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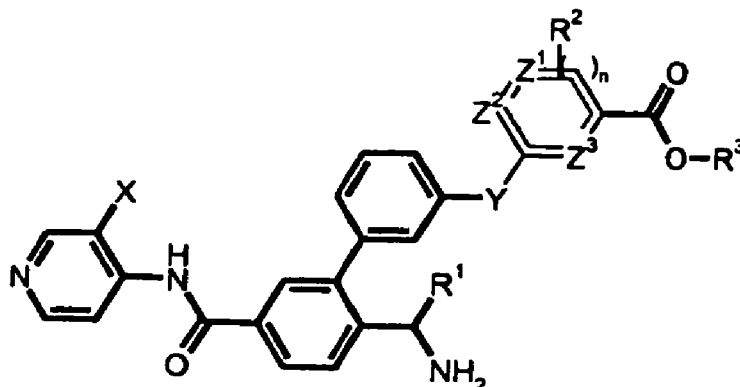
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(54) Title: NOVEL SOFT ROCK INHIBITORS



(57) **Abstract:** The present invention relates to new kinase inhibitors, more specifically ROCK inhibitors, compositions, in particular pharmaceuticals, comprising such inhibitors, and to uses of such inhibitors in the treatment and prophylaxis of disease. In particular, the present invention relates to new ROCK inhibitors, compositions, in particular pharmaceuticals, comprising such inhibitors, and to uses of such inhibitors in the treatment and prophylaxis of disease. In addition, the invention relates to methods of treatment and use of said compounds in the manufacture of a medicament for the application to a number of therapeutic indications including sexual dysfunction, inflammatory diseases and ophthalmic diseases.

**Novel soft ROCK inhibitors****Field of the invention**

The present invention relates to new kinase inhibitors, more specifically ROCK inhibitors, compositions, in particular pharmaceuticals, comprising such inhibitors, and to uses of such inhibitors in the treatment and prophylaxis of disease. In particular, the present invention relates to new ROCK inhibitors, compositions, in particular pharmaceuticals, comprising such inhibitors, and to uses of such inhibitors in the treatment and prophylaxis of disease.

**Background of the invention**

The serine/threonine protein kinase ROCK consists in humans of two isoforms ROCK I and ROCK II. ROCK I is encoded on chromosome 18 whereas ROCK II, also called Rho-kinase, is located on chromosome 12. They both have a molecular weight close to 160kDa. They share an overall homology of 65% while being 95% homologous in their kinase domains. Despite their sequence similarity, they differ by their tissue distributions. The highest levels of expression for ROCK I are observed in heart, lung and skeletal tissues whereas ROCK II is mostly expressed in brain. Recent data indicate that these two isoforms are partially function redundant, ROCK I being more involved in immunological events, ROCK II in smooth muscle function. The term ROCK refers to ROCK I (ROK- $\beta$ , p160ROCK, or Rho-kinase  $\beta$ ) and ROCK II (ROCK- $\alpha$  or Rho-kinase  $\alpha$ ).

ROCK activity has been shown to be enhanced by GTPase RhoA that is a member of the Rho (Ras homologous) GTP-binding proteins. The active GTP-bound state of RhoA interacts with Rho-binding domain (RBD) of ROCK that is located in an autoinhibitory carboxyl-terminal loop. Upon binding, the interactions between the ROCK negative regulatory domain and the kinase domain are disrupted. The process enables the kinase to acquire an open conformation in which it is fully active. The open conformation is also induced by the binding of lipid activators such as arachidonic acid to the PH domain in the kinase carboxyl-terminal domain. Another activation mechanism has been described during apoptosis and involves the cleavage of carboxyl terminus by caspase-3 and -2 (or granzyme B) for ROCK I and II, respectively.

ROCK plays an important role in various cellular functions such as smooth muscle contraction, actin cytoskeleton organization, platelet activation, downregulation of myosin phosphatase cell adhesion, -migration, -proliferation and survival, thrombin-induced responses of aortic smooth muscle cells, hypertrophy of cardiomyocytes, bronchial smooth muscle contraction, smooth muscle contraction and cytoskeletal reorganization of non- muscle cells, activation of volume- regulated anion channels, neurite retraction, wound healing, cell transformation and gene expression. ROCK also acts in several signaling pathways that are involved in auto-immunity and inflammation. ROCK has been shown to play a part in the activation of NF- $\kappa$ B, a critical molecule that leads to the production of TNF and other inflammatory cytokines. ROCK inhibitors are reported to act against

TNF-alpha and IL-6 production in lipopolysaccharide (LPS)-stimulated THP-1 macrophages. Therefore, ROCK inhibitors provide a useful therapy to treat autoimmune and inflammatory diseases as well as oxidative stress.

In conclusion, ROCK is a major control point in smooth muscle cell function and a key signaling component involved in inflammatory processes in various inflammatory cells as well as fibrosis and remodeling in many diseased organs. In addition, ROCK has been implicated in various diseases and disorders including eye diseases; airway diseases; cardiovascular and vascular diseases; inflammatory diseases; neurological and CNS disorders: proliferative diseases; kidney diseases; sexual dysfunction; blood diseases; bone diseases; diabetes; benign prostatic hyperplasia, transplant rejection, liver disease, systemic lupus erythematosus, spasm, hypertension, chronic obstructive bladder disease, premature birth, infection, allergy, obesity, pancreatic disease and AIDS.

ROCK appears to be a safe target, as exemplified by knockout models and a large number of academic studies. These KO mice data, in combination with post-marketing surveillance studies with Fasudil, a moderately potent ROCK inhibitor used for the treatment of vasospasm after subarachnoid hemorrhage, indicate that ROCK is a genuine and significant drug target.

ROCK inhibitors would be useful as therapeutic agents for the treatment of disorders implicated in the ROCK pathway. Accordingly, there is a great need to develop ROCK inhibitors that are useful in treating various diseases or conditions associated with ROCK activation, particularly given the inadequate treatments currently available for the majority of these disorders. A non-limiting example is glaucoma.

Glaucoma is a neurodegenerative disease that is the second most important cause of irreversible blindness. This disease is characterized by a raised intra-ocular pressure (IOP) and by progressive retinal ganglion cell apoptosis, resulting in irreversible visual field loss. Current treatment of this disease is directed towards the reduction of IOP, which is the main -but not only- risk factor for glaucoma. There is a need for improved treatment as the current therapy does only control and not cure the disease and further suffers from irritation, local and systemic side effects. In addition, additional positive effects, as the anti-inflammatory and nerve regenerating components of ROCK inhibitors, would be highly preferred. Reference ROCK inhibitors, such as Y-27632 cause changes in cell shape and decrease stress fibers, focal adhesions and MLC phosphorylation in cultured human TM cells; they relax human trabecular meshwork *in vitro*, relax human Schlemm's canal endothelial cells *in vitro* and when topically applied to animals give a significant increase in trabecular outflow, resulting into a strong lowering of intra ocular pressure.

Several different classes of ROCK inhibitors are known. The current focus is oncology and cardiovascular applications. Until now, the outstanding therapeutic potential of ROCK inhibitors has only been explored to a limited extent because ROCK is such a potent and widespread biochemical regulator that systemic inhibition of ROCK leads to strong biological effects which are considered as being side effects for the treatment of most of the diseases. Indeed, the medical use

of ROCK inhibitors for non-cardiological indications is hampered by the pivotal role of ROCK in the regulation of the tonic phase of smooth muscle cell contraction. Systemically available ROCK inhibitors induce a marked decrease in blood pressure. Therefore, ROCK inhibitors with different properties are highly required.

- 5 For the target specific treatment of disorders by regulating smooth muscle function and/or inflammatory processes and/or remodeling, it is highly desired to deliver a ROCK inhibitor to the target organ and to avoid significant amounts of these drugs to enter other organs. Therefore, local or topical application is desired. Typically, topical administration of drugs has been applied for the treatment of airway-, eye, sexual dysfunction and skin disorders. In addition, local injection /
- 10 infiltration into diseased tissues further extend the potential medical use of locally applied ROCK inhibitors. Given certain criteria are fulfilled, these local applications allow high drug concentration to be reached in the target tissue. In addition, the incorporation of ROCK inhibitors into implants and stents can further expand the medical application towards the local treatment of CV diseases such as atherosclerosis, coronary diseases and heart failure.
- 15 Despite the fact that direct local application is preferred in medical practice, there are concerns regarding drug levels reached into the systemic circulation. For example the treatment of airway diseases by local delivery by for instance inhalation, poses the risk of systemic exposure due to large amounts entering the GI tract and/or systemic absorption through the lungs. For the treatment of eye diseases by local delivery, also significant amounts enter the GI tract and/or systemic
- 20 circulation due to the low permeability of the cornea, low capacity for fluid, efficient drainage and presence of blood vessels in the eyelids. Also for dermal applications, local injections and implantable medical devices, there is a severe risk of leakage into the systemic circulation. Therefore, in addition to local application, the compounds should preferably have additional properties to avoid significant systemic exposure.
- 25 Soft drugs are biologically active compounds that are inactivated once they enter the systemic circulation. This inactivation can be achieved in the liver, but the preferred inactivation should occur in the blood. These compounds, once applied locally to the target tissue / organ exert their desired effect locally. When they leak out of this tissue into the systemic circulation, they are very rapidly inactivated. Thus, soft drugs of choice are sufficiently stable in the target tissue / organ to exert the
- 30 desired biological effect, but are rapidly degraded in the blood to biologically inactive compounds. In addition, it is highly preferable that the soft drugs of choice have retention at their biological target. This property will limit the number of daily applications and is highly desired to reduce the total load of drug and metabolites and in addition will significantly increase the patient compliance.

In conclusion, there is a continuing need to design and develop soft ROCK inhibitors for the

35 treatment of a wide range of disease states. The compounds described herein and pharmaceutically acceptable compositions thereof are useful for treating or lessening the severity of a variety of disorders or conditions associated with ROCK activation. More specifically, the compounds of the invention are preferably used in the prevention and/or treatment of at least one

disease or disorder, in which ROCK is involved, such as diseases linked to smooth muscle cell function, inflammation, fibrosis, excessive cell proliferation, excessive angiogenesis, hyperreactivity, barrier dysfunction, neurodegeneration and remodeling. For example, the compounds of the invention may be used in the prevention and/or treatment of diseases and disorders such as:

- Eye diseases or disorders: including but not limited to retinopathy, optic neuropathy, glaucoma and degenerative retinal diseases such as macular degeneration, proliferative vitreoretinopathy, proliferative diabetic retinopathy retinitis pigmentosa and inflammatory eye diseases (such as anterior uveitis, panuveitis, intermediate uveitis and posterior uveitis), glaucoma filtration surgery failure, dry eye, allergic conjunctivitis, posterior capsule opacification, corneal diseases (such as but not limited to Fuch's dystrophy and keratitis), abnormalities of corneal wound healing and ocular pain.

- Airway diseases; including but not limited to pulmonary fibrosis, emphysema, chronic bronchitis, asthma, fibrosis, pneumonia, cystic fibrosis, chronic obstructive pulmonary disease (COPD); bronchitis and rhinitis and respiratory distress syndrome

- Throat, Nose and Ear diseases: including but not limited to sinus problems, hearing problems, toothache, tonsillitis, ulcer and rhinitis,

- Skin diseases: including but not limited to hyperkeratosis, parakeratosis, hypergranulosis, acanthosis, dyskeratosis, spongiosis and ulceration.

- Intestinal diseases; including but not limited to inflammatory bowel disease (IBD), colitis, gastroenteritis, ileus, ileitis, appendicitis and Crohn's disease.

- Cardiovascular and vascular diseases: including but not limited to, pulmonary hypertension and pulmonary vasoconstriction,.

- Inflammatory diseases: including but not limited to contact dermatitis, atopic dermatitis, psoriasis, rheumatoid arthritis, juvenile rheumatoid arthritis, ankylosing spondylitis, psoriatic arthritis, inflammatory bowel disease, Crohn's disease and ulcerative colitis.

- Neurological disorders: including but not limited to neuropathic pain. The present compounds are therefore suitable for preventing neurodegeneration and stimulating neurogeneration in various neurological disorders.

- Proliferative diseases: such as but not limited to cancer of , breast, colon, intestine, skin, head and neck, nerve, uterus, kidney, lung, ovary, pancreas, prostate, or thyroid gland; Castleman disease; sarcoma; malignoma; and melanoma.

- Kidney diseases: including but not limited to renal fibrosis or renal dysfunction

- Sexual dysfunction: is meant to include both male and female sexual dysfunction caused by a defective vasoactive response. The soft ROCK inhibitors of the present invention may also be used to treat sexual dysfunction arising from a variety of causes. For example, in an

embodiment, the soft ROCK inhibitors may be used to treat sexual dysfunction associated with hypogonadism and more particularly, wherein the hypogonadism is associated with reduced levels of androgen hormones. In another embodiment, the soft ROCK inhibitors may be used to treat sexual dysfunction associated with a variety of causes including, but not limited to, bladder disease, hypertension, diabetes, or pelvic surgery. In addition, the soft ROCK inhibitors may be used to treat sexual dysfunction associated with treatment using certain drugs, such as drugs used to treat hypertension, depression or anxiety.

- Bone diseases: including but not limited to osteoporosis and osteoarthritis

- In addition, the compounds of the invention may be used in the prevention and/or treatment of diseases and disorders such as benign prostatic hyperplasia, transplant rejection, spasm, chronic obstructive bladder disease, and allergy.

### **SUMMARY OF THE INVENTION**

We have surprisingly found that the compounds described herein act as inhibitors of ROCK, in particular as soft ROCK inhibitors. The compounds of the present invention are very rapidly converted into functionally inactive compounds for example by carboxylic ester hydrolases (EC 3.1.1) such as Cholinesterase or Carboxylesterases or by plasma proteins displaying pseudoesterase activity such as Human serum albumin. Carboxylic ester hydrolases (EC 3.1.1) represent a large group of enzymes involved in the degradation of carboxylic esters into alcohols and carboxylic acids. As such, enzymes displaying this catalytic activity are of potential interest for the design of soft kinase inhibitors. EC 3.1.1 includes the following sub-classes:

EC 3.1.1.1 carboxylesterase; EC 3.1.1.2 arylesterase; EC 3.1.1.3 triacylglycerol lipase; EC 3.1.1.4 ; phospholipase A2; EC 3.1.1.5 lysophospholipase; EC 3.1.1.6 acetylerase; EC 3.1.1.7 acetylcholinesterase; EC 3.1.1.8 cholinesterase; EC 3.1.1.10 tropinesterase; EC 3.1.1.11 pectinesterase; EC 3.1.1.13 sterol esterase; EC 3.1.1.14 chlorophyllase; EC 3.1.1.15 L-arabinonolactonase; EC 3.1.1.17 gluconolactonase; EC 3.1.1.19 uronolactonase; EC 3.1.1.20 tannase; EC 3.1.1.21 retinyl-palmitate esterase; EC 3.1.1.22 hydroxybutyrate-dimer hydrolase; EC 3.1.1.23 acylglycerol lipase; EC 3.1.1.24 3-oxoadipate enol-lactonase; EC 3.1.1.25 1,4-lactonase; EC 3.1.1.26 galactolipase; EC 3.1.1.27 4-pyridoxolactonase; EC 3.1.1.28 acylcarnitine hydrolase; EC 3.1.1.29 aminoacyl-tRNA hydrolase; EC 3.1.1.30 D-arabinonolactonase; EC 3.1.1.31 6-phosphogluconolactonase; EC 3.1.1.32 phospholipase A1; EC 3.1.1.33 6-acetylglucose deacetylase; EC 3.1.1.34 lipoprotein lipase; EC 3.1.1.35 dihydrocoumarin hydrolase; EC 3.1.1.36 limonin-D-ring-lactonase; EC 3.1.1.37 steroid-lactonase; EC 3.1.1.38 triacetate-lactonase; EC 3.1.1.39 actinomycin lactonase; EC 3.1.1.40 orsellinate-depside hydrolase; EC 3.1.1.41 cephalosporin-C deacetylase; EC 3.1.1.42 chlorogenate hydrolase; EC 3.1.1.43  $\alpha$ -amino-acid esterase; EC 3.1.1.44 4-methyloxaloacetate esterase; EC 3.1.1.45 carboxymethylenebutenolidase; EC 3.1.1.46 deoxylimonate A-ring-lactonase; EC 3.1.1.47 1-alkyl-2-acetylgllycerophosphocholine esterase; EC 3.1.1.48 fusarinine-C ornithinesterase; EC 3.1.1.49 sinapine esterase; EC 3.1.1.50

wax-ester hydrolase; EC 3.1.1.51 phorbol-diester hydrolase; EC 3.1.1.52 phosphatidylinositol deacylase; EC 3.1.1.53 sialate O-acetyltransferase; EC 3.1.1.54 acetoxymethylbithiophene deacetylase; EC 3.1.1.55 acetylsalicylate deacetylase; EC 3.1.1.56 methylumbelliferyl-acetate deacetylase; EC 3.1.1.57 2-pyrone-4,6-dicarboxylate lactonase; EC 3.1.1.58 N-acetylglucosaminoglycan deacetylase; EC 3.1.1.59 juvenile-hormone esterase; EC 3.1.1.60 bis(2-ethylhexyl)phthalate esterase; EC 3.1.1.61 protein-glutamate methyltransferase; EC 3.1.1.63 11-cis-retinyl-palmitate hydrolase; EC 3.1.1.64 all-trans-retinyl-palmitate hydrolase; EC 3.1.1.65 L-rhamnono-1,4-lactonase; EC 3.1.1.66 5-(3,4-diacetoxymethyl-2-yl)-2,2'-bithiophene deacetylase; EC 3.1.1.67 fatty-acyl-ethyl-ester synthase; EC 3.1.1.68 xylono-1,4-lactonase; EC 3.1.1.70 cetraxate benzylesterase; EC 3.1.1.71 acetylmethylglycerol acetylhydrolase; EC 3.1.1.72 acetylcholine esterase; EC 3.1.1.73 feruloyl esterase; EC 3.1.1.74 cutinase; EC 3.1.1.75 poly(3-hydroxybutyrate) depolymerase; EC 3.1.1.76 poly(3-hydroxyoctanoate) depolymerase; EC 3.1.1.77 acylacetylhydrolase; EC 3.1.1.78 polyneuridine-aldehyde esterase; EC 3.1.1.79 hormone-sensitive lipase; EC 3.1.1.80 acetylcholine esterase; EC 3.1.1.81 quorum-quenching N-acyl-homoserine lactonase; EC 3.1.1.82 pheophorbide; EC 3.1.1.83 monoterpene  $\epsilon$ -lactone hydrolase; EC 3.1.1.84 cocaine esterase; EC 3.1.1.85 mannosylglycerate hydrolases.

Cholinesterases are enzymes that are primarily known for their role in the degradation of the neurotransmitter acetylcholine. Acetylcholinesterase (EC 3.1.1.7) is also known as Choline esterase I, true cholinesterase, RBC cholinesterase, erythrocyte cholinesterase, or acetylcholine acetylhydrolase. As suggested by some of its alternative names, acetylcholinesterase is not only found in brain, but also in the erythrocyte fraction of blood. In addition to its action on acetylcholine, acetylcholinesterase hydrolyzes a variety of acetic esters, and also catalyzes transacetylations. Acetylcholinesterase usually displays a preference for substrates with short acid chains, as the acetyl group of acetylcholine. Butyrylcholinesterase (EC 3.1.1.8) is also known as benzoylcholinesterase, choline esterase II, non-specific cholinesterase, pseudocholinesterase, plasma cholinesterase or acylcholine acylhydrolase. While being found primarily in liver, butyrylcholinesterase is also present in plasma. As indicated by some of its alternative names, it is less specific than acetylcholinesterase and will typically carry out the hydrolysis of substrates with larger acid chains (such as the butyryl group of butyrylcholine or the benzoyl group of benzoylcholine) at a faster rate than acetylcholinesterase. In addition to its action on acetylcholine, butyrylcholinesterase is known to participate in the metabolism of several ester drugs, such as procaine.

Carboxylesterases (CES) represent a multigene family and show ubiquitous expression profiles, with high levels in liver, intestine and lungs. A majority of carboxylesterases can be classified either in carboxylesterase 1 (CES 1) or carboxylesterase 2 (CES2) families. Interestingly, these different CES families show differences in tissue distribution and substrate specificity. Human CES1 is widely distributed in many tissues, but is found in low levels in the intestine. CES1 preferentially hydrolyzes esters with relatively small alcohol groups and larger acid groups. As a typical example, hCES1 preferentially catalyzes the hydrolysis of the methyl ester of cocaine. Human CES2 is

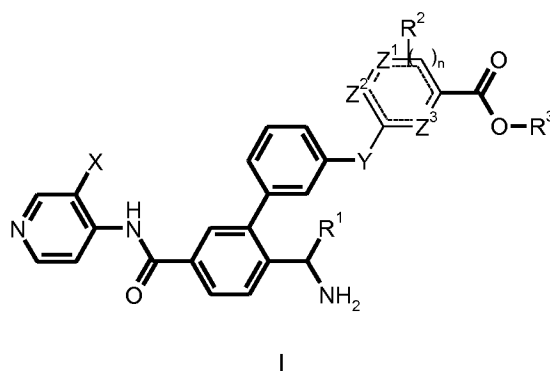
predominantly found in intestine, liver and kidney. CES2 preferentially hydrolyzes esters with smaller alcohol groups, and larger acid groups. As a typical example, human CES2 catalyzes the hydrolysis of the benzoyl ester of cocaine. Another interesting observation about CES enzymes is the lack of carboxylesterase activity in human plasma. Overall, carboxylesterases can play a major role in the bioconversion of ester-containing drugs and xenobiotics.

Paraoxonase 1 (PON1) is also known as arylesterase (EC 3.1.1.2) or A-esterase. PON1 is a  $\text{Ca}^{2+}$  dependent serum class A esterase, which is synthesized in the liver and secreted in the blood, where it associates exclusively with high-density lipoproteins (HDLs). Furthermore, it is able to cleave a unique subset of substrates including organophosphates, arylesters, lactones and cyclic carbonates. Therefore, the  $\text{R}_2$  substituent of the compounds of the present invention, generally represented by formula I hereinbelow, can be selected to comprise a substituent selected from the group of arylesters, lactones and cyclic carbonates, more specifically from arylesters and lactones.

Human serum albumin (HSA) is a major component of blood plasma, accounting for approximately 60% of all plasma proteins. HSA has been found to catalyze the hydrolysis of various compounds such as aspirin, cinnamoylimidazole, p-nitrophenyl acetate, organophosphate insecticides, fatty acid esters or nicotinic esters. HSA displays multiple nonspecific catalytic sites in addition to its primary reactive site. The catalytic efficiency of these sites is however low, and HSA has often been described not as a true esterase, but as a pseudoesterase. In spite of its low catalytic efficiency, HSA can still have a measurable contribution in the metabolism of drug-like compounds, because of its high concentration in plasma.

Unless a context dictates otherwise, asterisks are used herein to indicate the point at which a mono- or bivalent radical depicted is connected to the structure to which it relates and of which the radical forms part.

Viewed from a first aspect, the invention provides a compound of Formula I or a stereoisomer, tautomer, racemic, salt, hydrate, or solvate thereof,



Wherein,

X is hydrogen or halogen;

Y is  $-\text{NH}-\text{C}(=\text{O})-$  or  $-\text{C}(=\text{O})-\text{NH}-$ ;



$Z^1$ ,  $Z^2$ , and  $Z^3$  are each independently selected from the group consisting of C, N, O, and S;

$R^1$  is selected from the group comprising hydrogen,  $C_{1-20}$ alkyl, and  $C_{3-15}$ cycloalkyl;

$R^2$  is selected from the group comprising hydrogen,  $C_{1-20}$ alkyl, halogen and  $C_{1-20}$ alkoxy;

$R^3$  is selected from the group consisting of  $C_{1-20}$ alkyl,  $C_{3-20}$ alkenyl,  $C_{3-20}$ alkynyl,  $C_{3-15}$ cycloalkyl, aryl, heteroaryl, and  $C_{3-19}$ heterocyclyl; wherein said  $C_{1-20}$ alkyl,  $C_{3-20}$ alkenyl,  $C_{3-20}$ alkynyl,  $C_{3-15}$ cycloalkyl, aryl, heteroaryl, and  $C_{3-19}$ heterocyclyl is optionally substituted with one or more substituents selected from the group consisting of halo, hydroxyl, oxo, carbonyl, , amino, amido, , cyano, aryl, heteroaryl,  $C_{3-15}$ cycloalkyl,  $C_{3-19}$ heterocyclyl,  $C_{1-20}$ alkylamino,  $C_{1-6}$ alkyl, di( $C_{1-20}$ alkyl)amino,  $C_{1-20}$ alkoxy, halo- $C_{1-20}$ alkoxy, halo- $C_{1-20}$ alkyl, thiol,  $C_{1-20}$ alkylthio, carboxylic acid, acylamino,  $C_{1-20}$ alkyl esters, carbamate, thioamido, urea, and sulfonamido; and

n is 0 or 1.

Viewed from a further aspect, the invention provides the use of a compound of the invention, or a composition comprising such a compound, for inhibiting the activity of at least one kinase, in vitro or in vivo.

Viewed from a further aspect, the invention provides the use of a compound of the invention, or a composition comprising such a compound, for inhibiting the activity of at least one ROCK kinase, for example ROCKII and/or ROCKI isoforms.

Viewed from a further aspect, the invention provides a pharmaceutical and/or veterinary composition comprising a compound of the invention.

Viewed from a still further aspect, the invention provides a compound of the invention for use in human or veterinary medicine.

Viewed from a still further aspect, the invention provides the use of a compound of the invention in the preparation of a medicament for the prevention and/or treatment of at least one disease and/or disorder selected from the group comprising eye diseases; airway diseases; throat, nose and ear diseases; intestinal diseases; cardiovascular and vascular diseases; inflammatory diseases; neurological and CNS disorders: proliferative diseases; kidney diseases; sexual dysfunction; bone diseases; benign prostatic hyperplasia, transplant rejection, spasm, chronic obstructive bladder disease, and allergy.

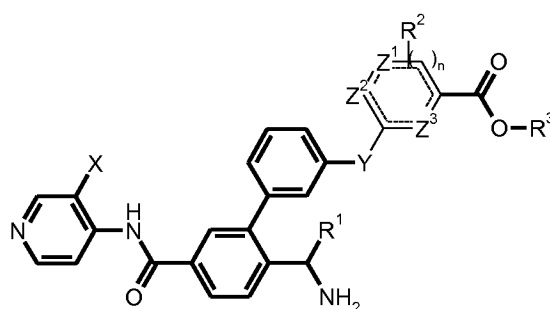
## **DETAILED DESCRIPTION OF THE INVENTION**

The present invention will now be further described. In the following passages, different aspects of the invention are defined in more detail. Each aspect so defined may be combined with any other aspect or aspects unless clearly indicated to the contrary. In particular, any feature indicated as being preferred or advantageous may be combined with any other feature or features indicated as being preferred or advantageous.

Unless a context dictates otherwise, asterisks are used herein to indicate the point at which a mono- or bivalent radical depicted is connected to the structure to which it relates and of which the radical forms part.

Undefined (racemic) asymmetric centers that may be present in the compounds of the present invention are interchangeably indicated by drawing a wavy bonds or a straight bond in order to visualize the undefined steric character of the bond.

As already mentioned hereinbefore, in a first aspect the present invention provides compounds of Formula I



I

Wherein, X, Y, Z<sup>1</sup>, Z<sup>2</sup>, Z<sup>3</sup>, R<sup>1</sup>, R<sup>2</sup>, R<sup>3</sup> and n are as defined hereinbefore, including the stereoisomeric forms, solvates, and pharmaceutically acceptable addition salts thereof.

When describing the compounds of the invention, the terms used are to be construed in accordance with the following definitions, unless a context dictates otherwise:

The term "alkyl" by itself or as part of another substituent refers to a fully saturated hydrocarbon of Formula C<sub>x</sub>H<sub>2x+1</sub> wherein x is a number greater than or equal to 1. Generally, alkyl groups of this invention comprise from 1 to 20 carbon atoms. Alkyl groups may be linear or branched and may be substituted as indicated herein. When a subscript is used herein following a carbon atom, the subscript refers to the number of carbon atoms that the named group may contain. Thus, for example, C<sub>1-4</sub>alkyl means an alkyl of one to four carbon atoms. Examples of alkyl groups are methyl, ethyl, n-propyl, i-propyl, butyl, and its isomers (e.g. n-butyl, i-butyl and t-butyl); pentyl and its isomers, hexyl and its isomers, heptyl and its isomers, octyl and its isomers, nonyl and its isomers; decyl and its isomers. C<sub>1</sub>-C<sub>6</sub> alkyl includes all linear, branched, or cyclic alkyl groups with between 1 and 6 carbon atoms, and thus includes methyl, ethyl, n-propyl, i-propyl, butyl and its isomers (e.g. n-butyl, i-butyl and t-butyl); pentyl and its isomers, hexyl and its isomers, cyclopentyl, 2-, 3-, or 4-methylcyclopentyl, cyclopentylmethylene, and cyclohexyl.

The term "optionally substituted alkyl" refers to an alkyl group optionally substituted with one or more substituents (for example 1 to 4 substituents, for example 1, 2, 3, or 4 substituents or 1 to 2 substituents; preferably one substituent) at any available point of attachment. Non-limiting examples of such substituents include halo, hydroxyl, oxo, carbonyl, amino, amido, cyano, aryl, heteroaryl, cycloalkyl, heterocyclyl, alkylamino, alkoxy, haloalkoxy, haloalkyl, thiol, alkylthio,

carboxylic acid, acylamino, alkyl esters, carbamate, thioamido, urea, sulfonamido and the like. In a particular embodiment, such substituents are selected from the group consisting of halo, hydroxyl, nitro, amino, cyano, aryl (in particular phenyl and halophenyl such as fluorophenyl), heteroaryl (more in particular pyridinyl), cycloalkyl, heterocyclyl, alkoxy, alkylamino, and dialkylamino. In  
5 another particular embodiment, such substituents are selected from the group consisting of cyano, aryl, heteroaryl, cycloalkyl, heterocyclyl, dialkylamino, and alkoxy.

The term "alkylamino", as used herein refers to an amino group substituted with one or more alkyl chain(s). This definition includes quaternary ammonium derivatives.

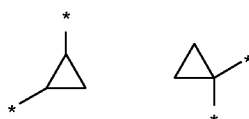
The term "alkenyl", as used herein, unless otherwise indicated, means straight-chain, cyclic, or  
10 branched-chain hydrocarbon radicals containing at least one carbon-carbon double bond. Examples of alkenyl radicals include ethenyl, E- and Z-propenyl, isopropenyl, E- and Z-butenyl, E- and Z-isobutenyl, E- and Z-pentenyl, E- and Z-hexenyl, E,E-, E,Z-, Z,E-, Z,Z-hexadienyl, and the like. An optionally substituted alkenyl refers to an alkenyl having optionally one or more substituents (for example 1, 2, 3 or 4), selected from those defined above for substituted alkyl.

15 The term "alkynyl", as used herein, unless otherwise indicated, means straight-chain or branched-chain hydrocarbon radicals containing at least one carbon-carbon triple bond. Examples of alkynyl radicals include ethynyl, propynyl, isopropynyl, butynyl, isobutynyl, pentynyl, hexynyl, and the like. An optionally substituted alkynyl refers to an alkynyl having optionally one or more substituents (for example 1, 2, 3 or 4), selected from those defined above for substituted alkyl.

20 The term "cycloalkyl" by itself or as part of another substituent is a cyclic alkyl group, that is to say, a monovalent, saturated, or unsaturated hydrocarbon group having 1, 2, or 3 cyclic structure. Cycloalkyl includes all saturated or partially saturated (containing 1 or 2 double bonds) hydrocarbon groups containing 1 to 3 rings, including monocyclic, bicyclic, or polycyclic alkyl groups. Cycloalkyl groups may comprise 3 or more carbon atoms in the ring and generally,  
25 according to this invention comprise from 3 to 15 atoms. The further rings of multi-ring cycloalkyls may be either fused, bridged and/or joined through one or more spiro atoms. Cycloalkyl groups may also be considered to be a subset of homocyclic rings discussed hereinafter. Examples of cycloalkyl groups include but are not limited to cyclopropyl, cyclobutyl, cyclopentyl, cyclohexyl, cycloheptyl, cyclooctyl, cyclononyl, adamantanyl, bicyclo(2.2.1)heptanyl and cyclodecyl with  
30 cyclopropyl, cyclopentyl, cyclohexyl, adamantanyl, and bicyclo(2.2.1)heptanyl being particularly preferred. An "optionally substituted cycloalkyl" refers to a cycloalkyl having optionally one or more substituents (for example 1 to 3 substituents, for example 1, 2, 3 or 4 substituents), selected from those defined above for substituted alkyl. When the suffix "ene" is used in conjunction with a cyclic group, hereinafter also referred to as "Cycloalkylene", this is intended to mean the cyclic group as  
35 defined herein having two single bonds as points of attachment to other groups. Cycloalkylene groups of this invention preferably comprise the same number of carbon atoms as their cycloalkyl radical counterparts.

Where alkyl groups as defined are divalent, i.e., with two single bonds for attachment to two other groups, they are termed "alkylene" groups. Non-limiting examples of alkylene groups includes methylene, ethylene, methylenemethylene, trimethylene, propylene, tetramethylene, ethylethylene, 1,2-dimethylethylene, pentamethylene and hexamethylene. Similarly, where alkenyl groups as defined above and alkynyl groups as defined above, respectively, are divalent radicals having single bonds for attachment to two other groups, they are termed "alkenylene" and "alkynylene" respectively.

Generally, alkylene groups of this invention preferably comprise the same number of carbon atoms as their alkyl counterparts. Where an alkylene or cycloalkylene biradical is present, connectivity to the molecular structure of which it forms part may be through a common carbon atom or different carbon atom, preferably a common carbon atom. To illustrate this applying the asterisk nomenclature of this invention, a C<sub>3</sub> alkylene group may be for example \*-CH<sub>2</sub>CH<sub>2</sub>CH<sub>2</sub>-, \*-CH(-CH<sub>2</sub>CH<sub>3</sub>)-\*, or \*-CH<sub>2</sub>CH(-CH<sub>3</sub>)-\*. Likewise a C<sub>3</sub> cycloalkylene group may be



Where a cycloalkylene group is present, this is preferably a C<sub>3</sub>-C<sub>6</sub> cycloalkylene group, more preferably a C<sub>3</sub> cycloalkylene (i.e. cyclopropylene group) wherein its connectivity to the structure of which it forms part is through a common carbon atom. Cycloalkylene and alkylene biradicals in compounds of the invention may be, but preferably are not, substituted.

The terms "heterocyclyl" or "heterocyclo" as used herein by itself or as part of another group refer to non-aromatic, fully saturated or partially unsaturated cyclic groups (for example, 3 to 13 member monocyclic, 7 to 17 member bicyclic, or 10 to 20 member tricyclic ring systems, or containing a total of 3 to 10 ring atoms) which have at least one heteroatom in at least one carbon atom-containing ring. Each ring of the heterocyclic group containing a heteroatom may have 1, 2, 3 or 4 heteroatoms selected from nitrogen atoms, oxygen atoms and/or sulfur atoms, where the nitrogen and sulfur heteroatoms may optionally be oxidized and the nitrogen heteroatoms may optionally be quaternized. The heterocyclic group may be attached at any heteroatom or carbon atom of the ring or ring system, where valence allows. The rings of multi-ring heterocycles may be fused, bridged and/or joined through one or more spiro atoms. An optionally substituted heterocyclyl refers to a heterocyclyl having optionally one or more substituents (for example 1 to 4 substituents, or for example 1, 2, 3 or 4), selected from those defined for substituted aryl.

Exemplary heterocyclic groups include piperidinyl, azetidiny, imidazoliny, imidazolidiny, isoxazoliny, oxazolidiny, isoxazolidiny, thiazolidiny, isothiazolidiny, piperidyl, succinimidyl, 3H-indolyl, isoindoliny, chromenyl, isochromanly, xanthenyl, 2H-pyrrolyl, 1-pyrroliny, 2-pyrroliny, 3-pyrroliny, pyrrolidiny, 4H-quinoliziny, 4aH-carbazolyl, 2-oxopiperaziny, piperaziny, homopiperaziny, 2-pyrazoliny, 3-pyrazoliny, pyranly, dihydro-2H-pyranly, 4H-pyranly, 3,4-dihydro-2H-pyranly, phthalaziny, oxetany, thietany, 3-dioxolany, 1,3-dioxany, 2,5-dioximidazolidiny,

2,2,4-piperidonyl, 2-oxopiperidinyl, 2-oxopyrrolodiny, 2-oxoazepinyl, indolinyl, tetrahydropyranyl, tetrahydrofuranyl, tetrahydrothienyl, tetrahydroquinolinyl, tetrahydroisoquinolinyl, thiomorpholinyl, thiomorpholinyl sulfoxide, thiomorpholinyl sulfone, 1,3-dioxolanyl, 1,4-oxathianyl, 1,4-dithianyl, 1,3,5-trioxanyl, 6H-1,2,5-thiadiazinyl, 2H-1,5,2-dithiazinyl, 2H-oxocinyl, 1H-pyrrolizinyl, tetrahydro-  
5 1,1-dioxothienyl, N-formylpiperazinyl, and morpholinyl.

The term "aryl" as used herein refers to a polyunsaturated, aromatic hydrocarbyl group having a single ring (i.e. phenyl) or multiple aromatic rings fused together (e.g. naphthalene or anthracene) or linked covalently, typically containing 6 to 10 atoms; wherein at least one ring is aromatic. The aromatic ring may optionally include one to three additional rings (either cycloalkyl, heterocyclyl, or  
10 heteroaryl) fused thereto. Aryl is also intended to include the partially hydrogenated derivatives of the carbocyclic systems enumerated herein. Non-limiting examples of aryl comprise phenyl, biphenyl, biphenylenyl, 5- or 6-tetralinyl, 1-, 2-, 3-, 4-, 5-, 6-, 7-, or 8-azulenyl, 1- or 2-naphthyl, 1-, 2-, or 3-indenyl, 1-, 2-, or 9-anthryl, 1-, 2-, 3-, 4-, or 5-acenaphthylenyl, 3-, 4-, or 5-acenaphthenyl, 1-, 2-, 3-, 4-, or 10-phenanthryl, 1- or 2-pentalenyl, 1-, 2-, 3-, or 4-fluorenyl, 4- or 5-indanyl, 5-, 6-, 7-, or  
15 8-tetrahydronaphthyl, 1,2,3,4-tetrahydronaphthyl, 1,4-dihydronaphthyl, dibenzo[a,d]cycloheptenyl, and 1-, 2-, 3-, 4-, or 5-pyrenyl.

The aryl ring can optionally be substituted by one or more substituents. An "optionally substituted aryl" refers to an aryl having optionally one or more substituents (for example 1 to 5 substituents, for example 1, 2, 3 or 4) at any available point of attachment. Non-limiting examples of such  
20 substituents are selected from halogen, hydroxyl, oxo, nitro, amino, hydrazine, aminocarbonyl, azido, cyano, alkyl, cycloalkyl, alkenyl, alkynyl, cycloalkylalkyl, alkylamino, alkoxy, -SO<sub>2</sub>-NH<sub>2</sub>, aryl, heteroaryl, aralkyl, haloalkyl, haloalkoxy, alkoxycarbonyl, alkylaminocarbonyl, heteroarylalkyl, alkylsulfonamide, heterocyclyl, alkylcarbonylaminoalkyl, aryloxy, alkylcarbonyl, arylcarbonyl, aminocarbonyl, alkylsulfoxide, -SO<sub>2</sub>R<sup>a</sup>, alkylthio, carboxyl, and the like, wherein R<sup>a</sup> is alkyl or  
25 cycloalkyl.

Where a carbon atom in an aryl group is replaced with a heteroatom, the resultant ring is referred to herein as a heteroaryl ring.

The term "heteroaryl" as used herein by itself or as part of another group refers but is not limited to 5 to 12 carbon-atom aromatic rings or ring systems containing 1 to 3 rings which are fused together  
30 or linked covalently, typically containing 5 to 8 atoms; at least one of which is aromatic in which one or more carbon atoms in one or more of these rings can be replaced by oxygen, nitrogen or sulfur atoms where the nitrogen and sulfur heteroatoms may optionally be oxidized and the nitrogen heteroatoms may optionally be quaternized. Such rings may be fused to an aryl, cycloalkyl, heteroaryl or heterocyclyl ring. Non-limiting examples of such heteroaryl, include: pyrrolyl, furanyl,  
35 thiophenyl, pyrazolyl, imidazolyl, oxazolyl, isoxazolyl, thiazolyl, isothiazolyl, triazolyl, oxadiazolyl, thiadiazolyl, tetrazolyl, oxatriazolyl, thiatriazolyl, pyridinyl, pyrimidyl, pyrazinyl, pyridazinyl, oxazinyl, dioxinyl, thiazinyl, triazinyl, imidazo[2,1-b][1,3]thiazolyl, thieno[3,2-b]furanyl, thieno[3,2-b]thiophenyl, thieno[2,3-d][1,3]thiazolyl, thieno[2,3-d]imidazolyl, tetrazolo[1,5-a]pyridinyl, indolyl, indolizinyl,

isoindolyl, benzofuranyl, benzopyranyl, 1(4H)-benzopyranyl, 1(2H)-benzopyranyl, 3,4-dihydro-1(2H)-benzopyranyl, 3,4-dihydro-1(2H)-benzopyranyl, isobenzofuranyl, benzothiophenyl, isobenzothiophenyl, indazolyl, benzimidazolyl, 1,3-benzoxazolyl, 1,2-benzisoxazolyl, 2,1-benzisoxazolyl, 1,3-benzothiazolyl, 1,2-benzoisothiazolyl, 2,1-benzoisothiazolyl, benzotriazolyl, 1,2,3-benzoxadiazolyl, 2,1,3-benzoxadiazolyl, 1,2,3-benzothiadiazolyl, 2,1,3-benzothiadiazolyl, thienopyridinyl, purinyl, imidazo[1,2-a]pyridinyl, 6-oxo-pyridazin-1(6H)-yl, 2-oxopyridin-1(2H)-yl, 6-oxo-pyridazin-1(6H)-yl, 2-oxopyridin-1(2H)-yl, 1,3-benzodioxolyl, quinolinyl, isoquinolinyl, cinnolinyl, quinazolinyl, quinoxalinyl, 7-azaindolyl, 6-azaindolyl, 5-azaindolyl, 4-azaindolyl.

The term "pyrrolyl" (also called azolyl) as used herein includes pyrrol-1-yl, pyrrol-2-yl and pyrrol-3-yl. The term "furanyl" (also called "furyl") as used herein includes furan-2-yl and furan-3-yl (also called furan-2-yl and furan-3-yl). The term "thiophenyl" (also called "thienyl") as used herein includes thiophen-2-yl and thiophen-3-yl (also called thien-2-yl and thien-3-yl). The term "pyrazolyl" (also called 1H-pyrazolyl and 1,2-diazolyl) as used herein includes pyrazol-1-yl, pyrazol-3-yl, pyrazol-4-yl and pyrazol-5-yl. The term "imidazolyl" as used herein includes imidazol-1-yl, imidazol-2-yl, imidazol-4-yl and imidazol-5-yl. The term "oxazolyl" (also called 1,3-oxazolyl) as used herein includes oxazol-2-yl; oxazol-4-yl and oxazol-5-yl. The term "isoxazolyl" (also called 1,2-oxazolyl), as used herein includes isoxazol-3-yl, isoxazol-4-yl, and isoxazol-5-yl. The term "thiazolyl" (also called 1,3-thiazolyl), as used herein includes thiazol-2-yl, thiazol-4-yl and thiazol-5-yl (also called 2-thiazolyl, 4-thiazolyl and 5-thiazolyl). The term "isothiazolyl" (also called 1,2-thiazolyl) as used herein includes isothiazol-3-yl, isothiazol-4-yl, and isothiazol-5-yl. The term "triazolyl" as used herein includes 1H-triazolyl and 4H-1,2,4-triazolyl, "1H-triazolyl" includes 1H-1,2,3-triazol-1-yl, 1H-1,2,3-triazol-4-yl, 1H-1,2,3-triazol-5-yl, 1H-1,2,4-triazol-1-yl, 1H-1,2,4-triazol-3-yl and 1H-1,2,4-triazol-5-yl. "4H-1,2,4-triazolyl" includes 4H-1,2,4-triazol-4-yl, and 4H-1,2,4-triazol-3-yl. The term "oxadiazolyl" as used herein includes 1,2,3-oxadiazol-4-yl, 1,2,3-oxadiazol-5-yl, 1,2,4-oxadiazol-3-yl, 1,2,4-oxadiazol-5-yl, 1,2,5-oxadiazol-3-yl and 1,3,4-oxadiazol-2-yl. The term "thiadiazolyl" as used herein includes 1,2,3-thiadiazol-4-yl, 1,2,3-thiadiazol-5-yl, 1,2,4-thiadiazol-3-yl, 1,2,4-thiadiazol-5-yl, 1,2,5-thiadiazol-3-yl (also called furazan-3-yl) and 1,3,4-thiadiazol-2-yl. The term "tetrazolyl" as used herein includes 1H-tetrazol-1-yl, 1H-tetrazol-5-yl, 2H-tetrazol-2-yl, and 2H-tetrazol-5-yl. The term "oxatriazolyl" as used herein includes 1,2,3,4-oxatriazol-5-yl and 1,2,3,5-oxatriazol-4-yl. The term "thiatriazolyl" as used herein includes 1,2,3,4-thiatriazol-5-yl and 1,2,3,5-thiatriazol-4-yl. The term "pyridinyl" (also called "pyridyl") as used herein includes pyridin-2-yl, pyridin-3-yl and pyridin-4-yl (also called 2-pyridyl, 3-pyridyl and 4-pyridyl). The term "pyrimidyl" as used herein includes pyrimid-2-yl, pyrimid-4-yl, pyrimid-5-yl and pyrimid-6-yl. The term "pyrazinyl" as used herein includes pyrazin-2-yl and pyrazin-3-yl. The term "pyridazinyl" as used herein includes pyridazin-3-yl and pyridazin-4-yl. The term "oxazinyl" (also called "1,4-oxazinyl") as used herein includes 1,4-oxazin-4-yl and 1,4-oxazin-5-yl. The term "dioxinyl" (also called "1,4-dioxinyl") as used herein includes 1,4-dioxin-2-yl and 1,4-dioxin-3-yl. The term "thiazinyl" (also called "1,4-thiazinyl") as used herein includes 1,4-thiazin-2-yl, 1,4-thiazin-3-yl, 1,4-thiazin-4-yl, 1,4-thiazin-5-yl and 1,4-thiazin-6-yl. The term "triazinyl" as used herein includes 1,3,5-triazin-2-yl, 1,2,4-triazin-3-yl,

1,2,4-triazin-5-yl, 1,2,4-triazin-6-yl, 1,2,3-triazin-4-yl and 1,2,3-triazin-5-yl. The term "imidazo[2,1-b][1,3]thiazolyl" as used herein includes imidazo[2,1-b][1,3]thiazol-2-yl, imidazo[2,1-b][1,3]thiazol-3-yl, imidazo[2,1-b][1,3]thiazol-5-yl and imidazo[2,1-b][1,3]thiazol-6-yl. The term "thieno[3,2-b]furanyl" as used herein includes thieno[3,2-b]furan-2-yl, thieno[3,2-b]furan-3-yl, thieno[3,2-b]furan-4-yl, and thieno[3,2-b]furan-5-yl. The term "thieno[3,2-b]thiophenyl" as used herein includes thieno[3,2-b]thien-2-yl, thieno[3,2-b]thien-3-yl, thieno[3,2-b]thien-5-yl and thieno[3,2-b]thien-6-yl. The term "thieno[2,3-d][1,3]thiazolyl" as used herein includes thieno[2,3-d][1,3]thiazol-2-yl, thieno[2,3-d][1,3]thiazol-5-yl and thieno[2,3-d][1,3]thiazol-6-yl. The term "thieno[2,3-d]imidazolyl" as used herein includes thieno[2,3-d]imidazol-2-yl, thieno[2,3-d]imidazol-4-yl and thieno[2,3-d]imidazol-5-yl. The term "tetrazolo[1,5-a]pyridinyl" as used herein includes tetrazolo[1,5-a]pyridine-5-yl, tetrazolo[1,5-a]pyridine-6-yl, tetrazolo[1,5-a]pyridine-7-yl, and tetrazolo[1,5-a]pyridine-8-yl. The term "indolyl" as used herein includes indol-1-yl, indol-2-yl, indol-3-yl, indol-4-yl, indol-5-yl, indol-6-yl and indol-7-yl. The term "indoliziny" as used herein includes indolizin-1-yl, indolizin-2-yl, indolizin-3-yl, indolizin-5-yl, indolizin-6-yl, indolizin-7-yl, and indolizin-8-yl. The term "isoindolyl" as used herein includes isoindol-1-yl, isoindol-2-yl, isoindol-3-yl, isoindol-4-yl, isoindol-5-yl, isoindol-6-yl and isoindol-7-yl. The term "benzofuranyl" (also called benzo[b]furanyl) as used herein includes benzofuran-2-yl, benzofuran-3-yl, benzofuran-4-yl, benzofuran-5-yl, benzofuran-6-yl and benzofuran-7-yl. The term "isobenzofuranyl" (also called benzo[c]furanyl) as used herein includes isobenzofuran-1-yl, isobenzofuran-3-yl, isobenzofuran-4-yl, isobenzofuran-5-yl, isobenzofuran-6-yl and isobenzofuran-7-yl. The term "benzothiophenyl" (also called benzo[b]thienyl) as used herein includes 2-benzo[b]thiophenyl, 3-benzo[b]thiophenyl, 4-benzo[b]thiophenyl, 5-benzo[b]thiophenyl, 6-benzo[b]thiophenyl and 7-benzo[b]thiophenyl (also called benzothien-2-yl, benzothien-3-yl, benzothien-4-yl, benzothien-5-yl, benzothien-6-yl and benzothien-7-yl). The term "isobenzothiophenyl" (also called benzo[c]thienyl) as used herein includes isobenzothien-1-yl, isobenzothien-3-yl, isobenzothien-4-yl, isobenzothien-5-yl, isobenzothien-6-yl and isobenzothien-7-yl. The term "indazolyl" (also called 1H-indazolyl or 2-azaindolyl) as used herein includes 1H-indazol-1-yl, 1H-indazol-3-yl, 1H-indazol-4-yl, 1H-indazol-5-yl, 1H-indazol-6-yl, 1H-indazol-7-yl, 2H-indazol-2-yl, 2H-indazol-3-yl, 2H-indazol-4-yl, 2H-indazol-5-yl, 2H-indazol-6-yl, and 2H-indazol-7-yl. The term "benzimidazolyl" as used herein includes benzimidazol-1-yl, benzimidazol-2-yl, benzimidazol-4-yl, benzimidazol-5-yl, benzimidazol-6-yl and benzimidazol-7-yl. The term "1,3-benzoxazolyl" as used herein includes 1,3-benzoxazol-2-yl, 1,3-benzoxazol-4-yl, 1,3-benzoxazol-5-yl, 1,3-benzoxazol-6-yl and 1,3-benzoxazol-7-yl. The term "1,2-benzisoxazolyl" as used herein includes 1,2-benzisoxazol-3-yl, 1,2-benzisoxazol-4-yl, 1,2-benzisoxazol-5-yl, 1,2-benzisoxazol-6-yl and 1,2-benzisoxazol-7-yl. The term "2,1-benzisoxazolyl" as used herein includes 2,1-benzisoxazol-3-yl, 2,1-benzisoxazol-4-yl, 2,1-benzisoxazol-5-yl, 2,1-benzisoxazol-6-yl and 2,1-benzisoxazol-7-yl. The term "1,3-benzothiazolyl" as used herein includes 1,3-benzothiazol-2-yl, 1,3-benzothiazol-4-yl, 1,3-benzothiazol-5-yl, 1,3-benzothiazol-6-yl and 1,3-benzothiazol-7-yl. The term "1,2-benzisothiazolyl" as used herein includes 1,2-benzisothiazol-3-yl, 1,2-benzisothiazol-4-yl, 1,2-benzisothiazol-5-yl, 1,2-benzisothiazol-6-yl and 1,2-benzisothiazol-7-yl. The term "2,1-benzisothiazolyl" as used herein includes 2,1-benzisothiazol-3-yl, 2,1-benzisothiazol-4-yl, 2,1-

benzothiazol-5-yl, 2,1-benzothiazol-6-yl and 2,1-benzothiazol-7-yl. The term "benzotriazolyl" as used herein includes benzotriazol-1-yl, benzotriazol-4-yl, benzotriazol-5-yl, benzotriazol-6-yl and benzotriazol-7-yl. The term "1,2,3-benzoxadiazolyl" as used herein includes 1,2,3-benzoxadiazol-4-yl, 1,2,3-benzoxadiazol-5-yl, 1,2,3-benzoxadiazol-6-yl and 1,2,3-benzoxadiazol-7-yl. The term "2,1,3-benzoxadiazolyl" as used herein includes 2,1,3-benzoxadiazol-4-yl, 2,1,3-benzoxadiazol-5-yl, 2,1,3-benzoxadiazol-6-yl and 2,1,3-benzoxadiazol-7-yl. The term "1,2,3-benzothiadiazolyl" as used herein includes 1,2,3-benzothiadiazol-4-yl, 1,2,3-benzothiadiazol-5-yl, 1,2,3-benzothiadiazol-6-yl and 1,2,3-benzothiadiazol-7-yl. The term "2,1,3-benzothiadiazolyl" as used herein includes 2,1,3-benzothiadiazol-4-yl, 2,1,3-benzothiadiazol-5-yl, 2,1,3-benzothiadiazol-6-yl and 2,1,3-benzothiadiazol-7-yl. The term "thienopyridinyl" as used herein includes thieno[2,3-b]pyridinyl, thieno[2,3-c]pyridinyl, thieno[3,2-c]pyridinyl and thieno[3,2-b]pyridinyl. The term "purinyl" as used herein includes purin-2-yl, purin-6-yl, purin-7-yl and purin-8-yl. The term "imidazo[1,2-a]pyridinyl", as used herein includes imidazo[1,2-a]pyridin-2-yl, imidazo[1,2-a]pyridin-3-yl, imidazo[1,2-a]pyridin-4-yl, imidazo[1,2-a]pyridin-5-yl, imidazo[1,2-a]pyridin-6-yl and imidazo[1,2-a]pyridin-7-yl. The term "1,3-benzodioxolyl", as used herein includes 1,3-benzodioxol-4-yl, 1,3-benzodioxol-5-yl, 1,3-benzodioxol-6-yl, and 1,3-benzodioxol-7-yl. The term "quinolinyl" as used herein includes quinolin-2-yl, quinolin-3-yl, quinolin-4-yl, quinolin-5-yl, quinolin-6-yl, quinolin-7-yl and quinolin-8-yl. The term "isoquinolinyl" as used herein includes isoquinolin-1-yl, isoquinolin-3-yl, isoquinolin-4-yl, isoquinolin-5-yl, isoquinolin-6-yl, isoquinolin-7-yl and isoquinolin-8-yl. The term "cinnolinyl" as used herein includes cinnolin-3-yl, cinnolin-4-yl, cinnolin-5-yl, cinnolin-6-yl, cinnolin-7-yl and cinnolin-8-yl. The term "quinazolinyl" as used herein includes quinazolin-2-yl, quinazolin-4-yl, quinazolin-5-yl, quinazolin-6-yl, quinazolin-7-yl and quinazolin-8-yl. The term "quinoxalinyl", as used herein includes quinoxalin-2-yl, quinoxalin-5-yl, and quinoxalin-6-yl. The term "7-azaindolyl" as used herein refers to 1H-Pyrrolo[2,3-b]pyridinyl and includes 7-azaindol-1-yl, 7-azaindol-2-yl, 7-azaindol-3-yl, 7-azaindol-4-yl, 7-azaindol-5-yl, 7-azaindol-6-yl. The term "6-azaindolyl" as used herein refers to 1H-Pyrrolo[2,3-c]pyridinyl and includes 6-azaindol-1-yl, 6-azaindol-2-yl, 6-azaindol-3-yl, 6-azaindol-4-yl, 6-azaindol-5-yl, 6-azaindol-7-yl. The term "5-azaindolyl" as used herein refers to 1H-Pyrrolo[3,2-c]pyridinyl and includes 5-azaindol-1-yl, 5-azaindol-2-yl, 5-azaindol-3-yl, 5-azaindol-4-yl, 5-azaindol-6-yl, 5-azaindol-7-yl. The term "4-azaindolyl" as used herein refers to 1H-Pyrrolo[3,2-b]pyridinyl and includes 4-azaindol-1-yl, 4-azaindol-2-yl, 4-azaindol-3-yl, 4-azaindol-5-yl, 4-azaindol-6-yl, 4-azaindol-7-yl.

For example, non-limiting examples of heteroaryl can be 2- or 3-furyl, 2- or 3-thienyl, 1-, 2- or 3-pyrrolyl, 1-, 2-, 4- or 5-imidazolyl, 1-, 3-, 4- or 5-pyrazolyl, 3-, 4- or 5-isoxazolyl, 2-, 4- or 5-oxazolyl, 3-, 4- or 5-isothiazolyl, 2-, 4- or 5-thiazolyl, 1,2,3-triazol-1-, -4- or -5-yl, 1,2,4-triazol-1-, -3-, -4- or -5-yl, 1H-tetrazol-1-, or -5-yl, 2H-tetrazol-2-, or -5-yl, 1,2,3-oxadiazol-4- or -5-yl, 1,2,4-oxadiazol-3- or -5-yl, 1,2,5-oxadiazolyl, 1,3,4-oxadiazolyl, 1,2,3-thiadiazol-4- or -5-yl, 1,2,4-thiadiazol-3- or -5-yl, 1,2,5-thiadiazol-3- or -4-yl, 1,3,4-thiadiazolyl, 1- or 5-tetrazolyl, 2-, 3- or 4-pyridyl, 3- or 4-pyridazinyl, 2-, 4-, 5- or 6-pyrimidyl, 2-, 3-, 4-, 5- 6H-thiopyranyl, 2-, 3- or 4-4H-thiopyranyl, 4-azaindol-1-, 2-, 3-, 5-, or 7-yl, 5-azaindol-1-, or 2-, 3-, 4-, 6-, or 7-yl, 6-azaindol-1, 2-, 3-, 4-, 5-, or 7-



yl, 7-azaindol-1-, 2-, 3-, 4, 5-, or 6-yl, 2-, 3-, 4-, 5-, 6- or 7-benzofuryl, 1-, 3-, 4- or 5-isobenzofuryl, 2-, 3-, 4-, 5-, 6- or 7-benzothienyl, 1-, 3-, 4- or 5-isobenzothienyl, 1-, 2-, 3-, 4-, 5-, 6- or 7-indolyl, 2- or 3-pyrazinyl, 1,4-oxazin-2- or -3-yl, 1,4-dioxin-2- or -3-yl, 1,4-thiazin-2- or -3-yl, 1,2,3-triazinyl, 1,2,4-triazinyl, 1,3,5-triazin-2-, -4- or -6-yl, thieno[2,3-b]furan-2-, -3-, -4-, or -5-yl, benzimidazol-1-yl, 5 -2-yl, -4-yl, -5-yl, -6-yl, or -7-yl, 1-, 3-, 4-, 5-, 6- or 7-benzopyrazolyl, 3-, 4-, 5-, 6- or 7-benzisoxazolyl, 2-, 4-, 5-, 6- or 7-benzoxazolyl, 3-, 4-, 5-, 6- or 7-benzisothiazolyl, 1,3-benzothiazol-2-yl, -4-yl, -5-yl, -6-yl or -7-yl, 1,3-benzodioxol-4-yl, -5-yl, -6-yl, or -7-yl, benzotriazol-1-yl, -4-yl, -5-yl, -6-yl or -7-yl, 1, 2-thianthrenyl, 3-, 4- or 5-isobenzofuranyl, 1-, 2-, 3-, 4- or 9-xanthenyl, 1-, 2-, 3- or 4-phenoxathiinyl, 2-, 3-pyrazinyl, 1-, 2-, 3-, 4-, 5-, 6-, 7- or 8-indoliziny, 2-, 3-, 4- or 5-isoindolyl, 1H-10 indazol-1-yl, 3-yl, -4-yl, -5-yl, -6-yl, or -7-yl, 2H-indazol-2-yl, 3-yl, -4-yl, -5-yl, -6-yl, or -7-yl, imidazo[2,1-b][1,3]thiazol-2-yl, imidazo[2,1-b][1,3]thiazol-3-yl, imidazo[2,1-b][1,3]thiazol-5-yl or imidazo[2,1-b][1,3]thiazol-6-yl, imidazo[1,2-a]pyridin-2-yl, imidazo[1,2-a]pyridin-3-yl, imidazo[1,2-a]pyridin-4-yl, imidazo[1,2-a]pyridin-5-yl, imidazo[1,2-a]pyridin-6-yl or imidazo[1,2-a]pyridin-7-yl, tetrazolo[1,5-a]pyridine-5-yl, tetrazolo[1,5-a]pyridine-6-yl, tetrazolo[1,5-a]pyridine-7-yl, or 15 tetrazolo[1,5-a]pyridine-8-yl, 2-, 6-, 7- or 8-puriny, 4-, 5- or 6-phthalazinyl, 2-, 3- or 4-naphthyridinyl, 2-, 5- or 6-quinoxaliny, 2-, 4-, 5-, 6-, 7- or 8-quinazolinyl, 1-, 2-, 3- or 4-quinoliziny, 2-, 3-, 4-, 5-, 6-, 7-, or 8-quinoliny(quinolyl), 2-, 4-, 5-, 6-, 7- or 8-quinazolyl, 1-, 3-, 4-, 5-, 6-, 7- or 8-isoquinoliny(isoquinolyl), 3-, 4-, 5-, 6-, 7- or 8-cinnoliny, 2-, 4-, 6- or 7-pteridinyl, 1-, 2-, 3-, 4- or 9-carbazolyl, 1-, 2-, 3-, 4-, 5-, 6-, 7-, 8- or 9-carboliny, 1-, 2-, 3-, 4-, 5-, 6-, 7-, 8-, 9- or 10-20 phenanthridinyl, 1-, 2-, 3- or 4-acridinyl, 1-, 2-, 3-, 4-, 5-, 6-, 7-, 8- or 9-perimidinyl, 2-, 3-, 4-, 5-, 6-, 7-, 8-, 9- or 10-(1,7)phenanthroliny, 1- or 2-phenazinyl, 1-, 2-, 3-, 4-, or 10-phenothiazinyl, 3- or 4-furazany, 1-, 2-, 3-, 4-, or 10-phenoxazinyl, or additionally substituted derivatives thereof.

An "optionally substituted heteroaryl" refers to a heteroaryl having optionally one or more substituents (for example 1 to 4 substituents, for example 1, 2, 3 or 4), selected from those defined 25 above for substituted aryl.

The term "oxo" as used herein refers to the group =O.

The term "alkoxy" or "alkyloxy" as used herein refers to a radical having the Formula -OR<sup>b</sup> wherein R<sup>b</sup> is alkyl. Preferably, alkoxy is C<sub>1</sub>-C<sub>10</sub> alkoxy, C<sub>1</sub>-C<sub>6</sub> alkoxy, or C<sub>1</sub>-C<sub>4</sub> alkoxy. Non-limiting examples of suitable alkoxy include methoxy, ethoxy, propoxy, isopropoxy, butoxy, isobutoxy, sec-30 butoxy, tert-butoxy, pentyloxy and hexyloxy. Where the oxygen atom in an alkoxy group is substituted with sulfur, the resultant radical is referred to as thioalkoxy. "Haloalkoxy" is an alkoxy group wherein one or more hydrogen atoms in the alkyl group are substituted with halogen. Non-limiting examples of suitable haloalkoxy include fluoromethoxy, difluoromethoxy, trifluoromethoxy, 2,2,2-trifluoroethoxy, 1,1,2,2-tetrafluoroethoxy, 2-fluoroethoxy, 2-chloroethoxy, 2,2-difluoroethoxy, 35 2,2,2-trichloroethoxy; trichloromethoxy, 2-bromoethoxy, pentafluoroethyl, 3,3,3-trichloropropoxy, 4,4,4-trichlorobutoxy.

The term "aryloxy" as used herein denotes a group -O-aryl, wherein aryl is as defined above.

The term "arylcarbonyl" or "aroyl" as used herein denotes a group  $-C(O)\text{-aryl}$ , wherein aryl is as defined above.

The term "heterocyclyl-alkyl" by itself or as part of another substituents refers to a group having one of the aforementioned heterocyclyl group attached to one of the aforementioned alkyl group, i.e., to a group  $-R^d\text{-}R^c$  wherein  $R^d$  is alkylene or alkylene substituted by alkyl group and  $R^c$  is a heterocyclyl group.

The term "carboxy" or "carboxyl" or "hydroxycarbonyl" by itself or as part of another substituent refers to the group  $-\text{CO}_2\text{H}$ . Thus, a carboxyalkyl is an alkyl group as defined above having at least one substituent that is  $-\text{CO}_2\text{H}$ .

10 The term "alkoxycarbonyl" by itself or as part of another substituent refers to a carboxy group linked to an alkyl radical i.e. to form  $-\text{C}(=\text{O})\text{OR}^e$ , wherein  $R^e$  is as defined above for alkyl.

The term "alkylcarbonyloxy" by itself or as part of another substituent refers to a  $-\text{O}-\text{C}(=\text{O})\text{R}^e$  wherein  $R^e$  is as defined above for alkyl.

15 The term "alkylcarbonylamino" by itself or as part of another substituent refers to an group of Formula  $-\text{NH}(\text{C}=\text{O})\text{R}$  or  $-\text{NR}'(\text{C}=\text{O})\text{R}$ , wherein R and R' are each independently alkyl or substituted alkyl.

The term "thiocarbonyl" by itself or as part of another substituent refers to the group  $-\text{C}(=\text{S})-$ .

20 The term "alkoxy" by itself or as part of another substituent refers to a group consisting of an oxygen atom attached to one optionally substituted straight or branched alkyl group, cycloalkyl group, aralkyl, or cycloalkylalkyl group. Non-limiting examples of suitable alkoxy group include methoxy, ethoxy, n-propoxy, isopropoxy, n-butoxy, iso-butoxy, sec-butoxy, tert-butoxy, hexanoxy, and the like.

The term "halo" or "halogen" as a group or part of a group is generic for fluoro, chloro, bromo, or iodo.

25 The term "haloalkyl" alone or in combination, refers to an alkyl radical having the meaning as defined above wherein one or more hydrogens are replaced with a halogen as defined above. Non-limiting examples of such haloalkyl radicals include chloromethyl, 1-bromoethyl, fluoromethyl, difluoromethyl, trifluoromethyl, 1,1,1-trifluoroethyl, and the like.

30 The term "haloaryl" alone or in combination, refers to an aryl radical having the meaning as defined above wherein one or more hydrogens are replaced with a halogen as defined above.

The term "haloalkoxy" alone or in combination refers to a group of Formula  $-\text{O-alkyl}$  wherein the alkyl group is substituted by 1, 2, or 3 halogen atoms. For example, "haloalkoxy" includes  $-\text{OCF}_3$ ,  $-\text{OCHF}_2$ ,  $-\text{OCH}_2\text{F}$ ,  $-\text{O-CF}_2\text{-CF}_3$ ,  $-\text{O-CH}_2\text{-CF}_3$ ,  $-\text{O-CH}_2\text{-CHF}_2$ , and  $-\text{O-CH}_2\text{-CH}_2\text{F}$ .

35 Whenever the term "substituted" is used in the present invention, it is meant to indicate that one or more hydrogens on the atom indicated in the expression using "substituted" is replaced with a

selection from the indicated group, provided that the indicated atom's normal valency is not exceeded, and that the substitution results in a chemically stable compound, i.e. a compound that is sufficiently robust to survive isolation to a useful degree of purity from a reaction mixture, and formulation into a therapeutic agent.

- 5 As used herein the terms such as "alkyl, aryl, or cycloalkyl, each being optionally substituted with" or "alkyl, aryl, or cycloalkyl, optionally substituted with" refers to optionally substituted alkyl, optionally substituted aryl and optionally substituted cycloalkyl.

As described herein, some of the compounds of the invention may contain one or more asymmetric carbon atoms that serve as a chiral center, which may lead to different optical forms (e.g.  
10 enantiomers or diastereoisomers). The invention comprises all such optical forms in all possible configurations, as well as mixtures thereof.

More generally, from the above, it will be clear to the skilled person that the compounds of the invention may exist in the form of different isomers and/or tautomers, including but not limited to geometrical isomers, conformational isomers, E/Z-isomers, stereochemical isomers (i.e.  
15 enantiomers and diastereoisomers) and isomers that correspond to the presence of the same substituents on different positions of the rings present in the compounds of the invention. All such possible isomers, tautomers and mixtures thereof are included within the scope of the invention.

Whenever used in the present invention the term "compounds of the invention" or a similar term is meant to include the compounds of general Formula I and any subgroup thereof. This term also  
20 refers to the compounds as depicted in examples, their derivatives, *N*-oxides, salts, solvates, hydrates, stereoisomeric forms, racemic mixtures, tautomeric forms, optical isomers, analogues, , as well as their quaternized nitrogen analogues. The *N*-oxide forms of said compounds are meant to comprise compounds wherein one or several nitrogen atoms are oxidized to the so-called *N*-oxide.

- 25 As used in the specification and the appended claims, the singular forms "a", "an", and "the" include plural referents unless the context clearly dictates otherwise. By way of example, "a compound" means one compound or more than one compound.

The terms described above and others used in the specification are well understood to those in the art.

30

In a further embodiment, the present invention provides compounds of formula I as described hereinabove, wherein;

R<sup>1</sup> is selected from the group comprising hydrogen, C<sub>1-6</sub>alkyl, and C<sub>3-6</sub>cycloalkyl; in particular hydrogen.

35

In a preferred embodiment, the present invention provides compounds of formula I, wherein;

X is hydrogen or halogen; in particular halogen; more in particular fluoro;

Y is  $\text{-NH-C(=O)-}$  or  $\text{-C(=O)-NH-}$ ;

$Z^1$ ,  $Z^2$ , and  $Z^3$  are each independently selected from the group consisting of C, N, O, and S; in particular from the group consisting of C, and N; more in particular  $Z^1$ ,  $Z^2$ , and  $Z^3$  are each C;

- 5  $R^1$  is selected from the group comprising hydrogen,  $C_{1-20}$ alkyl, and  $C_{3-15}$ cycloalkyl; in particular hydrogen;

$R^2$  is selected from the group comprising hydrogen,  $C_{1-20}$ alkyl, halogen and  $C_{1-20}$ alkoxy;

- $R^3$  is selected from the group consisting of  $C_{1-20}$ alkyl,  $C_{3-20}$ alkenyl,  $C_{3-20}$ alkynyl,  $C_{3-15}$ cycloalkyl, aryl, heteroaryl, and  $C_{3-19}$ heterocyclyl; wherein said  $C_{1-20}$ alkyl,  $C_{3-20}$ alkenyl,  $C_{3-20}$ alkynyl,  $C_{3-15}$ cycloalkyl, aryl, heteroaryl, and  $C_{3-19}$ heterocyclyl is optionally substituted with one or more substituents selected from the group consisting of halo, hydroxyl, oxo, carbonyl, amino, amido, cyano, aryl, heteroaryl,  $C_{1-6}$ alkyl,  $C_{3-15}$ cycloalkyl,  $C_{3-19}$ heterocyclyl,  $C_{1-20}$ alkylamino, di( $C_{1-20}$ alkyl)amino,  $C_{1-20}$ alkoxy, halo- $C_{1-20}$ alkoxy, halo- $C_{1-20}$ alkyl, thiol,  $C_{1-20}$ alkylthio, carboxylic acid, acylamino,  $C_{1-20}$ alkyl esters, carbamate, thioamido, urea, and sulfonamido; and

- 15 n is 0 or 1; in particular n is 1.

In an even further embodiment, the present invention provides compounds of formula I as described herein before, wherein;

- 20  $R^2$  is selected from the group consisting of hydrogen,  $C_{1-20}$ alkyl, and halogen; in particular from the group consisting of hydrogen,  $C_{1-6}$ alkyl, and halogen; more in particular from the group consisting of hydrogen, methyl and fluoro;

In yet another embodiment, the present invention provides compounds of formula I as described herein before, wherein;

- 25  $R^3$  is selected from the group consisting of  $C_{1-20}$ alkyl,  $C_{3-20}$ alkenyl,  $C_{3-20}$ alkynyl,  $C_{3-15}$ cycloalkyl, aryl, heteroaryl, and  $C_{3-19}$ heterocyclyl; wherein said  $C_{1-20}$ alkyl,  $C_{3-20}$ alkenyl, and  $C_{3-20}$ alkynyl is optionally substituted with one or more substituents selected from the group consisting of halo, hydroxyl, oxo, carbonyl, amino, amido, cyano, aryl, heteroaryl,  $C_{1-6}$ alkyl,  $C_{3-15}$ cycloalkyl,  $C_{3-19}$ heterocyclyl,  $C_{1-20}$ alkylamino, di( $C_{1-20}$ alkyl)amino,  $C_{1-20}$ alkoxy, halo- $C_{1-20}$ alkoxy, halo- $C_{1-20}$ alkyl, thiol,  $C_{1-20}$ alkylthio, 30 carboxylic acid, acylamino,  $C_{1-20}$ alkyl esters, carbamate, thioamido, urea, and sulfonamido;

in particular  $R^3$  is selected from the group consisting of  $C_{1-20}$ alkyl,  $C_{3-20}$ alkenyl,  $C_{3-20}$ alkynyl,  $C_{3-15}$ cycloalkyl, aryl, heteroaryl, and  $C_{3-19}$ heterocyclyl; wherein said  $C_{1-20}$ alkyl is optionally substituted with one or more substituents selected from the group consisting of halo, hydroxyl, oxo, carbonyl, amino, amido, cyano, aryl, heteroaryl,  $C_{3-15}$ cycloalkyl,  $C_{3-19}$ heterocyclyl,  $C_{1-20}$ alkylamino, di( $C_{1-20}$ alkyl)amino,  $C_{1-20}$ alkoxy, halo- $C_{1-20}$ alkoxy, halo- $C_{1-20}$ alkyl, thiol,  $C_{1-20}$ alkylthio, carboxylic acid, acylamino,  $C_{1-20}$ alkyl esters, carbamate, thioamido, urea, and sulfonamido;

<sub>20</sub>alkyl)amino, C<sub>1-20</sub>alkoxy, halo-C<sub>1-20</sub>alkoxy, halo-C<sub>1-20</sub>alkyl, thiol, C<sub>1-20</sub>alkylthio, carboxylic acid, acylamino, C<sub>1-20</sub>alkyl esters, carbamate, thioamido, urea, and sulfonamido.

In a further embodiment, the present invention provides compounds of formula I as described hereinbefore, wherein;

R<sup>3</sup> is selected from the group consisting of C<sub>1-20</sub>alkyl, C<sub>3-20</sub>alkenyl, C<sub>3-20</sub>alkynyl, and aryl; wherein said C<sub>1-20</sub>alkyl, C<sub>3-20</sub>alkenyl, C<sub>3-20</sub>alkynyl, and aryl is optionally substituted with one or more substituents selected from the group consisting of halo, hydroxyl, oxo, carbonyl, amino, amido, cyano, aryl, heteroaryl, C<sub>1-6</sub>alkyl, C<sub>3-15</sub>cycloalkyl, C<sub>3-19</sub>heterocyclyl, C<sub>1-20</sub>alkylamino, di(C<sub>1-20</sub>alkyl)amino, C<sub>1-20</sub>alkoxy, halo-C<sub>1-20</sub>alkoxy, halo-C<sub>1-20</sub>alkyl, thiol, C<sub>1-20</sub>alkylthio, carboxylic acid, acylamino, C<sub>1-20</sub>alkyl esters, carbamate, thioamido, urea, and sulfonamido;

in particular R<sup>3</sup> is selected from the group consisting of C<sub>1-20</sub>alkyl, C<sub>3-20</sub>alkenyl, C<sub>3-20</sub>alkynyl, and aryl; wherein said C<sub>1-20</sub>alkyl is optionally substituted with one or more substituents selected from the group consisting of halo, hydroxyl, oxo, carbonyl, amino, amido, cyano, aryl, heteroaryl, C<sub>3-15</sub>cycloalkyl, C<sub>3-19</sub>heterocyclyl, C<sub>1-20</sub>alkylamino, di(C<sub>1-20</sub>alkyl)amino, C<sub>1-20</sub>alkoxy, halo-C<sub>1-20</sub>alkoxy, halo-C<sub>1-20</sub>alkyl, thiol, C<sub>1-20</sub>alkylthio, carboxylic acid, acylamino, C<sub>1-20</sub>alkyl esters, carbamate, thioamido, urea, and sulfonamido.

In a particular embodiment, the present invention provides compounds of formula I as described hereinbefore, wherein;

said one or more optional substituents for R<sup>3</sup> are selected from the group consisting of halo, hydroxyl, nitro, amino, cyano, aryl, heteroaryl, C<sub>3-15</sub>cycloalkyl, C<sub>3-19</sub>heterocyclyl, C<sub>1-20</sub>alkylamino, di(C<sub>1-20</sub>alkyl)amino, C<sub>1-20</sub>alkoxy, and halo-C<sub>1-20</sub>alkyl; in particular from the group consisting of cyano, C<sub>3-15</sub>cycloalkyl, C<sub>3-19</sub>heterocyclyl, C<sub>1-20</sub>alkoxy, di(C<sub>1-20</sub>alkyl)amino, aryl, and heteroaryl; more in particular from cyano, C<sub>3-6</sub>cycloalkyl, C<sub>3-6</sub>heterocyclyl, C<sub>1-6</sub>alkoxy, di(C<sub>1-6</sub>alkyl)amino, aryl, and heteroaryl.

It is also an object of the invention to provide those compounds of formula I wherein one or more of the following restriction apply:

- X is halogen; in particular fluoro;
- Y is -C(=O)-NH-;
- Z<sup>1</sup>, Z<sup>2</sup>, and Z<sup>3</sup> are each independently selected from C, and N;
- Z<sup>1</sup>, Z<sup>2</sup> and Z<sup>3</sup> are C;
- R<sup>1</sup> is hydrogen;
- R<sup>2</sup> is selected from the group comprising hydrogen, C<sub>1-20</sub>alkyl, and halogen; in particular hydrogen, C<sub>1-6</sub>alkyl, and halogen; more in particular hydrogen, methyl and fluoro;

- $R^2$  is hydrogen;
- $R^2$  is fluoro;
- $R^3$  is selected from the group consisting of  $C_{1-20}$ alkyl,  $C_{3-20}$ alkenyl,  $C_{3-20}$ alkynyl,  $C_{3-15}$ cycloalkyl, aryl, heteroaryl, and  $C_{3-19}$ heterocyclyl; wherein said  $C_{1-20}$ alkyl,  $C_{3-20}$ alkenyl, and  $C_{3-20}$ alkynyl is optionally substituted with one or more substituents selected from the group consisting of halo, hydroxyl, oxo, carbonyl, amino, amido, cyano, aryl, heteroaryl,  $C_{3-15}$ cycloalkyl,  $C_{3-19}$ heterocyclyl,  $C_{1-20}$ alkylamino, di( $C_{1-20}$ alkyl)amino,  $C_{1-20}$ alkoxy, halo- $C_{1-20}$ alkoxy, halo- $C_{1-20}$ alkyl, thiol,  $C_{1-20}$ alkylthio, carboxylic acid, acylamino,  $C_{1-20}$ alkyl esters, carbamate, thioamido, urea, and sulfonamido; in particular  $R^3$  is selected from the group consisting of  $C_{1-20}$ alkyl,  $C_{3-20}$ alkenyl,  $C_{3-20}$ alkynyl,  $C_{3-15}$ cycloalkyl, aryl, heteroaryl, and  $C_{3-19}$ heterocyclyl; wherein said  $C_{1-20}$ alkyl is optionally substituted with one or more substituents selected from the group consisting of halo, hydroxyl, oxo, carbonyl, amino, amido, cyano, aryl, heteroaryl,  $C_{3-15}$ cycloalkyl,  $C_{3-19}$ heterocyclyl,  $C_{1-20}$ alkylamino, di( $C_{1-20}$ alkyl)amino,  $C_{1-20}$ alkoxy, halo- $C_{1-20}$ alkoxy, halo- $C_{1-20}$ alkyl, thiol,  $C_{1-20}$ alkylthio, carboxylic acid, acylamino,  $C_{1-20}$ alkyl esters, carbamate, thioamido, urea, and sulfonamido.
- $R^3$  is selected from the group consisting of  $C_{1-20}$ alkyl,  $C_{3-20}$ alkenyl,  $C_{3-20}$ alkynyl, and aryl; wherein said  $C_{1-20}$ alkyl,  $C_{3-20}$ alkenyl,  $C_{3-20}$ alkynyl, and aryl is optionally substituted with one or more substituents selected from the group consisting of halo, hydroxyl, oxo, carbonyl, amino, amido, cyano, aryl, heteroaryl,  $C_{1-6}$ alkyl,  $C_{3-15}$ cycloalkyl,  $C_{3-19}$ heterocyclyl,  $C_{1-20}$ alkylamino, di( $C_{1-20}$ alkyl)amino,  $C_{1-20}$ alkoxy, halo- $C_{1-20}$ alkoxy, halo- $C_{1-20}$ alkyl, thiol,  $C_{1-20}$ alkylthio, carboxylic acid, acylamino,  $C_{1-20}$ alkyl esters, carbamate, thioamido, urea, and sulfonamido; in particular  $R^3$  is selected from the group consisting of  $C_{1-20}$ alkyl,  $C_{3-20}$ alkenyl,  $C_{3-20}$ alkynyl, and aryl; wherein said  $C_{1-20}$ alkyl is optionally substituted with one or more substituents selected from the group consisting of halo, hydroxyl, oxo, carbonyl, amino, amido, cyano, aryl, heteroaryl,  $C_{3-15}$ cycloalkyl,  $C_{3-19}$ heterocyclyl,  $C_{1-20}$ alkylamino, di( $C_{1-20}$ alkyl)amino,  $C_{1-20}$ alkoxy, halo- $C_{1-20}$ alkoxy, halo- $C_{1-20}$ alkyl, thiol,  $C_{1-20}$ alkylthio, carboxylic acid, acylamino,  $C_{1-20}$ alkyl esters, carbamate, thioamido, urea, and sulfonamido.
- $R^3$  is  $C_{1-6}$ alkyl optionally substituted with a substituent selected from the group consisting of halo, hydroxyl, oxo, carbonyl, amino, amido, cyano, aryl, heteroaryl,  $C_{3-15}$ cycloalkyl,  $C_{3-19}$ heterocyclyl,  $C_{1-20}$ alkylamino, di( $C_{1-20}$ alkyl)amino,  $C_{1-20}$ alkoxy, halo- $C_{1-20}$ alkoxy, halo- $C_{1-20}$ alkyl, thiol,  $C_{1-20}$ alkylthio, carboxylic acid, acylamino,  $C_{1-20}$ alkyl esters, carbamate, thioamido, urea, and sulfonamido;
- said one or more optional substituents for  $R^3$  are selected from the group consisting of halo, hydroxyl, nitro, amino, cyano, aryl, heteroaryl,  $C_{1-6}$ alkyl,  $C_{3-15}$ cycloalkyl,  $C_{3-19}$ heterocyclyl,  $C_{1-20}$ alkylamino, di( $C_{1-20}$ alkyl)amino,  $C_{1-20}$ alkoxy, and halo- $C_{1-20}$ alkyl; in particular from the group consisting of cyano,  $C_{3-15}$ cycloalkyl,  $C_{3-19}$ heterocyclyl,  $C_{1-20}$ alkoxy, di( $C_{1-20}$ alkyl)amino, aryl, and heteroaryl; more in particular from cyano,  $C_{3-6}$ cycloalkyl,  $C_{3-6}$ heterocyclyl,  $C_{1-6}$ alkoxy, di( $C_{1-6}$ alkyl)amino, aryl, and heteroaryl;

- said one or more optional substituents for  $R^3$  are selected from the group consisting of cyano,  $C_{3-6}$ cycloalkyl, pyrrolidinyl, tetrahydrofuranyl,  $C_{1-6}$ alkoxy, di( $C_{1-6}$ alkyl)amino, phenyl, and pyridinyl;
- n is 1.

5

The compounds of the present invention can be prepared according to the reaction schemes provided in the examples hereinafter, but those skilled in the art will appreciate that these are only illustrative for the invention and that the compounds of this invention can be prepared by any of several standard synthetic processes commonly used by those skilled in the art of organic chemistry.

10

In a preferred embodiment, the compounds of the present invention are useful as kinase inhibitors, either in vitro or in vivo, more in particular for the inhibition of at least one ROCK kinase, selected from ROCKI and ROCKII, in particular soft ROCK inhibitors. Accordingly the present invention provides the compounds as defined herein, or a composition comprising said compound(s) for use as a medicine.

15

The present invention further provides the use of a compound as defined hereinbefore or the use of a composition comprising said compound, as a human or veterinary medicine, in particular for prevention and/or treatment of at least one disease or disorder, in which ROCK is involved, such as diseases linked to smooth muscle cell function, inflammation, fibrosis, excessive cell proliferation, excessive angiogenesis, hyperreactivity, barrier dysfunction, neurodegeneration, and remodeling.

20

In a further embodiment, the invention provides the use of a compound as defined hereinbefore, or the use of a composition comprising said compound in the prevention and/or treatment of at least one disease or disorder selected from the group comprising eye diseases; airway diseases; throat, nose and ear diseases; intestinal diseases; cardiovascular and vascular diseases; inflammatory diseases; neurological and CNS disorders: proliferative diseases; kidney diseases; sexual dysfunction; bone diseases; benign prostatic hyperplasia, transplant rejection, spasm, hypertension, chronic obstructive bladder disease, and allergy.

25

In a preferred embodiment, the invention provides the use of a compound as defined hereinbefore or the use of a composition comprising said compound in the prevention and/or treatment of eyes diseases including but not limited to retinopathy, optic neuropathy, glaucoma and degenerative retinal diseases such as macular degeneration, retinitis pigmentosa and inflammatory eye diseases (such as anterior uveitis, panuveitis, intermediate uveitis and posterior uveitis), corneal diseases (such as but not limited to Fuch's dystrophy and keratitis), abnormalities of corneal wound healing and ocular pain, and/or for preventing, treating and/or alleviating complications and/or symptoms associated therewith.

35

In another embodiment, the invention provides the use of a compound as defined hereinbefore or the use of a composition comprising said compound in the prevention and/or treatment of airway

diseases; including but not limited to pulmonary fibrosis, emphysema, chronic bronchitis, asthma, fibrosis, pneumonia, cystic fibrosis, chronic obstructive pulmonary disease (COPD); bronchitis and rhinitis and respiratory distress syndrome, and/or for preventing, treating and/or alleviating complications and/or symptoms associated therewith.

- 5 In a further embodiment, the invention provides the use of a compound as defined hereinbefore or the use of a composition comprising said compound in the prevention and/or treatment of cardiovascular and vascular diseases: including but not limited to pulmonary hypertension and pulmonary vasoconstriction, and/or for preventing, treating and/or alleviating complications and/or symptoms associated therewith and/or alleviating complications and/or symptoms associated therewith.

In a further embodiment, the invention provides the use of a compound as defined hereinbefore or the use of a composition comprising said compound in the prevention and/or treatment of throat, nose and ear diseases: including but not limited to sinus problems, hearing problems, toothache, tonsillitis, ulcer and rhinitis,

- 15 In a further embodiment, the invention provides the use of a compound as defined hereinbefore or the use of a composition comprising said compound in the prevention and/or treatment of skin diseases: including but not limited to hyperkeratosis, parakeratosis, hypergranulosis, acanthosis, dyskeratosis, spongiosis and ulceration.

- In a further embodiment, the invention provides the use of a compound as defined hereinbefore or the use of a composition comprising said compound in the prevention and/or treatment of intestinal diseases; including but not limited to inflammatory bowel disease (IBD), ulcerative colitis, gastroenteritis, ileus, ileitis, appendicitis and Crohn's disease.

- In yet another embodiment, the invention provides the use of a compound as defined hereinbefore or the use of a composition comprising said compound in the prevention and/or treatment of inflammatory diseases: including but not limited to contact dermatitis, atopic dermatitis, psoriasis, rheumatoid arthritis, juvenile rheumatoid arthritis, ankylosing spondylitis, psoriatic arthritis, inflammatory bowel disease, Crohn's disease and ulcerative colitis, and/or for preventing, treating and/or alleviating complications and/or symptoms and/or inflammatory responses associated therewith.

- 30 In another embodiment, the invention provides the use of a compound as defined hereinbefore or the use of a composition comprising said compound in the prevention, treatment and/or management of neurological and CNS disorders: including but not limited to neuropathic pain. The present compounds are therefore suitable for preventing neurodegeneration and stimulating neurogeneration in various neurological disorders, and/or for preventing, treating and/or alleviating complications and/or symptoms associated therewith.

In another embodiment, the invention provides the use of a compound as defined hereinbefore or the use of a composition comprising said compound in the prevention and/or treatment of



proliferative diseases: such as but not limited to cancer of breast, colon, intestine, skin, head and neck, nerve, uterus, kidney, lung, ovary, pancreas, prostate, or thyroid gland; Castleman disease; sarcoma; malignoma; and melanoma; and/or for preventing, treating and/or alleviating complications and/or symptoms and/or inflammatory responses associated therewith.

- 5 In another embodiment, the invention provides the use of a compound as defined hereinbefore or the use of a composition comprising said compound in the prevention and/or treatment of kidney diseases: including but not limited to renal fibrosis or renal dysfunction; and/or for preventing, treating and/or alleviating complications and/or symptoms and/or inflammatory responses associated therewith.
- 10 In another embodiment, the invention provides the use of a compound as defined hereinbefore or the use of a composition comprising said compound in the prevention and/or treatment of sexual dysfunction: including but not limited to hypogonadism, bladder disease, hypertension, diabetes, or pelvic surgery; and/or to treat sexual dysfunction associated with treatment using certain drugs, such as drugs used to treat hypertension, depression or anxiety.
- 15 In another embodiment, the invention provides the use of a compound as defined hereinbefore or the use of a composition comprising said compound in the prevention and/or treatment of bone diseases: including but not limited to osteoporosis and osteoarthritis; and/or for preventing, treating and/or alleviating complications and/or symptoms and/or inflammatory responses associated therewith.
- 20 In another embodiment, the invention provides the use of a compound as defined hereinbefore or the use of a composition comprising said compound in the prevention and/or treatment of diseases and disorders such as benign prostatic hyperplasia, transplant rejection, spasm, chronic obstructive bladder disease, and allergy, and/or for preventing, treating and/or alleviating complications and/or symptoms associated therewith.
- 25 In a preferred embodiment the present invention provides the use of a compound as defined hereinbefore or the use of a composition comprising said compound in the prevention and/or treatment of eye diseases.

#### **METHOD OF TREATMENT**

- 30 The present invention further provides a method for the prevention and/or treatment of at least one disease or disorder selected from the group comprising eye diseases; airway diseases; cardiovascular and vascular diseases; inflammatory diseases; neurological and CNS disorders; proliferative diseases; kidney diseases; sexual dysfunction; bone diseases; benign prostatic hyperplasia; transplant rejection; spasm; hypertension; chronic obstructive bladder disease; and
- 35 allergy; said method comprising administering to a subject in need thereof a therapeutic effective amount of a compound or a composition as defined herein.

In a preferred embodiment, the invention provides a method for the prevention and/or treatment of eye diseases including but not limited to retinopathy, optic neuropathy, glaucoma and degenerative retinal diseases such as macular degeneration, retinitis pigmentosa and inflammatory eye diseases (such as anterior uveitis, panuveitis, intermediate uveitis and posterior uveitis), corneal diseases (such as but not limited to Fuch's dystrophy and keratitis), ; said method comprising administering to a subject in need thereof a therapeutic effective amount of a compound or a composition as defined herein.

In another embodiment, the invention provides a method for the prevention and/or treatment of airway diseases including but not limited to pulmonary fibrosis, emphysema, chronic bronchitis, asthma, fibrosis, pneumonia, cystic fibrosis, chronic obstructive pulmonary disease (COPD) bronchitis, rhinitis, and respiratory distress syndrome; said method comprising administering to a subject in need thereof a therapeutic effective amount of a compound or a composition as defined herein.

In another embodiment, the invention provides a method for the prevention and/or treatment of cardiovascular and vascular diseases: including but not limited to pulmonary hypertension and pulmonary vasoconstriction; said method comprising administering to a subject in need thereof a therapeutic effective amount of a compound or a composition as defined herein.

In another embodiment, the invention provides a method for the prevention and/or treatment of inflammatory diseases: including but not limited to contact dermatitis, atopic dermatitis, psoriasis, rheumatoid arthritis, juvenile rheumatoid arthritis, ankylosing spondylitis, psoriatic arthritis, inflammatory bowel disease, Crohn's disease and ulcerative colitis; said method comprising administering to a subject in need thereof a therapeutic effective amount of a compound or a composition as defined herein.

In another embodiment, the invention provides a method for the prevention and/or treatment of neurological and CNS disorders: including but not limited to neuropathic pain. The present compounds are therefore suitable for preventing neurodegeneration and stimulating neurogeneration in various neurological disorders; said method comprising administering to a subject in need thereof a therapeutic effective amount of a compound or a composition as defined herein.

In another embodiment, the invention provides a method for the prevention and/or treatment of proliferative diseases: such as but not limited to cancer of breast, colon, intestine, skin, head and neck, nerve, uterus, kidney, lung, liver, ovary, pancreas, prostate, or thyroid gland; Castleman disease; leukemia; sarcoma; lymphoma; malignoma; and melanoma; said method comprising administering to a subject in need thereof a therapeutic effective amount of a compound or a composition as defined herein.

In another embodiment, the invention provides a method for the prevention and/or treatment of kidney diseases: including but not limited to renal fibrosis or renal dysfunction; said method

comprising administering to a subject in need thereof a therapeutic effective amount of a compound or a composition as defined herein.

In another embodiment, the invention provides a method for the prevention and/or treatment of sexual dysfunction: including but not limited to hypogonadism, bladder disease, hypertension, diabetes, or pelvic surgery; and/or to treat sexual dysfunction associated with treatment using certain drugs, such as drugs used to treat hypertension, depression or anxiety; said method comprising administering to a subject in need thereof a therapeutic effective amount of a compound or a composition as defined herein.

In another embodiment, the invention provides a method for the prevention and/or treatment of bone diseases: including but not limited to osteoporosis and osteoarthritis; said method comprising administering to a subject in need thereof a therapeutic effective amount of a compound or a composition as defined herein.

In another embodiment, the invention provides a method for the prevention and/or treatment of diseases and disorders such as benign prostatic hyperplasia, transplant rejection, spasm, chronic obstructive bladder disease, and allergy; said method comprising administering to a subject in need thereof a therapeutic effective amount of a compound or a composition as defined herein.

In a preferred embodiment, the invention provides a method for the prevention and/or treatment of glaucoma, asthma, sexual dysfunction or COPD; said method comprising administering to a subject in need thereof a therapeutic effective amount of a compound or a composition as defined herein.

In the invention, particular preference is given to compounds of Formula I or any subgroup thereof that in the inhibition assay for ROCK described below inhibit ROCK with an  $IC_{50}$  value of less than 10  $\mu$ M, preferably less than 1  $\mu$ M, even more preferably less than 0.1  $\mu$ M.

Said inhibition may be effected *in vitro* and/or *in vivo*, and when effected *in vivo*, is preferably effected in a selective manner, as defined above.

The term "ROCK-mediated condition" or "disease", as used herein, means any disease or other deleterious condition in which ROCK is known to play a role. The term "ROCK-mediated condition" or "disease" also means those diseases or conditions that are alleviated by treatment with a ROCK inhibitor. Accordingly, another embodiment of the present invention relates to treating or lessening the severity of one or more diseases in which ROCK is known to play a role.

For pharmaceutical use, the compounds of the invention may be used as a free acid or base, and/or in the form of a pharmaceutically acceptable acid-addition and/or base-addition salt (e.g. obtained with non-toxic organic or inorganic acid or base), in the form of a hydrate, solvate and/or complex, and/or in the form of a pro-drug or pre-drug, such as an ester. As used herein and unless

otherwise stated, the term "solvate" includes any combination which may be formed by a compound of this invention with a suitable inorganic solvent (e.g. hydrates) or organic solvent.

The pharmaceutically acceptable salts of the compounds according to the invention, i.e. in the form of water-, oil-soluble, or dispersible products, include the conventional non-toxic salts which are formed, e.g., from inorganic or organic acids. Examples of such acid addition salts include acetate, adipate, alginate, aspartate, benzoate, benzenesulfonate, bisulfate, butyrate, citrate, camphorate, camphorsulfonate, cyclopentanepropionate, digluconate, dodecylsulfate, ethanesulfonate, fumarate, glucoheptanoate, glycerophosphate, hemisulfate, heptanoate, hexanoate, hydrochloride, hydrobromide, hydroiodide, 2-hydroxyethanesulfonate, lactate, maleate, methanesulfonate, 2-naphthalene-sulfonate, nicotinate, oxalate, palmoate, pectinate, persulfate, 3-phenylpropionate, picrate, pivalate, propionate, succinate, tartrate, thiocyanate, tosylate, and undecanoate.

Generally, for pharmaceutical use, the compounds of the inventions may be formulated as a pharmaceutical preparation or pharmaceutical composition comprising at least one compound of the invention and at least one pharmaceutically acceptable carrier, diluent or excipient and/or adjuvant, and optionally one or more further pharmaceutically active compounds.

By means of non-limiting examples, such a formulation may be in a form suitable for oral administration, for parenteral administration (such as by, intramuscular or subcutaneous injection or intravenous infusion), for topical administration (including ocular), for administration by inhalation, by a skin patch, by an implant, by a suppository, etc.. Such suitable administration forms – which may be solid, semi-solid or liquid, depending on the manner of administration – as well as methods and carriers, diluents and excipients for use in the preparation thereof, will be clear to the skilled person.

Some preferred, but non-limiting examples of such preparations include tablets, pills, powders, lozenges, sachets, cachets, elixirs, suspensions, emulsions, solutions, syrups, aerosols, ointments, creams, lotions, soft and hard gelatin capsules, suppositories, eye drops, sterile injectable solutions and sterile packaged powders (which are usually reconstituted prior to use) for administration as a bolus and/or for continuous administration, which may be formulated with carriers, excipients, and diluents that are suitable per se for such formulations, such as lactose, dextrose, sucrose, sorbitol, mannitol, starches, gum acacia, calcium phosphate, alginates, tragacanth, gelatin, calcium silicate, microcrystalline cellulose, polyvinylpyrrolidone, polyethylene glycol, cellulose, (sterile) water, methylcellulose, methyl- and propylhydroxybenzoates, talc, magnesium stearate, edible oils, vegetable oils and mineral oils or suitable mixtures thereof. The formulations can optionally contain other pharmaceutically active substances (which may or may not lead to a synergistic effect with the compounds of the invention) and other substances that are commonly used in pharmaceutical formulations, such as lubricating agents, wetting agents, emulsifying and suspending agents, dispersing agents, disintegrants, bulking agents, fillers, preserving agents, sweetening agents, flavoring agents, flow regulators, release agents, etc. The compositions may also be formulated so as to provide rapid, sustained or delayed release of the active compound(s) contained therein, for

example using liposomes or hydrophilic polymeric matrices based on natural gels or synthetic polymers. In order to enhance the solubility and/or the stability of the compounds of a pharmaceutical composition according to the invention, it can be advantageous to employ  $\alpha$ -,  $\beta$ - or  $\gamma$ -cyclodextrins or their derivatives.

- 5 In addition, co-solvents such as alcohols may improve the solubility and/or the stability of the compounds. In the preparation of aqueous compositions, addition of salts of the compounds of the invention can be more suitable due to their increased water solubility.

For the treatment of pain, the compounds of the invention may be used locally. For local administration, the compounds may advantageously be used in the form of a spray, ointment or  
10 transdermal patch or another suitable form for topical, transdermal and/or intradermal administration.

For ophthalmic application, solutions, gels, tablets and the like are often prepared using a physiological saline solution, gel or excipient as a major vehicle. Ophthalmic formulations should preferably be prepared at a comfortable pH with an appropriate buffer system.

- 15 More in particular, the compositions may be formulated in a pharmaceutical formulation comprising a therapeutically effective amount of particles consisting of a solid dispersion of the compounds of the invention and one or more pharmaceutically acceptable water-soluble polymers.

The term "a solid dispersion" defines a system in a solid state (as opposed to a liquid or gaseous state) comprising at least two components, wherein one component is dispersed more or less  
20 evenly throughout the other component or components. When said dispersion of the components is such that the system is chemically and physically uniform or homogenous throughout or consists of one phase as defined in thermodynamics, such a solid dispersion is referred to as "a solid solution". Solid solutions are preferred physical systems because the components therein are usually readily bioavailable to the organisms to which they are administered.

- 25 It may further be convenient to formulate the compounds in the form of nanoparticles which have a surface modifier adsorbed on the surface thereof in an amount sufficient to maintain an effective average particle size of less than 1000 nm. Suitable surface modifiers can preferably be selected from known organic and inorganic pharmaceutical excipients. Such excipients include various polymers, low molecular weight oligomers, natural products and surfactants. Preferred surface  
30 modifiers include nonionic and anionic surfactants.

Yet another interesting way of formulating the compounds according to the invention involves a pharmaceutical composition whereby the compounds are incorporated in hydrophilic polymers and applying this mixture as a coat film over many small beads, thus yielding a composition with good bio-availability which can conveniently be manufactured and which is suitable for preparing  
35 pharmaceutical dosage forms for oral administration. Materials suitable for use as cores in the beads are manifold, provided that said materials are pharmaceutically acceptable and have

appropriate dimensions and firmness. Examples of such materials are polymers, inorganic substances, organic substances, and saccharides and derivatives thereof.

The preparations may be prepared in a manner known per se, which usually involves mixing at least one compound according to the invention with the one or more pharmaceutically acceptable carriers, and, if desired, in combination with other pharmaceutical active compounds, when necessary under aseptic conditions. The pharmaceutical preparations of the invention are preferably in a unit dosage form, and may be suitably packaged, for example in a box, blister, vial, bottle, sachet, ampoule or in any other suitable single-dose or multi-dose holder or container (which may be properly labeled); optionally with one or more leaflets containing product information and/or instructions for use. The compounds can be administered by a variety of routes including the oral, rectal, ocular, transdermal, subcutaneous, intramuscular or intranasal routes, depending mainly on the specific preparation used and the condition to be treated or prevented, and with oral and intravenous administration usually being preferred. The at least one compound of the invention will generally be administered in an "effective amount", by which is meant any amount of a compound of the Formula I or any subgroup thereof that, upon suitable administration, is sufficient to achieve the desired therapeutic or prophylactic effect in the individual to which it is administered. Usually, depending on the condition to be prevented or treated and the route of administration, such an effective amount will usually be between 0.001 to 1000 mg per kilogram body weight of the patient per day, more often between 0.1 and 500 mg, such as between 1 and 250 mg, for example about 5, 10, 20, 50, 100, 150, 200 or 250 mg, per kilogram body weight of the patient per day, which may be administered as a single daily dose, divided over one or more daily doses, or essentially continuously. The amount(s) to be administered, the route of administration and the further treatment regimen may be determined by the treating clinician, depending on factors such as the age, gender and general condition of the patient and the nature and severity of the disease/symptoms to be treated. Reference is again made to US-A-6,372,778, US-A-6,369,086, US-A-6,369,087 and US-A-6,372,733 and the further prior art mentioned above, as well as to the standard handbooks, such as the latest edition of Remington's Pharmaceutical Sciences.

In accordance with the method of the present invention, said pharmaceutical composition can be administered separately at different times during the course of therapy or concurrently in divided or single combination forms. The present invention is therefore to be understood as embracing all such regimes of simultaneous or alternating treatment and the term "administering" is to be interpreted accordingly.

For an oral administration form, the compositions of the present invention can be mixed with suitable additives, such as excipients, stabilizers, or inert diluents, and brought by means of the customary methods into the suitable administration forms, such as tablets, coated tablets, hard capsules, aqueous, alcoholic, or oily solutions. Examples of suitable inert carriers are gum arabic, magnesia, magnesium carbonate, potassium phosphate, lactose, glucose, or starch, in particular, corn starch. In this case, the preparation can be carried out both as dry and as moist granules. Suitable oily excipients or solvents are vegetable or animal oils, such as sunflower oil or cod liver

oil. Suitable solvents for aqueous or alcoholic solutions are water, ethanol, sugar solutions, or mixtures thereof. Polyethylene glycols and polypropylene glycols are also useful as further auxiliaries for other administration forms. As immediate release tablets, these compositions may contain microcrystalline cellulose, dicalcium phosphate, starch, magnesium stearate and lactose  
5 and/or other excipients, binders, extenders, disintegrants, diluents and lubricants known in the art.

When administered by nasal aerosol or inhalation, these compositions may be prepared according to techniques well-known in the art of pharmaceutical formulation and may be prepared as solutions in saline, employing benzyl alcohol or other suitable preservatives, absorption promoters to enhance bioavailability, fluorocarbons, and/or other solubilizing or dispersing agents known in  
10 the art. Suitable pharmaceutical formulations for administration in the form of aerosols or sprays are, for example, solutions, suspensions or emulsions of the compounds of the invention or their physiologically tolerable salts in a pharmaceutically acceptable solvent, such as ethanol or water, or a mixture of such solvents. If required, the formulation can also additionally contain other pharmaceutical auxiliaries such as surfactants, emulsifiers and stabilizers as well as a propellant.

For subcutaneous administration, the compound according to the invention, if desired with the substances customary therefore such as solubilizers, emulsifiers or further auxiliaries are brought into solution, suspension, or emulsion. The compounds of the invention can also be lyophilized and the lyophilizates obtained used, for example, for the production of injection or infusion preparations. Suitable solvents are, for example, water, physiological saline solution or alcohols, e.g. ethanol,  
20 propanol, glycerol, in addition also sugar solutions such as glucose or mannitol solutions, or alternatively mixtures of the various solvents mentioned. The injectable solutions or suspensions may be formulated according to known art, using suitable non-toxic, parenterally-acceptable diluents or solvents, such as mannitol, 1,3-butanediol, water, Ringer's solution or isotonic sodium chloride solution, or suitable dispersing or wetting and suspending agents, such as sterile, bland,  
25 fixed oils, including synthetic mono- or diglycerides, and fatty acids, including oleic acid.

When rectally administered in the form of suppositories, these formulations may be prepared by mixing the compounds according to the invention with a suitable non-irritating excipient, such as cocoa butter, synthetic glyceride esters or polyethylene glycols, which are solid at ordinary temperatures, but liquefy and/or dissolve in the rectal cavity to release the drug.

30 In preferred embodiments, the compounds and compositions of the invention are used locally, for instance topical or in both absorbed and non-adsorbed applications.

The compositions are of value in the veterinary field, which for the purposes herein not only includes the prevention and/or treatment of diseases in animals, but also – for economically important animals such as cattle, pigs, sheep, chicken, fish, etc. – enhancing the growth and/or  
35 weight of the animal and/or the amount and/or the quality of the meat or other products obtained from the animal. Thus, in a further aspect, the invention relates to a composition for veterinary use that contains at least one compound of the invention and at least one suitable carrier (i.e. a carrier

suitable for veterinary use). The invention also relates to the use of a compound of the invention in the preparation of such a composition.

The invention will now be illustrated by means of the following synthetic and biological examples, which do not limit the scope of the invention in any way.

5

## **EXAMPLES**

### **A. Physicochemical properties of the compounds**

#### **A.1. Compound purity**

10 Unless indicated otherwise, the purity of the compounds was confirmed by liquid chromatography/mass spectrometry (LC/MS).

#### **A.2. Attribution of the configuration:**

The Cahn-Ingold-Prelog system was used to attribute the absolute configuration of chiral center, in which the four groups on an asymmetric carbon are ranked to a set of sequences rules. Reference is made to Cahn; Ingold; Prelog *Angew. Chem. Int. Ed. Engl.* **1966**, 5, 385-415.

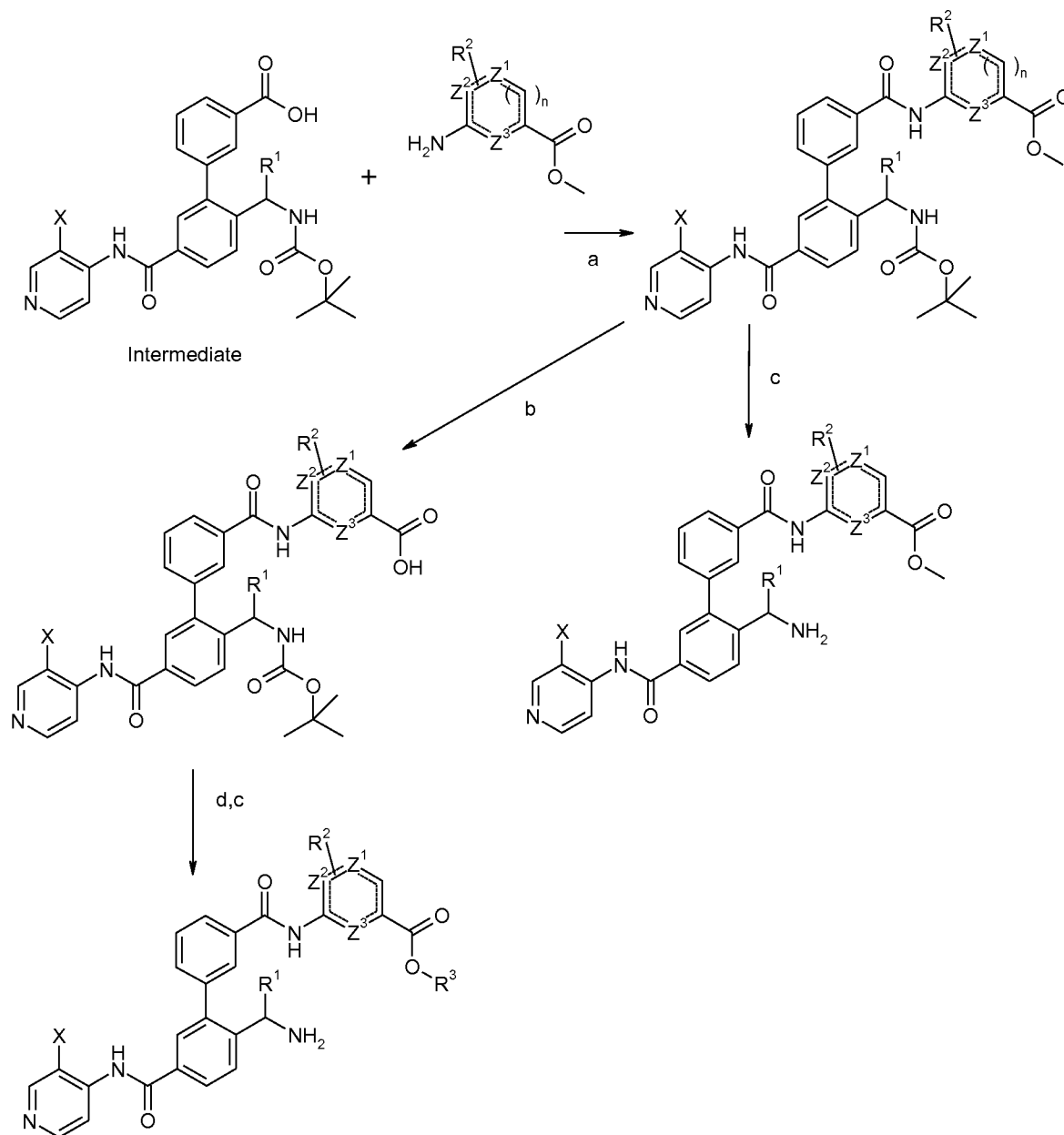
#### **A.3. Stereochemistry:**

15 It is known by those skilled in the art that specific enantiomers (or diastereoisomers) can be obtained by different methods such as, but not limited to chiral resolution (for example, salts formed with optically active acids or bases may be used to form diastereoisomeric salts that can facilitate the separation of optically active isomers of the compounds of Formula I or any subgroup thereof),  
20 asymmetric synthesis or preparative chiral chromatography. Whenever it is convenient, stereoisomers can be obtained starting from commercial materials with known configuration (such compounds include aminoacid for instance).



**B. Compound synthesis*****B.1. Compounds of the invention***

The compounds of the invention can be made according to the following general procedures:



- 5 Reaction a: To a solution of carboxylic acid (1eq) in an organic solvent such as DMF at room temperature was added an appropriate coupling reagent (such as TBTU (1.5 eq)/ HOBt (0.3 eq)) and DIEA (3 to 10 eq) as required. After 5 min the corresponding aniline (1.5 eq) was added and the mixture stirred at room temperature until completion of the reaction. Then the solvent was removed under vacuum and the residue diluted in EtOAc. The organic phase was washed with
- 10 saturated NaHCO<sub>3</sub>, brine, dried over Na<sub>2</sub>SO<sub>4</sub> and filtered. After evaporation of the solvent, the residue was purified by flash chromatography, eluted for instance with DCM/EtOAc (100/0 to 50/50) to give the expected product as a white powder.

Reaction b: To a suspension of the corresponding methyl ester in acetonitrile/water 2/1 was added dropwise a solution 1.6M of LiOH in water. The mixture was stirred at room temperature until completion of the reaction. Then a solution 0.5M of HCl in water was added until pH = 4 and the mixture extracted with EtOAc (x3). The combined organic phases were washed with brine, dried  
5 over Na<sub>2</sub>SO<sub>4</sub> and filtered. The solvent was removed under vacuum to give the expected compound as a white powder. The compound was usually used in the next step without further purification.

Reaction c: Through a solution or suspension of the Boc-protected amine in DCM (or dioxane, or diethyl-ether), HCl (gas) was bubbled at room temperature for 5 to 10 min. The mixture was stirred at room temperature until completion of the reaction. The resulting precipitate was filtered, washed  
10 with Ether (x3) and dried under vacuum to give the HCl salt of the expected compound as a white powder.

Reaction d: To a solution of carboxylic acid (1eq) in in an organic solvent such as DMF at room temperature was added an appropriate coupling reagent (such as TBTU (1.5 eq)/ HOBt (0.3 eq)) and DIEA (3 to 10 eq) as required.. After 5 min the alcohol (R<sup>3</sup>-OH; 6 eq) was added and the  
15 mixture stirred at room temperature until completion of the reaction. The solvent was subsequently removed under vacuum and the residue diluted in EtOAc. The organic phase was washed with saturated NaHCO<sub>3</sub>, brine, dried over Na<sub>2</sub>SO<sub>4</sub> and filtered. After evaporation of the solvent, the residue was purified by flash chromatography, eluted for instance with DCM/EtOAc (100/0 to 50/50) to give the expected product as a white powder.

20 Similarly, amino-heterocyclic starting materials can be used (Examples 50-52).

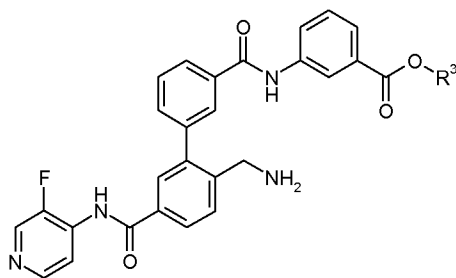
In case Y = -NHC(O)-, compounds of the invention can be obtained in a similar manner from the corresponding aniline intermediate and the appropriate carboxylic acid,.

Preparation of the required intermediate(s) is known to the skilled person, for example from PCT application WO 2011/107608 A1

25 In the tables that are set forth below, exemplary compounds of the invention are set out in tabulated form. In this table, an arbitrarily assigned compound number and structural information are set out.

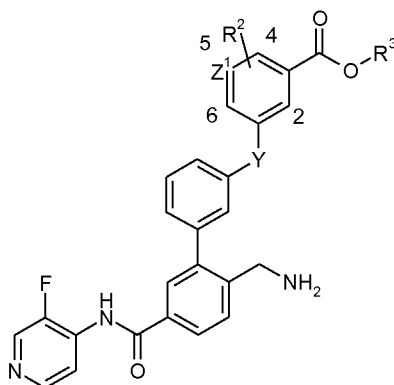
-34-

Table 1



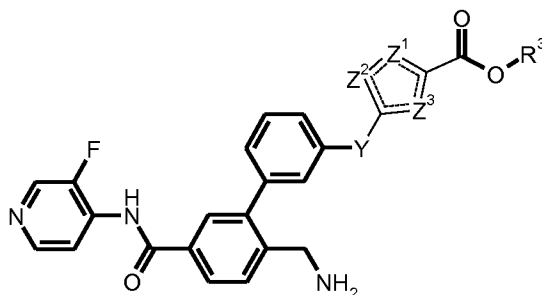
#	R <sup>3</sup>
1	-Me
2	-nPr
3	
4	
5	
6	
7	-iPr
8	-nBu
9	-secBu
10	
11	
12	
13	
14	
15	
16	-(CH <sub>2</sub> ) <sub>2</sub> -OMe
17	-(CH <sub>2</sub> ) <sub>2</sub> -O-C <sub>4</sub> H <sub>9</sub>
18	-CH <sub>2</sub> -CN
19	-(CH <sub>2</sub> ) <sub>2</sub> -NMe <sub>2</sub>
20	-(CH <sub>2</sub> ) <sub>2</sub> -NEt <sub>2</sub>
21	
22	-Ph
23	-Bn
24	

Table 2



#	Y	Z¹	R²				R³
			2	4	5	6	
25	-C(O)NH-	C			-F		-Me
26	-C(O)NH-	C	-F				-Me
27	-C(O)NH-	C			-F		-nPr
28	-C(O)NH-	C				-F	-Me
29	-C(O)NH-	C				-F	-nPr
30	-C(O)NH-	C				-F	
31	-C(O)NH-	C				-F	
32	-C(O)NH-	N	-H				-Me
33	-C(O)NH-	C		-Me			-Me
34	-C(O)NH-	C		-Me			-nPr
35	-NHC(O)-	C	-H				-Me
36	-NHC(O)-	C	-H				-nPr
37	-NHC(O)-	C				-F	-Me
38	-NHC(O)-	C				-F	
39	-NHC(O)-	C				-F	
40	-NHC(O)-	C				-F	
41	-NHC(O)-	C				-F	
42	-NHC(O)-	C				-F	-iPr
43	-NHC(O)-	C				-F	
44	-NHC(O)-	C				-F	
45	-NHC(O)-	C				-F	-Ph
46	-NHC(O)-	C				-F	
47	-NHC(O)-	C				-F	-CH₂-CN
48	-NHC(O)-	C	-H				
49	-NHC(O)-	C	-H				-(CH₂)₂-OMe

Table 3



#	Y	Z <sup>1</sup>	Z <sup>2</sup>	Z <sup>3</sup>	R <sup>3</sup>
50	-C(O)NH-	CH	N	S	-Me
51	-C(O)NH-	N	N	O	-Et
52	-C(O)NH-	CH	CH	O	-Me

### C. In vitro and in vivo assays

#### 5 C.1. ROCK inhibitory activity screening

##### C.1.1. Kinase inhibition (ROCKI or ROCKII)

On-target activity against ROCK was measured in a biochemical assay, using the following reagents: Base Reaction buffer; 20 mM Hepes (pH 7.5), 10 mM MgCl<sub>2</sub>, 1mM EGTA, 0.02% Brij35, 0.02 mg/ml BSA, 0.1 mM Na<sub>3</sub>VO<sub>4</sub>, 2 mM DTT, 1% DMSO. Required cofactors are added individually to each kinase reaction. The reaction procedure first involved the preparation of a peptide substrate in a freshly prepared reaction buffer. Required cofactors were then added to the substrate solution. ROCK (1nM final concentration) was then delivered to the substrate solution. After gentle mix, DMSO solutions of the test compounds were added to the enzyme. Substrate mix <sup>33</sup>P-ATP (specific activity 0.01 μCi/μl final) was then delivered into the reaction mixture to initiate the reaction. The kinase reaction was incubated for 120 min. at room temperature. Reactions were then spotted onto P81 ion exchange paper (Whatman # 3698-915). Filters were washed extensively in 0.1% Phosphoric acid. A radiometric count was then performed and IC<sub>50</sub> values were subsequently determined.

When evaluated under such conditions, compounds of the invention inhibit ROCK2 with an IC<sub>50</sub> < 100nM.

##### C.1.2. Myosin Light Chain Phosphorylation assay

Rat smooth muscle cell line A7r5 is used. The endogenous expression of ROCK results in a constitutive phosphorylation of the regulatory myosin light chain at T18/S19. A7r5 cells were plated in DMEM supplemented with 10%FCS in multiwall cell culture plates. After serum starvation overnight, cells were incubated with compounds in serum-free medium.

Quantification of MLC-T18/S19 phosphorylation is assessed in 96 well-plates via ELISA using a phspho-MLC-T18/S19 specific antibody and a secondary detection antibody. Raw data were

converted into percent substrate phosphorylation relative to high controls, which were set to 100%. EC<sub>50</sub> values were determined using GraphPad Prism 5.01 software using a nonlinear regression curve fit with variable hill slope.

When evaluated under such conditions, compounds of the invention display EC<sub>50</sub> values under 10µM. Preferred compounds display EC<sub>50</sub> values under 1µM.

## C.2. Pharmacological Characterization

### *C.2.1. Stability assay in human (and/or animal) plasma*

Compounds are incubated at a concentration of 1 µM in human plasma or animal (rat, mice, dog, monkey, minipig or rabbit) plasma. Samples are taken at fixed time points and the remnant of compound is determined by LC-MS/MS after protein precipitation. Half life is expressed in minutes.

The compounds of the invention (Examples 1-10, 12-24, 26-31, 40, 41, 43-48) have a half life < 60 minutes in human plasma..

Plasma from human or rat (or other species) can be replaced by whole blood while keeping the same protocol.

### *C.2.2. Stability assay in rabbit aqueous humor*

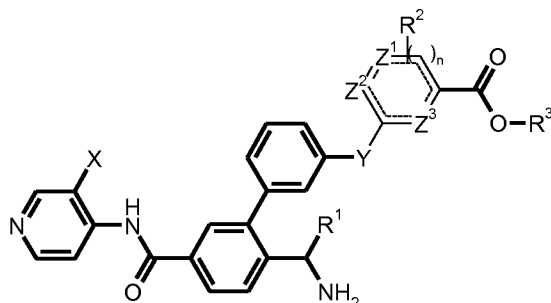
Compounds are incubated at a concentration of 1 µM in rabbit aqueous humor (AH). Samples are taken at fixed time points and the remnant of compound is determined by LC-MS/MS after protein precipitation. Half-life values for compounds of the invention are provided in table 4.

Table 4

# Cpd	t <sub>1/2</sub> Rabbit AH (min)	# Cpd	t <sub>1/2</sub> Rabbit AH (min)
1	> 60	32	> 60
2	> 60	33	> 60
6	> 60	34	> 60
7	> 60	35	> 60
8	> 60	37	> 60
9	> 60	38	> 60
16	> 60	39	> 60
18	> 60	40	> 60
23	> 60	41	> 60
24	> 60	42	> 60
27	> 60	43	> 60
28	> 60	44	> 60
29	> 60	48	> 60
31	> 60	49	> 60

**CLAIMS**

1. A compound of Formula I or a stereoisomer, tautomer, racemic, salt, hydrate, or solvate thereof,



I

Wherein,

X is hydrogen or halogen;

Y is  $\text{-NH-C(=O)-}$  or  $\text{-C(=O)-NH-}$ ;

$Z^1$ ,  $Z^2$ , and  $Z^3$  are each independently selected from the group consisting of C, N, O, and S;

$R^1$  is selected from the group comprising hydrogen,  $\text{C}_{1-20}$ alkyl, and  $\text{C}_{3-15}$ cycloalkyl;

$R^2$  is selected from the group comprising hydrogen,  $\text{C}_{1-20}$ alkyl, halogen and  $\text{C}_{1-20}$ alkoxy;

$R^3$  is selected from the group consisting of  $\text{C}_{1-20}$ alkyl,  $\text{C}_{3-20}$ alkenyl,  $\text{C}_{3-20}$ alkynyl,  $\text{C}_{3-15}$ cycloalkyl, aryl, heteroaryl, and  $\text{C}_{3-19}$ heterocyclyl; wherein said  $\text{C}_{1-20}$ alkyl,  $\text{C}_{3-20}$ alkenyl,  $\text{C}_{3-20}$ alkynyl,  $\text{C}_{3-15}$ cycloalkyl, aryl, heteroaryl, and  $\text{C}_{3-19}$ heterocyclyl is optionally substituted with one or more substituents selected from the group consisting of halo, hydroxyl, oxo, carbonyl, amino, amido, cyano, aryl, heteroaryl,  $\text{C}_{3-15}$ cycloalkyl,  $\text{C}_{3-19}$ heterocyclyl,  $\text{C}_{1-20}$ alkylamino,  $\text{di(C}_{1-20}\text{alkyl)amino}$ ,  $\text{C}_{1-20}$ alkoxy, halo- $\text{C}_{1-20}$ alkoxy, halo- $\text{C}_{1-20}$ alkyl, thiol,  $\text{C}_{1-20}$ alkylthio, carboxylic acid, acylamino,  $\text{C}_{1-20}$ alkyl esters, carbamate, thioamido, urea, and sulfonamido; and

n is 0 or 1.

2. A compound of formula I according to claim 1, wherein;

$R^1$  is selected from the group comprising hydrogen,  $\text{C}_{1-6}$ alkyl, and  $\text{C}_{3-6}$ cycloalkyl; in particular hydrogen.

3. A compound of formula I according to claim 1 or 2, wherein;

X is halogen; in particular fluoro;

Y is  $\text{-NH-C(=O)-}$  or  $\text{-C(=O)-NH-}$ ;

$Z^1$ ,  $Z^2$ , and  $Z^3$  are each independently selected from the group consisting of C, N, O, and S; in particular from the group consisting of C, and N; more in particular  $Z^1$ ,  $Z^2$ , and  $Z^3$  are each C;

$R^1$  is selected from the group comprising hydrogen,  $C_{1-20}$ alkyl, and  $C_{3-15}$ cycloalkyl; in particular hydrogen;

5  $R^2$  is selected from the group comprising hydrogen,  $C_{1-20}$ alkyl, halogen and  $C_{1-20}$ alkoxy;

$R^3$  is selected from the group consisting of  $C_{1-20}$ alkyl,  $C_{3-20}$ alkenyl,  $C_{3-20}$ alkynyl,  $C_{3-15}$ cycloalkyl, aryl, heteroaryl, and  $C_{3-19}$ heterocyclyl; wherein said  $C_{1-20}$ alkyl,  $C_{3-20}$ alkenyl,  $C_{3-20}$ alkynyl,  $C_{3-15}$ cycloalkyl, aryl, heteroaryl, and  $C_{3-19}$ heterocyclyl is optionally substituted with one or more substituents selected from the group consisting of halo, hydroxyl, oxo, carbonyl, amino, amido, cyano, aryl, heteroaryl,  $C_{3-15}$ cycloalkyl,  $C_{3-19}$ heterocyclyl,  $C_{1-20}$ alkylamino, di( $C_{1-20}$ alkyl)amino,  $C_{1-20}$ alkoxy, halo- $C_{1-20}$ alkoxy, halo- $C_{1-20}$ alkyl, thiol,  $C_{1-20}$ alkylthio, carboxylic acid, acylamino,  $C_{1-20}$ alkyl esters, carbamate, thioamido, urea, and sulfonamido; and

n is 0 or 1; in particular n is 1.

15 4. A compound of formula I according to claim any one of the previous claims, wherein;

$R^2$  is selected from the group consisting of hydrogen,  $C_{1-20}$ alkyl, and halogen; in particular from the group consisting of hydrogen,  $C_{1-6}$ alkyl, and halogen; more in particular from the group consisting of hydrogen, methyl and fluoro.

20 5. A compound of formula I according to any one of the previous claims, wherein;

$R^3$  is selected from the group consisting of  $C_{1-20}$ alkyl,  $C_{3-20}$ alkenyl,  $C_{3-20}$ alkynyl, and aryl; wherein said  $C_{1-20}$ alkyl,  $C_{3-20}$ alkenyl,  $C_{3-20}$ alkynyl, and aryl is optionally substituted with one or more substituents selected from the group consisting of halo, hydroxyl, oxo, carbonyl, amino, amido, cyano, aryl, heteroaryl,  $C_{3-15}$ cycloalkyl,  $C_{3-19}$ heterocyclyl,  $C_{1-20}$ alkylamino, di( $C_{1-20}$ alkyl)amino,  $C_{1-20}$ alkoxy, halo- $C_{1-20}$ alkoxy, halo- $C_{1-20}$ alkyl, thiol,  $C_{1-20}$ alkylthio, carboxylic acid, acylamino,  $C_{1-20}$ alkyl esters, carbamate, thioamido, urea, and sulfonamido.

6. A compound of formula I according to any one of the previous claims, wherein one or more of the following restrictions apply:

- 30
- X is halogen; in particular fluoro;
  - Y is  $-C(=O)-NH-$ ;
  - $Z^1$ ,  $Z^2$ , and  $Z^3$  are each independently selected from C, and N;
  - $Z^1$ ,  $Z^2$  and  $Z^3$  are C;
  - $R^1$  is hydrogen;



- $R^2$  is selected from the group comprising hydrogen,  $C_{1-20}$ alkyl, and halogen; in particular hydrogen,  $C_{1-6}$ alkyl, and halogen; more in particular hydrogen, methyl and fluoro;
- $R^2$  is hydrogen;
- $R^2$  is fluoro;
- 5 •  $R^3$  is selected from the group consisting of  $C_{1-20}$ alkyl,  $C_{3-20}$ alkenyl,  $C_{3-20}$ alkynyl,  $C_{3-15}$ cycloalkyl, aryl, heteroaryl, and  $C_{3-19}$ heterocyclyl; wherein said  $C_{1-20}$ alkyl,  $C_{3-20}$ alkenyl, and  $C_{3-20}$ alkynyl is optionally substituted with one or more substituents selected from the group consisting of halo, hydroxyl, oxo, carbonyl, amino, amido, cyano, aryl, heteroaryl,  $C_{3-15}$ cycloalkyl,  $C_{3-19}$ heterocyclyl,  $C_{1-20}$ alkylamino, di( $C_{1-20}$ alkyl)amino,  $C_{1-20}$ alkoxy, halo- $C_{1-20}$ alkoxy, halo- $C_{1-20}$ alkyl, thiol,  $C_{1-20}$ alkylthio, carboxylic acid, acylamino,  $C_{1-20}$ alkyl esters, carbamate, thioamido, urea, and sulfonamido; in particular  $R^3$  is selected from the group consisting of  $C_{1-20}$ alkyl,  $C_{3-20}$ alkenyl,  $C_{3-20}$ alkynyl,  $C_{3-15}$ cycloalkyl, aryl, heteroaryl, and  $C_{3-19}$ heterocyclyl; wherein said  $C_{1-20}$ alkyl is optionally substituted with one or more substituents selected from the group consisting of halo, hydroxyl, oxo, carbonyl, amino, amido, cyano, aryl, heteroaryl,  $C_{3-15}$ cycloalkyl,  $C_{3-19}$ heterocyclyl,  $C_{1-20}$ alkylamino, di( $C_{1-20}$ alkyl)amino,  $C_{1-20}$ alkoxy, halo- $C_{1-20}$ alkoxy, halo- $C_{1-20}$ alkyl, thiol,  $C_{1-20}$ alkylthio, carboxylic acid, acylamino,  $C_{1-20}$ alkyl esters, carbamate, thioamido, urea, and sulfonamido.
- 10 •  $R^3$  is selected from the group consisting of  $C_{1-20}$ alkyl,  $C_{3-20}$ alkenyl,  $C_{3-20}$ alkynyl, and aryl; wherein said  $C_{1-20}$ alkyl,  $C_{3-20}$ alkenyl,  $C_{3-20}$ alkynyl, and aryl is optionally substituted with one or more substituents selected from the group consisting of halo, hydroxyl, oxo, carbonyl, amino, amido, cyano, aryl, heteroaryl,  $C_{3-15}$ cycloalkyl,  $C_{3-19}$ heterocyclyl,  $C_{1-20}$ alkylamino, di( $C_{1-20}$ alkyl)amino,  $C_{1-20}$ alkoxy, halo- $C_{1-20}$ alkoxy, halo- $C_{1-20}$ alkyl, thiol,  $C_{1-20}$ alkylthio, carboxylic acid, acylamino,  $C_{1-20}$ alkyl esters, carbamate, thioamido, urea, and sulfonamido;
- 15 •  $R^3$  is selected from the group consisting of  $C_{1-20}$ alkyl,  $C_{3-20}$ alkenyl,  $C_{3-20}$ alkynyl, and aryl; wherein said  $C_{1-20}$ alkyl is optionally substituted with one or more substituents selected from the group consisting of halo, hydroxyl, oxo, carbonyl, amino, amido, cyano, aryl, heteroaryl,  $C_{3-15}$ cycloalkyl,  $C_{3-19}$ heterocyclyl,  $C_{1-20}$ alkylamino, di( $C_{1-20}$ alkyl)amino,  $C_{1-20}$ alkoxy, halo- $C_{1-20}$ alkoxy, halo- $C_{1-20}$ alkyl, thiol,  $C_{1-20}$ alkylthio, carboxylic acid, acylamino,  $C_{1-20}$ alkyl esters, carbamate, thioamido, urea, and sulfonamido.
- 20 •  $R^3$  is  $C_{1-6}$ alkyl optionally substituted with a substituent selected from the group consisting of halo, hydroxyl, oxo, carbonyl, amino, amido, cyano, aryl, heteroaryl,  $C_{3-15}$ cycloalkyl,  $C_{3-19}$ heterocyclyl,  $C_{1-20}$ alkylamino, di( $C_{1-20}$ alkyl)amino,  $C_{1-20}$ alkoxy, halo- $C_{1-20}$ alkoxy, halo- $C_{1-20}$ alkyl, thiol,  $C_{1-20}$ alkylthio, carboxylic acid, acylamino,  $C_{1-20}$ alkyl esters, carbamate, thioamido, urea, and sulfonamido;
- 25 •  $R^3$  is  $C_{1-6}$ alkyl optionally substituted with a substituent selected from the group consisting of halo, hydroxyl, oxo, carbonyl, amino, amido, cyano, aryl, heteroaryl,  $C_{3-15}$ cycloalkyl,  $C_{3-19}$ heterocyclyl,  $C_{1-20}$ alkylamino, di( $C_{1-20}$ alkyl)amino,  $C_{1-20}$ alkoxy, halo- $C_{1-20}$ alkoxy, halo- $C_{1-20}$ alkyl, thiol,  $C_{1-20}$ alkylthio, carboxylic acid, acylamino,  $C_{1-20}$ alkyl esters, carbamate, thioamido, urea, and sulfonamido;
- 30 •  $R^3$  is  $C_{1-6}$ alkyl optionally substituted with a substituent selected from the group consisting of halo, hydroxyl, oxo, carbonyl, amino, amido, cyano, aryl, heteroaryl,  $C_{3-15}$ cycloalkyl,  $C_{3-19}$ heterocyclyl,  $C_{1-20}$ alkylamino, di( $C_{1-20}$ alkyl)amino,  $C_{1-20}$ alkoxy, halo- $C_{1-20}$ alkoxy, halo- $C_{1-20}$ alkyl, thiol,  $C_{1-20}$ alkylthio, carboxylic acid, acylamino,  $C_{1-20}$ alkyl esters, carbamate, thioamido, urea, and sulfonamido;
- 35 • said one or more optional substituents for  $R^3$  are selected from the group consisting of halo, hydroxyl, nitro, amino, cyano, aryl, heteroaryl,  $C_{3-15}$ cycloalkyl,  $C_{3-19}$ heterocyclyl,  $C_{1-20}$ alkylamino, di( $C_{1-20}$ alkyl)amino,  $C_{1-20}$ alkoxy, and halo- $C_{1-20}$ alkyl; in particular from the group consisting of cyano,  $C_{3-15}$ cycloalkyl,  $C_{3-19}$ heterocyclyl,  $C_{1-20}$ alkoxy,

di(C<sub>1-20</sub>alkyl)amino, aryl, and heteroaryl; more in particular from cyano, C<sub>3-6</sub>cycloalkyl, C<sub>3-6</sub>heterocyclyl, C<sub>1-6</sub>alkoxy, di(C<sub>1-6</sub>alkyl)amino, aryl, and heteroaryl;

• said one or more optional substituents for R<sup>3</sup> are selected from the group consisting of cyano, C<sub>3-6</sub>cycloalkyl, pyrrolidinyl, tetrahydrofuranyl, C<sub>1-6</sub>alkoxy, di(C<sub>1-6</sub>alkyl)amino, phenyl, and pyridinyl;

• n is 1.

7. A compound according to any one of claims 1 to 6 for use as a medicine.

8. A composition comprising a compound as defined in any one of claims 1 to 6, for use as a human or veterinary medicine.

9. A compound according to any one of claims 1 to 6, or a composition according to claim 8, for use in the prevention and/or treatment of a disease or disorder, in which ROCK is involved, such as diseases linked to smooth muscle cell function, inflammation, fibrosis, excessive cell proliferation, excessive angiogenesis, hyperreactivity, barrier dysfunction, neurodegeneration, and remodeling.

10. A compound according to any one of claims 1 to 6, or a composition according to claim 8, for use in the prevention and/or treatment of at least one disease or disorder according to claim 9, selected from the group comprising eye diseases; airway diseases; throat, nose and ear diseases; intestinal diseases; cardiovascular and vascular diseases; inflammatory diseases; neurological and CNS disorders: proliferative diseases; kidney diseases; sexual dysfunction; bone diseases; benign prostatic hyperplasia, transplant rejection, spasm, hypertension, chronic obstructive bladder disease, and allergy.

11. A compound according to any one of claims 1 to 6, or a composition according to claim 8, for use in the prevention and/or treatment of an eye disease according to claim 9 or 10; including but not limited to retinopathy, optic neuropathy, glaucoma and degenerative retinal diseases such as macular degeneration, retinitis pigmentosa, inflammatory eye diseases (such as anterior uveitis, panuveitis, intermediate uveitis and posterior uveitis), neurodegeneration, corneal diseases (such as but not limited to Fuch's dystrophy and keratitis), abnormalities of corneal wound healing and ocular pain, and/or for preventing, treating and/or alleviating complications and/or symptoms associated therewith.

12. Use of a compound according to any one of claims 1 to 6, or a composition according to claim 8, for inhibiting the activity of at least one kinase, in vitro or in vivo.

13. Use of a compound according to any one of claims 1 to 6, or a composition according to claim 8, as a kinase inhibitor; in particular as a ROCK inhibitor, for example as a ROCKI and/or ROCKII inhibitor; more in particular as a soft ROCK inhibitor.

14. A method for the prevention and/or treatment of at least one disease or disorder selected from the group comprising eye diseases; airway diseases; cardiovascular and vascular diseases; inflammatory diseases; neurological and CNS disorders: proliferative diseases; kidney diseases; sexual dysfunction; bone diseases; benign prostatic hyperplasia; transplant rejection; spasm; hypertension; chronic obstructive bladder disease; and allergy; said method comprising administering to a subject in need thereof a therapeutic effective amount of a compound according to any one of claims 1 to 6, or a composition according to claim 8.

# INTERNATIONAL SEARCH REPORT

International application No  
PCT/EP2012/067017

<b>A. CLASSIFICATION OF SUBJECT MATTER</b> INV. C07D213/75 C07D213/80 C07D405/12 C07D413/12 C07D417/12 A61K31/44 A61K31/443 A61K31/4439 A61P27/02 A61P11/00 A61P29/00 A61P9/00		
According to International Patent Classification (IPC) or to both national classification and IPC		
<b>B. FIELDS SEARCHED</b> Minimum documentation searched (classification system followed by classification symbols) C07D A61K A61P		
Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched		
Electronic data base consulted during the international search (name of data base and, where practicable, search terms used) EPO-Internal, WPI Data, BIOSIS, EMBASE, CHEM ABS Data		
<b>C. DOCUMENTS CONSIDERED TO BE RELEVANT</b>		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	WO 2007/042321 A2 (DEVGEN NV [BE]; VAN ROMPAEY PHILIPPE [BE]; ARZEL PHILIPPE [BE]; DEFERT) 19 April 2007 (2007-04-19) abstract; claims 1-28; examples 3,4; tables 1-3; compounds 4,6,17,19-22 -----	1-14
A	WO 2007/006547 A1 (DEVGEN NV [BE]; DEFERT OLIVIER [FR]; VAN ROMPAEY PHILIPPE [BE]; BLOM P) 18 January 2007 (2007-01-18) abstract; claims 1-39; examples 1,2; tables 1-7; compounds 1-172 -----	1-14
<div style="display: flex; justify-content: space-between;"> <span><input type="checkbox"/> Further documents are listed in the continuation of Box C.</span> <span><input checked="" type="checkbox"/> See patent family annex.</span> </div>		
<div style="display: flex;"> <div style="flex: 1;"> <p>* Special categories of cited documents :</p> <p>"A" document defining the general state of the art which is not considered to be of particular relevance</p> <p>"E" earlier application or patent but published on or after the international filing date</p> <p>"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)</p> <p>"O" document referring to an oral disclosure, use, exhibition or other means</p> <p>"P" document published prior to the international filing date but later than the priority date claimed</p> </div> <div style="flex: 1;"> <p>"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention</p> <p>"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone</p> <p>"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art</p> <p>"&amp;" document member of the same patent family</p> </div> </div>		
Date of the actual completion of the international search  <div style="text-align: center; font-size: 1.2em;">16 October 2012</div>		Date of mailing of the international search report  <div style="text-align: center; font-size: 1.2em;">05/11/2012</div>
Name and mailing address of the ISA/ European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016		Authorized officer  <div style="text-align: center; font-size: 1.2em;">Sarakinis, Georgios</div>

# INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

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