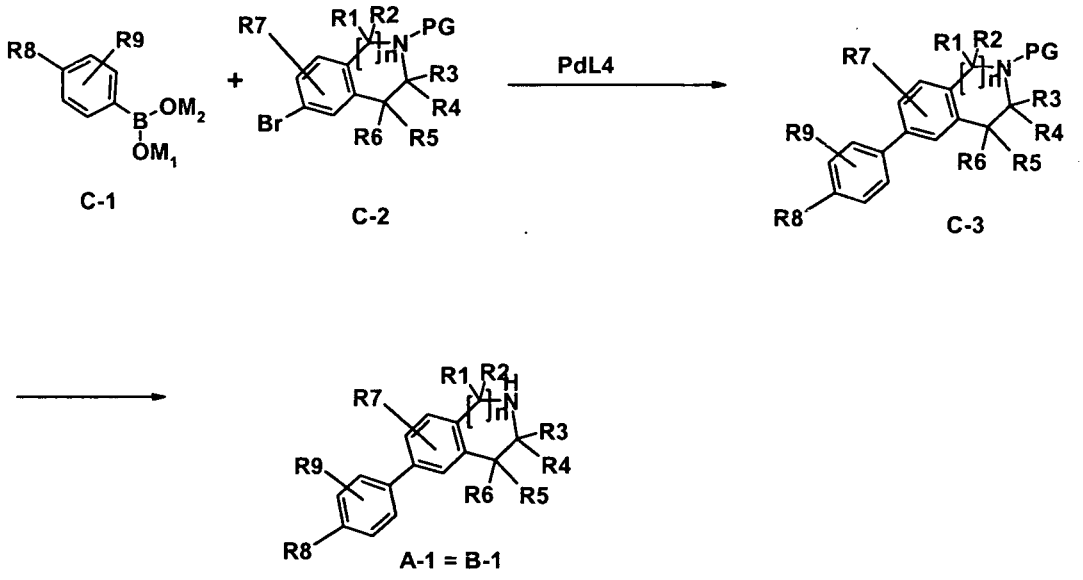
treating it with a base as 1,8-diazabicyclo[5.4.0]undec-7-ene in a solvent as acetonitrile.

Examples 3 – 5 were obtained according to process B.

Other compounds can be obtained accordingly or by known processes.

Process C:

This process is used for synthesizing the building blocks A-1 and B-1, where R1, R2, R3, R4, R5, R6, R7, R8 and R9 are as defined.



A boronic acid or a boronic ester of general formula C-1, where M1 and M2 can be independently hydrogen or alkyl (in the case of alkyl, M1 and M2 can form a ring system) and R8 and R9 are as defined is reacted with an arylbromide of general formula C-2, where R1, R2, R3, R4, R5, R6 and R7 are as defined and PG means a protecting group (as for example tert. Butyloxycarbonyl (BOC)), using a catalytic amount of a transition metal as for example palladium and a ligand as for example triphenylphosphine in the presence of a base as for example Na_2CO_3 in a solvent as for example DMF/water, to obtain a compound of general formula C-3. The protecting group PG of compound of general formula C-3 is removed, in case of BOC for

example by treatment with an acid as trifluoroacetic acid in a solvent as dichloromethane for example, to obtain the compound of general formula A1 = B1.

List of abbreviation:

Ac	acetyl
AIBN	2,2´-Azobis(2-methylpropionitrile)
Bn	benzyl
iBu	isobutyl
tBu	tert-Butyl
BuLi	n-butyllithium
Bz	benzoyl
Cy	cyclohexyl
DBU	1,8-Diazabicyclo[5.4.0]undec-7-ene
DCI	Direct chemical ionization (MS)
DCM	dichloromethane
DMAP	N,N-dimethylaminopyridine
DMF	N,N-dimethylformamide
DMSO	dimethylsulfoxide
EE	ethyl acetate
eq	equivalents
ESI	electrospray-Ionisation (MS)
FG	Leaving group
Hal	halogen
HPLC	High performance liquid chromatography
LC-MS	liquid chromatography coupled with mass-spectroscopy
Me	methyl
MS	mass-spectroscopy
MsCl	Methansulfonylchloride
NBS	N-Bromosuccinimide
NMR	Nuclear magnetic resonance
p	para

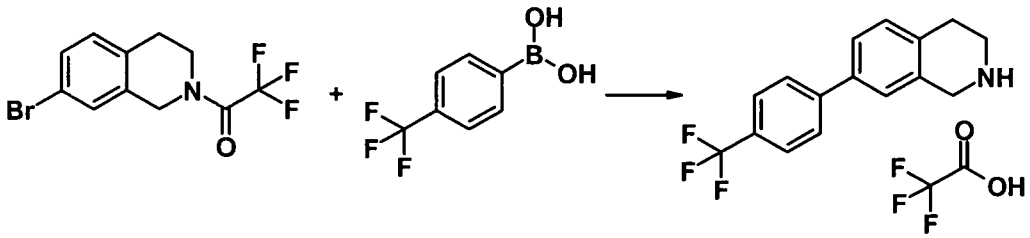
Pd/C	palladium on carbon
iPr	isopropyl
nPr	n-propyl
Rf	retention factor (TLC)
tert	Tertiary
TBAF	Tetrabutyl ammonium fluoride
TFA	Trifluoroacetic acid
TLC	Thin layer chromatography

Further compounds of the formula I can be prepared correspondingly or by known processes.

The experimental procedures for preparing the examples mentioned above are described below:

Building block synthesis according to process C:

7-(4-Trifluoromethyl-phenyl)-1,2,3,4-tetrahydro-isoquinoline trifluoroacetate



4.63 g 4-(Trifluormethyl)phenylboronic acid was dissolved in 15 ml ethanol and added to a mixture of 5.0 g 1-(7-bromo-3,4-dihydro-1H-isoquinolin-2-yl)-2,2,2-trifluoro-ethanone in 150 ml toluene and 54 ml of a 2 molar sodium carbonate solution. The reaction mixture was degassed then 940 mg tetrakis(triphenylphosphine)palladium(0) was added and the mixture heated under reflux for two hours. The cooled reaction mixture was evaporated, the resulting residue was dissolved in 150 ml ethyl acetate and washed with 50 ml water and brine. The organic layer was dried over $MgSO_4$ and the solvent removed in vacuo. The resulting crude material was purified by reversed

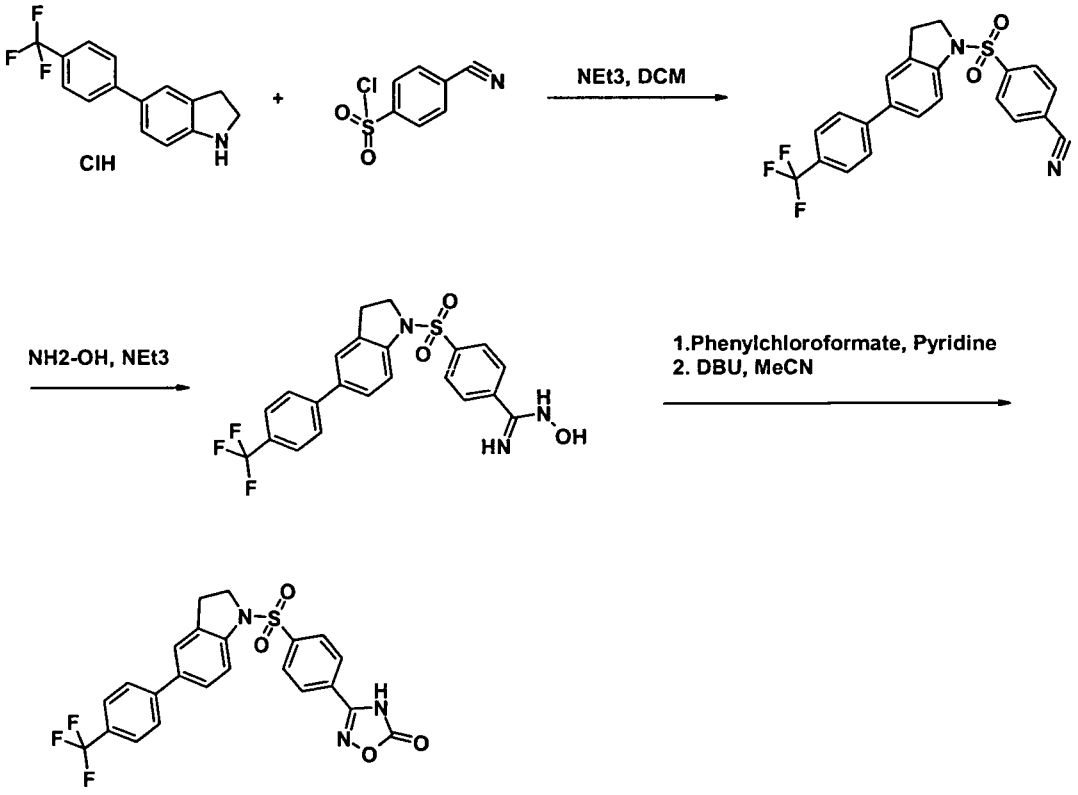
phase HPLC to obtain 2.0 g 7-(4-trifluoromethyl-phenyl)-1,2,3,4-tetrahydro-isoquinoline as its trifluoroacetate salt.

C16H14F3N.C2HF3O2 (391.3), MS(ESI+): 288.3 (M+H+).

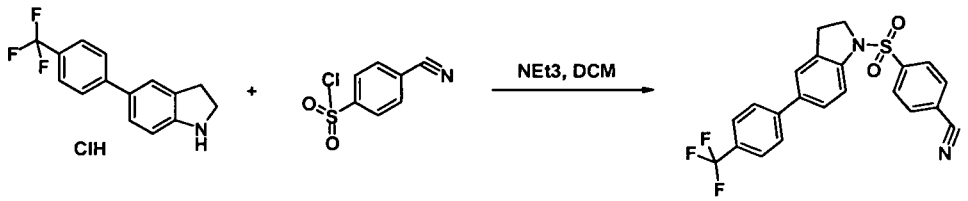
The following examples were prepared according to process A:

Example 1

3-{4-[5-(4-Trifluoromethyl-phenyl)-2,3-dihydro-indole-1-sulfonyl]-phenyl}-4H-[1,2,4]oxadiazol-5-one



4-[5-(4-Trifluoromethyl-phenyl)-2,3-dihydro-indole-1-sulfonyl]-benzonitrile

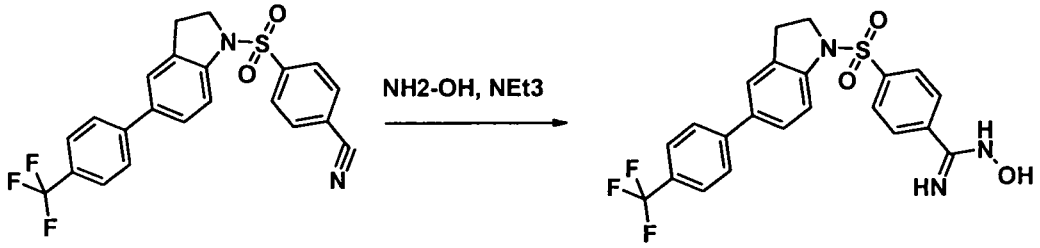


1.25 g of commercially available 4-cyano-benzenesulfonyl chloride were dissolved in 35 ml dichloromethane. Then 760 mg 5-(4-trifluoromethyl-phenyl)-2,3-dihydro-1H-indole hydrochloride were added followed by 2.14 ml triethylamine. The mixture was

stirred at room temperature for fifteen minutes. Then 100 ml of dichloromethane were added, the mixture washed with 40ml water and brine and then dried over $MgSO_4$. The solvent was removed in vacuo. The resulting crude material was purified by reversed phase HPLC to obtain 517 mg of 4-[5-(4-trifluoromethyl-phenyl)-2,3-dihydro-indole-1-sulfonyl]-benzonitrile as amorphous lyophilisate.

C22H15F3N2O2S (428.44), Rf(n-heptane: ethyl acetate = 1:1) = 0.57.

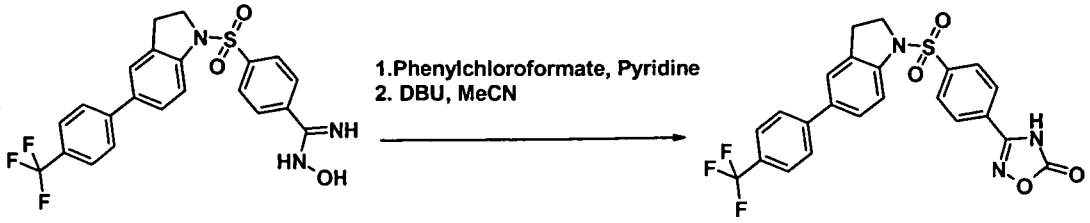
N-Hydroxy-4-[5-(4-trifluoromethyl-phenyl)-2,3-dihydro-indole-1-sulfonyl]-benzamidine



517 mg 4-[5-(4-trifluoromethyl-phenyl)-2,3-dihydro-indole-1-sulfonyl]-benzonitrile were dissolved in a mixture of 10 ml tetrahydrofuran and 10 ml methanol. 1.68 g hydroxylamine hydrochloride were added followed by the addition of 3.35 ml triethylamine. The reaction mixture was stirred at 65°C for eight hours. The solvents were removed in vacuo and the resulting residue poured into water and extracted five times with ethylacetate. The combined organic extracts were washed with brine, dried over $MgSO_4$ and the solvent was evaporated in vacuo to obtain 550 mg N-hydroxy-4-[5-(4-trifluoromethyl-phenyl)-2,3-dihydro-indole-1-sulfonyl]-benzamidine as an oil.

C22H18F3N3O3S (461,47), MS(ESI): 462.2 ($M+H^+$).

3-{4-[5-(4-Trifluoromethyl-phenyl)-2,3-dihydro-indole-1-sulfonyl]-phenyl}-4H-[1,2,4]oxadiazol-5-one

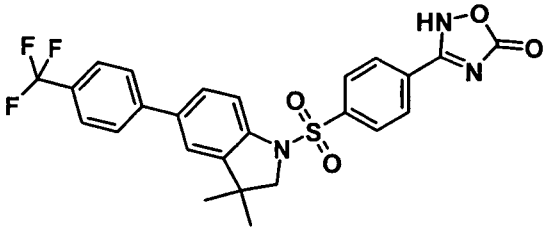


550 mg N-hydroxy-4-[5-(4-trifluoromethyl-phenyl)-2,3-dihydro-indole-1-sulfonyl]-benzamidine were dissolved in 10 ml dichloromethane. 0,17 ml pyridine and 0,18 ml phenylchloroformate were added and the mixture stirred at room temperature for ten minutes. The mixture was diluted by the addition of 20 ml acetonitrile and 0,89 ml 1,8-diazabicyclo[5.4.0]undec-7-ene were added. The mixture was stirred at room temperature for 15 minutes. The mixture was evaporated in vacuo and the resulting crude material was purified by reversed phase HPLC to obtain 330 mg 3-{4-[5-(4-trifluoromethyl-phenyl)-2,3-dihydro-indole-1-sulfonyl]-phenyl}-4H-[1,2,4]oxadiazol-5-one as an amorphous lyophilisate.

C23H16F3N3O4S (487.46), MS(ESI-): 486.2 ($M-H^+$).

Example 2

3-{4-[3,3-Dimethyl-5-(4-trifluoromethyl-phenyl)-2,3-dihydro-indole-1-sulfonyl]-phenyl}-2H-[1,2,4]oxadiazol-5-one



According to the method described for 3-{4-[5-(4-trifluoromethyl-phenyl)-2,3-dihydro-indole-1-sulfonyl]-phenyl}-4H-[1,2,4]oxadiazol-5-one in example 1, 3-{4-[3,3-dimethyl-5-(4-trifluoromethyl-phenyl)-2,3-dihydro-indole-1-sulfonyl]-phenyl}-2H-[1,2,4]oxadiazol-5-one was obtained from commercially available 4-cyano-benzenesulfonyl chloride and 3,3-dimethyl-5-(4-trifluoromethyl-phenyl)-2,3-dihydro-1H-indole[1].

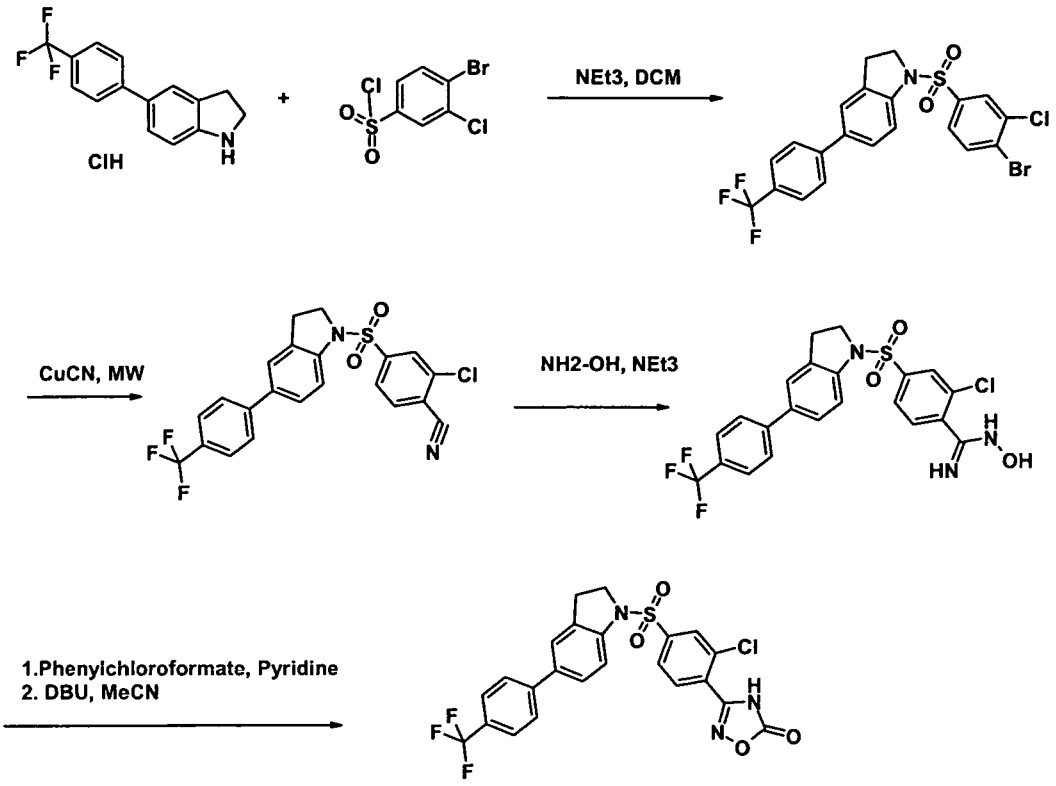
C25H20F3N3O4S (515.51), MS(ESI-): 514.10 ($M-H^+$).

The following examples were prepared according to process B:

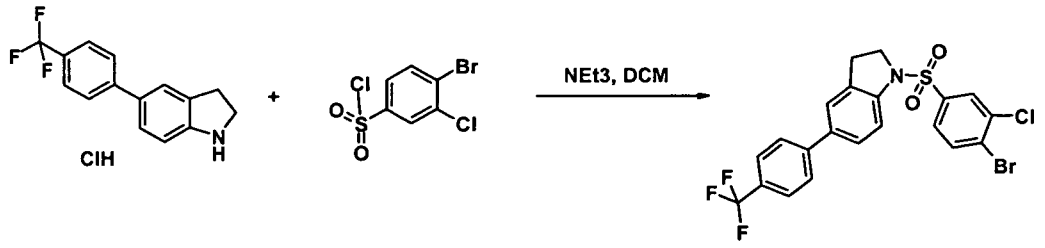
Example 3

3-{2-Chloro-4-[5-(4-trifluoromethyl-phenyl)-2,3-dihydro-indole-1-sulfonyl]-phenyl}-4H-[1,2,4]oxadiazol-5-one

[1] DE10335449, DE10335450, WO2005019169



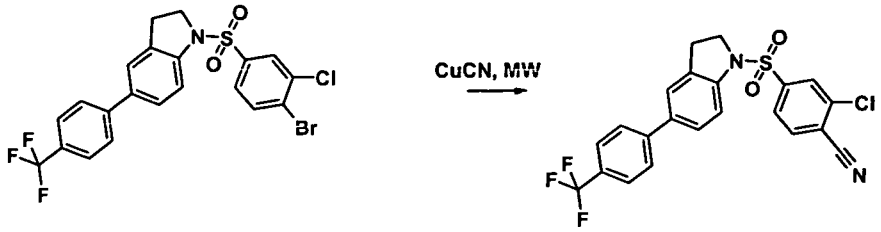
1-(4-Bromo-3-chloro-benzenesulfonyl)-5-(4-trifluoromethyl-phenyl)-2,3-dihydro-1H-indole



1.79 g of commercially available 4-bromo-benzenesulfonyl chloride were dissolved in 35 ml dichloromethane. Then 1.85 g 5-(4-trifluoromethyl-phenyl)-2,3-dihydro-1H-indole hydrochloride were added followed by 2.14 ml triethylamine. The mixture was stirred at room temperature for fifteen minutes. Then 100 ml of dichloromethane were added, the mixture washed with 40ml water and brine and then dried over $MgSO_4$. The solvent was removed in vacuoto obtain 2.48g crude 1-(4-bromo-3-chloro-benzenesulfonyl)-5-(4-trifluoromethyl-phenyl)-2,3-dihydro-1H-indole. This material was used without further purification.

C21H14BrClF3NO2S (516.77), Rf(n-heptane: ethyl acetate = 1:1) = 0.61.

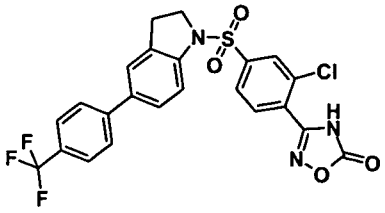
2-Chloro-4-[5-(4-trifluoromethyl-phenyl)-2,3-dihydro-indole-1-sulfonyl]-benzonitrile



2.48 g 1-(4-bromo-3-chloro-benzenesulfonyl)-5-(4-trifluoromethyl-phenyl)-2,3-dihydro-1H-indole were dissolved in 10 ml dimethylformamide. 2.15g copper cyanide were added and tghe resulting mixture stirred under microwave irradiation at 200°C for thirty minutes. The mixture was diluted by addition of 100 ml ethyl acetate and washed five times with portions of 50 ml saturated ammonium chloride solution. The organic layer was dried over $MgSO_4$ then the solvent was removed in vacuo to obtain 935 mg crude 2-chloro-4-[5-(4-trifluoromethyl-phenyl)-2,3-dihydro-indole-1-sulfonyl]-benzonitrile. This material was used without further purification.

C22H14ClF3N2O2S (462.88).

3-{2-Chloro-4-[5-(4-trifluoromethyl-phenyl)-2,3-dihydro-indole-1-sulfonyl]-phenyl}-4H-[1,2,4]oxadiazol-5-one

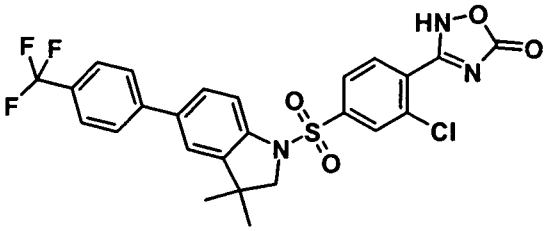


According to the method described for 3-{4-[5-(4-trifluoromethyl-phenyl)-2,3-dihydro-indole-1-sulfonyl]-phenyl}-4H-[1,2,4]oxadiazol-5-one in example 1, 3-{2-chloro-4-[5-(4-trifluoromethyl-phenyl)-2,3-dihydro-indole-1-sulfonyl]-phenyl}-4H-[1,2,4]oxadiazol-5-one was obtained from 2-chloro-4-[5-(4-trifluoromethyl-phenyl)-2,3-dihydro-indole-1-sulfonyl]-benzonitrile.

C23H15ClF3N3O4S (521.91), MS(ESI-): 520.5 (M-H+).

Example 4

3-{2-Chloro-4-[3,3-dimethyl-5-(4-trifluoromethyl-phenyl)-2,3-dihydro-indole-1-sulfonyl]-phenyl}-2H-[1,2,4]oxadiazol-5-one

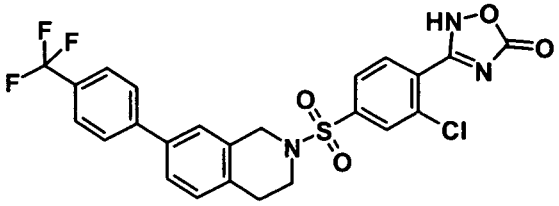


According to the method described for 3-{2-chloro-4-[5-(4-trifluoromethyl-phenyl)-2,3-dihydro-indole-1-sulfonyl]-phenyl}-4H-[1,2,4]oxadiazol-5-one in example 3, 3-{2-chloro-4-[3,3-dimethyl-5-(4-trifluoromethyl-phenyl)-2,3-dihydro-indole-1-sulfonyl]-phenyl}-2H-[1,2,4]oxadiazol-5-one was obtained from commercially available 4-bromo-benzenesulfonyl chloride and 3,3-dimethyl-5-(4-trifluoromethyl-phenyl)-2,3-dihydro-1H-indole[2].

C25H19ClF3N3O4S (549.96), MS(ESI+): 550.1 ($M+H^+$).

Example 5

3-{2-Chloro-4-[7-(4-trifluoromethyl-phenyl)-3,4-dihydro-1H-isoquinoline-2-sulfonyl]-phenyl}-2H-[1,2,4]oxadiazol-5-one



According to the method described for 3-{2-chloro-4-[5-(4-trifluoromethyl-phenyl)-2,3-dihydro-indole-1-sulfonyl]-phenyl}-4H-[1,2,4]oxadiazol-5-one in example 3, 3-{2-chloro-4-[7-(4-trifluoromethyl-phenyl)-3,4-dihydro-1H-isoquinoline-2-sulfonyl]-phenyl}-2H-[1,2,4]oxadiazol-5-one was obtained from commercially available 4-bromo-

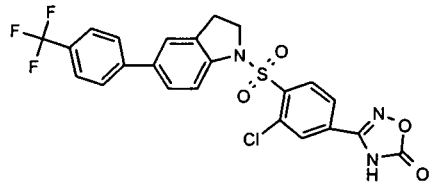
[2] DE10335449, DE10335450, WO2005019169

benzenesulfonyl chloride and 7-(4-trifluoromethyl-phenyl)-1,2,3,4-tetrahydro-isoquinoline trifluoroacetate.

C24H17ClF3N3O4S (535.93), MS(ESI+): 536.1 ($M+H^+$).

Example 6

3-{3-Chloro-4-[5-(4-trifluoromethyl-phenyl)-2,3-dihydro-indole-1-sulfonyl]-phenyl}-4H-[1,2,4]oxadiazol-5-one

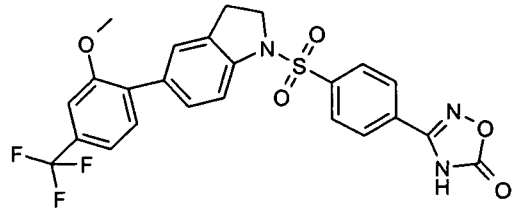


According to the method described for 3-{4-[5-(4-trifluoromethyl-phenyl)-2,3-dihydro-indole-1-sulfonyl]-phenyl}-4H-[1,2,4]oxadiazol-5-one in Example 1, 3-{3-Chloro-4-[5-(4-trifluoromethyl-phenyl)-2,3-dihydro-indole-1-sulfonyl]-phenyl}-4H-[1,2,4]oxadiazol-5-one was obtained from commercially available 2-Chloro-4-cyano-benzenesulfonyl chloride and 5-(4-Trifluoromethyl-phenyl)-2,3-dihydro-1H-indole.

C23H15ClF3N3O4S (521.04), MS(ESI-): 520.09 ($M-H^+$).

Example 7

3-{4-[5-(2-Methoxy-4-trifluoromethyl-phenyl)-2,3-dihydro-indole-1-sulfonyl]-phenyl}-4H-[1,2,4]oxadiazol-5-one



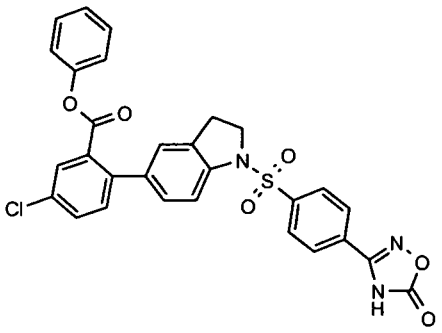
According to the method described in process C and A, 3-{4-[5-(2-Methoxy-4-trifluoromethyl-phenyl)-2,3-dihydro-indole-1-sulfonyl]-phenyl}-4H-[1,2,4]oxadiazol-5-one was obtained from commercially available 2-Methoxy-4-trifluoromethyl-benzene-boronic

acid, 5-Bromo-2,3-dihydro-1H-indole and 4-Cyano-benzenesulfonyl chloride.

C24H18F3N3O5S (517.09), MS(ESI-): 516.00 (M-H+)

Example 8

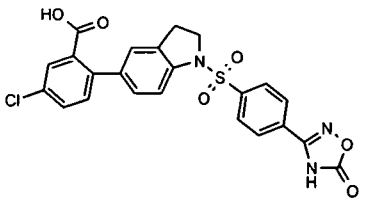
5-Chloro-2-{1-[4-(5-oxo-4,5-dihydro-[1,2,4]oxadiazol-3-yl)-benzenesulfonyl]-2,3-dihydro-1H-indol-5-yl}-benzoic acid phenyl ester



According to the method described in process C and A, 5-Chloro-2-{1-[4-(5-oxo-4,5-dihydro-[1,2,4]oxadiazol-3-yl)-benzenesulfonyl]-2,3-dihydro-1H-indol-5-yl}-benzoic acid phenyl ester was obtained from commercially available 4-Chloro-2-(ethoxycarbonyl)benzene-boronic acid, 5-Bromo-2,3-dihydro-1H-indole and 4-Cyano-benzenesulfonyl chloride. Under the conditions described for the synthesis of 3-{4-[5-(4-Trifluoromethyl-phenyl)-2,3-dihydro-indole-1-sulfonyl]-phenyl}-4H-[1,2,4]oxadiazol-5-one the ethoxycarbonyl-group was converted to a phenoxycarbonyl-group. C29H20ClN3O6S (573.08), MS(ESI-): 571.98 (M-H+)

Example 9

5-Chloro-2-{1-[4-(5-oxo-4,5-dihydro-[1,2,4]oxadiazol-3-yl)-benzenesulfonyl]-2,3-dihydro-1H-indol-5-yl}-benzoic acid

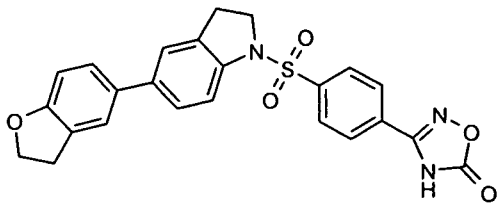


According to the method described in process C and A, 5-Chloro-2-{1-[4-(5-oxo-4,5-dihydro-[1,2,4]oxadiazol-3-yl)-benzenesulfonyl]-2,3-dihydro-1H-indol-5-yl}-benzoic acid was obtained from commercially available 4-Chloro-2-(ethoxycarbonyl)benzene-boronic acid, 5-Bromo-2,3-dihydro-1H-indole and 4-Cyano-benzenesulfonyl chloride. Under the conditions described for the synthesis of 7-(4-Trifluoromethyl-phenyl)-1,2,3,4-tetrahydro-isoquinoline trifluoroacetate the ethoxycarbonyl-group was converted to a carboxyl acid-group.

C23H16ClN3O6S (497.04), MS(ESI-): 495.95 (M-H+)

Example 10

3-{4-[5-(2,3-Dihydro-benzofuran-5-yl)-2,3-dihydro-indole-1-sulfonyl]-phenyl}-4H-[1,2,4]oxadiazol-5-one



According to the method described in process C and A, 3-{4-[5-(2,3-Dihydro-benzofuran-5-yl)-2,3-dihydro-indole-1-sulfonyl]-phenyl}-4H-[1,2,4]oxadiazol-5-one was obtained from commercially available 2,3-Dihydro-benzofuran-5-boronic acid, 5-Bromo-2,3-dihydro-1H-indole and 4-Cyano-benzenesulfonyl chloride.

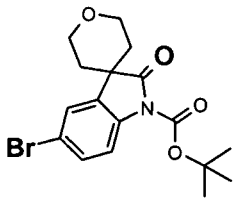
C24H19N3O5S (461.10), MS(ESI-): 459.95 (M-H+)

Example 11:

3-{4-[3,3-(4-Spiro-tetrahydropyran)-5-(4-trifluoromethyl-phenyl)-2,3-dihydro-indole-1-sulfonyl]-phenyl}-4H-[1,2,4]oxadiazol-5-one

Step 1:

5-Bromo-3,3-(4-spiro-tetrahydropyran)-2-oxo-2,3-dihydro-indole-1-carboxylic acid tert-butyl ester

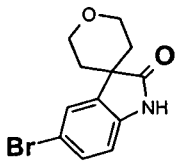


To an ice-cold solution of 5-Bromo-2-oxo-2,3-dihydro-indole-1-carboxylic acid tert-butyl ester (270 mg, 0.86 mmol) in dry DMF (7 mL) was carefully added NaH (60 %) (38 mg, 0.95 mmol). The mixture was stirred for 30 min and then allowed to warm to room temperature. 1-Iodo-2-(2-iodo-ethoxy)-ethane (395 mg, 1.2 mmol) was added and stirring was continued. After 4 h water (50 mL) was added and the mixture was extracted with ethyl acetate. The organic phase was dried over $MgSO_4$ and the solvent

was evaporated under reduced pressure. The raw product was purified by silica gel chromatography to yield 207 mg of a solid material.

Step 2:

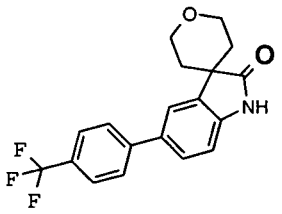
5-Bromo-3,3-(4-spiro-tetrahydropyran)-1,3-dihydro-indol-2-one



A solution of 5-Bromo-3,3-(4-spiro-tetrahydropyran)-2-oxo-2,3-dihydro-indole-1-carboxylic acid tert-butyl ester (207 mg, 0.54 mmol) in CH_2Cl_2 (6.7 mL) and trifluoroacetic acid (0.8 mL) was stirred at room temperature for 2 h. The solvents were evaporated under reduced pressure. The remaining oil was used in the next step without further purification.

Step 3:

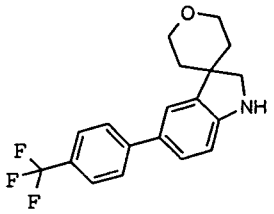
3,3-(4-Spiro-tetrahydropyran)-5-(4-trifluoromethyl-phenyl)-1,3-dihydro-indol-2-one



A solution of 5-Bromo-3,3-(4-Spiro-tetrahydropyran)-1,3-dihydro-indol-2-one (195 mg, 0.69 mol), 4-Trifluoromethylphenyl-boronic acid (144 mg, 0.76 mmol), Cs2CO3 (675 mg, 2.07 mmol) and Tetrakis-triphenylphosphin-palladium (39,9 mg, 0.034 mmol) in DMF (10 mL) and water (3 mL) was heated to 90 °C for 6h. The reaction mixture was allowed to cool to room temperature. Water (50 mL) was added and the mixture was extracted with ethyl acetate (50 mL). The organic phase was dried over $MgSO_4$ and the solvent was evaporated under reduced pressure. The residue was purified by silica gel chromatography to yield 285 mg solid material.

Step 4:

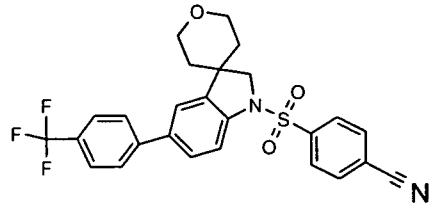
3,3-(4-Spiro-tetrahydropyran)-5-(4-trifluoromethyl-phenyl)-2,3-dihydro-1H-indole



To a solution of 3,3-(4-Spiro-tetrahydropyran)-5-(4-trifluoromethyl-phenyl)-1,3-dihydro-indol-2-one (255 mg, 0.73 mmol) in dry THF (20 mL) was carefully added a 1 M solution of LiAlH4 in THF (2.4 mL, 2.4 mmol). After 2 h at room temperature 100 µL of water, 100 µL of 15 % NaOH solution and 100 µL of water were added successively. The mixture was stirred for 1 h, filtered and the solvent was evaporated under reduced pressure to yield 253 mg of an oily material which was used without further purification in the next step.

Step 5:

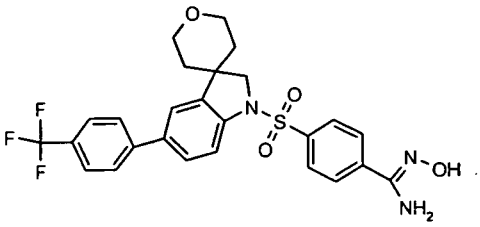
4-[3,3-(4-Spiro-tetrahydropyran)-5-(4-trifluoromethyl-phenyl)-2,3-dihydro-indole-1-sulfonyl]-benzonitrile



To a solution of 3,3-(4-Spiro-tetrahydropyran)-5-(4-trifluoromethyl-phenyl)-2,3-dihydro-1H-indole (103 mg, 0.31 mmol) and triethylamine (149 µL, 0.93 mmol) in CH_2Cl_2 (5 mL) was slowly added 4-Cyano-benzenesulfonyl chloride (62.3 mg, 0,31 mmol). The mixture was stirred for 10 h at room temperature. Water (50 mL) was added and the mixture was extracted three-times with ethyl acetate (50 ml each). The organic phase was dried over $MgSO_4$ and the solvent was evaporated under reduced pressure. The residue was purified by silica gel chromatography to yield 57 mg of solid material.

Step 6:

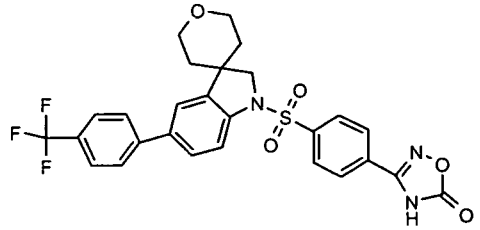
4-[3,3-(4-Spiro-tetrahydropyran)-5-(4-trifluoromethyl-phenyl)-2,3-dihydro-indole-1-sulfonyl]-N-hydroxy-benzamidine



To a solution of 4-[3,3-(4-Spiro-tetrahydropyran)-5-(4-trifluoromethyl-phenyl)-2,3-dihydro-indole-1-sulfonyl]-benzonitrile in THF (9 mL) and methanol (9 mL) was added hydroxylamine hydrochloride (198,6 mg, 2.85 mmol) and triethylamine (400 µL, 2.85 mmol). The mixture was heated to 90 °C for 2 h. The mixture was allowed to cool to room temperature, diluted with water (50 mL) and extracted three-times with ethyl acetate (50 mL each). The organic phase was dried over $MgSO_4$ and the solvent was evaporated under reduced pressure to yield 66 mg of solid material which was used directly in the next step.

Step 7:

3-{4-[3,3-(4-Spiro-tetrahydropyran)-5-(4-trifluoromethyl-phenyl)-2,3-dihydro-indole-1-sulfonyl]-phenyl}-4H-[1,2,4]oxadiazol-5-one

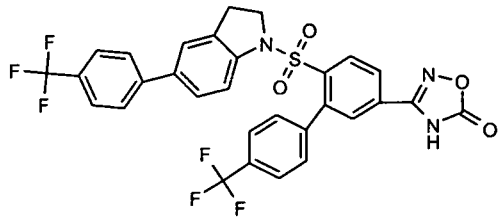


To an ice-cold solution of 4-[3,3-(4-Spiro-tetrahydropyran)-5-(4-trifluoromethyl-phenyl)-2,3-dihydro-indole-1-sulfonyl]-N-hydroxy-benzamidine (66 mg, 0,12 mmol) in CH_2Cl_2 (4mL) and pyridine (12 µL, 015 mmol) was slowly added a solution of phenylchloroformiate (19 µL, 0,15 mmol). The mixture was stirred for 15 min, the cooling bath was removed and the solution was allowed to warm to room temperature. The mixture was diluted with CH3CN (4 mL) and DBU (93 µL, 0,62 mmol) was added. The mixture was stirred for 1 h. The solvents were evaporated under reduced pressure and the residue was purified by PR-chromatography to yield 10 mg product.

C27H22F3N3O5S (557.12), MS(ESI-): 556.23 (M-H+)

Example 12:

3-{4'-Trifluoromethyl-6-[5-(4-trifluoromethyl-phenyl)-2,3-dihydro-indole-1-sulfonyl]-biphenyl-3-yl}-4H-[1,2,4]oxadiazol-5-one

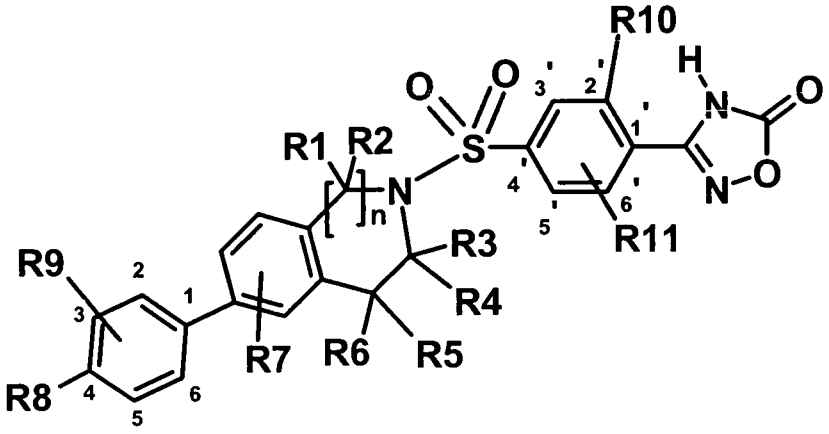


3-{4'-Trifluoromethyl-6-[5-(4-trifluoromethyl-phenyl)-2,3-dihydro-indole-1-sulfonyl]-biphenyl-3-yl}-4H-[1,2,4]oxadiazol-5-one was synthesized from 3-{3-Chloro-4-[5-(4-trifluoromethyl-phenyl)-2,3-dihydro-indole-1-sulfonyl]-phenyl}-4H-[1,2,4]oxadiazol-5-one (Example 6) by Suzuki-type reaction with 4-trifluoromethyl-phenyl boronic acid under conditions described in Example 11.

C30H19F6N3O4S (631.10), MS(ESI-): 630.04 (M-H+)

Claims:

1. Compound of the formula I:



formula I

wherein

n is 0,1

R1, R2 are independently H, (C1-C8) alkyl, (C0-C4) alkylene -(C3-C7) cycloalkyl, (C0-C4) alkylene -(C6-C10) aryl, wherein alkyl and alkylene are unsubstituted or 1- to 3-fold substitued by F;

R3,R4 are independently H, (C1-C8) alkyl, (C0-C4) alkylene -(C3-C7) cycloalkyl, (C0-C4) alkylene -(C6-C10) ary,l wherein alkyl and alkylene are unsubstituted or 1- to 3-fold substitued by F;

R5,R6 are independently H, (C1-C8) alkyl, (C0-C4) alkylene -(C3-C7) cycloalkyl, (C0-C4) alkylene -(C6-C10) aryl, wherein alkyl and alkylene are unsubstituted or 1- to 3-fold substitued by F; or

R5 and R6 together with the carbon atom carrying them form a (C3-C7) cycloalkylring, wherein one carbon atom can be replaced by one heteroatom O, S, N;

R7 is H, halogen, (C1-C8) alkyl, (C0-C4) alkylene-O-(C0-C4) alkylene-H, (C3-C7) cycloalkyl, wherein alkyl and alkylene are unsubstituted or 1- to 3-fold substitued by F;

R8, R9 are independently H, halogen, (C1-C8) alkyl, (C0-C4) alkylene-O-(C0-C4) alkylene-H, (C3-C7) cycloalkyl, -CO-O-(C0-C4)-alkylene-H, CO-O-phenyl, -CO-NR12R13, wherein alkyl and alkylene are unsubstituted or 1- to 3-fold substitued by F, NR12R13 and phenyl is unsubstituted or 1- to 3-fold substituted by halogen, (C1-C4) alkyl, (C0-C4) alkylene-O-(C0-C4) alkylene-H, or NR12R13; or

R8 and R9 together with the carbon atoms to which they are bonded form a (C5-C7) cycloalkyl ring, wherein one carbon atom can be replaced by one heteroatom O, S, N;

R10, R11 are independently H, halogen, (C1-C8) alkyl, (C0-C4) alkylene-O-(C0-C4) alkylene-H, (C3-C7) cycloalkyl, (C6-C10) aryl, wherein cycloalkyl and aryl are unsubstituted or 1- to 2-fold substituted by (C1-C4) alkyl and wherein alkyl and alkylene are unsubstituted or 1- to 3-fold substitued by F;

R12, R13 are independently H, (C1-C6) alkyl;

in all its stereoisomeric forms and mixtures in any ratio, and its physiologically acceptable salts and tautomeric forms.

2. Compound of the formula I as claimed in claim 1, wherein
R9 is in position 2.

3. Compound of the formula I as claimed in claim 1 or 2, wherein
R11 is in position 3'.

4. Compound of the formula I as claimed in claims 1 to 3, wherein
R11 is in position 3' and

R10 is H.

5. Compound of the formula I as claimed in claims 1 to 4, wherein

n is 0,1;

R1, R2 are H;

R3, R4 are H;

R5, R6 are independently H, (C1-C6) alkyl; or

R5 and R6 together with the carbon atom carrying them form a (C5-C6) cycloalkyl ring wherein one carbon atom can be replaced by one heteroatom O or N;

R7 is H;

R8 is CF_3, Cl;

R9 is in position 2 and

R9 is H, F, O-(C1-C4) alkyl, COOH, CO-O-phenyl, O-(C1-C4) alkyl-NR12R13, CO-O-(C1-C4) alkyl-NR12R13, CO-NH-(C1-C4) alkyl-NR12R13; or

R8 and R9 together with the carbon atoms to which they are bonded form a (C5-C6) cycloalkyl ring, wherein one carbon atom is replaced by one heteroatom O;

R10 is H, Cl, F, CH_3;

R11 is H, Cl, phenyl-CF_3;

R12, R13 are (C1-C4) alkyl.

6. Compound of the formula I as claimed in claims 1 to 5, wherein

n is 0, 1;

R1, R2 are H;

R3, R4 are H;

R5, R6 are independently H, (C1-C6) alkyl, preferably, H, CH_3;

R7 is H;

R8 is CF_3;

R9 is H;

R10 is Cl;

R11 is H.

7. A pharmaceutical comprising one or more compounds of the formula I as claimed in one or more of claims 1 to 6.

8. A pharmaceutical comprising one or more compounds of the formula I as claimed in one or more of claims 1 to 6 and one or more active substances which have favorable effects on metabolic disturbances or disorders frequently associated therewith.

9. A pharmaceutical comprising one or more compounds of the formula I as claimed in one or more of claims 1 to 6 and one or more antidiabetics.

10. A pharmaceutical comprising one or more compounds of the formula I as claimed in one or more of claims 1 to 6 and one or more lipid modulators.

11. Compounds of the formula I as claimed in one or more of claims 1 to 6 for use in the treatment and/or prevention of disorders of fatty acid metabolism and glucose utilization disorders.

12. Compounds of the formula I as claimed in one or more of claims 1 to 6 for use in the treatment and/or prevention of disorders in which insulin resistance is involved.

13. Compounds of the formula I as claimed in one or more of claims 1 to 6 for use in the treatment and/or prevention of diabetes mellitus including the prevention of the squelae associated therewith.

14. Compounds of the formula I as claimed in one or more of claims 1 to 6 for use in the treatment and/or prevention of dyslipidemias and their squelae.

15. Compounds of the formula I as claimed in one or more of claims 1 to 6 for use in the treatment and/or prevention of conditions which may be associated with the metabolic syndrome.

16. Compounds of the formula I as claimed in one or more of claims 1 to 6 for use in the treatment and/or prevention of demyelinating and other neurodegenerative disorders of the central and peripheral nervous system.

17. Compounds as claimed in one or more of claims 1 to 6 in combination with at least one further active compound for use in the treatment of disorders of fatty acid metabolism and glucose utilization disorders.

18. Compounds as claimed in one or more of claims 1 to 6 in combination with at least one further active compound for use in the treatment of disorders in which insulin resistance is involved.

19. A process for preparing a pharmaceutical comprising one or more of the compounds as claimed in one or more of claims 1 to 6, which comprises mixing the active compound with a pharmaceutically suitable carrier and bringing this mixture into a form suitable for administration.