

## PYRIDIN-2(1H)-ONE DERIVATIVES AS JAK INHIBITORS

Cytokines have critical functions in regulating many aspects of immunity and inflammation, ranging from the development and differentiation of immune cells to the suppression of immune responses. Type I and type II cytokine receptors lack intrinsic enzymatic activity capable of mediating signal transduction, and thus require association with tyrosine kinases for this purpose. The JAK family of kinases comprises four different members, namely JAK1, JAK2, JAK3 and TYK2, which bind to type I and type II cytokine receptors for controlling signal transduction (Murray PJ, (2007). The JAK-STAT signalling pathway: input and output integration. *J Immunol*, 178: 2623). Each of the JAK kinases is selective for the receptors of certain cytokines. In this regard, JAK-deficient cell lines and mice have validated the essential role of each JAK protein in receptor signalling: JAK1 in class II cytokine receptors (IFN and IL-10 family), those sharing the gp130 chain (IL-6 family) and the common gamma chain (IL-2, IL-4, IL-7, IL-9, IL-15 and IL-21) (Rodig et al. (1998). Disruption of the JAK1 gene demonstrates obligatory and nonredundant roles of the Jaks in cytokine-induced biological response. *Cell*, 93:373; Guschin et al. (1995). A major role for the protein tyrosine kinase JAK1 in the JAK/STAT signal transduction pathway in response to interleukin-6. *EMBO J.* 14: 1421; Briscoe et al. (1996). Kinase-negative mutants of JAK1 can sustain interferon-gamma-inducible gene expression but not an antiviral state. *EMBO J.* 15:799; JAK2 in hematopoietic factors (Epo, Tpo, GM-CSF, IL-3, IL-5) and type II IFNs (Parganas et al., (1998). JAK2 is essential for signalling through a variety of cytokine receptors. *Cell*, 93:385; JAK3 in receptors sharing the common gamma chain (IL-2 family) (Park et al., (1995). Developmental defects of lymphoid cells in JAK3 kinase-deficient mice. *Immunity*, 3:771; Thomis et al., (1995). Defects in B lymphocyte maturation and T lymphocyte activation in mice lacking JAK3. *Science*, 270:794; Russell et al., (1995). Mutation of JAK3 in a patient with SCID: Essential role of JAK3 in lymphoid development. *Science*, 270:797; and Tyk2 in the receptors of IL-12, IL-23, IL-13 and type I IFNs (Karaghiosoff et al., (2000). Partial impairment of cytokine responses in Tyk2-deficient mice. *Immunity*, 13:549; Shimoda et al., (2000). Tyk2 plays a restricted role in IFN $\gamma$  signaling, although it is required for IL-12-mediated T cell function. *Immunity*, 13:561; Minegishi et al., (2006). Human Tyrosine kinase 2 deficiency reveals its requisite roles in multiple cytokine signals involved in innate and acquired immunity. *Immunity*, 25:745).

Receptor stimulation leads sequentially to JAK activation by phosphorylation, receptor phosphorylation, STAT protein recruitment and STAT activation and dimerization. The

STAT dimer then functions as a transcription factor, translocating to the nucleus and activating the transcription of multiple response genes. There are seven STAT proteins identified: STAT1, STAT2, STAT3, STAT4, STAT5a, STAT5b and STAT6. Each particular cytokine receptor associates preferentially with a particular STAT protein.

- 5 Some associations are independent of cell type (ex: IFNg- STAT1) while others may be cell type dependent (Murray PJ, (2007). The JAK-STAT signaling pathway: input and output integration. *J Immunol*, 178: 2623).

- The phenotype of deficient mice has provided insights on the function of each JAK and the cytokine receptors signaling through them. JAK3 associates exclusively with the common gamma chain of the receptors for IL-2, IL-4, IL-7, IL-9, IL-15 and IL-21 cytokines. By virtue of this exclusive association, JAK3 knock out mice and common gamma chain deficient mice have an identical phenotype (Thomis et al., (1995). Defects in B lymphocyte maturation and T lymphocyte activation in mice lacking JAK3. *Science*, 270:794; DiSanto et al., (1995). Lymphoid development in mice with a targeted deletion of the interleukin 2 receptor gamma chain. *PNAS*, 92:377). Moreover, this phenotype is shared to a great extent with SCID patients that hold mutations/defects in the common gamma chain or JAK3 genes (O'Shea et al., (2004). JAK3 and the pathogenesis of severe combined immunodeficiency. *Mol Immunol*, 41: 727). JAK3-deficient mice are viable but display abnormal lymphopoiesis which leads to a reduced thymus size (10-100 fold smaller than wild type). JAK3-deficient peripheral T cells are unresponsive and have an activated/memory cell phenotype (Baird et al., (1998). T cell development and activation in JAK3-deficient mice. *J. Leuk. Biol.* 63: 669). The thymic defect in these mice strongly resembles that seen in IL-7 and IL-7 receptor knockout mice, suggesting that the absence of IL-7 signaling accounts for this defect in JAK3  $\gamma$ -mice (von Freeden-Jeffry et al., (1995). Lymphopenia in Interleukin (IL)-7 Gene-deleted Mice Identifies IL-7 as a non-redundant Cytokine. *J Exp Med*, 181:1519; Peschon et al, (1994). Early lymphocyte expansion is severely impaired in interleukin 7 receptor-deficient mice. *J Exp Med*, 180: 1955). These mice, like SCID humans, have no NK cells, probably due to the absence of IL-15 signaling, a survival factor for these cells. JAK3 knockout mice, unlike SCID patients, show deficient B cell lymphopoiesis while in human patients, B cells are present in circulation but are not responsive leading to hypoglobulinemia (O'Shea et al., (2004). JAK3 and the pathogenesis of severe combined immunodeficiency. *Mol Immunol*, 41: 727). This is explained by species-specific differences in IL-7 function in B and T cell development in mice and humans. On the other hand, Grossman et al. (1999. Dysregulated myelopoiesis in mice lacking JAK3. *Blood*, 94:932:939) have shown that the loss of

JAK3 in the T-cell compartment drives the expansion of the myeloid lineages leading to dysregulated myelopoiesis.

JAK2-deficient mice are embryonically lethal, due to the absence of definitive erythropoiesis. Myeloid progenitors fail to respond to Epo, Tpo, IL-3 or GM-CSF, while G-CSF and IL-6 signaling are not affected. JAK2 is not required for the generation, amplification or functional differentiation of lymphoid progenitors (Parganas et al., (1998). JAK2 is essential for signaling through a variety of cytokine receptors. *Cell*, 93:385).

JAK1-deficient mice die perinatally due to a nursing defect. JAK1 binds exclusively to the gp130 chain shared by the IL-6 cytokine family (i.e. LIF, CNTF, OSM, CT-1) and along with JAK3, is an essential component of the receptors sharing the common gamma chain, by binding to the non-shared receptor subunit. In this regard, JAK1-deficient mice show similar hematopoiesis defects as JAK3-deficient mice. In addition, they show defective responses to neurotrophic factors and to all interferons (class II cytokine receptors) (Rodig et al., (1998). Disruption of the JAK1 gene demonstrates obligatory and non-redundant roles of the JAKs in cytokine-induced biological response. *Cell*, 93:373).

Finally, Tyk2-deficient mice show an impaired response to IL-12 and IL-23 and only partially impaired to IFN-alpha (Karaghiosoff et al., (2000). Partial impairment of cytokine responses in Tyk2-deficient mice. *Immunity*, 13:549; Shimoda et al., (2000). Tyk2 plays a restricted role in IFN $\gamma$  signaling, although it is required for IL-12-mediated T cell function. *Immunity*, 13:561). However, human Tyk2 deficiency demonstrates that Tyk2 is involved in the signaling from IFN- $\alpha$ , IL-6, IL-10, IL-12 and IL-23 (Minegishi et al., (2006). Human Tyrosine kinase 2 deficiency reveals its requisite roles in multiple cytokine signals involved in innate and acquired immunity. *Immunity*, 25:745).

The role of JAK kinases in transducing the signal from a myriad of cytokines makes them potential targets for the treatment of diseases in which cytokines have a pathogenic role, such as inflammatory diseases, including but not limited to allergies and asthma, chronic obstructive pulmonary disease (COPD), psoriasis, autoimmune diseases such as rheumatoid arthritis, amyotrophic lateral sclerosis and multiple sclerosis, uveitis, transplant rejection, as well as in solid and hematologic malignancies such as myeloproliferative disorders, leukemia and lymphomas.

Inhibition of JAK kinases, especially JAK1 and JAK3, could give rise to potent immunosuppression which could be used therapeutically to prevent transplant rejection. In this regard, the JAK inhibitor CP-690,550 (tofacitinib, formerly tasocitinib)

has shown efficacy in several animal models of transplantation (heterotopic heart transplantation in mice, cardiac allografts implanted in the ear of mice, renal allotransplantation in cynomolgous monkeys, aorta and tracheal transplantation in rats) by prolonging the mean survival time of grafts (West K (2009). CP-690,550, a JAK3 inhibitor as an immunosuppressant for the treatment of rheumatoid arthritis, transplant rejection, psoriasis and other immune-mediated disorders. *Curr. Op. Invest. Drugs* 10: 491).

In rheumatoid joints, an imbalance between pro and anti-inflammatory cytokine activities favours the induction of autoimmunity, followed by chronic inflammation and tissue destruction. In this regard, the pathogenic role of IL-6 in rheumatoid arthritis (RA) has been validated clinically by the use of the anti-IL-6R antibody tocilizumab. IL-6 activates the transcription factor STAT3, through the use of JAK1 binding to the gp130 receptor chain (Heinrich et al., (2003). Principles of interleukin (IL)-6-type cytokine signaling and its regulation. *Biochem J.* 374: 1). Constitutive STAT3 mediates the abnormal growth and survival properties of RA synoviocytes (Ivashkiv and Hu (2003). The JAK/STAT pathway in rheumatoid arthritis: pathogenic or protective? *Arth & Rheum.* 48:2092). Other cytokines that have been implicated in the pathogenesis of arthritis include IL-12 and IL-23, implicated in Th1 and Th17 cell proliferation, respectively; IL-15, and GM-CSF (McInnes and Schett, (2007). Cytokines in the pathogenesis of rheumatoid arthritis. *Nature Rev Immunol.* 7:429.). The receptors for these cytokines also utilize JAK proteins for signal transduction, making JAK inhibitors potential pleiotropic drugs in this pathology. Consequently, administration of several JAK inhibitors in animal models of murine collagen-induced arthritis and rat adjuvant-induced arthritis has shown to reduce inflammation, and tissue destruction (Milici et al., (2008). Cartilage preservation by inhibition of Janus kinase 3 in two rodent models of rheumatoid arthritis. *Arth. Res.* 10:R14).

Inflammatory bowel disease (IBD) encloses two major forms of intestinal inflammation: ulcerative colitis and Crohn's disease. Growing evidence has shown that multiple cytokines, including interleukins and interferons, are involved in the pathogenesis of IBD (Strober et al, (2002). The immunology of mucosal models of inflammation. *Annu Rev Immunol.* 20: 495). Activation of the IL-6/STAT3 cascade in lamina propria T cells has been shown to induce prolonged survival of pathogenic T cells (Atreya et al, (2000). Blockade of interleukin 6 trans signaling suppresses T-cell resistance against apoptosis in chronic intestinal inflammation: Evidence in Crohn's disease and experimental colitis in vivo. *Nature Med.* 6:583). Specifically, STAT3 has been shown

to be constitutively active in intestinal T cells of Crohn's disease patients and a JAK inhibitor has been shown to block the constitutive activation of STAT3 in these cells (Lovato et al, (2003). Constitutive STAT3 activation in intestinal T cells from patients with Crohn's disease. *J Biol Chem.* 278:16777). These observations indicate that the JAK-STAT pathway plays a pathogenic role in IBD and that a JAK inhibitor could be therapeutic in this setting.

Multiple sclerosis is an autoimmune demyelinating disease characterized by the formation of plaques in the white matter. The role of cytokines in the generation of multiple sclerosis has long been known. Potential therapies include blockade of IFN-g, IL-6, IL-12 and IL-23 (Steinman L. (2008). Nuanced roles of cytokines in three major human brain disorders. *J Clin Invest.* 118:3557), cytokines that signal through the JAK-STAT pathways. Use of tyrphostin, a JAK inhibitor, has been shown to inhibit IL-12-induced phosphorylation of STAT3, and to reduce the incidence and severity of active and passive experimental autoimmune encephalitis (EAE) (Bright et al., (1999) Tyrphostin B42 inhibits IL-12-induced tyrosine phosphorylation and activation of Janus kinase-2 and prevents experimental allergic encephalomyelitis. *J Immunol.* 162:6255). Another multikinase inhibitor, CEP701, has been shown to reduce secretion of TNF-alpha, IL-6 and IL-23 as well as the levels of phospho-STAT1, STAT3, and STAT5 in peripheral DCs of mice with EAE, significantly improving the clinical course of EAE in mice (Skarica et al, (2009). Signal transduction inhibition of APCs diminishes Th17 and Th1 responses in experimental autoimmune encephalomyelitis. *J. Immunol.* 182:4192.).

Psoriasis is a skin inflammatory disease which involves a process of immune cell infiltration and activation that culminates in epithelial remodeling. The current theory behind the cause of psoriasis states the existence of a cytokine network that governs the interaction between immune and epithelial cells (Nickoloff BJ. (2007). Cracking the cytokine code in psoriasis, *Nat Med*, 13:242). In this regard, IL-23 produced by dendritic cells is found elevated in psoriatic skin, along with IL-12. IL-23 induces the formation of Th17 cells which in turn produce IL-17 and IL-22, the last one being responsible for epidermis thickening. IL-23 and IL-22 induce the phosphorylation of STAT-3, which is found abundantly in psoriatic skin. JAK inhibitors may thus be therapeutic in this setting. In accordance, a JAK1/3 inhibitor, R348, has been found to attenuate psoriasiform skin inflammation in a spontaneous T cell-dependent mouse model of psoriasis (Chang et al., (2009). JAK3 inhibition significantly attenuates psoriasiform skin inflammation on CD18 mutant PL/J mice. *J Immunol.* 183:2183).

Th2 cytokine-driven diseases such as allergy and asthma could also be a target of JAK inhibitors. IL-4 promotes Th2 differentiation, regulates B-cell function and immunoglobulin class switching, regulates eotaxin production, induces expression of IgE receptor and MHC II on B cells, and stimulates mast cells. Other Th2 cytokines like IL-5 and IL-13 can also contribute to eosinophil recruitment in bronchoalveolar lavage by stimulating eotaxin production. Pharmacological inhibition of JAK has been shown to reduce the expression of IgE receptor and MHCII induced by IL-4 stimulation on B cells (Kudlacz et al., (2008). The JAK3 inhibitor CP-690,550 is a potent anti-inflammatory agent in a murine model of pulmonary eosinophilia. *European J. Pharm.* 582: 154). Furthermore, JAK3-deficient mice display poor eosinophil recruitment and mucus secretion to the airway lumen upon OVA challenge, as compared to wild type mice (Malaviya et al, (2000). Treatment of allergic asthma by targeting Janus kinase 3-dependent leukotriene synthesis in mast cells with 4-(3', 5'- dibromo-4'-hydroxyphenyl)amino-6,7-dimethoxyquinazoline (WHI-P97). *JPET* 295:912.). In this regard, systemic administration of the CP-690,550 JAK inhibitor in mice has been shown to reduce the eosinophil count as well as the levels of eotaxin and IL13 in BAL in a murine model of pulmonary eosinophilia (Kudlacz et al., (2008). The JAK3 inhibitor CP-690,550 is a potent anti-inflammatory agent in a murine model of pulmonary eosinophilia. *European J. Pharm.* 582:154).

There is increasing evidence that cytokines play a pathogenetic role in ocular inflammatory disease such as uveitis or dry eye syndrome. Some cytokines implicated in experimental autoimmune uveitis, such as IL-2, IL-6, IL-12 and IFN $\gamma$ , would be amenable to JAK inhibition (Vallochi et al, (2007). The role of cytokines in the regulation of ocular autoimmune inflammation. *Cytok Growth Factors Rev.* 18:135). In this regard, drugs or biologicals that interfere with IL-2 signaling such as cyclosporine or anti-IL-2 receptor antibody (daclizumab) have shown efficacy in the treatment of keratoconjunctivitis sicca and refractory uveitis, respectively (Lim et al, (2006). Biologic therapies for inflammatory eye disease. *Clin Exp Opht* 34:365). Similarly, allergic conjunctivitis, a common allergic eye disease characterized by conjunctival congestion, mast cell activation and eosinophil infiltration, could benefit from JAK inhibition. STAT6-deficient mice, showing decreased TH2-mediated immune responses which are normally triggered by IL-4, do not develop the classical early and late phase responses, suggesting that IL-4 pathway abrogation through JAK inhibition may be therapeutic in this setting (Ozaki et al, (2005). The control of allergic conjunctivitis by suppression of cytokine signaling (SOCS)3 and SOCS5 in a murine model. *J Immunol*, 175:5489).

There is growing evidence of the critical role of STAT3 activity in processes involved in tumorigenesis like cell cycle dysregulation, promotion of uncontrolled growth, induction of survival factors and inhibition of apoptosis (Siddiquee et al., (2008). STAT3 as a target for inducing apoptosis in solid and haematological tumors. *Cell Res.* 18: 254).

Antagonism of STAT3 by means of dominant-negative mutants or antisense oligonucleotides has shown to promote apoptosis of cancer cells, inhibition of angiogenesis and up-regulation of host immunocompetence. Inhibition of constitutively active STAT3 in human tumors by means of JAK inhibitors may provide a therapeutic option to the treatment of this disease. In this regard, the use of the JAK inhibitor tyrphostin has been shown to induce apoptosis of malignant cells and inhibit cell proliferation in vitro and in vivo (Meydan et al., (1996). Inhibition of acute lymphoblastic leukemia by a JAK-2 inhibitor. *Nature*, 379:645).

Hematological malignancies with dysregulated JAK-STAT pathways may benefit from JAK inhibition. Recent studies have implicated dysregulation of JAK2 kinase activity by chromosomal translocations and mutations within the pseudokinase domain (such as the JAK2V617F mutation) in a spectrum of myeloproliferative diseases (Ihle and Gililand, 2007), including polycythemia vera, myelofibrosis and essential thrombocythemia. In this regard, several JAK inhibitors that tackle JAK2 potently, such as TG-101209 (Pardanani et al., (2007). TG101209, a small molecular JAK2-selective inhibitor potently inhibits myeloproliferative disorder-associated JAK2V617F and MPLW515L/K mutations *Leukemia*. 21:1658–68), TG101348 (Wernig et al, (2008). Efficacy of TG101348, a selective JAK2 inhibitor, in treatment of a murine model of JAK2V617F-induced polycythemia vera. *Cancer Cell*, 13: 311), CEP701, (Hexner et al, (2008). Lestaurtinib (CEP701) is a JAK2 inhibitor that suppresses JAK2/STAT5 signaling and the proliferation of primary erythroid cells from patients with myeloproliferative disorders. *Blood*, 111: 5663), CP-690,550 (Manshour et al, (2008). The JAK kinase inhibitor CP-690,550 suppresses the growth of human polycythemia vera cells carrying the JAK2V617F mutation. *Cancer Sci*, 99:1265), and CYT387 (Pardanani et al., (2009). CYT387, a selective JAK1/JAK2 inhibitor: invitro assessment of kinase selectivity and preclinical studies using cell lines and primary cells from polycythemia vera patients. *Leukemia*, 23:1441) have been proposed for treating myeloproliferative diseases on the basis of their antiproliferative activity on cells carrying the JAK2V617F mutation. Similarly, T-cell leukemia due to human T-cell leukemia virus (HTLV-1) transformation is associated with JAK3 and STAT5 constitutive activation (Migone et al, (1995). Constitutively activated JAK-STAT

pathway in T cells transformed with HTLV-I. *Science*, 269: 79) and JAK inhibitors may be therapeutic in this setting (Tomita et al, (2006). Inhibition of constitutively active JAK-STAT pathway suppresses cell growth of human T-cell leukemia virus type I-infected T cell lines and primary adult T-cell leukemia cells. *Retrovirology*, 3:22). JAK1-  
 5 activating mutations have also been identified in adult acute lymphoblastic leukemia of T cell origin (Flex et al, (2008). Somatic acquired *JAK1* mutations in adult acute lymphoblastic leukemia. *J. Exp. Med.* 205:751-8) pointing to this kinase as a target for the development of novel antileukemic drugs.

10 Conditions in which targeting of the JAK pathway or modulation of the JAK kinases, particularly JAK1, JAK2 and JAK3 kinases, are contemplated to be therapeutically useful for the treatment or prevention of diseases include: neoplastic diseases (e.g. leukemia, lymphomas, solid tumors); transplant rejection, bone marrow transplant applications (e.g., graft- versus-host disease); autoimmune diseases (e.g. diabetes,  
 15 multiple sclerosis, rheumatoid arthritis, inflammatory bowel disease); respiratory inflammation diseases (e.g. asthma, chronic obstructive pulmonary disease), inflammation-linked ocular diseases or allergic eye diseases (e.g. dry eye, glaucoma, uveitis, diabetic retinopathy, allergic conjunctivitis or age-related macular degeneration) and skin inflammatory diseases (e.g., atopic dermatitis or psoriasis).

20 In view of the numerous conditions that are contemplated to benefit by treatment involving modulation of the JAK pathway or of the JAK Kinases it is immediately apparent that new compounds that modulate JAK pathways and use of these compounds should provide substantial therapeutic benefits to a wide variety of  
 25 patients.

Provided herein are novel pyridin-2(1H)-one derivatives for use in the treatment of conditions in which targeting of the JAK pathway or inhibition of JAK kinases can be therapeutically useful.

30 The compounds described in the present invention are simultaneously potent JAK1, JAK2 and JAK3 inhibitors, i.e. pan-JAK inhibitors. This property makes them useful for the treatment or prevention of pathological conditions or diseases such as myeloproliferative disorders (such as polycythemia vera, essential thrombocythemia or  
 35 myelofibrosis), leukemia, lymphomas and solid tumors; bone marrow and organ transplant rejection; immune-mediated diseases and inflammatory diseases, including rheumatoid arthritis, multiple sclerosis, inflammatory bowel disease (such as ulcerative



colitis or Crohn's disease), inflammation-linked ocular diseases or allergic eye diseases (such as dry eye, uveitis, or allergic conjunctivitis), allergic rhinitis, asthma, chronic obstructive pulmonary disease (COPD), and skin inflammatory diseases (such as atopic dermatitis or psoriasis).

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It has now been found that certain pyridin-2(1H)-one derivatives are novel and potent JAK inhibitors and can therefore be used in the treatment or prevention of these diseases; and/or at least provide the public with a useful choice.

- 10 In this specification where reference has been made to patent specifications, other external documents, or other sources of information, this is generally for the purpose of providing a context for discussing the features of the invention. Unless specifically stated otherwise, reference to such external documents is not to be construed as an admission that such documents, or such sources of information, in any jurisdiction, are
- 15 prior art, or form part of the common general knowledge in the art.

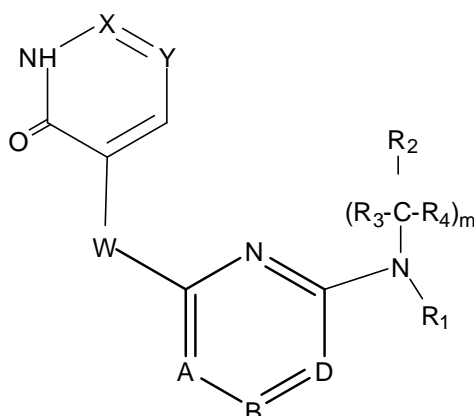
In the description in this specification reference may be made to subject matter that is not within the scope of the claims of the current application. That subject matter should be readily identifiable by a person skilled in the art and may assist in putting into

20 practice the invention as defined in the claims of this application.

### SUMMARY OF THE INVENTION

The present invention is directed to compounds of formula (I), or a pharmaceutically acceptable salt, or solvate, or N-oxide, or stereoisomer or deuterated derivative

25 thereof:



Formula (I)

wherein,

m is 0, 1, 2 or 3;

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A and B each independently represent a nitrogen atom or a -CR<sub>7</sub> group, wherein at least one of A and B represents a -CR<sub>7</sub> group;

10 D represents a nitrogen atom or a -CR<sub>5</sub> group, wherein when one of A and B represents a nitrogen atom, D represents a -CR<sub>5</sub> group;

W represents a linker selected from a -NR<sub>8</sub>- group, a -(CR<sub>9</sub>R<sub>10</sub>)- group, -O- or -S-;

15 R<sub>1</sub> represents a hydrogen atom, a linear or branched C<sub>1</sub>-C<sub>6</sub> alkyl group, a C<sub>1</sub>-C<sub>4</sub> haloalkyl group, a C<sub>1</sub>-C<sub>4</sub> hydroxyalkyl group, a C<sub>1</sub>-C<sub>4</sub> alkoxy group, a C<sub>3</sub>-C<sub>10</sub> cycloalkyl group, a C<sub>3</sub>-C<sub>10</sub> cycloalkenyl group, a monocyclic or bicyclic C<sub>6</sub>-C<sub>14</sub> aryl group, a 5- to 14- membered heteroaryl group containing at least one heteroatom selected from O, S and N, or a 5- to 14- membered heterocyclyl group containing at least one heteroatom selected from O, S and N,

20 wherein the cycloalkyl, cycloalkenyl, aryl, heteroaryl, and heterocyclyl groups are unsubstituted or substituted by one or more substituents selected from a halogen atom, a cyano group, a linear or branched C<sub>1</sub>-C<sub>6</sub> alkyl group, a C<sub>1</sub>-C<sub>4</sub> haloalkyl group, a C<sub>1</sub>-C<sub>4</sub> hydroxyalkyl group, a C<sub>1</sub>-C<sub>4</sub> alkylsulfonyl group, a C<sub>3</sub>-C<sub>7</sub> cycloalkyl group, a phenyl group, a pyridyl group, a pyrimidinyl group or a piperidyl group;

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R<sub>2</sub> and R<sub>7</sub> each independently represent a hydrogen atom, a halogen atom, a cyano group, a linear or branched C<sub>1</sub>-C<sub>6</sub> alkyl group, a C<sub>1</sub>-C<sub>4</sub> haloalkyl group, a C<sub>1</sub>-C<sub>4</sub> hydroxyalkyl group, a C<sub>3</sub>-C<sub>10</sub> cycloalkyl group, a C<sub>3</sub>-C<sub>10</sub> cycloalkenyl group, a monocyclic or bicyclic C<sub>6</sub>-C<sub>14</sub> aryl group, a 5- to 14- membered heteroaryl group containing at least one heteroatom selected from O, S and N, a 5- to 14- membered heterocyclyl group containing at least one heteroatom selected from O, S and N, or a bicycyl group which is a monocyclic C<sub>6</sub>-C<sub>9</sub> aryl or 5- to 9- membered heteroaryl group fused to a 5- to 9- membered cycloalkyl or heterocyclyl group, said heteroaryl or heterocyclyl group containing at least one heteroatom selected from O, S and N,

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35 wherein the cycloalkyl, cycloalkenyl, aryl, heteroaryl, and heterocyclyl groups, and the bicycyl group which is a monocyclic C<sub>6</sub>-C<sub>9</sub> aryl or 5- to 9- membered

heteroaryl group fused to a 5- to 9- membered cycloalkyl or heterocyclyl group are unsubstituted or substituted by one or more substituents selected from a halogen atom; a cyano group; a linear or branched C<sub>1</sub>-C<sub>6</sub> alkyl group; a C<sub>1</sub>-C<sub>4</sub> haloalkyl group; a C<sub>1</sub>-C<sub>4</sub> hydroxyalkyl group; a C<sub>3</sub>-C<sub>7</sub> cycloalkyl group; a  
 5 monocyclic or bicyclic C<sub>6</sub>-C<sub>14</sub> aryl group; a 5- to 14- membered heteroaryl group containing at least one heteroatom selected from O, S and N; a 5- to 14- membered heterocyclyl group containing at least one heteroatom selected from O, S and N; a -(CH<sub>2</sub>)<sub>1-3</sub>CN group; a -(CH<sub>2</sub>)<sub>n</sub>OR<sub>11</sub> group; a -NR<sub>11</sub>R<sub>12</sub> group; a -NR<sub>11</sub>C(O)-(CH<sub>2</sub>)<sub>n</sub>-R<sub>12</sub> group; a -NR<sub>11</sub>C(O)-(CH<sub>2</sub>)<sub>n</sub>-NR<sub>12</sub>R<sub>13</sub> group;  
 10 a -C(O)-(CH<sub>2</sub>)<sub>1-3</sub>-CN group; a -C(O)-(CH<sub>2</sub>)<sub>n</sub>-R<sub>11</sub> group; a -(CH<sub>2</sub>)<sub>n</sub>-C(O)-(CH<sub>2</sub>)<sub>n</sub>-NR<sub>11</sub>R<sub>12</sub> group; a -(CH<sub>2</sub>)<sub>n</sub>-S(O)<sub>2</sub>(CH<sub>2</sub>)<sub>n</sub>R<sub>11</sub> group; a -(CH<sub>2</sub>)<sub>n</sub>-S(O)<sub>2</sub>(CH<sub>2</sub>)<sub>n</sub>NR<sub>11</sub>R<sub>12</sub> group; a -NR<sub>11</sub>S(O)<sub>2</sub>(CH<sub>2</sub>)<sub>n</sub>R<sub>12</sub> group or a -NR<sub>11</sub>S(O)<sub>2</sub>(CH<sub>2</sub>)<sub>n</sub>NR<sub>12</sub>R<sub>13</sub> group; wherein each n' and n are 0, 1 or 2; said monocyclic or bicyclic C<sub>6</sub>-C<sub>14</sub> aryl group being unsubstituted or further substituted by one or more carboxyl  
 15 groups;

R<sub>3</sub> and R<sub>4</sub> each independently represent a hydrogen atom, a C<sub>1</sub>-C<sub>4</sub> haloalkyl group, a C<sub>1</sub>-C<sub>4</sub> hydroxyalkyl group or a linear or branched C<sub>1</sub>-C<sub>6</sub> alkyl group, which alkyl group is unsubstituted or substituted by one or more substituents selected from a C<sub>1</sub>-C<sub>4</sub> alkoxy  
 20 group, a cyano group, a C<sub>3</sub>-C<sub>7</sub> cycloalkyl group, a phenyl group, a pyridyl group, a pyrimidinyl group or a piperidyl group;

R<sub>5</sub> and R<sub>6</sub> each independently represent a hydrogen atom, a halogen atom, a cyano group, a linear or branched C<sub>1</sub>-C<sub>6</sub> alkyl group, a C<sub>1</sub>-C<sub>4</sub> haloalkyl group, a C<sub>1</sub>-C<sub>4</sub>  
 25 hydroxyalkyl group, a C<sub>3</sub>-C<sub>10</sub> cycloalkyl group, a C<sub>3</sub>-C<sub>10</sub> cycloalkenyl group, a monocyclic or bicyclic C<sub>6</sub>-C<sub>14</sub> aryl group, a 5- to 14- membered heteroaryl group containing at least one heteroatom selected from O, S and N, a 5- to 14- membered heterocyclyl group containing at least one heteroatom selected from O, S and N,  
 a -(CH<sub>2</sub>)<sub>n</sub>OR<sub>11</sub> group; a -NR<sub>11</sub>R<sub>12</sub> group; a -NR<sub>11</sub>C(O)-(CH<sub>2</sub>)<sub>n</sub>-R<sub>12</sub> group;  
 30 a -NR<sub>11</sub>C(O)-(CH<sub>2</sub>)<sub>n</sub>-NR<sub>12</sub>R<sub>13</sub> group; a -C(O)-(CH<sub>2</sub>)<sub>1-3</sub>-CN group; a -C(O)-(CH<sub>2</sub>)<sub>n</sub>-R<sub>11</sub> group; a -C(O)-(CH<sub>2</sub>)<sub>n</sub>-NR<sub>11</sub>R<sub>12</sub> group; a -S(O)<sub>2</sub>(CH<sub>2</sub>)<sub>n</sub>R<sub>11</sub> group; a -S(O)<sub>2</sub>(CH<sub>2</sub>)<sub>n</sub>NR<sub>11</sub>R<sub>12</sub> group; a -NR<sub>11</sub>S(O)<sub>2</sub>(CH<sub>2</sub>)<sub>n</sub>R<sub>12</sub> group or a -NR<sub>11</sub>S(O)<sub>2</sub>(CH<sub>2</sub>)<sub>n</sub>NR<sub>12</sub>R<sub>13</sub> group; wherein each n is 0, 1 or 2;

wherein the cycloalkyl, cycloalkenyl, aryl, heteroaryl, and heterocyclyl groups  
 35 are unsubstituted or substituted by one or more substituents selected from a halogen atom, a cyano group, a linear or branched C<sub>1</sub>-C<sub>6</sub> alkyl group, a C<sub>1</sub>-C<sub>4</sub>

haloalkyl group, a C<sub>1</sub>-C<sub>4</sub> hydroxyalkyl group, a C<sub>3</sub>-C<sub>7</sub> cycloalkyl, a phenyl group, a pyridyl group, a pyrimidinyl group, a piperidyl group or a -C(O)-(CH<sub>2</sub>)<sub>n</sub>-NR<sub>11</sub>R<sub>12</sub> group; wherein n is 0, 1 or 2;

5 R<sub>8</sub>, R<sub>9</sub> and R<sub>10</sub> each independently represent a hydrogen atom, a C<sub>1</sub>-C<sub>4</sub> haloalkyl group, a C<sub>1</sub>-C<sub>4</sub> hydroxyalkyl group or a linear or branched C<sub>1</sub>-C<sub>6</sub> alkyl group, which alkyl group is unsubstituted or substituted by one or more substituents selected from a C<sub>1</sub>-C<sub>4</sub> alkoxy group, a cyano group, a C<sub>3</sub>-C<sub>7</sub> cycloalkyl group, a phenyl group, a pyridyl group, a pyrimidinyl group or a piperidyl group;

10

R<sub>11</sub>, R<sub>12</sub> and R<sub>13</sub> each independently represent a hydrogen atom; a C<sub>1</sub>-C<sub>4</sub> haloalkyl group; a C<sub>1</sub>-C<sub>4</sub> hydroxyalkyl group; a 5-to 9- membered heterocyclyl group containing one, two or three heteroatoms selected from O, S and N, which heterocyclyl group is unsubstituted or substituted by one or more substituents selected from a halogen atom, a hydroxyl group, a linear or branched C<sub>1</sub>-C<sub>4</sub> alkyl group, a C<sub>1</sub>-C<sub>4</sub> haloalkyl group or a C<sub>1</sub>-C<sub>4</sub> hydroxyalkyl group; or linear or branched C<sub>1</sub>-C<sub>6</sub> alkyl group, which alkyl group is unsubstituted or substituted by one or more substituents selected from a C<sub>1</sub>-C<sub>4</sub> alkoxy group, a cyano group, a C<sub>3</sub>-C<sub>7</sub> cycloalkyl group, a phenyl group, a pyridyl group, a pyrimidinyl group or a piperidyl group;

20

wherein the compound of formula (I) is other than:

a) 3-[[5-Chloro-2-[[2,5-dimethyl-4-(piperidin-4-yl)phenyl]amino]pyrimidin-4-yl]amino]pyridin-2(1H)-one; and

b) 2-[7-[[5-Chloro-4-[(2-oxo-1,2-dihydropyridin-3-yl)amino]pyrimidin-2-yl]amino]-8-methoxy-1,2,4,5-tetrahydrobenzo[d]azepin-3-yl]-N,N-dimethylacetamide.

25

Further described are synthetic processes and intermediates described herein, which are useful for preparing said compounds.

30 The invention is also directed to a compound of the invention as described herein for use in the treatment of the human or animal body by therapy.

The invention also provides a pharmaceutical composition comprising a compound of the invention and a pharmaceutically acceptable diluent or carrier.

35

The invention is also directed to a compound of the invention as described herein, for use in the treatment of a pathological condition or disease susceptible to amelioration

by inhibition of Janus Kinases (JAK). In particular, wherein the pathological condition or disease is selected from myeloproliferative disorders, leukemia, lymphoid malignancies and solid tumors; bone marrow and organ transplant rejection; immune-mediated diseases and inflammatory diseases; more in particular wherein the

5 pathological condition or disease is selected from rheumatoid arthritis, multiple sclerosis, inflammatory bowel disease, dry eye, uveitis, allergic conjunctivitis, allergic rhinitis, asthma, chronic obstructive pulmonary disease (COPD), atopic dermatitis and psoriasis.

10 The invention is also directed to use of a compound of the invention as described herein, in the manufacture of a medicament for treatment of a pathological condition or disease susceptible to amelioration by inhibition of Janus Kinases (JAK). In particular, wherein the pathological condition or disease is selected from myeloproliferative disorders, leukemia, lymphoid malignancies and solid tumors; bone marrow and organ

15 transplant rejection; immune-mediated diseases and inflammatory diseases; more in particular wherein the pathological condition or disease is selected from rheumatoid arthritis, multiple sclerosis, inflammatory bowel disease, dry eye, uveitis, allergic conjunctivitis, allergic rhinitis, asthma, chronic obstructive pulmonary disease (COPD), atopic dermatitis and psoriasis.

20 Also described is a method of treatment of a pathological condition or disease susceptible to amelioration by inhibition of Janus Kinases (JAK), in particular wherein the pathological condition or disease is selected from myeloproliferative disorders, leukemia, lymphoid malignancies and solid tumors; bone marrow and organ transplant

25 rejection; immune-mediated diseases and inflammatory diseases, more in particular wherein the pathological condition or disease is selected from rheumatoid arthritis, multiple sclerosis, inflammatory bowel disease, dry eye, uveitis, allergic conjunctivitis, allergic rhinitis, asthma, chronic obstructive pulmonary disease (COPD), atopic dermatitis and psoriasis; comprising administering a therapeutically effective amount of

30 the compounds of the invention or a pharmaceutical composition of the invention to a subject in need of such treatment.

Generally described is a combination product comprising (i) the compounds of the invention as described herein; and (ii) one or more additional active substances which

35 are known to be useful in the treatment of myeloproliferative disorders (such as polycythemia vera, essential thrombocythemia or myelofibrosis), leukemia, lymphoid malignancies and solid tumors; bone marrow and organ transplant rejection; immune-

mediated diseases and inflammatory diseases, more in particular wherein the pathological condition or disease is selected from rheumatoid arthritis, multiple sclerosis, inflammatory bowel disease (such as ulcerative colitis or Crohn's disease), dry eye, uveitis, allergic conjunctivitis, allergic rhinitis, asthma, chronic obstructive pulmonary disease (COPD), atopic dermatitis and psoriasis.

In one embodiment, the invention provides a combination product comprising (i) a compound of the invention; and (ii) another compound selected from:

- a) Dyhydrofolate reductase inhibitors;
- 10 b) Dihydroorotate dehydrogenase (DHODH) inhibitors;
- c) Immunomodulators;
- d) Inhibitors of DNA synthesis and repair;
- e) Immunosuppressants;
- f) Anti-alpha 4 integrin antibodies;
- 15 g) Alpha 4 integrin antagonists;
- h) Corticoids and glucocorticoids;
- i) Fumaric acid esters;
- j) Anti-tumor necrosis factor-alpha (Anti-TNF-alpha) antibodies;
- k) Soluble Tumor necrosis factor-alpha (TNF-alpha) receptors;
- 20 l) Anti-CD20 (lymphocyte protein) monoclonal antibodies;
- m) Anti-CD52 (lymphocyte protein) monoclonal antibodies;
- n) Anti-CD25 (lymphocyte protein) monoclonal antibodies;
- o) Anti-CD88 (lymphocyte protein) monoclonal antibodies;
- p) Anti-Interleukin 6 Receptor (IL-6R) monoclonal antibodies;
- 25 q) Anti-Interleukin 12 Receptor (IL-12R) / Interleukin 23 Receptor (IL-23R) monoclonal antibodies;
- r) Calcineurin inhibitors;
- s) Inosine-monophosphate dehydrogenase (IMPDH) inhibitors;
- t) Cannabinoid receptor agonists;
- 30 u) Chemokine CCR1 antagonists;
- v) Chemokine CCR2 antagonists;
- w) Necrosis factor-kappaB (NF-kappaB or NFKB) Activation Inhibitors;
- x) Adenosine A<sub>2A</sub> agonists;
- y) Sphingosine-1 (S1P) phosphate receptor agonists;
- 35 z) Sphingosine-1 (S1P) liase inhibitors;
- aa) Spleen tyrosine kinase (Syk) inhibitors;
- bb) Protein Kinase Inhibitors (PKC) inhibitors;

- cc) Anti-cholinergic agents;
- dd) Beta adrenergic agonists;
- ee) Compounds having bifunctional Muscarinic Antagonist-Beta2 Agonist activity (MABAs);
- 5 ff) Histamine 1 (H1) receptor antagonists;
- gg) Chemoattractant receptor homologous molecule expressed on TH<sub>2</sub> cells (CRTH2) inhibitors;
- hh) Vitamin D derivatives;
- ii) Anti-inflammatory agents;
- 10 jj) Anti-allergic agents;
- kk) Anti-viral agents;
- ll) Phosphodiesterase (PDE) III inhibitors;
- mm) Phosphodiesterase (PDE) IV inhibitors;
- nn) Dual Phosphodiesterase (PDE) III/IV inhibitors;
- 15 oo) Xanthine derivatives;
- pp) p38 Mitogen-Activated Protein Kinase (p38 MAPK) Inhibitors;
- qq) Mitogen-activated extracellular signal regulated kinase kinase (MEK) inhibitor;
- rr) Phosphoinositide 3-Kinases (PI3Ks) inhibitors;
- 20 ss) Interferons; and
- tt) Interferon alpha.

The combination product of the invention in one embodiment is for simultaneous, separate or sequential use in the treatment of the human or animal body.

25

The invention also provides a use of (i) a compound of the invention, and (ii) another compound selected from:

- a) Dihydrofolate reductase inhibitors;
- b) Dihydroorotate dehydrogenase (DHODH) inhibitors;
- 30 c) Immunomodulators;
- d) Inhibitors of DNA synthesis and repair;
- e) Immunosuppressants;

- f) Anti-alpha 4 integrin antibodies;
- g) Alpha 4 integrin antagonists;
- h) Corticoids and glucocorticoids;
- i) Fumaric acid esters;
- 5 j) Anti-tumor necrosis factor-alpha (Anti-TNF-alpha) antibodies;
- k) Soluble Tumor necrosis factor-alpha (TNF-alpha) receptors;
- l) Anti-CD20 (lymphocyte protein) monoclonal antibodies;
- m) Anti-CD52 (lymphocyte protein) monoclonal antibodies;
- n) Anti-CD25 (lymphocyte protein) monoclonal antibodies;
- 10 o) Anti-CD88 (lymphocyte protein) monoclonal antibodies;
- p) Anti-Interleukin 6 Receptor (IL-6R) monoclonal antibodies;
- q) Anti-Interleukin 12 Receptor (IL-12R) / Interleukin 23 Receptor (IL-23R) monoclonal antibodies;
- r) Calcineurin inhibitors;
- 15 s) Inosine-monophosphate dehydrogenase (IMPDH) inhibitors;
- t) Cannabinoid receptor agonists;
- u) Chemokine CCR1 antagonists;
- v) Chemokine CCR2 antagonists;
- w) Necrosis factor-kappaB (NF-kappaB or NFkB) Activation Inhibitors;
- 20 x) Adenosine A<sub>2A</sub> agonists;
- y) Sphingosine-1 (S1P) phosphate receptor agonists;
- z) Sphingosine-1 (S1P) liase inhibitors;
- aa) Spleen tyrosine kinase (Syk) inhibitors;



- bb) Protein Kinase Inhibitors (PKC) inhibitors;
- cc) Anti-cholinergic agents;
- dd) Beta adrenergic agonists;
- ee) Compounds having bifunctional Muscarinic Antagonist-Beta2 Agonist activity (MABAs);
- 5 ff) Histamine 1 (H1) receptor antagonists;
- gg) Chemoattractant receptor homologous molecule expressed on TH<sub>2</sub> cells (CRTH2) inhibitors;
- hh) Vitamin D derivatives;
- 10 ii) Anti-inflammatory agents;,,
- jj) Anti-allergic agents;
- kk) Anti-viral agents;
- ll) Phosphodiesterase (PDE) III inhibitors;
- mm) Phosphodiesterase (PDE) IV inhibitors;
- 15 nn) Dual Phosphodiesterase (PDE) III/IV inhibitors;
- oo) Xanthine derivatives;
- pp) p38 Mitogen-Activated Protein Kinase (p38 MAPK) Inhibitors;
- qq) Mitogen-activated extracellular signal regulated kinase kinase (MEK) inhibitor;
- 20 rr) Phosphoinositide 3-Kinases (PI3Ks) inhibitors;
- ss) Interferons
- tt) Interferon alpha;

in the manufacture of a medicament for simultaneously, separately or sequentially treating a disease or condition of the human or animal body.

### Detailed Description

5

The term “comprising” as used in this specification means “consisting at least in part of”. When interpreting each statement in this specification that includes the term “comprising”, features other than that or those prefaced by the term may also be present. Related terms such as “comprise” and “comprises” are to be interpreted in the

10

As used herein the term C<sub>1</sub>-C<sub>6</sub> alkyl embraces linear or branched radicals having 1 to 6 carbon atoms, preferably 1 to 4 carbon atoms. Examples include methyl, ethyl, n-propyl, i-propyl, n-butyl, sec-butyl, t-butyl, n-pentyl, 1-methylbutyl, 2-methylbutyl, isopentyl, 1-ethylpropyl, 1,1-dimethylpropyl, 1,2-dimethylpropyl, n-hexyl, 1-ethylbutyl, 2-ethylbutyl, 1,1-dimethylbutyl, 1,2-dimethylbutyl, 1,3-dimethylbutyl, 2,2-dimethylbutyl, 2,3-dimethylbutyl, 2-methylpentyl, 3-methylpentyl and iso-hexyl radicals.

15

20

As used herein, the term C<sub>1</sub>-C<sub>4</sub> haloalkyl group is an alkyl group, for example a C<sub>1</sub>-C<sub>4</sub> or C<sub>1</sub>-C<sub>2</sub> alkyl group, which is bonded to one or more, preferably 1, 2 or 3 halogen atoms. Preferably, said haloalkyl group is chosen from -CCl<sub>3</sub>, -CHF<sub>2</sub> and -CF<sub>3</sub>.

25

As used herein, the term C<sub>1</sub>-C<sub>4</sub> hydroxyalkyl embraces linear or branched alkyl radicals having 1 to 4 carbon atoms, any one of which may be substituted by one or more, preferably 1 or 2, more preferably 1 hydroxyl radicals. Examples of such radicals include hydroxymethyl, hydroxyethyl, hydroxypropyl, and hydroxybutyl.

30

As used herein, the term C<sub>1</sub>-C<sub>4</sub> alkoxy (or alkyloxy) embraces linear or branched oxy-containing radicals each having alkyl portions of 1 to 4 carbon atoms. Examples of C<sub>1</sub>-C<sub>4</sub> alkoxy radicals include methoxy, ethoxy, n-propoxy, i-propoxy, n-butoxy, sec-butoxy or t-butoxy.

35

As used herein, the term C<sub>1</sub>-C<sub>4</sub> alkylsulfonyl embraces radicals containing an optionally substituted, linear or branched alkyl radicals of 1 to 4 carbon atoms attached to a divalent -SO<sub>2</sub>- radical.

As used herein, the term C<sub>3</sub>-C<sub>10</sub> cycloalkyl embraces saturated monocyclic or polycyclic carbocyclic radicals having from 3 to 10 carbon atoms, preferably from 3 to 7 carbon atoms. An optionally substituted C<sub>3</sub>-C<sub>10</sub> cycloalkyl radical is typically unsubstituted or substituted by 1, 2 or 3 substituents which may be the same or different. When a C<sub>3</sub>-C<sub>10</sub> cycloalkyl radical carries 2 or more substituents, the substituents may be the same or different. Typically the substituents on a C<sub>3</sub>-C<sub>10</sub> cycloalkyl group are themselves unsubstituted. Polycyclic cycloalkyl radicals contains two or more fused cycloalkyl groups, preferably two cycloalkyl groups. Typically, polycyclic cycloalkyl radicals are selected from decahydronaphthyl (decalyl), bicyclo[2.2.2]octyl, adamantly, camphyl or bornyl groups.

Examples of monocyclic cycloalkyl groups include cyclopropyl, cyclobutyl, cyclopentyl, cyclohexyl, cycloheptyl, cyclooctyl, cyclononyl and cyclodecyl.

As used herein, the term C<sub>3</sub>-C<sub>10</sub> cycloalkenyl embraces partially unsaturated carbocyclic radicals having from 3 to 10 carbon atoms, preferably from 3 to 7 carbon atoms. A C<sub>3</sub>-C<sub>10</sub> cycloalkenyl radical is typically unsubstituted or substituted by 1, 2 or 3 substituents which may be the same or different. When a C<sub>3</sub>-C<sub>10</sub> cycloalkenyl radical carries 2 or more substituents, the substituents may be the same or different. Typically, the substituents on a cycloalkenyl group are themselves unsubstituted. Examples include cyclobutenyl, cyclopentenyl, cyclohexenyl, cycloheptenyl, cyclooctenyl, cyclononenyl and cyclodecenyl.

As used herein, the term C<sub>6</sub>-C<sub>14</sub> aryl radical embraces typically a C<sub>6</sub>-C<sub>14</sub>, preferably C<sub>6</sub>-C<sub>10</sub> monocyclic or bicyclic aryl radical such as phenyl, naphthyl, anthranyl and phenanthryl. Phenyl is preferred. A said optionally substituted C<sub>6</sub>-C<sub>14</sub> aryl radical is typically unsubstituted or substituted by 1, 2 or 3 substituents which may be the same or different. When a C<sub>6</sub>-C<sub>14</sub> aryl radical carries 2 or more substituents, the substituents may be the same or different. Unless otherwise specified, the substituents on a C<sub>6</sub>-C<sub>14</sub> aryl group are typically themselves unsubstituted.

As used herein, the term 5- to 14- membered heteroaryl radical embraces typically a 5- to 14- membered ring system, preferably a 5- to 10- membered ring system, more preferably a 5- to 6- membered ring system, comprising at least one heteroaromatic ring and containing at least one heteroatom selected from O, S and N. A 5- to 14- membered heteroaryl radical may be a single ring or two or more fused rings wherein at least one ring contains a heteroatom.

A said optionally substituted 5- to 14- membered heteroaryl radical is typically unsubstituted or substituted by 1, 2 or 3 substituents which may be the same or different. When a 5- to 14- membered heteroaryl radical carries 2 or more substituents,  
 5 the substituents may be the same or different. Unless otherwise specified, the substituents on a 5- to 14- membered heteroaryl radical are typically themselves unsubstituted.

Examples include pyridyl, pyrazinyl, pyrimidinyl, pyridazinyl, furyl, benzofuranyl,  
 10 oxadiazolyl, oxazolyl, isoxazolyl, benzoxazolyl, imidazolyl, benzimidazolyl, thiazolyl, thiadiazolyl, thienyl, pyrrolyl, benzothiazolyl, indolyl, indazolyl, purinyl, quinolyl, isoquinolyl, phthalazinyl, naphthyridinyl, quinoxalyl, quinazolinyl, quinoliziny, cinnolinyl, triazolyl, indoliziny, indoliny, isoindoliny, isoindolyl, imidazolidinyl, pteridinyl, thianthrenyl, pyrazolyl, 2H-pyrazolo[3,4-d]pyrimidinyl, 1H-pyrazolo[3,4-d]pyrimidinyl,  
 15 thieno[2,3-d] pyrimidinyl and the various pyrrolopyridyl radicals.

As used herein, the term 5- to 14-membered heterocyclyl radical embraces typically a non-aromatic, saturated or unsaturated C<sub>5</sub>-C<sub>14</sub> carbocyclic ring system, preferably C<sub>5</sub>-C<sub>10</sub> carbocyclic ring system, more preferably C<sub>5</sub>-C<sub>6</sub> carbocyclic ring system, in which  
 20 one or more, for example 1, 2, 3 or 4 of the carbon atoms preferably 1 or 2 of the carbon atoms are replaced by a heteroatom selected from N, O and S. A heterocyclyl radical may be a single ring or two or more fused rings wherein at least one ring contains a heteroatom. When a 5 to 14-membered heterocyclyl radical carries 2 or more substituents, the substituents may be the same or different.

A said optionally substituted 5- to 14-membered heterocyclyl radical is typically unsubstituted or substituted by 1, 2 or 3 substituents which may be the same or different. Typically, the substituents on a 5 to 14-membered heterocyclyl radical are themselves unsubstituted.

Examples of 5- to 14-membered heterocyclyl radicals include piperidyl, pyrrolidyl, pyrrolinyl, piperazinyl, morpholinyl, thiomorpholinyl, pyrrolyl, pyrazolinyl, pirazolidinyl, quinuclidinyl, triazolyl, pyrazolyl, tetrazolyl, imidazolidinyl, imidazolyl, oxiranyl, thiaranyl, aziridinyl, oxetanyl, thiatanyl, azetidiny, 4,5-dihydro-oxazolyl, 2-benzofuran-1(3H)-one,  
 35 1,3-dioxol-2-one, tetrahydrofuranyl, 3-aza-tetrahydrofuranyl, tetrahydrothiophenyl, tetrahydropyranyl, tetrahydrothiopyranyl, 1,4-azathianyl, oxepanyl, thiephanyl, azepanyl, 1,4-dioxepnaye, 1,4-oxathiepanyl, 1,4-oxaazepanyl, 1,4-dithiepanyl, 1,4-

thiezepanyl, 1,4-diazepanyl, tropanyl, (1S,5R)-3-aza-bicyclo[3.1.0]hexyl, 3,4-dihydro-2H-pyranyl, 5,6-dihydro-2H-pyranyl, 2H-pyranyl, 2,3-hydrobenzofuranyl, 1,2,3,4-tetrahydropyridinyl, 1,2,5,6-tetrahydropyridinyl, isoindolinyl and indolinyl.

- 5 Where a 5- to 14-membered heterocyclyl radical carries 2 or more substituents, the substituents may be the same or different.

As used herein, the term bicyclyl group which is a monocyclic C<sub>6</sub>-C<sub>9</sub> aryl or 5- to 9-membered heteroaryl group fused to a 5- to 9- membered cycloalkyl or heterocyclyl group typically refers to a moiety containing a bond which is shared between a  
 10 monocyclic C<sub>6</sub>-C<sub>9</sub> aryl or 5- to 9- membered heteroaryl group and a 5- to 9- membered cycloalkyl or heterocyclyl group, wherein said heteroaryl or heterocyclyl group contains at least one heteroatom selected from O, S and N. Typically said bicyclyl group is a phenyl or 5- or 6- membered heteroaryl group fused to a 5- or 6-, preferably 6-,  
 15 membered cycloalkyl or heterocyclyl group. Typically said heteroaryl or heterocyclyl group contains 1, 2 or 3, preferably 1 or 2, for example 1, heteroatom selected from O, S and N, preferably N. Examples include chromanyl groups or 1,2,3,4-tetrahydronaphthalenyl groups. 1,2,3,4-tetrahydronaphthalenyl groups are preferred.

20 As used herein, some of the atoms, radicals, moieties, chains and cycles present in the general structures of the invention are "optionally substituted". This means that these atoms, radicals, moieties, chains and cycles can be either unsubstituted or substituted in any position by one or more, for example 1, 2, 3 or 4, substituents, whereby the hydrogen atoms bound to the unsubstituted atoms, radicals, moieties, chains and  
 25 cycles are replaced by chemically acceptable atoms, radicals, moieties, chains and cycles. When two or more substituents are present, each substituent may be the same or different. The substituents are typically themselves unsubstituted.

As used herein, the term halogen atom embraces chlorine, fluorine, bromine and iodine  
 30 atoms. A halogen atom is typically a fluorine, chlorine or bromine atom, most preferably chlorine or fluorine. The term halo when used as a prefix has the same meaning.

Compounds containing one or more chiral centre may be used in enantiomerically or diastereoisomerically pure form, in the form of racemic mixtures and in the form of  
 35 mixtures enriched in one or more stereoisomer. The scope of the invention as described and claimed encompasses the racemic forms of the compounds as well as the individual enantiomers, diastereomers, and stereoisomer-enriched mixtures.

Conventional techniques for the preparation/isolation of individual enantiomers include chiral synthesis from a suitable optically pure precursor or resolution of the racemate using, for example, chiral high pressure liquid chromatography (HPLC). Alternatively, the racemate (or a racemic precursor) may be reacted with a suitable optically active compound, for example, an alcohol, or, in the case where the compound contains an acidic or basic moiety, an acid or base such as tartaric acid or 1-phenylethylamine. The resulting diastereomeric mixture may be separated by chromatography and/or fractional crystallization and one or both of the diastereoisomers converted to the corresponding pure enantiomer(s) by means well known to one skilled in the art. Chiral compounds of the invention (and chiral precursors thereof) may be obtained in enantiomerically-enriched form using chromatography, typically HPLC, on an asymmetric resin with a mobile phase consisting of a hydrocarbon, typically heptane or hexane, containing from 0 to 50% isopropanol, typically from 2 to 20%, and from 0 to 5% of an alkylamine, typically 0.1 % diethylamine. Concentration of the eluate affords the enriched mixture. Stereoisomer conglomerates may be separated by conventional techniques known to those skilled in the art. See, e.g. "Stereochemistry of Organic Compounds" by Ernest L. Eliel (Wiley, New York, 1994).

As used herein, the term pharmaceutically acceptable salt refers to a salt prepared from a base or acid which is acceptable for administration to a patient, such as a mammal. Such salts can be derived from pharmaceutically-acceptable inorganic or organic bases and from pharmaceutically-acceptable inorganic or organic acids.

Pharmaceutically acceptable acids include both inorganic acids, for example hydrochloric, sulphuric, phosphoric, diphosphoric, hydrobromic, hydroiodic and nitric acid; and organic acids, for example citric, fumaric, gluconic, glutamic, lactic, maleic, malic, mandelic, mucic, ascorbic, oxalic, pantothenic, succinic, tartaric, benzoic, acetic, methanesulphonic, ethanesulphonic, benzenesulphonic, p-toluenesulphonic acid, xinafoic (1-hydroxy-2-naphthoic acid), napadisilic (1,5-naphthalenedisulfonic acid) and the like. Particularly preferred are salts derived from fumaric, hydrobromic, hydrochloric, acetic, sulfuric, methanesulfonic, xinafoic, and tartaric acids.

Salts derived from pharmaceutically-acceptable inorganic bases include aluminum, ammonium, calcium, copper, ferric, ferrous, lithium, magnesium, manganic, manganous, potassium, sodium, zinc and the like. Particularly preferred are ammonium, calcium, magnesium, potassium and sodium salts.

Salts derived from pharmaceutically-acceptable organic bases include salts of primary, secondary and tertiary amines, including alkyl amines, arylalkyl amines, heterocycl  
amines, cyclic amines, naturally-occurring amines and the like, such as arginine,  
5 betaine, caffeine, choline, N,N'-dibenzylethylenediamine, diethylamine, 2-  
diethylaminoethanol, 2-dimethylaminoethanol, ethanolamine, ethylenediamine, N-  
ethylmorpholine, N-ethylpiperidine, glucamine, glucosamine, histidine, hydrabamine,  
isopropylamine, lysine, methylglucamine, morpholine, piperazine, piperidine, polyamine  
resins, procaine, purines, theobromine, triethylamine, trimethylamine, tripropylamine,  
10 tromethamine and the like.

Other preferred salts according to the invention are quaternary ammonium compounds  
wherein an equivalent of an anion ( $X^-$ ) is associated with the positive charge of the N  
atom.  $X^-$  may be an anion of various mineral acids such as, for example, chloride,  
15 bromide, iodide, sulphate, nitrate, phosphate, or an anion of an organic acid such as,  
for example, acetate, maleate, fumarate, citrate, oxalate, succinate, tartrate, malate,  
mandelate, trifluoroacetate, methanesulphonate and *p*-toluenesulphonate.  $X^-$  is  
preferably an anion selected from chloride, bromide, iodide, sulphate, nitrate, acetate,  
maleate, oxalate, succinate or trifluoroacetate. More preferably  $X^-$  is chloride, bromide,  
20 trifluoroacetate or methanesulphonate.

As used herein, an N-oxide is formed from the tertiary basic amines or imines present  
in the molecule, using a convenient oxidising agent.

25 The compounds of the invention may exist in both unsolvated and solvated forms. The  
term solvate is used herein to describe a molecular complex comprising a compound of  
the invention and an amount of one or more pharmaceutically acceptable solvent  
molecules. The term hydrate is employed when said solvent is water. Examples of  
solvate forms include, but are not limited to, compounds of the invention in association  
30 with water, acetone, dichloromethane, 2-propanol, ethanol, methanol, dimethylsulfoxide  
(DMSO), ethyl acetate, acetic acid, ethanolamine, or mixtures thereof. It is specifically  
contemplated that in the present invention one solvent molecule can be associated with  
one molecule of the compounds of the present invention, such as a hydrate.

35 Furthermore, it is specifically contemplated that in the present invention, more than one  
solvent molecule may be associated with one molecule of the compounds of the  
present invention, such as a dihydrate. Additionally, it is specifically contemplated that

in the present invention less than one solvent molecule may be associated with one molecule of the compounds of the present invention, such as a hemihydrate.

Furthermore, solvates of the present invention are contemplated as solvates of compounds of the present invention that retain the biological effectiveness of the non-solvate form of the compounds.

The invention also includes isotopically-labeled compounds of the invention, wherein one or more atoms is replaced by an atom having the same atomic number, but an atomic mass or mass number different from the atomic mass or mass number usually found in nature. Examples of isotopes suitable for inclusion in the compounds of the invention include isotopes of hydrogen, such as  $^2\text{H}$  and  $^3\text{H}$ , carbon, such as  $^{11}\text{C}$ ,  $^{13}\text{C}$  and  $^{14}\text{C}$ , chlorine, such as  $^{36}\text{Cl}$ , fluorine, such as  $^{18}\text{F}$ , iodine, such as  $^{123}\text{I}$  and  $^{125}\text{I}$ , nitrogen, such as  $^{13}\text{N}$  and  $^{15}\text{N}$ , oxygen, such as  $^{15}\text{O}$ ,  $^{17}\text{O}$  and  $^{18}\text{O}$ , phosphorus, such as  $^{32}\text{P}$ , and sulfur, such as  $^{35}\text{S}$ . Certain isotopically-labeled compounds of the invention, for example, those incorporating a radioactive isotope, are useful in drug and/or substrate tissue distribution studies. The radioactive isotopes tritium,  $^3\text{H}$ , and carbon-14,  $^{14}\text{C}$ , are particularly useful for this purpose in view of their ease of incorporation and ready means of detection. Substitution with heavier isotopes such as deuterium,  $^2\text{H}$ , may afford certain therapeutic advantages resulting from greater metabolic stability, for example, increased in vivo half-life or reduced dosage requirements, and hence may be preferred in some circumstances. Substitution with positron emitting isotopes, such as  $^{11}\text{C}$ ,  $^{18}\text{F}$ ,  $^{15}\text{O}$  and  $^{13}\text{N}$ , can be useful in Positron Emission Topography (PET) studies for examining substrate receptor occupancy.

Isotopically-labeled compounds of the invention can generally be prepared by conventional techniques known to those skilled in the art or by processes analogous to those described herein, using an appropriate isotopically-labeled reagent in place of the non-labeled reagent otherwise employed.

Preferred isotopically-labeled compounds include deuterated derivatives of the compounds of the invention. As used herein, the term deuterated derivative embraces compounds of the invention where in a particular position at least one hydrogen atom is replaced by deuterium. Deuterium (D or  $^2\text{H}$ ) is a stable isotope of hydrogen which is present at a natural abundance of 0.015 molar %.



Hydrogen deuterium exchange (deuterium incorporation) is a chemical reaction in which a covalently bonded hydrogen atom is replaced by a deuterium atom. Said exchange (incorporation) reaction can be total or partial.

- 5 Typically, a deuterated derivative of a compound of the invention has an isotopic enrichment factor (ratio between the isotopic abundance and the natural abundance of that isotope, i.e. the percentage of incorporation of deuterium at a given position in a molecule in the place of hydrogen) for each deuterium present at a site designated as a potential site of deuteration on the compound of at least 3500 (52.5% deuterium  
10 incorporation).

- In a preferred embodiment, the isotopic enrichment factor is at least 5000 (75% deuterium). In a more preferred embodiment, the isotopic enrichment factor is at least 6333.3 (95% deuterium incorporation). In a most preferred embodiment, the isotopic  
15 enrichment factor is at least 6633.3 (99.5% deuterium incorporation). It is understood that the isotopic enrichment factor of each deuterium present at a site designated as a site of deuteration is independent from the other deuteration sites.

- The isotopic enrichment factor can be determined using conventional analytical  
20 methods known too en ordinary skilled in the art, including mass spectrometry (MS) and nuclear magnetic resonance (NMR).

- Prodrugs of the compounds described herein are also within the scope of the invention. Thus certain derivatives of the compounds of the present invention, which derivatives  
25 may have little or no pharmacological activity themselves, when administered into or onto the body may be converted into compounds of the present invention having the desired activity, for example, by hydrolytic cleavage. Such derivatives are referred to as 'prodrugs'. Further information on the use of prodrugs may be found in Pro-drugs as Novel Delivery Systems, Vol. 14, ACS Symposium Series (T. Higuchi and W. Stella)  
30 and Bioreversible Carriers in Drug Design, Pergamon Press, 1987 (ed. E. B. Roche, American Pharmaceutical Association).

- Prodrugs in accordance with the invention can, for example, be produced by replacing appropriate functionalities present in the compounds of the present invention with  
35 certain moieties known to those skilled in the art as 'pro-moieties' as described, for example, in Design of Prodrugs by H. Bundgaard (Elsevier, 1985).

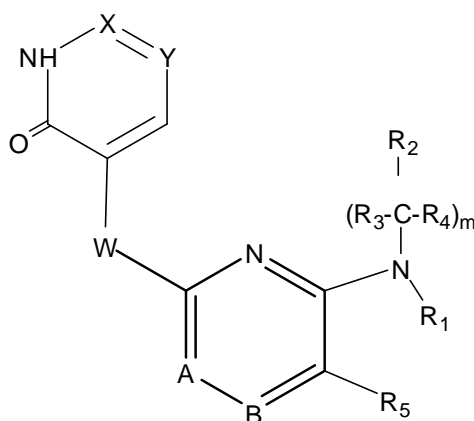
In the case of compounds that are solids, it is understood by those skilled in the art that the inventive compounds and salts may exist in different crystalline or polymorphic forms, or in an amorphous form, all of which are intended to be within the scope of the present invention.

5

Typically, in the compound of formula (I), m, X, Y, W, A, B, D and R<sub>1</sub> to R<sub>13</sub> are as defined above; and wherein when D represents a nitrogen atom, A and B represent a -CR<sub>7</sub> group, m is 0, R<sub>2</sub> is other than a substituted 2,3,4,5-tetrahydro-1H-benzo[d]azepine group or a phenyl group substituted by a piperidinyl group.

10

In a particular embodiment, the compound of formula (I) is one of formula (I')



15

Formula (I')

wherein,

m is 0 or an integer from 1 to 3;

20

X and Y each independently represent a nitrogen atom or a -CR<sub>6</sub> group, wherein at least one of X and Y represents a -CR<sub>6</sub> group;

A and B each independently represent a nitrogen atom or a -CR<sub>7</sub> group, wherein at least one of A and B represents a -CR<sub>7</sub> group;

25

W represents a linker selected from a -NR<sub>8</sub>- group, a -(CR<sub>9</sub>R<sub>10</sub>)- group, -O- or -S-;

R<sub>1</sub> represents a hydrogen atom, a linear or branched C<sub>1</sub>-C<sub>6</sub> alkyl group, a C<sub>1</sub>-C<sub>4</sub> haloalkyl group, a C<sub>1</sub>-C<sub>4</sub> hydroxyalkyl group, a C<sub>1</sub>-C<sub>4</sub> alkoxy group, a C<sub>3</sub>-C<sub>10</sub> cycloalkyl group, a C<sub>3</sub>-C<sub>10</sub> cycloalkenyl group, a monocyclic or bicyclic C<sub>6</sub>-C<sub>14</sub> aryl group, a 5- to 14- membered heteroaryl group containing at least one heteroatom selected from O, S and N, or a 5- to 14- membered heterocyclyl group containing at least one heteroatom selected from O, S and N,

wherein the cycloalkyl, cycloalkenyl, aryl, heteroaryl, and heterocyclyl groups are unsubstituted or substituted by one or more substituents selected from a halogen atom, a cyano group, a linear or branched C<sub>1</sub>-C<sub>6</sub> alkyl group, a C<sub>1</sub>-C<sub>4</sub> haloalkyl group, a C<sub>1</sub>-C<sub>4</sub> hydroxyalkyl group, a C<sub>1</sub>-C<sub>4</sub> alkylsulfonyl group, a C<sub>3</sub>-C<sub>7</sub> cycloalkyl group, a phenyl group, a pyridyl group, a pyrimidinyl group or a piperidyl group;

R<sub>2</sub> and R<sub>7</sub> each independently represent a hydrogen atom, a halogen atom, a cyano group, a linear or branched C<sub>1</sub>-C<sub>6</sub> alkyl group, a C<sub>1</sub>-C<sub>4</sub> haloalkyl group, a C<sub>1</sub>-C<sub>4</sub> hydroxyalkyl group, a C<sub>3</sub>-C<sub>10</sub> cycloalkyl group, a C<sub>3</sub>-C<sub>10</sub> cycloalkenyl group, a monocyclic or bicyclic C<sub>6</sub>-C<sub>14</sub> aryl group, a 5- to 14- membered heteroaryl group containing at least one heteroatom selected from O, S and N, a 5- to 14- membered heterocyclyl group containing at least one heteroatom selected from O, S and N, or a bicyclyl group which is a monocyclic C<sub>6</sub>-C<sub>9</sub> aryl or 5- to 9- membered heteroaryl group fused to a 5- to 9- membered cycloalkyl or heterocyclyl group, said heteroaryl or heterocyclyl group containing at least one heteroatom selected from O, S and N,

wherein the cycloalkyl, cycloalkenyl, aryl, heteroaryl, and heterocyclyl groups, and the bicyclyl group which is a monocyclic C<sub>6</sub>-C<sub>9</sub> aryl or 5- to 9- membered heteroaryl group fused to a 5- to 9- membered cycloalkyl or heterocyclyl group are unsubstituted or substituted by one or more substituents selected from a halogen atom; a cyano group; a linear or branched C<sub>1</sub>-C<sub>6</sub> alkyl group; a C<sub>1</sub>-C<sub>4</sub> haloalkyl group; a C<sub>1</sub>-C<sub>4</sub> hydroxyalkyl group; a C<sub>3</sub>-C<sub>7</sub> cycloalkyl group; a monocyclic or bicyclic C<sub>6</sub>-C<sub>14</sub> aryl group; a 5- to 14- membered heteroaryl group containing at least one heteroatom selected from O, S and N; a 5- to 14- membered heterocyclyl group containing at least one heteroatom selected from O, S and N; a -(CH<sub>2</sub>)<sub>1-3</sub>CN group; a -(CH<sub>2</sub>)<sub>n</sub>OR<sub>11</sub> group; a -NR<sub>11</sub>R<sub>12</sub> group; a -NR<sub>11</sub>C(O)-(CH<sub>2</sub>)<sub>n</sub>-R<sub>12</sub> group; a -NR<sub>11</sub>C(O)-(CH<sub>2</sub>)<sub>n</sub>-NR<sub>12</sub>R<sub>13</sub> group; a -C(O)-(CH<sub>2</sub>)<sub>1-3</sub>-CN group; a -C(O)-(CH<sub>2</sub>)<sub>n</sub>-R<sub>11</sub> group; a -C(O)-(CH<sub>2</sub>)<sub>n</sub>-NR<sub>11</sub>R<sub>12</sub> group; a -S(O)<sub>2</sub>(CH<sub>2</sub>)<sub>n</sub>R<sub>11</sub> group; a -S(O)<sub>2</sub>(CH<sub>2</sub>)<sub>n</sub>NR<sub>11</sub>R<sub>12</sub> group;

a  $-NR_{11}S(O)_2(CH_2)_nR_{12}$  group or a  $-NR_{11}S(O)_2(CH_2)_nNR_{12}R_{13}$  group; wherein each n is 0, 1 or 2; said monocyclic or bicyclic  $C_6-C_{14}$  aryl group being unsubstituted or further substituted by one or more carboxyl groups.

5  $R_3$  and  $R_4$  each independently represent a hydrogen atom, a  $C_1-C_4$  haloalkyl group, a  $C_1-C_4$  hydroxyalkyl group or a linear or branched  $C_1-C_6$  alkyl group, which alkyl group is unsubstituted or substituted by one or more substituents selected from a  $C_1-C_4$  alkoxy group, a cyano group, a  $C_3-C_7$  cycloalkyl group, a phenyl group, a pyridyl group, a pyrimidinyl group or a piperidyl group;

10

$R_5$  and  $R_6$  each independently represent a hydrogen atom, a halogen atom, a cyano group, a linear or branched  $C_1-C_6$  alkyl group, a  $C_1-C_4$  haloalkyl group, a  $C_1-C_4$  hydroxyalkyl group, a  $C_3-C_{10}$  cycloalkyl group, a  $C_3-C_{10}$  cycloalkenyl group, a monocyclic or bicyclic  $C_6-C_{14}$  aryl group, a 5- to 14- membered heteroaryl group

15 containing at least one heteroatom selected from O, S and N, a 5- to 14- membered heterocyclyl group containing at least one heteroatom selected from O, S and N,

a  $-(CH_2)_nOR_{11}$  group; a  $-NR_{11}R_{12}$  group; a  $-NR_{11}C(O)-(CH_2)_nR_{12}$  group;

a  $-NR_{11}C(O)-(CH_2)_nNR_{12}R_{13}$  group; a  $-C(O)-(CH_2)_{1-3}CN$  group; a  $-C(O)-(CH_2)_nR_{11}$

group; a  $-C(O)-(CH_2)_nNR_{11}R_{12}$  group; a  $-S(O)_2(CH_2)_nR_{11}$  group; a  $-S(O)_2(CH_2)_nNR_{11}R_{12}$

20 group; a  $-NR_{11}S(O)_2(CH_2)_nR_{12}$  group or a  $-NR_{11}S(O)_2(CH_2)_nNR_{12}R_{13}$  group; wherein each n is 0, 1 or 2;

wherein the cycloalkyl, cycloalkenyl, aryl, heteroaryl, and heterocyclyl groups are unsubstituted or substituted by one or more substituents selected from a

halogen atom, a cyano group, a linear or branched  $C_1-C_6$  alkyl group, a  $C_1-C_4$

25 haloalkyl group, a  $C_1-C_4$  hydroxyalkyl group, a  $C_3-C_7$  cycloalkyl, a phenyl group, a pyridyl group, a pyrimidinyl group, a piperidyl group or

a  $-C(O)-(CH_2)_nNR_{11}R_{12}$  group; wherein n is 0, 1 or 2;

$R_8$ ,  $R_9$  and  $R_{10}$  each independently represent a hydrogen atom, a  $C_1-C_4$  haloalkyl

30 group, a  $C_1-C_4$  hydroxyalkyl group or a linear or branched  $C_1-C_6$  alkyl group, which alkyl group is unsubstituted or substituted by one or more substituents selected from a  $C_1-C_4$  alkoxy group, a cyano group, a  $C_3-C_7$  cycloalkyl group, a phenyl group, a pyridyl group, a pyrimidinyl group or a piperidyl group;

35  $R_{11}$ ,  $R_{12}$  and  $R_{13}$  each independently represent a hydrogen atom, a  $C_1-C_4$  haloalkyl group, a  $C_1-C_4$  hydroxyalkyl group or a linear or branched  $C_1-C_6$  alkyl group, which alkyl group is unsubstituted or substituted by one or more substituents selected from a  $C_1-C_4$

alkoxy group, a cyano group, a C<sub>3</sub>-C<sub>7</sub> cycloalkyl group, a phenyl group, a pyridyl group, a pyrimidinyl group or a piperidyl group.

Typically, in the compound of formula (I) or formula (I'), X and Y each independently  
 5 represent a nitrogen atom or a -CR<sub>6</sub> group, wherein at least one of X and Y represents a -CR<sub>6</sub> group.

In one embodiment, in the compound of formula (I) or formula (I') X represents a  
 10 nitrogen atom and Y represents a -CR<sub>6</sub> group.

In other embodiment, in the compound of formula (I) or formula (I') Y represents a  
 nitrogen atom and X represents a -CR<sub>6</sub> group.

In another embodiment, in the compound of formula (I) or formula (I') both X and Y  
 15 represents a -CR<sub>6</sub> group.

For the avoidance of doubt, when two -CR<sub>6</sub> groups are present, they may be the same or different.

Preferably, in the compound of formula (I) or formula (I') both X and Y represents a -  
 20 CR<sub>6</sub> group.

In one embodiment, in the compound of formula (I) or formula (I') A represents a  
 25 nitrogen atom and B represents a -CR<sub>7</sub> group.

In other embodiment, in the compound of formula (I) or formula (I') B represents a  
 nitrogen atom and A represents a -CR<sub>7</sub> group.

In another embodiment, in the compound of formula (I) or formula (I') A and B  
 30 independently represent a -CR<sub>7</sub> group.

For the avoidance of doubt, when two -CR<sub>7</sub> groups are present, they may be the same or different.

Preferably, in the compound of formula (I) or formula (I') A represents a nitrogen atom  
 35 and B represents a -CR<sub>7</sub> group.

Typically, in the compound of formula (I), D represents a nitrogen atom or a -CR<sub>5</sub> group, wherein when one of A and B represents a nitrogen atom, D represents a -CR<sub>5</sub> group.

- 5 In one embodiment, in the compound of formula (I) D represents a nitrogen atom when A and B independently represent a -CR<sub>7</sub> group.

In another embodiment, in the compound of formula (I) D represents a -CR<sub>5</sub> group when A represents a nitrogen atom and B represents a -CR<sub>7</sub> group.

10

In another embodiment, in the compound of formula (I) D represents a -CR<sub>5</sub> group when A represents a -CR<sub>7</sub> group and B represents a nitrogen atom.

15

Typically, in the compound of formula (I) or formula (I') R<sub>1</sub> represents a hydrogen atom, a linear or branched C<sub>1</sub>-C<sub>6</sub> alkyl group, a C<sub>1</sub>-C<sub>4</sub> haloalkyl group, a C<sub>1</sub>-C<sub>4</sub> hydroxyalkyl group, a C<sub>3</sub>-C<sub>7</sub> cycloalkyl group, a phenyl group, a pyridyl group, a pyrimidinyl group or a piperidyl group.

20

Preferably, in the compound of formula (I) or formula (I') R<sub>1</sub> represents a hydrogen atom, a linear or branched C<sub>1</sub>-C<sub>4</sub> alkyl group, a C<sub>1</sub>-C<sub>4</sub> haloalkyl group, a C<sub>1</sub>-C<sub>4</sub> hydroxyalkyl group, a C<sub>3</sub>-C<sub>7</sub> cycloalkyl group, a phenyl group or a pyridyl group.

25

More preferably in the compound of formula (I) or formula (I') R<sub>1</sub> represents a hydrogen atom, a linear or branched C<sub>1</sub>-C<sub>3</sub> alkyl group, a C<sub>1</sub>-C<sub>3</sub> haloalkyl group or a C<sub>1</sub>-C<sub>3</sub> hydroxyalkyl group. Most preferably R<sub>1</sub> represents a hydrogen atom.

30

Typically, in the compound of formula (I) R<sub>2</sub> represents a linear or branched C<sub>1</sub>-C<sub>6</sub> alkyl group, a C<sub>1</sub>-C<sub>4</sub> haloalkyl group, a C<sub>1</sub>-C<sub>4</sub> hydroxyalkyl group, a C<sub>3</sub>-C<sub>7</sub> cycloalkyl group, a monocyclic or bicyclic C<sub>6</sub>-C<sub>10</sub> aryl group, a 5- to 7- membered heteroaryl group containing one, two or three heteroatoms selected from O, S and N, a 5- to 7- membered heterocyclyl group containing one, two or three heteroatoms selected from O, S and N,

35

wherein the cycloalkyl, cycloalkenyl, aryl, heteroaryl, and heterocyclyl groups are unsubstituted or substituted by one or more substituents selected from a halogen atom; a cyano group; a linear or branched C<sub>1</sub>-C<sub>6</sub> alkyl group; a C<sub>1</sub>-C<sub>4</sub> haloalkyl group; a C<sub>1</sub>-C<sub>4</sub> hydroxyalkyl group; a C<sub>3</sub>-C<sub>7</sub> cycloalkyl group; a monocyclic or bicyclic C<sub>6</sub>-C<sub>14</sub> aryl group; a 5- to 14- membered heteroaryl group

containing at least one heteroatom selected from O, S and N; a 5- to 14-membered heterocyclyl group containing at least one heteroatom selected from O, S and N; a  $-(CH_2)_{1-3}CN$  group; a  $-(CH_2)_nOR_{11}$  group; a  $-NR_{11}R_{12}$  group; a  $-NR_{11}C(O)-(CH_2)_n-R_{12}$  group; a  $-NR_{11}C(O)-(CH_2)_n-NR_{12}R_{13}$  group; a  $-C(O)-(CH_2)_{1-3}-CN$  group; a  $-C(O)-(CH_2)_n-R_{11}$  group; a  $-(CH_2)_n-C(O)-(CH_2)_n-NR_{11}R_{12}$  group; a  $-(CH_2)_n-S(O)_2(CH_2)_nR_{11}$  group; a  $-(CH_2)_n-S(O)_2(CH_2)_nNR_{11}R_{12}$  group; a  $-NR_{11}S(O)_2(CH_2)_nR_{12}$  group or a  $-NR_{11}S(O)_2(CH_2)_nNR_{12}R_{13}$  group; wherein each  $n'$  and  $n$  are 0, 1 or 2; and wherein  $R_{11}$ ,  $R_{12}$  and  $R_{13}$  are as defined above and said monocyclic or bicyclic  $C_6-C_{14}$  aryl group is unsubstituted or further substituted by one or more carboxyl groups.

Preferably in the compound of formula (I)  $R_2$  represents a linear or branched  $C_1-C_6$  alkyl group, a  $C_1-C_4$  haloalkyl group, a  $C_1-C_4$  hydroxyalkyl group, a  $C_3-C_7$  cycloalkyl group, a phenyl group, a pyridyl group, a pyrimidinyl group, a triazolyl group, a thiazolyl group, a pyrrolidinyl group, or a piperidyl group;

wherein the cycloalkyl, phenyl, pyridyl, pyrimidinyl, triazolyl, thiazolyl, pyrrolidinyl or piperidyl groups are unsubstituted or substituted by one, two or three substituents selected from a halogen atom, a cyano group, a linear or branched  $C_1-C_6$  alkyl group, a  $C_1-C_4$  haloalkyl group, a  $C_1-C_4$  hydroxyalkyl group, a  $C_3-C_7$  cycloalkyl group, a phenyl group, a phenyl group substituted by a carboxyl group, a pyridyl group, a triazolyl group, a thiazolyl group, a pyrimidinyl group, a piperidyl group, a  $-(CH_2)_{1-3}CN$  group, a  $-(CH_2)_nOR_{11}$  group, a  $-NR_{11}R_{12}$  group, a  $-NR_{11}C(O)-(CH_2)_n-R_{12}$  group, a  $-NR_{11}C(O)-(CH_2)_n-NR_{12}R_{13}$  group, a  $-C(O)-(CH_2)_{1-3}-CN$  group, a  $-C(O)-(CH_2)_n-R_{11}$  group, a  $-(CH_2)_n-C(O)-(CH_2)_n-NR_{11}R_{12}$  group; a  $-(CH_2)_n-S(O)_2(CH_2)_nR_{11}$  group; a  $-(CH_2)_n-S(O)_2(CH_2)_nNR_{11}R_{12}$  group; a  $-NR_{11}S(O)_2(CH_2)_nR_{12}$  group or a  $-NR_{11}S(O)_2(CH_2)_nNR_{12}R_{13}$  group; wherein each  $n'$  and  $n$  are 0, 1 or 2; and wherein  $R_{11}$ ,  $R_{12}$  and  $R_{13}$  are as defined above.

More preferably, in the compound of formula (I)  $R_2$  represents a  $C_3-C_7$  cycloalkyl group, a phenyl group, a pyridyl group or a piperidinyl group,

wherein the cycloalkyl, phenyl, pyridyl or pyrimidinyl groups are unsubstituted or substituted by one, two or three substituents selected from a halogen atom, a linear or branched  $C_1-C_3$  alkyl group, a  $C_1-C_3$  haloalkyl group, a triazolyl group, a  $-(CH_2)_{1-3}CN$  group, a  $-(CH_2)_nOR_{11}$  group, a  $-C(O)-(CH_2)_{1-3}-CN$  group, a  $-C(O)-(CH_2)_n-NR_{11}R_{12}$  group or a  $-(CH_2)_n-S(O)_2(CH_2)_nR_{11}$ ; wherein each  $n'$  and  $n$  are 0,

1 or 2; and wherein  $R_{11}$  and  $R_{12}$  each independently represent a hydrogen atom, a methyl group, or a piperidinyl group substituted by a hydroxyl group.

It is particularly preferred that in the compound of formula (I) the cycloalkyl,

5 cycloalkenyl, aryl, heteroaryl, and heterocyclyl groups that  $R_2$  may represent are unsubstituted or substituted by one, two or three, preferably one or two, substituents selected from a halogen atom; a cyano group; a linear or branched  $C_1$ - $C_6$  alkyl group; a triazolyl group; a  $-(CH_2)_{1-3}CN$  group; a  $-C(O)-(CH_2)_{1-3}-CN$  group; or a  $-(CH_2)_n-S(O)_2(CH_2)_nR_{11}$ ; wherein  $n'$  is 0, 1 or 2 and  $R_{11}$  represents a piperidinyl group  
10 substituted by a hydroxyl group

More preferably  $R_2$  represents a cyclohexyl group, a pyridyl group or a piperidyl group, wherein the cyclohexyl, pyridyl and piperidyl groups are unsubstituted or substituted by one, two or three substituents selected from a halogen atom, a triazolyl group, a  
15  $-(CH_2)_{1-3}CN$  group, a  $-C(O)-(CH_2)_{1-3}-CN$  group, or a  $-(CH_2)_n-S(O)_2(CH_2)_nR_{11}$ ; wherein  $n'$  is 0, 1 or 2 and  $R_{11}$  represents a piperidinyl group substituted by a hydroxyl group.

Preferably, in the compound of formula (I) when  $R_2$  is a  $C_3$ - $C_7$  cycloalkyl group, it is a cyclopropyl group, a cyclobutyl group, a cyclopentyl group, a cyclohexyl group or a  
20 cycloheptyl group, which group is unsubstituted or substituted by one, two or three substituents selected from a halogen atom (preferably a fluorine atom or a chlorine atom), a linear or branched  $C_1$ - $C_3$  alkyl group, a  $C_1$ - $C_3$  haloalkyl group, a  $-(CH_2)_{1-3}CN$  group, a hydroxyl group or a  $-(CH_2)_n-S(O)_2(CH_2)_nR_{11}$ ; wherein  $n'$  is 0, 1 or 2 and  $R_{11}$  represents a piperidinyl group substituted by a hydroxyl group. More preferably, when  
25  $R_2$  is a  $C_3$ - $C_7$  cycloalkyl group, it is preferably a cyclohexyl group unsubstituted or substituted by one, two or three substituents selected from linear or branched  $C_1$ - $C_3$  alkyl group (preferably a methyl group), a  $-(CH_2)_{1-3}CN$  group, a hydroxyl group or a  $-(CH_2)_n-S(O)_2(CH_2)_nR_{11}$ ; wherein  $n'$  is 0, 1 or 2 and  $R_{11}$  represents a piperidinyl group substituted by a hydroxyl group.

30

Preferably, in the compound of formula (I) when  $R_2$  is a  $C_3$ - $C_7$  cycloalkyl group  $m$  is 0. In other words, when  $R_2$  is a  $C_3$ - $C_7$  cycloalkyl group it is directly bonded to the nitrogen atom of the  $-N-R_1$  group.

35 Preferably, in the compound of formula (I) when  $R_2$  is a pyridyl group, said group is linked to the rest of the molecule via a ring carbon atom, in other words they are linked to the group  $-(R_3-C-R_4)_m-$ , which is bonded to the nitrogen atom of the  $-N-R_1$  group, via



- a ring carbon atom. Pyridyl groups are unsubstituted or substituted with one, two or three substituents selected from a halogen atom (preferably a fluorine atom or a chlorine atom), a cyano group, a linear or branched C<sub>1</sub>-C<sub>3</sub> alkyl group, a C<sub>1</sub>-C<sub>4</sub> haloalkyl group (preferably a -CHF<sub>2</sub> group or a -CF<sub>3</sub> group), a C<sub>3</sub>-C<sub>7</sub> cycloalkyl group, a phenyl group, a pyridyl group, a pyrimidinyl group, a piperidyl group, a -(CH<sub>2</sub>)<sub>1-3</sub>CN group; a -(CH<sub>2</sub>)<sub>n</sub>OR<sub>11</sub> group; a -NR<sub>11</sub>R<sub>12</sub> group; a -NR<sub>11</sub>C(O)-(CH<sub>2</sub>)<sub>n</sub>-R<sub>12</sub> group; a -NR<sub>11</sub>C(O)-(CH<sub>2</sub>)<sub>n</sub>-NR<sub>12</sub>R<sub>13</sub> group; a -C(O)-(CH<sub>2</sub>)<sub>1-3</sub>-CN group; a -C(O)-(CH<sub>2</sub>)<sub>n</sub>-R<sub>11</sub> group; a -(CH<sub>2</sub>)<sub>n</sub>-C(O)-(CH<sub>2</sub>)<sub>n</sub>-NR<sub>11</sub>R<sub>12</sub> group; a -(CH<sub>2</sub>)<sub>n</sub>-S(O)<sub>2</sub>(CH<sub>2</sub>)<sub>n</sub>R<sub>11</sub> group; a -(CH<sub>2</sub>)<sub>n</sub>-S(O)<sub>2</sub>(CH<sub>2</sub>)<sub>n</sub>NR<sub>11</sub>R<sub>12</sub> group; a -NR<sub>11</sub>S(O)<sub>2</sub>(CH<sub>2</sub>)<sub>n</sub>R<sub>12</sub> group or a -NR<sub>11</sub>S(O)<sub>2</sub>(CH<sub>2</sub>)<sub>n</sub>NR<sub>12</sub>R<sub>13</sub> group; wherein each n' and n are 0, 1 or 2; and wherein R<sub>11</sub>, R<sub>12</sub> and R<sub>13</sub> each independently represent a hydrogen atom or a linear or branched C<sub>1</sub>-C<sub>3</sub> alkyl group. More preferably, pyridyl groups are substituted by one or two halogen atoms.
- 15 Preferably, in the compound of formula (I) when R<sub>2</sub> is a piperidinyl group, it is linked to the rest of the molecule via a ring carbon atom. In this case, m is 0. In other words, when R<sub>2</sub> is a piperidinyl group it is directly bonded to the nitrogen atom of the -N-R<sub>1</sub> group.
- Preferably, in the compound of formula (I) when R<sub>2</sub> is a piperidinyl group, it is unsubstituted or substituted by one, two or three substituents selected from a halogen atom (preferably a fluorine atom or a chlorine atom), a cyano group, a linear or branched C<sub>1</sub>-C<sub>3</sub> alkyl group, a C<sub>1</sub>-C<sub>4</sub> haloalkyl group (preferably a -CHF<sub>2</sub> group or a -CF<sub>3</sub> group), a C<sub>3</sub>-C<sub>7</sub> cycloalkyl group, a phenyl group, a pyridyl group, a pyrimidinyl group, a piperidyl group, a triazolyl group, a -(CH<sub>2</sub>)<sub>1-3</sub>CN group; a -(CH<sub>2</sub>)<sub>n</sub>OR<sub>11</sub> group; a -NR<sub>11</sub>R<sub>12</sub> group; a -NR<sub>11</sub>C(O)-(CH<sub>2</sub>)<sub>n</sub>-R<sub>12</sub> group; a -NR<sub>11</sub>C(O)-(CH<sub>2</sub>)<sub>n</sub>-NR<sub>12</sub>R<sub>13</sub> group; a -C(O)-(CH<sub>2</sub>)<sub>1-3</sub>-CN group; a -C(O)-(CH<sub>2</sub>)<sub>n</sub>-R<sub>11</sub> group; a -(CH<sub>2</sub>)<sub>n</sub>-C(O)-(CH<sub>2</sub>)<sub>n</sub>-NR<sub>11</sub>R<sub>12</sub> group; a -(CH<sub>2</sub>)<sub>n</sub>-S(O)<sub>2</sub>(CH<sub>2</sub>)<sub>n</sub>R<sub>11</sub> group; a -(CH<sub>2</sub>)<sub>n</sub>-S(O)<sub>2</sub>(CH<sub>2</sub>)<sub>n</sub>NR<sub>11</sub>R<sub>12</sub> group; a -NR<sub>11</sub>S(O)<sub>2</sub>(CH<sub>2</sub>)<sub>n</sub>R<sub>12</sub> group or a -NR<sub>11</sub>S(O)<sub>2</sub>(CH<sub>2</sub>)<sub>n</sub>NR<sub>12</sub>R<sub>13</sub> group; wherein each n' and n are 0, 1 or 2; and wherein R<sub>11</sub>, R<sub>12</sub> and R<sub>13</sub> each independently represent a hydrogen atom or a linear or branched C<sub>1</sub>-C<sub>3</sub> alkyl group. Preferably when R<sub>2</sub> is a piperidinyl group it is substituted by one or two substituents selected from a halogen atom, a -C(O)-(CH<sub>2</sub>)<sub>1-3</sub>-CN group or a triazolyl group.

- Typically, in the compound of formula (I') R<sub>2</sub> represents a linear or branched C<sub>1</sub>-C<sub>6</sub> alkyl group, a C<sub>1</sub>-C<sub>4</sub> haloalkyl group, a C<sub>1</sub>-C<sub>4</sub> hydroxyalkyl group, a C<sub>3</sub>-C<sub>7</sub> cycloalkyl group, a monocyclic or bicyclic C<sub>6</sub>-C<sub>10</sub> aryl group, a 5- to 7- membered heteroaryl group containing one, two or three heteroatoms selected from O, S and N, a 5- to 7-

membered heterocyclyl group containing one, two or three heteroatoms selected from O, S and N,

wherein the cycloalkyl, cycloalkenyl, aryl, heteroaryl, and heterocyclyl groups are unsubstituted or substituted by one or more substituents selected from a halogen atom; a cyano group; a linear or branched C<sub>1</sub>-C<sub>6</sub> alkyl group; a C<sub>1</sub>-C<sub>4</sub> haloalkyl group; a C<sub>1</sub>-C<sub>4</sub> hydroxyalkyl group; a C<sub>3</sub>-C<sub>7</sub> cycloalkyl group; a monocyclic or bicyclic C<sub>6</sub>-C<sub>14</sub> aryl group; a 5- to 14- membered heteroaryl group containing at least one heteroatom selected from O, S and N; a 5- to 14- membered heterocyclyl group containing at least one heteroatom selected from O, S and N; a -(CH<sub>2</sub>)<sub>1-3</sub>CN group; a -(CH<sub>2</sub>)<sub>n</sub>OR<sub>11</sub> group; a -NR<sub>11</sub>R<sub>12</sub> group; a -NR<sub>11</sub>C(O)-(CH<sub>2</sub>)<sub>n</sub>-R<sub>12</sub> group; a -NR<sub>11</sub>C(O)-(CH<sub>2</sub>)<sub>n</sub>-NR<sub>12</sub>R<sub>13</sub> group; a -C(O)-(CH<sub>2</sub>)<sub>1-3</sub>-CN group; a -C(O)-(CH<sub>2</sub>)<sub>n</sub>-R<sub>11</sub> group; a -C(O)-(CH<sub>2</sub>)<sub>n</sub>-NR<sub>11</sub>R<sub>12</sub> group; a -S(O)<sub>2</sub>(CH<sub>2</sub>)<sub>n</sub>R<sub>11</sub> group; a -S(O)<sub>2</sub>(CH<sub>2</sub>)<sub>n</sub>NR<sub>11</sub>R<sub>12</sub> group; a -NR<sub>11</sub>S(O)<sub>2</sub>(CH<sub>2</sub>)<sub>n</sub>R<sub>12</sub> group or a -NR<sub>11</sub>S(O)<sub>2</sub>(CH<sub>2</sub>)<sub>n</sub>NR<sub>12</sub>R<sub>13</sub> group; wherein each n is 0, 1 or 2; and wherein R<sub>11</sub>, R<sub>12</sub> and R<sub>13</sub> are as defined above and said monocyclic or bicyclic C<sub>6</sub>-C<sub>14</sub> aryl group is unsubstituted or further substituted by one or more carboxyl groups.

Preferably in the compound of formula (I') R<sub>2</sub> represents a linear or branched C<sub>1</sub>-C<sub>6</sub> alkyl group, a C<sub>1</sub>-C<sub>4</sub> haloalkyl group, a C<sub>1</sub>-C<sub>4</sub> hydroxyalkyl group, a C<sub>3</sub>-C<sub>7</sub> cycloalkyl group, a phenyl group, a pyridyl group, a pyrimidinyl group, a triazolyl group, a thiazolyl group, a pyrrolidinyl group, or a piperidyl group;

wherein the cycloalkyl, phenyl, pyridyl, pyrimidinyl, triazolyl, thiazolyl, pyrrolidinyl or piperidyl groups are unsubstituted or substituted by one, two or three substituents selected from a halogen atom, a cyano group, a linear or branched C<sub>1</sub>-C<sub>6</sub> alkyl group, a C<sub>1</sub>-C<sub>4</sub> haloalkyl group, a C<sub>1</sub>-C<sub>4</sub> hydroxyalkyl group, a C<sub>3</sub>-C<sub>7</sub> cycloalkyl group, a phenyl group, a phenyl group substituted by a carboxyl group, a pyridyl group, a triazolyl group, a thiazolyl group, a pyrimidinyl group, a piperidyl group, a -(CH<sub>2</sub>)<sub>1-3</sub>CN group, a -(CH<sub>2</sub>)<sub>n</sub>OR<sub>11</sub> group, a -NR<sub>11</sub>R<sub>12</sub> group, a -NR<sub>11</sub>C(O)-(CH<sub>2</sub>)<sub>n</sub>-R<sub>12</sub> group, a -NR<sub>11</sub>C(O)-(CH<sub>2</sub>)<sub>n</sub>-NR<sub>12</sub>R<sub>13</sub> group, a -C(O)-(CH<sub>2</sub>)<sub>1-3</sub>-CN group, a -C(O)-(CH<sub>2</sub>)<sub>n</sub>-R<sub>11</sub> group, a -C(O)-(CH<sub>2</sub>)<sub>n</sub>-NR<sub>11</sub>R<sub>12</sub> group; a -S(O)<sub>2</sub>(CH<sub>2</sub>)<sub>n</sub>R<sub>11</sub> group; a -S(O)<sub>2</sub>(CH<sub>2</sub>)<sub>n</sub>NR<sub>11</sub>R<sub>12</sub> group; a -NR<sub>11</sub>S(O)<sub>2</sub>(CH<sub>2</sub>)<sub>n</sub>R<sub>12</sub> group or a -NR<sub>11</sub>S(O)<sub>2</sub>(CH<sub>2</sub>)<sub>n</sub>NR<sub>12</sub>R<sub>13</sub> group; wherein each n is 0, 1 or 2 and wherein R<sub>11</sub>, R<sub>12</sub> and R<sub>13</sub> are as defined above.

More preferably, in the compound of formula (I') R<sub>2</sub> represents a C<sub>3</sub>-C<sub>7</sub> cycloalkyl group, a phenyl group, a pyridyl group or a piperidinyl group,

wherein the cycloalkyl, phenyl, pyridyl or pyrimidinyl groups are unsubstituted or substituted by one, two or three substituents selected from a halogen atom, a linear or branched C<sub>1</sub>-C<sub>3</sub> alkyl group, a C<sub>1</sub>-C<sub>3</sub> haloalkyl group, a triazolyl group, a -(CH<sub>2</sub>)<sub>1-3</sub>CN group, a -(CH<sub>2</sub>)<sub>n</sub>OR<sub>11</sub> group, a -C(O)-(CH<sub>2</sub>)<sub>1-3</sub>-CN group or a -C(O)-(CH<sub>2</sub>)<sub>n</sub>-NR<sub>11</sub>R<sub>12</sub> group; wherein each n is 0, 1 or 2; and wherein R<sub>11</sub> and R<sub>12</sub> each independently represent a hydrogen atom or a methyl group.

It is particularly preferred that in the compound of formula (I') the cycloalkyl, cycloalkenyl, aryl, heteroaryl, and heterocyclyl groups that R<sub>2</sub> may represent are unsubstituted or substituted by one, two or three, preferably one or two, substituents selected from a halogen atom; a cyano group; a linear or branched C<sub>1</sub>-C<sub>6</sub> alkyl group; a triazolyl group; a -(CH<sub>2</sub>)<sub>1-3</sub>CN group; and a -C(O)-(CH<sub>2</sub>)<sub>1-3</sub>-CN group.

More preferably R<sub>2</sub> represents a cyclohexyl group, a pyridyl group or a piperidyl group, wherein the cyclohexyl, pyridyl and piperidyl groups are unsubstituted or substituted by one, two or three substituents selected from a halogen atom, a triazolyl group, a -(CH<sub>2</sub>)<sub>1-3</sub>CN group or -C(O)-(CH<sub>2</sub>)<sub>1-3</sub>-CN group.

Preferably, when R<sub>2</sub> is a C<sub>3</sub>-C<sub>7</sub> cycloalkyl group, it is a cyclopropyl group, a cyclobutyl group, a cyclopentyl group, a cyclohexyl group or a cycloheptyl group, which group is unsubstituted or substituted by one, two or three substituents selected from a halogen atom (preferably a fluorine atom or a chlorine atom), a linear or branched C<sub>1</sub>-C<sub>3</sub> alkyl group, a C<sub>1</sub>-C<sub>3</sub> haloalkyl group, a -(CH<sub>2</sub>)<sub>1-3</sub>CN group or a hydroxy group. More preferably, when R<sub>2</sub> is a C<sub>3</sub>-C<sub>7</sub> cycloalkyl group, it is preferably a cyclohexyl group unsubstituted or substituted by one, two or three substituents selected from linear or branched C<sub>1</sub>-C<sub>3</sub> alkyl group (preferably a methyl group), a -(CH<sub>2</sub>)<sub>1-3</sub>CN group or a hydroxy group.

Preferably, in the compound of formula (I') when R<sub>2</sub> is a C<sub>3</sub>-C<sub>7</sub> cycloalkyl group m is 0. In other words, when R<sub>2</sub> is a C<sub>3</sub>-C<sub>7</sub> cycloalkyl group it is directly bonded to the nitrogen atom of the -N-R<sub>1</sub> group.

Preferably, in the compound of formula (I') when R<sub>2</sub> is a pyridyl group, said group is linked to the rest of the molecule via a ring carbon atom, in other words they are linked to the group -(R<sub>3</sub>-C-R<sub>4</sub>)<sub>m</sub><sup>-</sup>, which is bonded to the nitrogen atom of the -N-R<sub>1</sub> group, via a ring carbon atom. Pyridyl groups are unsubstituted or substituted with one, two or three

substituents selected from a halogen atom (preferably a fluorine atom or a chlorine atom), a cyano group, a linear or branched C<sub>1</sub>-C<sub>3</sub> alkyl group, a C<sub>1</sub>-C<sub>4</sub> haloalkyl group (preferably a -CHF<sub>2</sub> group or a -CF<sub>3</sub> group), a C<sub>3</sub>-C<sub>7</sub> cycloalkyl group, a phenyl group, a pyridyl group, a pyrimidinyl group, a piperidyl group, a -(CH<sub>2</sub>)<sub>1-3</sub>CN group;

- 5 a -(CH<sub>2</sub>)<sub>n</sub>OR<sub>11</sub> group; a -NR<sub>11</sub>R<sub>12</sub> group; a -NR<sub>11</sub>C(O)-(CH<sub>2</sub>)<sub>n</sub>-R<sub>12</sub> group; a -NR<sub>11</sub>C(O)-(CH<sub>2</sub>)<sub>n</sub>-NR<sub>12</sub>R<sub>13</sub> group; a -C(O)-(CH<sub>2</sub>)<sub>1-3</sub>-CN group; a -C(O)-(CH<sub>2</sub>)<sub>n</sub>-R<sub>11</sub> group; a -C(O)-(CH<sub>2</sub>)<sub>n</sub>-NR<sub>11</sub>R<sub>12</sub> group; a -S(O)<sub>2</sub>(CH<sub>2</sub>)<sub>n</sub>R<sub>11</sub> group; a -S(O)<sub>2</sub>(CH<sub>2</sub>)<sub>n</sub>NR<sub>11</sub>R<sub>12</sub> group; a -NR<sub>11</sub>S(O)<sub>2</sub>(CH<sub>2</sub>)<sub>n</sub>R<sub>12</sub> group or a -NR<sub>11</sub>S(O)<sub>2</sub>(CH<sub>2</sub>)<sub>n</sub>NR<sub>12</sub>R<sub>13</sub> group; wherein each n is 0, 1 or 2; and wherein R<sub>11</sub>, R<sub>12</sub> and R<sub>13</sub> each independently represent a
- 10 hydrogen atom or a linear or branched C<sub>1</sub>-C<sub>3</sub> alkyl group. More preferably, pyridyl groups are substituted by one or two halogen atoms.

Preferably, in the compound of formula (I') when R<sub>2</sub> is a piperidinyl group, it is linked to the rest of the molecule via a ring carbon atom. In this case, m is 0. In other words,

15 when R<sub>2</sub> is a piperidinyl group it is directly bonded to the nitrogen atom of the -N-R<sub>1</sub> group.

- Preferably, in the compound of formula (I') when R<sub>2</sub> is a piperidinyl group, it is unsubstituted or substituted by one, two or three substituents selected from a halogen atom (preferably a fluorine atom or a chlorine atom), a cyano group, a linear or
- 20 branched C<sub>1</sub>-C<sub>3</sub> alkyl group, a C<sub>1</sub>-C<sub>4</sub> haloalkyl group (preferably a -CHF<sub>2</sub> group or a -CF<sub>3</sub> group), a C<sub>3</sub>-C<sub>7</sub> cycloalkyl group, a phenyl group, a pyridyl group, a pyrimidinyl group, a piperidyl group, a triazolyl group,
- a -(CH<sub>2</sub>)<sub>1-3</sub>CN group; a -(CH<sub>2</sub>)<sub>n</sub>OR<sub>11</sub> group; a -NR<sub>11</sub>R<sub>12</sub> group; a -NR<sub>11</sub>C(O)-(CH<sub>2</sub>)<sub>n</sub>-R<sub>12</sub> group; a -NR<sub>11</sub>C(O)-(CH<sub>2</sub>)<sub>n</sub>-NR<sub>12</sub>R<sub>13</sub> group; a -C(O)-(CH<sub>2</sub>)<sub>1-3</sub>-CN group;
- 25 a -C(O)-(CH<sub>2</sub>)<sub>n</sub>-R<sub>11</sub> group; a -C(O)-(CH<sub>2</sub>)<sub>n</sub>-NR<sub>11</sub>R<sub>12</sub> group; a -S(O)<sub>2</sub>(CH<sub>2</sub>)<sub>n</sub>R<sub>11</sub> group; a -S(O)<sub>2</sub>(CH<sub>2</sub>)<sub>n</sub>NR<sub>11</sub>R<sub>12</sub> group; a -NR<sub>11</sub>S(O)<sub>2</sub>(CH<sub>2</sub>)<sub>n</sub>R<sub>12</sub> group or a -NR<sub>11</sub>S(O)<sub>2</sub>(CH<sub>2</sub>)<sub>n</sub>NR<sub>12</sub>R<sub>13</sub> group; wherein each n is 0, 1 or 2; and wherein R<sub>11</sub>, R<sub>12</sub> and R<sub>13</sub> each independently represent a hydrogen atom or a linear or branched C<sub>1</sub>-C<sub>3</sub> alkyl group. Preferably when R<sub>2</sub> is a piperidinyl group it is substituted by one or two
- 30 substituents selected from a halogen atom, a -C(O)-(CH<sub>2</sub>)<sub>1-3</sub>-CN group or a triazolyl group.

- Typically, in the compound of formula (I) or formula (I') R<sub>3</sub> and R<sub>4</sub> each independently represent a hydrogen atom or a linear or branched C<sub>1</sub>-C<sub>6</sub> alkyl group, which alkyl group
- 35 is unsubstituted or substituted by a C<sub>1</sub>-C<sub>2</sub> alkoxy group. Preferably, R<sub>3</sub> and R<sub>4</sub> each independently represent a hydrogen atom or a linear or branched C<sub>1</sub>-C<sub>3</sub> alkyl group.

More preferably,  $R_3$  and  $R_4$  each independently represent a hydrogen atom or a methyl group.

Typically, in the compound of formula (I) or formula (I')  $R_5$  represents a hydrogen atom,  
 5 a halogen atom, a cyano group, a linear or branched  $C_1$ - $C_4$  alkyl group, a  $C_1$ - $C_4$  haloalkyl group, a  $C_1$ - $C_4$  hydroxyalkyl group, a  $C_3$ - $C_7$  cycloalkyl group, a  $-(CH_2)_nOR_{11}$  group, a  $-NR_{11}R_{12}$  group, a  $-NR_{11}C(O)-(CH_2)_n-R_{12}$  group, a  $-NR_{11}C(O)-(CH_2)_n-NR_{12}R_{13}$  group, a  $-C(O)-(CH_2)_{1-3}-CN$  group, a  $-C(O)-(CH_2)_n-R_{11}$  group, a  $-C(O)-(CH_2)_n-NR_{11}R_{12}$  group, a  $-S(O)_2(CH_2)_nR_{11}$  group, a  $-S(O)_2(CH_2)_nNR_{11}R_{12}$  group, a  $-NR_{11}S(O)_2(CH_2)_nR_{12}$   
 10 group or a  $-NR_{11}S(O)_2(CH_2)_nNR_{12}R_{13}$  group; wherein each  $n$  is 0, 1 or 2; and wherein  $R_{11}$ ,  $R_{12}$  and  $R_{13}$  each independently represent a hydrogen atom or a linear or branched  $C_1$ - $C_3$  alkyl group.

Preferably, in the compound of formula (I) or formula (I')  $R_5$  represents a hydrogen  
 15 atom, a halogen atom, a cyano group, a linear or branched  $C_1$ - $C_4$  alkyl group, a  $C_1$ - $C_4$  haloalkyl group, a  $C_1$ - $C_4$  hydroxyalkyl group, a  $C_3$ - $C_7$  cycloalkyl group or a  $-C(O)-(CH_2)_n-NR_{11}R_{12}$  group; wherein  $n$  is 0, 1 or 2; and wherein  $R_{11}$  and  $R_{12}$  each independently represent a hydrogen atom or a linear or branched  $C_1$ - $C_3$  alkyl group.

20 More preferably, in the compound of formula (I) or formula (I')  $R_5$  represents a hydrogen atom, a halogen atom (preferably a fluorine atom or a chlorine atom), a linear or branched  $C_1$ - $C_3$  alkyl group, a  $C_1$ - $C_3$  haloalkyl group or a  $-C(O)-(CH_2)_n-NR_{11}R_{12}$  group; wherein  $n$  is 0 or 1; and wherein  $R_{11}$  and  $R_{12}$  each independently represent a hydrogen atom or a methyl group.

25 More preferably  $R_5$  represents a hydrogen atom, a halogen atom (preferably a fluorine atom or a chlorine atom), a linear or branched  $C_1$ - $C_3$  alkyl group or a  $-C(O)-(CH_2)_n-NR_{11}R_{12}$  group; wherein  $n$  is 0 or 1; and wherein  $R_{11}$  and  $R_{12}$  independently represent a hydrogen atom or a linear or branched  $C_1$ - $C_3$  alkyl group.

30 Typically, in the compound of formula (I) or formula (I'),  $R_6$  represents a hydrogen atom, a halogen atom, a cyano group, a linear or branched  $C_1$ - $C_4$  alkyl group, a  $C_1$ - $C_4$  haloalkyl group, a  $C_1$ - $C_4$  hydroxyalkyl group, a  $C_3$ - $C_7$  cycloalkyl group, a monocyclic or bicyclic  $C_6$ - $C_{10}$  aryl group, a 5- to 7- membered heteroaryl group containing one, two or  
 35 three heteroatoms selected from O, S and N, or a 5- to 7- membered heterocyclyl group containing one, two or three heteroatoms selected from O, S and N,

wherein the cycloalkyl, aryl, heteroaryl and heterocyclyl groups are unsubstituted or substituted by one, two or three substituents selected from a halogen atom, a cyano group, a linear or branched C<sub>1</sub>-C<sub>6</sub> alkyl group, a C<sub>1</sub>-C<sub>4</sub> haloalkyl group, a C<sub>1</sub>-C<sub>4</sub> hydroxyalkyl group, a C<sub>3</sub>-C<sub>7</sub> cycloalkyl, a phenyl group, a pyridyl group, a pyrimidinyl group, a piperidyl group, or a -C(O)-(CH<sub>2</sub>)<sub>n</sub>-NR<sub>11</sub>R<sub>12</sub> group; wherein n is 0, 1 or 2; and wherein R<sub>11</sub> and R<sub>12</sub> each independently represent a hydrogen atom or a linear or branched C<sub>1</sub>-C<sub>3</sub> alkyl group.

10 Preferably, in the compound of formula (I) or formula (I') R<sub>6</sub> represents a hydrogen atom, a halogen atom, a cyano group, a linear or branched C<sub>1</sub>-C<sub>3</sub> alkyl group, a C<sub>1</sub>-C<sub>4</sub> haloalkyl group, a C<sub>1</sub>-C<sub>4</sub> hydroxyalkyl group, a C<sub>3</sub>-C<sub>7</sub> cycloalkyl group, a phenyl group, a pyridyl group, a pyrimidinyl group, a pyrrolidinyl group, a piperidyl group, a tetrahydropyranyl group or a morpholinyl group;

15 wherein the cycloalkyl, phenyl, pyridyl, pyrimidinyl, pyrrolidinyl, piperidyl, tetrahydropyranyl or morpholinyl groups are unsubstituted or substituted by one, two or three substituents selected from a halogen atom, a cyano group, a linear or branched C<sub>1</sub>-C<sub>6</sub> alkyl group, a C<sub>1</sub>-C<sub>4</sub> haloalkyl group, a C<sub>1</sub>-C<sub>4</sub> hydroxyalkyl group, a C<sub>3</sub>-C<sub>7</sub> cycloalkyl group.

20 More preferably, in the compound of formula (I) or formula (I') R<sub>6</sub> represents a hydrogen atom, a halogen atom (preferably a fluorine atom or a chlorine atom), a cyano group, a linear or branched C<sub>1</sub>-C<sub>3</sub> alkyl group, a C<sub>1</sub>-C<sub>4</sub> haloalkyl group, a C<sub>1</sub>-C<sub>4</sub> hydroxyalkyl group, a C<sub>3</sub>-C<sub>7</sub> cycloalkyl group, a phenyl group, a pyridyl group, a pyrimidinyl group, or a morpholinyl group.

More preferably, R<sub>6</sub> represents a hydrogen atom or a halogen atom (preferably a fluorine atom or a chlorine atom).

30 Preferably, when R<sub>6</sub> is a pyridyl group, it is linked to the rest of the molecule via a ring carbon atom. In other words, when R<sub>6</sub> is pyridyl group it is bonded to the pyridin-2(1H)-one ring via a ring carbon atom of the pyridyl group.

35 Preferably, when R<sub>6</sub> is a pyrimidinyl group or a morpholinyl group it is linked to the rest of the molecule via the ring nitrogen atom. In other words, when R<sub>6</sub> is a pyrimidinyl group or a morpholinyl group it is bonded to the pyridin-2(1H)-one ring via the ring nitrogen atom of the pyrimidinyl group or the morpholinyl group.

Typically, in the compound of formula (I) or formula (I'),  $R_7$  represents a hydrogen atom, a halogen atom, a cyano group, a linear or branched  $C_1$ - $C_4$  alkyl group, a  $C_1$ - $C_4$  haloalkyl group, a  $C_1$ - $C_4$  hydroxyalkyl group, a  $C_3$ - $C_7$  cycloalkyl group, a monocyclic or bicyclic  $C_6$ - $C_{10}$  aryl group, a 5- to 7- membered heteroaryl group containing one, two or three heteroatoms selected from O, S and N, or a 5- to 7- membered heterocycl

group containing one, two or three heteroatoms selected from O, S and N, wherein the cycloalkyl, aryl, heteroaryl and heterocycl group are unsubstituted or substituted by one, two or three substituents selected from a halogen atom, a cyano group, a linear or branched  $C_1$ - $C_6$  alkyl group, a  $C_1$ - $C_4$  haloalkyl group, a  $C_1$ - $C_4$  hydroxyalkyl group, a  $C_3$ - $C_7$  cycloalkyl group, a phenyl group, a phenyl group substituted by a carboxyl group, a pyridyl group, a pyrimidinyl group, a piperidyl group, a  $-(CH_2)_{1-3}CN$  group, a  $-(CH_2)_nOR_{11}$  group, a  $-NR_{11}R_{12}$  group, a  $-NR_{11}C(O)-(CH_2)_n-R_{12}$  group, a  $-NR_{11}C(O)-(CH_2)_n-NR_{12}R_{13}$  group, a  $-C(O)-(CH_2)_{1-3}-CN$  group, a  $-C(O)-(CH_2)_n-R_{11}$  group, a  $-C(O)-(CH_2)_n-NR_{11}R_{12}$  group, a  $-S(O)_2(CH_2)_nR_{11}$  group, a  $-S(O)_2(CH_2)_nNR_{11}R_{12}$  group, a  $-NR_{11}S(O)_2(CH_2)_nR_{12}$  group or a  $-NR_{11}S(O)_2(CH_2)_nNR_{12}R_{13}$  group; wherein each  $n$  is 0, 1 or 2; and wherein  $R_{11}$ ,  $R_{12}$  and  $R_{13}$  each independently represent a hydrogen atom or a linear or branched  $C_1$ - $C_3$  alkyl group.

Preferably, in the compound of formula (I) or formula (I'),  $R_7$  represents a hydrogen atom, a halogen atom, a cyano group, a linear or branched  $C_1$ - $C_3$  alkyl group, a  $C_1$ - $C_4$  haloalkyl group, a  $C_1$ - $C_4$  hydroxyalkyl group, a  $C_3$ - $C_7$  cycloalkyl group, a phenyl group, a pyridyl group, a pyrimidinyl group, a triazolyl group, a thiazolyl group, a pyrrolidinyl group, a piperidyl group, a tetrahydropyranyl group or a morpholinyl group;

wherein the cycloalkyl, phenyl, pyridyl, pyrimidinyl, triazolyl, thiazolyl, pyrrolidinyl, piperidyl, tetrahydropyranyl or morpholinyl groups are unsubstituted or substituted by one, two or three substituents selected from a halogen atom, a linear or branched  $C_1$ - $C_6$  alkyl group, a  $C_1$ - $C_4$  haloalkyl group, a  $C_1$ - $C_4$  hydroxyalkyl group, a  $C_3$ - $C_7$  cycloalkyl group, a phenyl group, a phenyl group substituted by a carboxyl group, a pyridyl group, a triazolyl group, a thiazolyl group, a pyrimidinyl group, a piperidyl group, a  $-(CH_2)_nOR_{11}$  group, a  $-NR_{11}R_{12}$  group, a  $-NR_{11}C(O)-(CH_2)_n-R_{12}$  group, a  $-NR_{11}C(O)-(CH_2)_n-NR_{12}R_{13}$  group, a  $-C(O)-(CH_2)_{1-3}-CN$  group, a  $-C(O)-(CH_2)_n-R_{12}$  group, a  $-C(O)-(CH_2)_n-NR_{11}R_{12}$  group, a  $-S(O)_2(CH_2)_nR_{12}$  group, a  $-S(O)_2(CH_2)_nNR_{11}R_{12}$  group,

a  $-NR_{11}S(O)_2(CH_2)_nR_{12}$  group or a  $-NR_{11}S(O)_2(CH_2)_nNR_{12}R_{13}$  group; wherein each  $n$  is 0 or 1; and wherein  $R_{11}$ ,  $R_{12}$  and  $R_{13}$  each independently represent a hydrogen atom or methyl group.

5 It is particularly preferred that the cycloalkyl, aryl, heteroaryl and heterocyclyl groups that  $R_7$  may represent are unsubstituted or substituted by one, two or three, preferably one or two, substituents selected from a halogen atom, a linear or branched  $C_1$ - $C_6$  alkyl group, a phenyl group, a phenyl group substituted by a carboxyl group, and a  $-(CH_2)_nOR_{11}$  group wherein  $n$  is 0, 1 or 2 and wherein  $R_{11}$  represents a hydrogen atom  
10 or a linear or branched  $C_1$ - $C_3$  alkyl group.

Most preferably,  $R_7$  represents a hydrogen atom, piperidyl group, a thiazolyl group or a morpholinyl group; wherein the piperidyl, thiazolyl and morpholinyl groups are unsubstituted or substituted by one or two substituents selected from a hydroxy group or a benzoic acid.

15 Preferably, when  $R_7$  is a pyridyl group, a pyrimidinyl group, a triazolyl group or a thiazolyl group, it is linked to the rest of the molecule via a ring carbon atom. In other words, when  $R_7$  is a pyridyl group, a pyrimidinyl group, a triazolyl group or a thiazolyl group it is bonded to the central ring of the compound of formula (I) or formula (I') via a  
20 ring carbon atom of the pyridyl, pyrimidinyl, triazolyl or thiazolyl group.

Preferably, when  $R_7$  is a pyrimidinyl group or a morpholinyl group it is linked to the rest of the molecule via the ring nitrogen atom. In other words, when  $R_7$  is a pyrimidinyl group or a morpholinyl group it is bonded to the central ring of the compound of formula  
25 (I) via the ring nitrogen atom of the pyrimidinyl group or the morpholinyl group.

Typically, in the compound of formula (I) or formula (I'),  $m$  is 0, 1 or 2; preferably 0 or 1.

Typically, in the compound of formula (I) or formula (I')  $n$  represents 0, 1 or 2.

30 Typically, in the compound of formula (I)  $n'$  represents 0, 1 or 2.

Typically, in the compound of formula (I) or formula (I')  $R_8$  represents a hydrogen atom or a linear or branched  $C_1$ - $C_6$  alkyl group, which alkyl group is unsubstituted or  
35 substituted by a  $C_1$ - $C_2$  alkoxy group. Preferably  $R_8$  represents a hydrogen atom or a linear or branched  $C_1$ - $C_3$  alkyl group. More preferably  $R_8$  represents a hydrogen atom.



Typically, in the compound of formula (I) or formula (I')  $R_9$  and  $R_{10}$  each independently represent a hydrogen atom or a linear or branched  $C_1$ - $C_6$  alkyl group. Preferably  $R_9$  and  $R_{10}$  each independently represent a hydrogen atom or a linear or branched  $C_1$ - $C_3$  alkyl group. More preferably  $R_9$  and  $R_{10}$  each represent a hydrogen atom.

5

Typically, in the compound formula (I)  $R_{11}$ ,  $R_{12}$  and  $R_{13}$  each independently represent a hydrogen atom, a linear or branched  $C_1$ - $C_3$  alkyl group, or a 5- to 7- membered heterocyclyl group containing one, two or three heteroatoms selected from O, S and N, which heterocyclyl group is unsubstituted or substituted by one, two or three

10 substituents selected from a halogen atom, a hydroxyl group, a linear or branched  $C_1$ - $C_4$  alkyl group, a  $C_1$ - $C_4$  haloalkyl group or a  $C_1$ - $C_4$  hydroxyalkyl group. Preferably, in the compound formula (I)  $R_{11}$ ,  $R_{12}$  and  $R_{13}$  each independently represent a hydrogen atom or a linear or branched  $C_1$ - $C_3$  alkyl group.

15 Typically, in the compound formula (I')  $R_{11}$ ,  $R_{12}$  and  $R_{13}$  each independently represent a hydrogen atom or a linear or branched  $C_1$ - $C_3$  alkyl group.

Typically, in the compound of formula (I) or formula (I'), W represents a linker selected from a  $-NR_8-$  group, a  $-(CR_9R_{10})-$  group,  $-O-$  or  $-S-$ , wherein  $R_8$ ,  $R_9$  and  $R_{10}$  are as

20 defined above. Preferably, in the compound of formula (I) or formula (I'), W represents a linker selected from a  $-NR_8-$  group or a  $-(CR_9R_{10})-$  group, wherein  $R_8$ ,  $R_9$  and  $R_{10}$  are as defined above. More preferably W represents a  $-NR_8-$  group wherein  $R_8$  is as defined above. Even more preferably W represents a  $-NR_8-$  group wherein  $R_8$  is a hydrogen atom or a  $C_1$ - $C_3$  alkyl group. Most preferably, W represents a  $-NR_8-$  group  
25 wherein  $R_8$  is a hydrogen atom or a methyl group. Even more preferred, W represents a  $-NH-$  group.

When the cycloalkyl, cycloalkenyl, aryl, heteroaryl and heterocyclyl groups that  $R_2$ ,  $R_5$ ,  $R_6$  and  $R_7$  may represent are substituted by one or more  $-NR_{11}C(O)-(CH_2)_n-R_{12}$  groups  
30 or one or more  $-C(O)-(CH_2)_n-R_{11}$  groups, and n is 0, then it is preferred that  $R_{11}$  or  $R_{12}$  do not represent a hydrogen atom.

In a particularly preferred embodiment, in the compound of formula (I)

m is 0, 1 or 2;

5

X is a nitrogen atom and Y is a  $-\text{CR}_6$  group; or Y is a nitrogen atom and X is a  $-\text{CR}_6$  group; or both X and Y are a  $-\text{CR}_6$  group;

10

A is a nitrogen atom, B is a  $-\text{CR}_7$  group and D is a  $-\text{CR}_5$  group; or B is a nitrogen atom, A is a  $-\text{CR}_7$  group and D is a  $-\text{CR}_5$  group; or both A and B are a  $-\text{CR}_7$  group and D is nitrogen atom or a  $-\text{CR}_5$  group;

W represents a linker selected from a  $-\text{NR}_8-$  group or a  $-(\text{CR}_9\text{R}_{10})-$  group; preferably a  $-\text{NR}_8-$  group;

15

$\text{R}_1$  represents a hydrogen atom, a linear or branched  $\text{C}_1$ - $\text{C}_6$  alkyl group, a  $\text{C}_1$ - $\text{C}_4$  haloalkyl group, a  $\text{C}_1$ - $\text{C}_4$  hydroxyalkyl group, a  $\text{C}_3$ - $\text{C}_7$  cycloalkyl group, a phenyl group, a pyridyl group, a pyrimidinyl group or a piperidyl group;

20

$\text{R}_2$  represents a linear or branched  $\text{C}_1$ - $\text{C}_6$  alkyl group, a  $\text{C}_1$ - $\text{C}_4$  haloalkyl group, a  $\text{C}_1$ - $\text{C}_4$  hydroxyalkyl group, a  $\text{C}_3$ - $\text{C}_7$  cycloalkyl group, a monocyclic or bicyclic  $\text{C}_6$ - $\text{C}_{10}$  aryl group, a 5- to 7- membered heteroaryl group containing one, two or three heteroatoms selected from O, S and N, a 5- to 7- membered heterocyclyl group containing one, two or three heteroatoms selected from O, S and N,

25

wherein the cycloalkyl, cycloalkenyl, aryl, heteroaryl, and heterocyclyl groups are unsubstituted or substituted by one or more substituents selected from a halogen atom; a cyano group; a linear or branched  $\text{C}_1$ - $\text{C}_6$  alkyl group; a  $\text{C}_1$ - $\text{C}_4$  haloalkyl group; a  $\text{C}_1$ - $\text{C}_4$  hydroxyalkyl group; a  $\text{C}_3$ - $\text{C}_7$  cycloalkyl group; a monocyclic or bicyclic  $\text{C}_6$ - $\text{C}_{14}$  aryl group; a 5- to 14- membered heteroaryl group containing at least one heteroatom selected from O, S and N; a 5- to 14- membered heterocyclyl group containing at least one heteroatom selected from O, S and N; a  $-(\text{CH}_2)_{1-3}\text{CN}$  group; a  $-(\text{CH}_2)_n\text{OR}_{11}$  group; a  $-\text{NR}_{11}\text{R}_{12}$  group; a  $-\text{NR}_{11}\text{C}(\text{O})-(\text{CH}_2)_n-\text{R}_{12}$  group; a  $-\text{NR}_{11}\text{C}(\text{O})-(\text{CH}_2)_n-\text{NR}_{12}\text{R}_{13}$  group; a  $-\text{C}(\text{O})-(\text{CH}_2)_{1-3}-\text{CN}$  group; a  $-\text{C}(\text{O})-(\text{CH}_2)_n-\text{R}_{11}$  group; a  $-(\text{CH}_2)_n-\text{C}(\text{O})-(\text{CH}_2)_n-\text{NR}_{11}\text{R}_{12}$  group; a  $-(\text{CH}_2)_n-\text{S}(\text{O})_2(\text{CH}_2)_n\text{R}_{11}$  group; a  $-(\text{CH}_2)_n-\text{S}(\text{O})_2(\text{CH}_2)_n\text{NR}_{11}\text{R}_{12}$  group; a  $-\text{NR}_{11}\text{S}(\text{O})_2(\text{CH}_2)_n\text{R}_{12}$  group or a  $-\text{NR}_{11}\text{S}(\text{O})_2(\text{CH}_2)_n\text{NR}_{12}\text{R}_{13}$  group;

30

35

wherein each  $n'$  and  $n$  are 0, 1 or 2 and said monocyclic or bicyclic  $C_6$ - $C_{14}$  aryl group is unsubstituted or further substituted by one or more carboxyl groups.

$R_3$  and  $R_4$  each independently represent a hydrogen atom or a linear or branched  $C_1$ - $C_6$  alkyl group, which alkyl group is unsubstituted or substituted by a  $C_1$ - $C_2$  alkoxy group;

$R_5$  represents a hydrogen atom, a halogen atom, a cyano group, a linear or branched  $C_1$ - $C_4$  alkyl group, a  $C_1$ - $C_4$  haloalkyl group, a  $C_1$ - $C_4$  hydroxyalkyl group, a  $C_3$ - $C_7$  cycloalkyl group, a  $-(CH_2)_nOR_{11}$  group, a  $-NR_{11}R_{12}$  group, a  $-NR_{11}C(O)-(CH_2)_n-R_{12}$  group, a  $-NR_{11}C(O)-(CH_2)_n-NR_{12}R_{13}$  group, a  $-C(O)-(CH_2)_{1-3}-CN$  group, a  $-C(O)-(CH_2)_n-R_{11}$  group, a  $-C(O)-(CH_2)_n-NR_{11}R_{12}$  group, a  $-S(O)_2(CH_2)_nR_{11}$  group, a  $-S(O)_2(CH_2)_nNR_{11}R_{12}$  group, a  $-NR_{11}S(O)_2(CH_2)_nR_{12}$  group or a  $-NR_{11}S(O)_2(CH_2)_nNR_{12}R_{13}$  group; wherein each  $n$  is 0, 1 or 2;

$R_6$  represents a hydrogen atom, a halogen atom, a cyano group, a linear or branched  $C_1$ - $C_4$  alkyl group, a  $C_1$ - $C_4$  haloalkyl group, a  $C_1$ - $C_4$  hydroxyalkyl group, a  $C_3$ - $C_7$  cycloalkyl group, a monocyclic or bicyclic  $C_6$ - $C_{10}$  aryl group, a 5- to 7- membered heteroaryl group containing one, two or three heteroatoms selected from O, S and N, a 5- to 7- membered heterocyclyl group containing one, two or three heteroatoms selected from O, S and N,

wherein the cycloalkyl, aryl, heteroaryl and heterocyclyl groups are unsubstituted or substituted by one, two or three substituents selected from a halogen atom, a cyano group, a linear or branched  $C_1$ - $C_6$  alkyl group, a  $C_1$ - $C_4$  haloalkyl group, a  $C_1$ - $C_4$  hydroxyalkyl group, a  $C_3$ - $C_7$  cycloalkyl, a phenyl group, a pyridyl group, a pyrimidinyl group, a piperidyl group, or a  $-C(O)-(CH_2)_n-NR_{11}R_{12}$  group; wherein  $n$  is 0, 1 or 2

$R_7$  represents a hydrogen atom, a halogen atom, a cyano group, a linear or branched  $C_1$ - $C_4$  alkyl group, a  $C_1$ - $C_4$  haloalkyl group, a  $C_1$ - $C_4$  hydroxyalkyl group, a  $C_3$ - $C_7$  cycloalkyl group, a monocyclic or bicyclic  $C_6$ - $C_{10}$  aryl group, a 5- to 7- membered heteroaryl group containing one, two or three heteroatoms selected from O, S and N, a 5- to 7- membered heterocyclyl group containing one, two or three heteroatoms selected from O, S and N,

wherein the cycloalkyl, aryl, heteroaryl and heterocyclyl groups are unsubstituted or substituted by one, two or three substituents selected from a halogen atom, a cyano group, a linear or branched  $C_1$ - $C_6$  alkyl group, a  $C_1$ - $C_4$  haloalkyl group, a  $C_1$ - $C_4$  hydroxyalkyl group, a  $C_3$ - $C_7$  cycloalkyl group, a phenyl

group, a phenyl group substituted by a carboxyl group, a pyridyl group, a pyrimidinyl group, a piperidyl group, a  $-(CH_2)_{1-3}CN$  group, a  $-(CH_2)_nOR_{11}$  group, a  $-NR_{11}R_{12}$  group, a  $-NR_{11}C(O)-(CH_2)_n-R_{12}$  group, a  $-NR_{11}C(O)-(CH_2)_n-NR_{12}R_{13}$  group, a  $-C(O)-(CH_2)_{1-3}-CN$  group, a  $-C(O)-(CH_2)_n-R_{11}$  group, a  $-C(O)-(CH_2)_n-NR_{11}R_{12}$  group, a  $-S(O)_2(CH_2)_nR_{11}$  group, a  $-S(O)_2(CH_2)_nNR_{11}R_{12}$  group, a  $-NR_{11}S(O)_2(CH_2)_nR_{12}$  group or a  $-NR_{11}S(O)_2(CH_2)_nNR_{12}R_{13}$  group; wherein each n is 0, 1 or 2;

$R_8$  represents a hydrogen atom or a linear or branched  $C_1-C_6$  alkyl group, which alkyl group is unsubstituted or substituted by a  $C_1-C_2$  alkoxy group;

$R_9$  and  $R_{10}$  each independently represent a hydrogen atom or a linear or branched  $C_1-C_3$  alkyl group;

$R_{11}$ ,  $R_{12}$  and  $R_{13}$  each independently represent a hydrogen atom, a linear or branched  $C_1-C_3$  alkyl group, or a 5- to 7- membered heterocyclyl group containing one, two or three heteroatoms selected from O, S and N, which heterocyclyl group is unsubstituted or substituted by one, two or three substituents selected from a halogen atom, a hydroxyl group, a linear or branched  $C_1-C_4$  alkyl group, a  $C_1-C_4$  haloalkyl group or a  $C_1-C_4$  hydroxyalkyl group.

In a further particular preferred embodiment, in the compound of formula (I):

m is 0, 1 or 2;

both X and Y represents a  $-CR_6$  group;

A is a nitrogen atom, B is a  $-CR_7$  group and D is a  $-CR_5$  group; or B is a nitrogen atom, A is a  $-CR_7$  group and D is a  $-CR_5$  group; or both A and B are a  $-CR_7$  group and D is nitrogen atom or a  $-CR_5$  group;

W represents a linker selected from a  $-NR_8-$  group or a  $-(CR_9R_{10})-$  group; preferably a  $-NR_8-$  group;

$R_1$  represents a hydrogen atom, a linear or branched  $C_1$ - $C_6$  alkyl group, a  $C_1$ - $C_4$  haloalkyl group, a  $C_1$ - $C_4$  hydroxyalkyl group, a  $C_3$ - $C_7$  cycloalkyl group, a phenyl group, a pyridyl group, a pyrimidinyl group or a piperidyl group;

- 5  $R_2$  represents a linear or branched  $C_1$ - $C_6$  alkyl group, a  $C_1$ - $C_4$  haloalkyl group, a  $C_1$ - $C_4$  hydroxyalkyl group, a  $C_3$ - $C_7$  cycloalkyl group, a monocyclic or bicyclic  $C_6$ - $C_{10}$  aryl group, a 5- to 7- membered heteroaryl group containing one, two or three heteroatoms selected from O, S and N, a 5- to 7- membered heterocyclyl group containing one, two or three heteroatoms selected from O, S and N,

- 10 wherein the cycloalkyl, cycloalkenyl, aryl, heteroaryl, and heterocyclyl groups are unsubstituted or substituted by one or more substituents selected from a halogen atom; a cyano group; a linear or branched  $C_1$ - $C_6$  alkyl group; a  $C_1$ - $C_4$  haloalkyl group; a  $C_1$ - $C_4$  hydroxyalkyl group; a  $C_3$ - $C_7$  cycloalkyl group; a monocyclic or bicyclic  $C_6$ - $C_{14}$  aryl group; a 5- to 14- membered heteroaryl group  
 15 containing at least one heteroatom selected from O, S and N; a 5- to 14- membered heterocyclyl group containing at least one heteroatom selected from O, S and N; a  $-(CH_2)_{1-3}CN$  group; a  $-(CH_2)_nOR_{11}$  group; a  $-NR_{11}R_{12}$  group; a  $-NR_{11}C(O)-(CH_2)_n-R_{12}$  group; a  $-NR_{11}C(O)-(CH_2)_n-NR_{12}R_{13}$  group; a  $-C(O)-(CH_2)_{1-3}CN$  group; a  $-C(O)-(CH_2)_n-R_{11}$  group; a  $-(CH_2)_n-C(O)-(CH_2)_n-$   
 20  $NR_{11}R_{12}$  group; a  $-(CH_2)_n-S(O)_2(CH_2)_nR_{11}$  group; a  $-(CH_2)_n-S(O)_2(CH_2)_nNR_{11}R_{12}$  group; a  $-NR_{11}S(O)_2(CH_2)_nR_{12}$  group or a  $-NR_{11}S(O)_2(CH_2)_nNR_{12}R_{13}$  group; wherein each  $n'$  and  $n$  are 0, 1 or 2 and said monocyclic or bicyclic  $C_6$ - $C_{14}$  aryl group is unsubstituted or further substituted by one or more carboxyl groups.

- 25  $R_3$  and  $R_4$  each independently represent a hydrogen atom or a linear or branched  $C_1$ - $C_6$  alkyl group, which alkyl group is unsubstituted or substituted by a  $C_1$ - $C_2$  alkoxy group;

- $R_5$  represents a hydrogen atom, a halogen atom, a cyano group, a linear or branched  $C_1$ - $C_4$  alkyl group, a  $C_1$ - $C_4$  haloalkyl group, a  $C_1$ - $C_4$  hydroxyalkyl group, a  $C_3$ - $C_7$  cycloalkyl group, a  $-(CH_2)_nOR_{11}$  group, a  $-NR_{11}R_{12}$  group, a  $-NR_{11}C(O)-(CH_2)_n-R_{12}$  group, a  $-NR_{11}C(O)-(CH_2)_n-NR_{12}R_{13}$  group, a  $-C(O)-(CH_2)_{1-3}CN$  group, a  $-C(O)-(CH_2)_n-R_{11}$  group, a  $-C(O)-(CH_2)_n-NR_{11}R_{12}$  group, a  $-S(O)_2(CH_2)_nR_{11}$  group, a  $-S(O)_2(CH_2)_nNR_{11}R_{12}$  group, a  $-NR_{11}S(O)_2(CH_2)_nR_{12}$  group or a  $-NR_{11}S(O)_2(CH_2)_nNR_{12}R_{13}$  group; wherein each  $n$  is 0, 1 or 2;

- 35  $R_6$  represents a hydrogen atom, a halogen atom, a cyano group, a linear or branched  $C_1$ - $C_4$  alkyl group, a  $C_1$ - $C_4$  haloalkyl group, a  $C_1$ - $C_4$  hydroxyalkyl group, a  $C_3$ - $C_7$

cycloalkyl group, a monocyclic or bicyclic C<sub>6</sub>-C<sub>10</sub> aryl group, a 5- to 7- membered heteroaryl group containing one, two or three heteroatoms selected from O, S and N, a 5- to 7- membered heterocyclyl group containing one, two or three heteroatoms selected from O, S and N,

- 5            wherein the cycloalkyl, aryl, heteroaryl and heterocyclyl groups are unsubstituted or substituted by one, two or three substituents selected from a halogen atom, a cyano group, a linear or branched C<sub>1</sub>-C<sub>6</sub> alkyl group, a C<sub>1</sub>-C<sub>4</sub> haloalkyl group, a C<sub>1</sub>-C<sub>4</sub> hydroxyalkyl group, a C<sub>3</sub>-C<sub>7</sub> cycloalkyl, a phenyl group, a pyridyl group, a pyrimidinyl group, a piperidyl group, or
- 10           a -C(O)-(CH<sub>2</sub>)<sub>n</sub>-NR<sub>11</sub>R<sub>12</sub> group; wherein n is 0, 1 or 2

R<sub>7</sub> represents a hydrogen atom, a halogen atom, a cyano group, a linear or branched C<sub>1</sub>-C<sub>4</sub> alkyl group, a C<sub>1</sub>-C<sub>4</sub> haloalkyl group, a C<sub>1</sub>-C<sub>4</sub> hydroxyalkyl group, a C<sub>3</sub>-C<sub>7</sub> cycloalkyl group, a monocyclic or bicyclic C<sub>6</sub>-C<sub>10</sub> aryl group, a 5- to 7- membered heteroaryl group containing one, two or three heteroatoms selected from O, S and N, a 5- to 7- membered heterocyclyl group containing one, two or three heteroatoms selected from O, S and N,

- wherein the cycloalkyl, aryl, heteroaryl and heterocyclyl groups are unsubstituted or substituted by one, two or three substituents selected from a
- 20           halogen atom, a cyano group, a linear or branched C<sub>1</sub>-C<sub>6</sub> alkyl group, a C<sub>1</sub>-C<sub>4</sub> haloalkyl group, a C<sub>1</sub>-C<sub>4</sub> hydroxyalkyl group, a C<sub>3</sub>-C<sub>7</sub> cycloalkyl group, a phenyl group, a phenyl group substituted by a carboxyl group, a pyridyl group, a pyrimidinyl group, a piperidyl group, a -(CH<sub>2</sub>)<sub>1-3</sub>CN group, a -(CH<sub>2</sub>)<sub>n</sub>OR<sub>11</sub> group, a -NR<sub>11</sub>R<sub>12</sub> group, a -NR<sub>11</sub>C(O)-(CH<sub>2</sub>)<sub>n</sub>-R<sub>12</sub> group,
- 25           a -NR<sub>11</sub>C(O)-(CH<sub>2</sub>)<sub>n</sub>-NR<sub>12</sub>R<sub>13</sub> group, a -C(O)-(CH<sub>2</sub>)<sub>1-3</sub>-CN group, a -C(O)-(CH<sub>2</sub>)<sub>n</sub>-R<sub>11</sub> group, a -C(O)-(CH<sub>2</sub>)<sub>n</sub>-NR<sub>11</sub>R<sub>12</sub> group, a -S(O)<sub>2</sub>(CH<sub>2</sub>)<sub>n</sub>R<sub>11</sub> group, a -S(O)<sub>2</sub>(CH<sub>2</sub>)<sub>n</sub>NR<sub>11</sub>R<sub>12</sub> group, a -NR<sub>11</sub>S(O)<sub>2</sub>(CH<sub>2</sub>)<sub>n</sub>R<sub>12</sub> group or a -NR<sub>11</sub>S(O)<sub>2</sub>(CH<sub>2</sub>)<sub>n</sub>NR<sub>12</sub>R<sub>13</sub> group; wherein each n is 0, 1 or 2;

- 30           R<sub>8</sub> represents a hydrogen atom or a linear or branched C<sub>1</sub>-C<sub>6</sub> alkyl group, which alkyl group is unsubstituted or substituted by a C<sub>1</sub>-C<sub>2</sub> alkoxy group;

R<sub>9</sub> and R<sub>10</sub> each independently represent a hydrogen atom or a linear or branched C<sub>1</sub>-C<sub>3</sub> alkyl group;

- 35           R<sub>11</sub>, R<sub>12</sub> and R<sub>13</sub> each independently represent a hydrogen atom, a linear or branched C<sub>1</sub>-C<sub>3</sub> alkyl group, or a 5- to 7- membered heterocyclyl group containing one, two or

three heteroatoms selected from O, S and N, which heterocyclyl group is unsubstituted or substituted by one, two or three substituents selected from a halogen atom, a hydroxyl group, a linear or branched C<sub>1</sub>-C<sub>4</sub> alkyl group, a C<sub>1</sub>-C<sub>4</sub> haloalkyl group or a C<sub>1</sub>-C<sub>4</sub> hydroxyalkyl group.

5

In a further particular preferred embodiment, in the compound of formula (I):

m is 0 or 1;

10 both X and Y represents a -CR<sub>6</sub> group;

A is a nitrogen atom, B is a -CR<sub>7</sub> group and D is a -CR<sub>5</sub> group; or B is a nitrogen atom, A is a -CR<sub>7</sub> group and D is a -CR<sub>5</sub> group; or both A and B are a -CR<sub>7</sub> group and D is nitrogen atom or a -CR<sub>5</sub> group;

15

W represents a linker selected from a -NR<sub>8</sub>- group or a -(CR<sub>9</sub>R<sub>10</sub>)- group; preferably a -NR<sub>8</sub>- group;

R<sub>1</sub> represents a hydrogen atom, a linear or branched C<sub>1</sub>-C<sub>3</sub> alkyl group, a C<sub>1</sub>-C<sub>3</sub>

20 haloalkyl group or a C<sub>1</sub>-C<sub>3</sub> hydroxyalkyl group;

R<sub>2</sub> represents a linear or branched C<sub>1</sub>-C<sub>6</sub> alkyl group, a C<sub>1</sub>-C<sub>4</sub> haloalkyl group, a C<sub>1</sub>-C<sub>4</sub> hydroxyalkyl group, a C<sub>3</sub>-C<sub>7</sub> cycloalkyl group, a phenyl group, a pyridyl group, a pyrimidinyl group, a triazolyl group, a thiazolyl group, a pyrrolidinyl group or a piperidyl

25

group;  
 wherein the cycloalkyl, phenyl, pyridyl, pyrimidinyl, triazolyl, thiazolyl, pyrrolidinyl or piperidyl groups are unsubstituted or substituted by one, two or three substituents selected from a halogen atom, a cyano group, a linear or branched C<sub>1</sub>-C<sub>6</sub> alkyl group, a C<sub>1</sub>-C<sub>4</sub> haloalkyl group, a C<sub>1</sub>-C<sub>4</sub> hydroxyalkyl group, a C<sub>3</sub>-C<sub>7</sub> cycloalkyl group, a phenyl group, a phenyl group substituted by a carboxyl group, a pyridyl group, a triazolyl group, a thiazolyl group, a pyrimidinyl group, a piperidyl group, a -(CH<sub>2</sub>)<sub>n</sub>OR<sub>11</sub> group, a -NR<sub>11</sub>R<sub>12</sub> group, a -NR<sub>11</sub>C(O)-(CH<sub>2</sub>)<sub>n</sub>-R<sub>12</sub> group, a -NR<sub>11</sub>C(O)-(CH<sub>2</sub>)<sub>n</sub>-NR<sub>12</sub>R<sub>13</sub> group, a -C(O)-(CH<sub>2</sub>)<sub>1-3</sub>-CN group, a -C(O)-(CH<sub>2</sub>)<sub>n</sub>-R<sub>11</sub> group, a -(CH<sub>2</sub>)<sub>n</sub>-C(O)-(CH<sub>2</sub>)<sub>n</sub>-NR<sub>11</sub>R<sub>12</sub> group; a -(CH<sub>2</sub>)<sub>n</sub>-S(O)<sub>2</sub>(CH<sub>2</sub>)<sub>n</sub>R<sub>11</sub> group; a -(CH<sub>2</sub>)<sub>n</sub>-S(O)<sub>2</sub>(CH<sub>2</sub>)<sub>n</sub>NR<sub>11</sub>R<sub>12</sub> group; a -NR<sub>11</sub>S(O)<sub>2</sub>(CH<sub>2</sub>)<sub>n</sub>R<sub>12</sub> group or a -NR<sub>11</sub>S(O)<sub>2</sub>(CH<sub>2</sub>)<sub>n</sub>NR<sub>12</sub>R<sub>13</sub> group;

30

35

wherein each n' and n are 0, 1 or 2;

R<sub>3</sub> and R<sub>4</sub> each independently represent a hydrogen atom or a linear or branched C<sub>1</sub>-C<sub>3</sub> alkyl group;

- 5 R<sub>5</sub> represents a hydrogen atom, a halogen atom, a cyano group, a linear or branched C<sub>1</sub>-C<sub>3</sub> alkyl group, a C<sub>1</sub>-C<sub>4</sub> haloalkyl group, a C<sub>1</sub>-C<sub>4</sub> hydroxyalkyl group, a C<sub>3</sub>-C<sub>7</sub> cycloalkyl group, a -(CH<sub>2</sub>)<sub>1-3</sub>CN group, a -(CH<sub>2</sub>)<sub>n</sub>OR<sub>11</sub> group, a -NR<sub>11</sub>R<sub>12</sub> group, a -NR<sub>11</sub>C(O)-(CH<sub>2</sub>)<sub>n</sub>-R<sub>12</sub> group, a -NR<sub>11</sub>C(O)-(CH<sub>2</sub>)<sub>n</sub>-NR<sub>12</sub>R<sub>13</sub> group, a -C(O)-(CH<sub>2</sub>)<sub>1-3</sub>-CN group, a -C(O)-(CH<sub>2</sub>)<sub>n</sub>-R<sub>11</sub> group, a -C(O)-(CH<sub>2</sub>)<sub>n</sub>-NR<sub>11</sub>R<sub>12</sub> group, a -S(O)<sub>2</sub>(CH<sub>2</sub>)<sub>n</sub>R<sub>11</sub> group, a -S(O)<sub>2</sub>(CH<sub>2</sub>)<sub>n</sub>NR<sub>11</sub>R<sub>12</sub> group, a -NR<sub>11</sub>S(O)<sub>2</sub>(CH<sub>2</sub>)<sub>n</sub>R<sub>12</sub> group or  
10 a -NR<sub>11</sub>S(O)<sub>2</sub>(CH<sub>2</sub>)<sub>n</sub>NR<sub>12</sub>R<sub>13</sub> group; wherein each n is 0, 1 or 2;

- R<sub>6</sub> represents a hydrogen atom, a halogen atom, a cyano group, a linear or branched C<sub>1</sub>-C<sub>3</sub> alkyl group, a C<sub>1</sub>-C<sub>4</sub> haloalkyl group, a C<sub>1</sub>-C<sub>4</sub> hydroxyalkyl group, a C<sub>3</sub>-C<sub>7</sub> cycloalkyl group, a phenyl group, a pyridyl group, a pyrimidinyl group, a pyrazolyl group, a pyrrolidinyl group, a piperidyl group, a tetrahydropyranyl group or a morpholinyl group;

- R<sub>7</sub> represents a hydrogen atom, a halogen atom, a cyano group, a linear or branched C<sub>1</sub>-C<sub>3</sub> alkyl group, a C<sub>1</sub>-C<sub>4</sub> haloalkyl group, a C<sub>1</sub>-C<sub>4</sub> hydroxyalkyl group, a C<sub>3</sub>-C<sub>7</sub> cycloalkyl group, a phenyl group, a pyridyl group, a pyrimidinyl group, a triazolyl group, a thiazolyl group, a pyrrolidinyl group, a piperidyl group, a tetrahydropyranyl group or a morpholinyl group;

- wherein the cycloalkyl, phenyl, pyridyl, pyrimidinyl, triazolyl, thiazolyl, pyrrolidinyl, piperidyl, tetrahydropyranyl or morpholinyl groups are unsubstituted or substituted by one, two or three substituents selected from a halogen atom, a linear or branched C<sub>1</sub>-C<sub>6</sub> alkyl group, a C<sub>1</sub>-C<sub>4</sub> haloalkyl group, a C<sub>1</sub>-C<sub>4</sub> hydroxyalkyl group, a C<sub>3</sub>-C<sub>7</sub> cycloalkyl group, a phenyl group, a phenyl group substituted by a carboxyl group, a pyridyl group, a triazolyl group, a thiazolyl group, a pyrimidinyl group, a piperidyl group,  
25 a -(CH<sub>2</sub>)<sub>n</sub>OR<sub>11</sub> group, a -NR<sub>11</sub>R<sub>12</sub> group, a -NR<sub>11</sub>C(O)-(CH<sub>2</sub>)<sub>n</sub>-R<sub>12</sub> group, a -NR<sub>11</sub>C(O)-(CH<sub>2</sub>)<sub>n</sub>-NR<sub>12</sub>R<sub>13</sub> group, a -C(O)-(CH<sub>2</sub>)<sub>1-3</sub>-CN group, a -C(O)-(CH<sub>2</sub>)<sub>n</sub>-R<sub>12</sub> group, a -C(O)-(CH<sub>2</sub>)<sub>n</sub>-NR<sub>11</sub>R<sub>12</sub> group, a -S(O)<sub>2</sub>(CH<sub>2</sub>)<sub>n</sub>R<sub>12</sub> group, a -S(O)<sub>2</sub>(CH<sub>2</sub>)<sub>n</sub>NR<sub>11</sub>R<sub>12</sub> group, a -NR<sub>11</sub>S(O)<sub>2</sub>(CH<sub>2</sub>)<sub>n</sub>R<sub>12</sub> group or  
30 a -NR<sub>11</sub>S(O)<sub>2</sub>(CH<sub>2</sub>)<sub>n</sub>NR<sub>12</sub>R<sub>13</sub> group; wherein each n is 0, 1 or 2;  
35

R<sub>8</sub> represents a hydrogen atom or a linear or branched C<sub>1</sub>-C<sub>3</sub> alkyl group;



R<sub>9</sub> and R<sub>10</sub> each independently represent a hydrogen atom or a linear or branched C<sub>1</sub>-C<sub>3</sub> alkyl group;

- 5 R<sub>11</sub>, R<sub>12</sub> and R<sub>13</sub> each independently represent a hydrogen atom or a linear or branched C<sub>1</sub>-C<sub>3</sub> alkyl group, or a 5- to 7- membered heterocyclyl group containing one, two or three heteroatoms selected from O, S and N, which heterocyclyl group is unsubstituted or substituted by one, two or three substituents selected from a halogen atom, a hydroxyl group, a linear or branched C<sub>1</sub>-C<sub>4</sub> alkyl group, a C<sub>1</sub>-C<sub>4</sub> haloalkyl group or a C<sub>1</sub>-  
10 C<sub>4</sub> hydroxyalkyl group.

In a further particular preferred embodiment, in the compound of formula (I):

m is 0 or 1;

15

both X and Y represents a -CR<sub>6</sub> group;

A is a nitrogen atom, B is a -CR<sub>7</sub> group and D is a -CR<sub>5</sub> group; or B is a nitrogen atom, A is a -CR<sub>7</sub> group and D is a -CR<sub>5</sub> group; or both A and B are a -CR<sub>7</sub> group and D is  
20 nitrogen atom or a -CR<sub>5</sub> group;

W represents a -NH- group or a -CH<sub>2</sub>- group; preferably a -NH- group;

- 25 R<sub>1</sub> represents a hydrogen atom, a C<sub>1</sub>-C<sub>3</sub> haloalkyl group, a C<sub>1</sub>-C<sub>3</sub> hydroxyalkyl group or a linear or branched C<sub>1</sub>-C<sub>3</sub> alkyl group;

R<sub>2</sub> represents a C<sub>3</sub>-C<sub>7</sub> cycloalkyl group, a phenyl group, a pyridyl group, a pyrimidinyl group, a piperidinyl group or a morpholinyl group,

- 30 wherein the cycloalkyl, phenyl, pyridyl, pyrimidinyl, piperidinyl or morpholinyl group are unsubstituted or substituted by one, two or three substituents selected from a halogen atom, a linear or branched C<sub>1</sub>-C<sub>3</sub> alkyl group, a C<sub>1</sub>-C<sub>3</sub> haloalkyl group, a triazolyl group, a -(CH<sub>2</sub>)<sub>1-3</sub>CN group, a -(CH<sub>2</sub>)<sub>0-2</sub>OR<sub>11</sub> group or a -C(O)-(CH<sub>2</sub>)<sub>1-3</sub>-CN group;

- 35 R<sub>3</sub> and R<sub>4</sub> each independently represent a hydrogen atom or a methyl group;

R<sub>5</sub> represents a hydrogen atom, a halogen atom, a linear or branched C<sub>1</sub>-C<sub>3</sub> alkyl group, a C<sub>1</sub>-C<sub>3</sub> haloalkyl group, a C<sub>3</sub>-C<sub>7</sub> cycloalkyl group or a -C(O)-(CH<sub>2</sub>)<sub>n</sub>-NR<sub>11</sub>R<sub>12</sub> group; wherein n is 0 or 1;

- 5 R<sub>6</sub> represents a hydrogen atom, a halogen atom, a linear or branched C<sub>1</sub>-C<sub>3</sub> alkyl group, a C<sub>1</sub>-C<sub>3</sub> haloalkyl group, a C<sub>3</sub>-C<sub>7</sub> cycloalkyl group, a phenyl group, a pyridyl group, a pyrimidinyl group, a piperidinyl group or a morpholinyl group,  
 wherein the cycloalkyl, phenyl, pyridyl, pyrimidinyl, piperidinyl or morpholinyl group are unsubstituted or substituted by one, two or three substituents  
 10 selected from a halogen atom, a linear or branched C<sub>1</sub>-C<sub>3</sub> alkyl group, a C<sub>1</sub>-C<sub>3</sub> haloalkyl group, a triazolyl group, a -(CH<sub>2</sub>)<sub>1-3</sub>CN group or a -(CH<sub>2</sub>)<sub>0-2</sub>OR<sub>11</sub> group;

R<sub>7</sub> represents a hydrogen atom, a halogen atom, a linear or branched C<sub>1</sub>-C<sub>3</sub> alkyl group, a C<sub>1</sub>-C<sub>3</sub> haloalkyl group, a C<sub>3</sub>-C<sub>7</sub> cycloalkyl group, a phenyl group, a pyridyl group, a pyrimidinyl group, a piperidinyl group or a morpholinyl group,

- 15 wherein the cycloalkyl, phenyl, pyridyl, pyrimidinyl, piperidinyl or morpholinyl group are unsubstituted or substituted by one, two or three substituents  
 selected from a halogen atom, a hydroxy group, a linear or branched C<sub>1</sub>-C<sub>3</sub> alkyl group, a C<sub>1</sub>-C<sub>3</sub> haloalkyl group, a phenyl group, a phenyl group substituted by a carboxyl group, a triazolyl group, a -(CH<sub>2</sub>)<sub>1-3</sub>CN group or a -(CH<sub>2</sub>)<sub>0-2</sub>OR<sub>11</sub> group;

20

R<sub>8</sub>, R<sub>9</sub> and R<sub>10</sub> each independently represent a hydrogen atom or a methyl group;

R<sub>11</sub> and R<sub>12</sub> each independently represent a hydrogen atom or a methyl group.

25

In yet a further particular preferred embodiment, in the compound of formula (I):

m is 0 or 1;

30

both X and Y represents a -CR<sub>6</sub> group;

A is a nitrogen atom, B is a -CR<sub>7</sub> group and D is a -CR<sub>5</sub> group; or B is a nitrogen atom, A is a -CR<sub>7</sub> group and D is a -CR<sub>5</sub> group; or both A and B are a -CR<sub>7</sub> group and D is nitrogen atom or a -CR<sub>5</sub> group;

35

W represents a -NH- group or a -CH<sub>2</sub>- group; preferably a -NH- group;

R<sub>1</sub> represents a hydrogen atom;

R<sub>2</sub> represents a cyclohexyl group, a pyridyl group or a piperidyl group,

5 wherein the cyclohexyl, pyridyl and piperidyl groups are unsubstituted or substituted by one, two or three substituents selected from a halogen atom, a triazolyl group, a  $-(CH_2)_{1-3}CN$  group,  $-C(O)-(CH_2)_{1-3}CN$  group or a  $-(CH_2)-S(O)_2-$  pyrimidinyl group, which pyrimidinyl is unsubstituted or substituted by one, two or three hydroxyl groups;

10 R<sub>3</sub> and R<sub>4</sub> each independently represent a hydrogen atom or a methyl group;

R<sub>5</sub> represents a hydrogen atom, a halogen atom, a hydroxyl group, a linear or branched C<sub>1</sub>-C<sub>3</sub> alkyl group, a  $-OCH_3$  group or a  $-C(O)-(CH_2)_n-NR_{11}R_{12}$  group; wherein n is 0 or 1; and wherein R<sub>11</sub> and R<sub>12</sub> independently represent a hydrogen atom or a linear or

15 branched C<sub>1</sub>-C<sub>3</sub> alkyl group;

R<sub>6</sub> represents a hydrogen atom, a halogen atom or a pyrazolyl group;

R<sub>7</sub> represents a hydrogen atom, piperidyl group, a thiazolyl group or a morpholinyl group;

20 wherein the piperidyl, thiazolyl and morpholinyl groups are unsubstituted or substituted by one or two substituents selected from a hydroxy group or a benzoic acid.

25 In a particularly preferred embodiment, in the compound of formula (I')

m is 0, 1 or 2;

30 X is a nitrogen atom and Y is a  $-CR_6$  group; or Y is a nitrogen atom and X is a  $-CR_6$  group; or both X and Y are a  $-CR_6$  group;

A is a nitrogen atom and B is a  $-CR_7$  group; or B is a nitrogen atom and A is a  $-CR_7$  group; or both A and B are a  $-CR_7$  group;

35 W represents a linker selected from a  $-NR_8-$  group or a  $-(CR_9R_{10})-$  group;

R<sub>1</sub> represents a hydrogen atom, a linear or branched C<sub>1</sub>-C<sub>6</sub> alkyl group, a C<sub>1</sub>-C<sub>4</sub> haloalkyl group, a C<sub>1</sub>-C<sub>4</sub> hydroxyalkyl group, a C<sub>3</sub>-C<sub>7</sub> cycloalkyl group, a phenyl group, a pyridyl group, a pyrimidinyl group or a piperidyl group;

- 5 R<sub>2</sub> represents a linear or branched C<sub>1</sub>-C<sub>6</sub> alkyl group, a C<sub>1</sub>-C<sub>4</sub> haloalkyl group, a C<sub>1</sub>-C<sub>4</sub> hydroxyalkyl group, a C<sub>3</sub>-C<sub>7</sub> cycloalkyl group, a monocyclic or bicyclic C<sub>6</sub>-C<sub>10</sub> aryl group, a 5- to 7- membered heteroaryl group containing one, two or three heteroatoms selected from O, S and N, a 5- to 7- membered heterocyclyl group containing one, two or three heteroatoms selected from O, S and N,

- 10 wherein the cycloalkyl, cycloalkenyl, aryl, heteroaryl, and heterocyclyl groups are unsubstituted or substituted by one or more substituents selected from a halogen atom; a cyano group; a linear or branched C<sub>1</sub>-C<sub>6</sub> alkyl group; a C<sub>1</sub>-C<sub>4</sub> haloalkyl group; a C<sub>1</sub>-C<sub>4</sub> hydroxyalkyl group; a C<sub>3</sub>-C<sub>7</sub> cycloalkyl group; a monocyclic or bicyclic C<sub>6</sub>-C<sub>14</sub> aryl group; a 5- to 14- membered heteroaryl group  
 15 containing at least one heteroatom selected from O, S and N; a 5- to 14- membered heterocyclyl group containing at least one heteroatom selected from O, S and N; a -(CH<sub>2</sub>)<sub>1-3</sub>CN group; a -(CH<sub>2</sub>)<sub>n</sub>OR<sub>11</sub> group; a -NR<sub>11</sub>R<sub>12</sub> group; a -NR<sub>11</sub>C(O)-(CH<sub>2</sub>)<sub>n</sub>-R<sub>12</sub> group; a -NR<sub>11</sub>C(O)-(CH<sub>2</sub>)<sub>n</sub>-NR<sub>12</sub>R<sub>13</sub> group; a -C(O)-(CH<sub>2</sub>)<sub>1-3</sub>-CN group; a -C(O)-(CH<sub>2</sub>)<sub>n</sub>-R<sub>11</sub> group; a -C(O)-(CH<sub>2</sub>)<sub>n</sub>-NR<sub>11</sub>R<sub>12</sub>  
 20 group; a -S(O)<sub>2</sub>(CH<sub>2</sub>)<sub>n</sub>R<sub>11</sub> group; a -S(O)<sub>2</sub>(CH<sub>2</sub>)<sub>n</sub>NR<sub>11</sub>R<sub>12</sub> group; a -NR<sub>11</sub>S(O)<sub>2</sub>(CH<sub>2</sub>)<sub>n</sub>R<sub>12</sub> group or a -NR<sub>11</sub>S(O)<sub>2</sub>(CH<sub>2</sub>)<sub>n</sub>NR<sub>12</sub>R<sub>13</sub> group; wherein each n is 0, 1 or 2 and said monocyclic or bicyclic C<sub>6</sub>-C<sub>14</sub> aryl group is unsubstituted or further substituted by one or more carboxyl groups.

- 25 R<sub>3</sub> and R<sub>4</sub> each independently represent a hydrogen atom or a linear or branched C<sub>1</sub>-C<sub>6</sub> alkyl group, which alkyl group is unsubstituted or substituted by a C<sub>1</sub>-C<sub>2</sub> alkoxy group;

- R<sub>5</sub> represents a hydrogen atom, a halogen atom, a cyano group, a linear or branched C<sub>1</sub>-C<sub>4</sub> alkyl group, a C<sub>1</sub>-C<sub>4</sub> haloalkyl group, a C<sub>1</sub>-C<sub>4</sub> hydroxyalkyl group, a C<sub>3</sub>-C<sub>7</sub>  
 30 cycloalkyl group, a -(CH<sub>2</sub>)<sub>n</sub>OR<sub>11</sub> group, a -NR<sub>11</sub>R<sub>12</sub> group, a -NR<sub>11</sub>C(O)-(CH<sub>2</sub>)<sub>n</sub>-R<sub>12</sub> group, a -NR<sub>11</sub>C(O)-(CH<sub>2</sub>)<sub>n</sub>-NR<sub>12</sub>R<sub>13</sub> group, a -C(O)-(CH<sub>2</sub>)<sub>1-3</sub>-CN group, a -C(O)-(CH<sub>2</sub>)<sub>n</sub>-R<sub>11</sub> group, a -C(O)-(CH<sub>2</sub>)<sub>n</sub>-NR<sub>11</sub>R<sub>12</sub> group, a -S(O)<sub>2</sub>(CH<sub>2</sub>)<sub>n</sub>R<sub>11</sub> group, a -S(O)<sub>2</sub>(CH<sub>2</sub>)<sub>n</sub>NR<sub>11</sub>R<sub>12</sub> group, a -NR<sub>11</sub>S(O)<sub>2</sub>(CH<sub>2</sub>)<sub>n</sub>R<sub>12</sub> group or a -NR<sub>11</sub>S(O)<sub>2</sub>(CH<sub>2</sub>)<sub>n</sub>NR<sub>12</sub>R<sub>13</sub> group; wherein each n is 0, 1 or 2;

- 35 R<sub>6</sub> represents a hydrogen atom, a halogen atom, a cyano group, a linear or branched C<sub>1</sub>-C<sub>4</sub> alkyl group, a C<sub>1</sub>-C<sub>4</sub> haloalkyl group, a C<sub>1</sub>-C<sub>4</sub> hydroxyalkyl group, a C<sub>3</sub>-C<sub>7</sub>

cycloalkyl group, a monocyclic or bicyclic C<sub>6</sub>-C<sub>10</sub> aryl group, a 5- to 7- membered heteroaryl group containing one, two or three heteroatoms selected from O, S and N, a 5- to 7- membered heterocyclyl group containing one, two or three heteroatoms selected from O, S and N,

- 5            wherein the cycloalkyl, aryl, heteroaryl and heterocyclyl groups are unsubstituted or substituted by one, two or three substituents selected from a halogen atom, a cyano group, a linear or branched C<sub>1</sub>-C<sub>6</sub> alkyl group, a C<sub>1</sub>-C<sub>4</sub> haloalkyl group, a C<sub>1</sub>-C<sub>4</sub> hydroxyalkyl group, a C<sub>3</sub>-C<sub>7</sub> cycloalkyl, a phenyl group, a pyridyl group, a pyrimidinyl group, a piperidyl group, or
- 10           a -C(O)-(CH<sub>2</sub>)<sub>n</sub>-NR<sub>11</sub>R<sub>12</sub> group; wherein n is 0, 1 or 2

R<sub>7</sub> represents a hydrogen atom, a halogen atom, a cyano group, a linear or branched C<sub>1</sub>-C<sub>4</sub> alkyl group, a C<sub>1</sub>-C<sub>4</sub> haloalkyl group, a C<sub>1</sub>-C<sub>4</sub> hydroxyalkyl group, a C<sub>3</sub>-C<sub>7</sub> cycloalkyl group, a monocyclic or bicyclic C<sub>6</sub>-C<sub>10</sub> aryl group, a 5- to 7- membered heteroaryl group containing one, two or three heteroatoms selected from O, S and N, a 5- to 7- membered heterocyclyl group containing one, two or three heteroatoms selected from O, S and N,

- wherein the cycloalkyl, aryl, heteroaryl and heterocyclyl groups are unsubstituted or substituted by one, two or three substituents selected from a
- 20           halogen atom, a cyano group, a linear or branched C<sub>1</sub>-C<sub>6</sub> alkyl group, a C<sub>1</sub>-C<sub>4</sub> haloalkyl group, a C<sub>1</sub>-C<sub>4</sub> hydroxyalkyl group, a C<sub>3</sub>-C<sub>7</sub> cycloalkyl group, a phenyl group, a phenyl group substituted by a carboxyl group, a pyridyl group, a pyrimidinyl group, a piperidyl group, a -(CH<sub>2</sub>)<sub>1-3</sub>CN group, a -(CH<sub>2</sub>)<sub>n</sub>OR<sub>11</sub> group, a -NR<sub>11</sub>R<sub>12</sub> group, a -NR<sub>11</sub>C(O)-(CH<sub>2</sub>)<sub>n</sub>-R<sub>12</sub> group,
- 25           a -NR<sub>11</sub>C(O)-(CH<sub>2</sub>)<sub>n</sub>-NR<sub>12</sub>R<sub>13</sub> group, a -C(O)-(CH<sub>2</sub>)<sub>1-3</sub>-CN group, a -C(O)-(CH<sub>2</sub>)<sub>n</sub>-R<sub>11</sub> group, a -C(O)-(CH<sub>2</sub>)<sub>n</sub>-NR<sub>11</sub>R<sub>12</sub> group, a -S(O)<sub>2</sub>(CH<sub>2</sub>)<sub>n</sub>R<sub>11</sub> group, a -S(O)<sub>2</sub>(CH<sub>2</sub>)<sub>n</sub>NR<sub>11</sub>R<sub>12</sub> group, a -NR<sub>11</sub>S(O)<sub>2</sub>(CH<sub>2</sub>)<sub>n</sub>R<sub>12</sub> group or a -NR<sub>11</sub>S(O)<sub>2</sub>(CH<sub>2</sub>)<sub>n</sub>NR<sub>12</sub>R<sub>13</sub> group; wherein each n is 0, 1 or 2;

- 30           R<sub>8</sub> represents a hydrogen atom or a linear or branched C<sub>1</sub>-C<sub>6</sub> alkyl group, which alkyl group is unsubstituted or substituted by a C<sub>1</sub>-C<sub>2</sub> alkoxy group;

R<sub>9</sub> and R<sub>10</sub> each independently represent a hydrogen atom or a linear or branched C<sub>1</sub>-C<sub>3</sub> alkyl group;

- 35           R<sub>11</sub>, R<sub>12</sub> and R<sub>13</sub> each independently represent a hydrogen atom or a linear or branched C<sub>1</sub>-C<sub>3</sub> alkyl group.

In a further particular preferred embodiment, in the compound of formula (I'):

m is 0 or 1;

5

X and Y each independently are a  $-CR_6$  group;

A is a nitrogen atom and B is a  $-CR_7$  group; or B is a nitrogen atom and A is a  $-CR_7$  group; or both A and B are a  $-CR_7$  group;

10

W represents a linker selected from a  $-NR_8-$  group or a  $-(CR_9R_{10})-$  group;

$R_1$  represents a hydrogen atom, a linear or branched  $C_1-C_3$  alkyl group, a  $C_1-C_3$  haloalkyl group or a  $C_1-C_3$  hydroxyalkyl group;

15

$R_2$  represents a linear or branched  $C_1-C_6$  alkyl group, a  $C_1-C_4$  haloalkyl group, a  $C_1-C_4$  hydroxyalkyl group, a  $C_3-C_7$  cycloalkyl group, a phenyl group, a pyridyl group, a pyrimidinyl group, a triazolyl group, a thiazolyl group, a pyrrolidinyl group or a piperidyl group;

20

wherein the cycloalkyl, phenyl, pyridyl, pyrimidinyl, triazolyl, thiazolyl, pyrrolidinyl or piperidyl groups are unsubstituted or substituted by one, two or three substituents selected from a halogen atom, a cyano group, a linear or branched  $C_1-C_6$  alkyl group, a  $C_1-C_4$  haloalkyl group, a  $C_1-C_4$  hydroxyalkyl group, a  $C_3-C_7$  cycloalkyl group, a phenyl group, a phenyl group substituted by a carboxyl group, a pyridyl group, a triazolyl group, a thiazolyl group, a pyrimidinyl group, a piperidyl group, a  $-(CH_2)_nOR_{11}$  group, a  $-NR_{11}R_{12}$  group, a  $-NR_{11}C(O)-(CH_2)_n-R_{12}$  group, a  $-NR_{11}C(O)-(CH_2)_n-NR_{12}R_{13}$  group, a  $-C(O)-(CH_2)_{1-3}-CN$  group, a  $-C(O)-(CH_2)_n-R_{11}$  group, a  $-C(O)-(CH_2)_n-NR_{11}R_{12}$  group, a  $-S(O)_2(CH_2)_nR_{11}$  group, a  $-S(O)_2(CH_2)_nNR_{11}R_{12}$  group, a  $-NR_{11}S(O)_2(CH_2)_nR_{12}$  group or a  $-NR_{11}S(O)_2(CH_2)_nNR_{12}R_{13}$  group; wherein each n is 0, 1 or 2;

25

30

$R_3$  and  $R_4$  each independently represent a hydrogen atom or a linear or branched  $C_1-C_3$  alkyl group;

35

R<sub>5</sub> represents a hydrogen atom, a halogen atom, a cyano group, a linear or branched C<sub>1</sub>-C<sub>3</sub> alkyl group, a C<sub>1</sub>-C<sub>4</sub> haloalkyl group, a C<sub>1</sub>-C<sub>4</sub> hydroxyalkyl group, a C<sub>3</sub>-C<sub>7</sub> cycloalkyl group, a -(CH<sub>2</sub>)<sub>1-3</sub>CN group, a -(CH<sub>2</sub>)<sub>n</sub>OR<sub>11</sub> group, a -NR<sub>11</sub>R<sub>12</sub> group, a -NR<sub>11</sub>C(O)-(CH<sub>2</sub>)<sub>n</sub>-R<sub>12</sub> group, a -NR<sub>11</sub>C(O)-(CH<sub>2</sub>)<sub>n</sub>-NR<sub>12</sub>R<sub>13</sub> group, a -C(O)-(CH<sub>2</sub>)<sub>1-3</sub>-CN group, a -C(O)-(CH<sub>2</sub>)<sub>n</sub>-R<sub>11</sub> group, a -C(O)-(CH<sub>2</sub>)<sub>n</sub>-NR<sub>11</sub>R<sub>12</sub> group, a -S(O)<sub>2</sub>(CH<sub>2</sub>)<sub>n</sub>R<sub>11</sub> group, a -S(O)<sub>2</sub>(CH<sub>2</sub>)<sub>n</sub>NR<sub>11</sub>R<sub>12</sub> group, a -NR<sub>11</sub>S(O)<sub>2</sub>(CH<sub>2</sub>)<sub>n</sub>R<sub>12</sub> group or a -NR<sub>11</sub>S(O)<sub>2</sub>(CH<sub>2</sub>)<sub>n</sub>NR<sub>12</sub>R<sub>13</sub> group; wherein each n is 0, 1 or 2;

R<sub>6</sub> represents a hydrogen atom, a halogen atom, a cyano group, a linear or branched C<sub>1</sub>-C<sub>3</sub> alkyl group, a C<sub>1</sub>-C<sub>4</sub> haloalkyl group, a C<sub>1</sub>-C<sub>4</sub> hydroxyalkyl group, a C<sub>3</sub>-C<sub>7</sub> cycloalkyl group, a phenyl group, a pyridyl group, a pyrimidinyl group, a pyrrolidinyl group, a piperidyl group, a tetrahydropyranyl group or a morpholinyl group;

R<sub>7</sub> represents a hydrogen atom, a halogen atom, a cyano group, a linear or branched C<sub>1</sub>-C<sub>3</sub> alkyl group, a C<sub>1</sub>-C<sub>4</sub> haloalkyl group, a C<sub>1</sub>-C<sub>4</sub> hydroxyalkyl group, a C<sub>3</sub>-C<sub>7</sub> cycloalkyl group, a phenyl group, a pyridyl group, a pyrimidinyl group, a triazolyl group, a thiazolyl group, a pyrrolidinyl group, a piperidyl group, a tetrahydropyranyl group or a morpholinyl group;

wherein the cycloalkyl, phenyl, pyridyl, pyrimidinyl, triazolyl, thiazolyl, pyrrolidinyl, piperidyl, tetrahydropyranyl or morpholinyl groups are unsubstituted or substituted by one, two or three substituents selected from a halogen atom, a linear or branched C<sub>1</sub>-C<sub>6</sub> alkyl group, a C<sub>1</sub>-C<sub>4</sub> haloalkyl group, a C<sub>1</sub>-C<sub>4</sub> hydroxyalkyl group, a C<sub>3</sub>-C<sub>7</sub> cycloalkyl group, a phenyl group, a phenyl group substituted by a carboxyl group, a pyridyl group, a triazolyl group, a thiazolyl group, a pyrimidinyl group, a piperidyl group, a -(CH<sub>2</sub>)<sub>n</sub>OR<sub>11</sub> group, a -NR<sub>11</sub>R<sub>12</sub> group, a -NR<sub>11</sub>C(O)-(CH<sub>2</sub>)<sub>n</sub>-R<sub>12</sub> group, a -NR<sub>11</sub>C(O)-(CH<sub>2</sub>)<sub>n</sub>-NR<sub>12</sub>R<sub>13</sub> group, a -C(O)-(CH<sub>2</sub>)<sub>1-3</sub>-CN group, a -C(O)-(CH<sub>2</sub>)<sub>n</sub>-R<sub>12</sub> group, a -C(O)-(CH<sub>2</sub>)<sub>n</sub>-NR<sub>11</sub>R<sub>12</sub> group, a -S(O)<sub>2</sub>(CH<sub>2</sub>)<sub>n</sub>R<sub>12</sub> group, a -S(O)<sub>2</sub>(CH<sub>2</sub>)<sub>n</sub>NR<sub>11</sub>R<sub>12</sub> group, a -NR<sub>11</sub>S(O)<sub>2</sub>(CH<sub>2</sub>)<sub>n</sub>R<sub>12</sub> group or a -NR<sub>11</sub>S(O)<sub>2</sub>(CH<sub>2</sub>)<sub>n</sub>NR<sub>12</sub>R<sub>13</sub> group; wherein each n is 0, 1 or 2;

R<sub>8</sub> represents a hydrogen atom or a linear or branched C<sub>1</sub>-C<sub>3</sub> alkyl group;

R<sub>9</sub> and R<sub>10</sub> each independently represent a hydrogen atom or a linear or branched C<sub>1</sub>-C<sub>3</sub> alkyl group;

$R_{11}$ ,  $R_{12}$  and  $R_{13}$  each independently represent a hydrogen atom or a linear or branched  $C_1$ - $C_3$  alkyl group.

In a further particular preferred embodiment, in the compound of formula (I'):

5

$m$  is 0 or 1;

both  $X$  and  $Y$  represents a  $-CR_6$  group;

10  $A$  is a nitrogen atom and  $B$  is a  $-CR_7$  group; or  $B$  is a nitrogen atom and  $A$  is a  $-CR_7$  group; or both  $A$  and  $B$  are a  $-CR_7$  group;

$W$  represents a linker selected from a  $-NR_8-$  group or a  $-(CR_9R_{10})-$  group;

15  $R_1$  represents a hydrogen atom, a  $C_1$ - $C_3$  haloalkyl group, a  $C_1$ - $C_3$  hydroxyalkyl group or a linear or branched  $C_1$ - $C_3$  alkyl group;

$R_2$  represents a  $C_3$ - $C_7$  cycloalkyl group, a phenyl group, a pyridyl group, a pyrimidinyl group, a piperidinyl group or a morpholinyl group,

20 wherein the cycloalkyl, phenyl, pyridyl, pyrimidinyl, piperidinyl or morpholinyl group are unsubstituted or substituted by one, two or three substituents selected from a halogen atom, a linear or branched  $C_1$ - $C_3$  alkyl group, a  $C_1$ - $C_3$  haloalkyl group, a triazolyl group, a  $-(CH_2)_{1-3}CN$  group, a  $-(CH_2)_{0-2}OR_{11}$  group or a  $-C(O)-(CH_2)_{1-3}-CN$  group;

25

$R_3$  and  $R_4$  each independently represent a hydrogen atom or a methyl group;

$R_5$  represents a hydrogen atom, a halogen atom, a linear or branched  $C_1$ - $C_3$  alkyl group, a  $C_1$ - $C_3$  haloalkyl group, a  $C_3$ - $C_7$  cycloalkyl group or a  $-C(O)-(CH_2)_n-NR_{11}R_{12}$  group; wherein  $n$  is 0 or 1;

30

$R_6$  represents a hydrogen atom, a halogen atom, a linear or branched  $C_1$ - $C_3$  alkyl group, a  $C_1$ - $C_3$  haloalkyl group, a  $C_3$ - $C_7$  cycloalkyl group, a phenyl group, a pyridyl group, a pyrimidinyl group, a piperidinyl group or a morpholinyl group,

35 wherein the cycloalkyl, phenyl, pyridyl, pyrimidinyl, piperidinyl or morpholinyl group are unsubstituted or substituted by one, two or three substituents



selected from a halogen atom, a linear or branched C<sub>1</sub>-C<sub>3</sub> alkyl group, a C<sub>1</sub>-C<sub>3</sub> haloalkyl group, a triazolyl group, a -(CH<sub>2</sub>)<sub>1-3</sub>CN group or a -(CH<sub>2</sub>)<sub>0-2</sub>OR<sub>11</sub> group;

R<sub>7</sub> represents a hydrogen atom, a halogen atom, a linear or branched C<sub>1</sub>-C<sub>3</sub> alkyl group, a C<sub>1</sub>-C<sub>3</sub> haloalkyl group, a C<sub>3</sub>-C<sub>7</sub> cycloalkyl group, a phenyl group, a pyridyl group, a pyrimidinyl group, a piperidinyl group or a morpholinyl group,

wherein the cycloalkyl, phenyl, pyridyl, pyrimidinyl, piperidinyl or morpholinyl group are unsubstituted or substituted by one, two or three substituents

selected from a halogen atom, a hydroxy group, a linear or branched C<sub>1</sub>-C<sub>3</sub> alkyl group, a C<sub>1</sub>-C<sub>3</sub> haloalkyl group, a phenyl group, a phenyl group substituted by a carboxyl group, a triazolyl group, a -(CH<sub>2</sub>)<sub>1-3</sub>CN group or a -(CH<sub>2</sub>)<sub>0-2</sub>OR<sub>11</sub> group;

R<sub>8</sub>, R<sub>9</sub> and R<sub>10</sub> each independently represent a hydrogen atom or a methyl group;

R<sub>11</sub> and R<sub>12</sub> each independently represent a hydrogen atom or a methyl group.

In yet a further particular preferred embodiment, in the compound of formula (I'):

m is 0 or 1;

both X and Y represents a -CR<sub>6</sub> group;

A is a nitrogen atom and B is a -CR<sub>7</sub> group; or B is a nitrogen atom and A is a -CR<sub>7</sub> group; or both A and B are a -CR<sub>7</sub> group;

W represents a -NH- group or a -CH<sub>2</sub>- group;

R<sub>1</sub> represents a hydrogen atom;

R<sub>2</sub> represents a cyclohexyl group, a pyridyl group or a piperidyl group,

wherein the cyclohexyl, pyridyl and piperidyl groups are unsubstituted or substituted by one, two or three substituents selected from a halogen atom, a triazolyl group, a -(CH<sub>2</sub>)<sub>1-3</sub>CN group or -C(O)-(CH<sub>2</sub>)<sub>1-3</sub>-CN group;

R<sub>3</sub> and R<sub>4</sub> each independently represent a hydrogen atom or a methyl group;

R<sub>5</sub> represents a hydrogen atom, a halogen atom, a linear or branched C<sub>1</sub>-C<sub>3</sub> alkyl group or a -C(O)-(CH<sub>2</sub>)<sub>n</sub>-NR<sub>11</sub>R<sub>12</sub> group; wherein n is 0 or 1; and wherein R<sub>11</sub> and R<sub>12</sub> independently represent a hydrogen atom or a linear or branched C<sub>1</sub>-C<sub>3</sub> alkyl group;

5 R<sub>6</sub> represents a hydrogen atom or a halogen atom;

R<sub>7</sub> represents a hydrogen atom, piperidyl group, a thiazolyl group or a morpholinyl group;

10 wherein the piperidyl, thiazolyl and morpholinyl groups are unsubstituted or substituted by one or two substituents selected from a hydroxy group or a benzoic acid.

Particular individual compounds of the invention include:

- (S)-3-(4-(1-(5-fluoropyridin-2-yl)ethylamino)pyrimidin-2-ylamino)pyridin-2(1H)-one;
- 15 (S)-3-(4-(1-(5-fluoropyridin-2-yl)ethylamino)-5-methylpyrimidin-2-ylamino)pyridin-2(1H)-one;
- (S)-3-(5-chloro-4-(1-(5-fluoropyridin-2-yl)ethylamino)pyrimidin-2-ylamino)pyridin-2(1H)-one;
- (S)-3-(4-(1-(5-fluoropyridin-2-yl)ethylamino)-5-methoxypyrimidin-2-ylamino)pyridin-
- 20 2(1H)-one;
- (S)-3-(4-(1-(5-fluoropyridin-2-yl)ethylamino)-5-hydroxypyrimidin-2-ylamino)pyridin-2(1H)-one;
- (S)-4-(1-(5-fluoropyridin-2-yl)ethylamino)-2-(2-oxo-1,2-dihydropyridin-3-ylamino)pyrimidine-5-carboxamide;
- 25 (S)-5-chloro-3-(4-(1-(5-fluoropyridin-2-yl)ethylamino)-5-methylpyrimidin-2-ylamino)pyridin-2(1H)-one;
- (S)-3-(4-(1-(5-fluoropyridin-2-yl)ethylamino)-5-methylpyrimidin-2-ylamino)-5-(1H-pyrazol-4-yl)pyridin-2(1H)-one;
- (S)-3-(4-(1-(5-fluoropyridin-2-yl)ethylamino)-6-(4-hydroxypiperidin-1-yl)pyrimidin-2-
- 30 ylamino)pyridin-2(1H)-one;
- (S)-3-(5-fluoro-4-(1-(5-fluoropyridin-2-yl)ethylamino)-6-morpholinopyrimidin-2-ylamino)pyridin-2(1H)-one;
- (S)-3-(6-(1-(5-fluoropyridin-2-yl)ethylamino)pyrazin-2-ylamino)pyridin-2(1H)-one;
- (S)-3-(6-(1-(5-fluoropyridin-2-yl)ethylamino)pyridin-2-ylamino)pyridin-2(1H)-one;
- 35 2-((1r,4r)-4-(5-methyl-2-(2-oxo-1,2-dihydropyridin-3-ylamino)pyrimidin-4-ylamino)cyclohexyl)acetonitrile;

3-(4-((1r,4r)-4-((3-hydroxypiperidin-1-ylsulfonyl)methyl)cyclohexylamino)pyrimidin-2-ylamino)pyridin-2(1H)-one;

(R)-3-oxo-3-(3-(2-(2-oxo-1,2-dihydropyridin-3-ylamino)pyrimidin-4-ylamino)piperidin-1-yl)propanenitrile;

5 (R)-3-(3-(5-methyl-2-(2-oxo-1,2-dihydropyridin-3-ylamino)pyrimidin-4-ylamino)piperidin-1-yl)-3-oxopropanenitrile;

(R)-3-(3-(5-fluoro-2-(2-oxo-1,2-dihydropyridin-3-ylamino)pyrimidin-4-ylamino)piperidin-1-yl)-3-oxopropanenitrile;

(R)-3-(4-(1-(4H-1,2,4-triazol-3-yl)piperidin-3-ylamino)-5-fluoropyrimidin-2-

10 ylamino)pyridin-2(1H)-one;

(R)-3-(3-(2-(5-chloro-2-oxo-1,2-dihydropyridin-3-ylamino)-5-methylpyrimidin-4-ylamino)piperidin-1-yl)-3-oxopropanenitrile;

(R)-3-(3-(5-fluoro-6-morpholino-2-(2-oxo-1,2-dihydropyridin-3-ylamino)pyrimidin-4-ylamino)piperidin-1-yl)-3-oxopropanenitrile;

15 (R)-3-(3-(5-methyl-6-morpholino-2-(2-oxo-1,2-dihydropyridin-3-ylamino)pyrimidin-4-ylamino)piperidin-1-yl)-3-oxopropanenitrile;

(R)-3-(3-(5-methyl-4-morpholino-6-(2-oxo-1,2-dihydropyridin-3-ylamino)pyrimidin-2-ylamino)piperidin-1-yl)-3-oxopropanenitrile;

(R)-3-(3-(4-(5-chloro-2-oxo-1,2-dihydropyridin-3-ylamino)-5-methyl-6-

20 morpholinopyrimidin-2-ylamino)piperidin-1-yl)-3-oxopropanenitrile;

(R)-3-(3-(5-chloro-2-(2-oxo-1,2-dihydropyridin-3-ylamino)pyrimidin-4-ylamino)piperidin-1-yl)-3-oxopropanenitrile;

3-[(4-[(1S)-1-(5-Fluoropyridin-2-yl)ethyl]amino)pyrimidin-2-yl)methyl]pyridin-2(1H)-one;

(S)-3-(5-(6-(1-(5-fluoropyridin-2-yl)ethylamino)-2-(2-oxo-1,2-dihydropyridin-3-

25 ylamino)pyrimidin-4-yl)thiazol-2-yl)benzoic acid;

or a pharmaceutically acceptable salt, or solvate, or N-oxide, or stereoisomer or deuterated derivative thereof.

30

In an embodiment, particular individual compounds of the invention include:

(S)-3-(4-(1-(5-fluoropyridin-2-yl)ethylamino)pyrimidin-2-ylamino)pyridin-2(1H)-one;

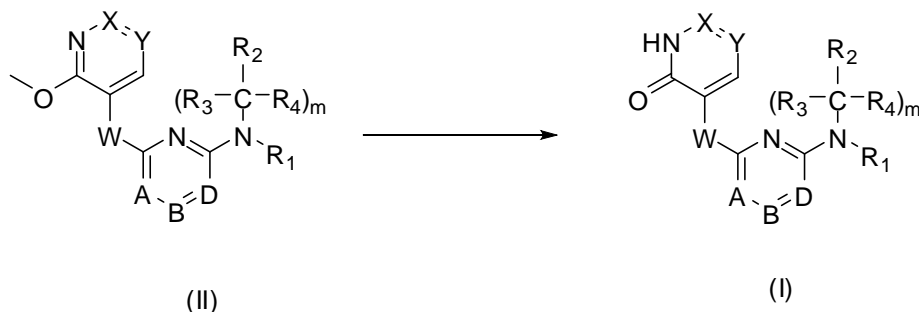
(S)-3-(4-(1-(5-fluoropyridin-2-yl)ethylamino)-5-methylpyrimidin-2-ylamino)pyridin-2(1H)-one;

35 (S)-5-chloro-3-(4-(1-(5-fluoropyridin-2-yl)ethylamino)-5-methylpyrimidin-2-ylamino)pyridin-2(1H)-one;

- (S)-4-(1-(5-fluoropyridin-2-yl)ethylamino)-2-(2-oxo-1,2-dihydropyridin-3-ylamino)pyrimidine-5-carboxamide;
- (R)-3-oxo-3-(3-(2-(2-oxo-1,2-dihydropyridin-3-ylamino)pyrimidin-4-ylamino)piperidin-1-yl)propanenitrile;
- 5 (R)-3-(3-(5-methyl-2-(2-oxo-1,2-dihydropyridin-3-ylamino)pyrimidin-4-ylamino)piperidin-1-yl)-3-oxopropanenitrile;
- (R)-3-(3-(5-fluoro-2-(2-oxo-1,2-dihydropyridin-3-ylamino)pyrimidin-4-ylamino)piperidin-1-yl)-3-oxopropanenitrile;
- (R)-3-(4-(1-(4H-1,2,4-triazol-3-yl)piperidin-3-ylamino)-5-fluoropyrimidin-2-ylamino)pyridin-2(1H)-one;
- 10 (R)-3-(3-(2-(5-chloro-2-oxo-1,2-dihydropyridin-3-ylamino)-5-methylpyrimidin-4-ylamino)piperidin-1-yl)-3-oxopropanenitrile;
- (S)-3-(6-(1-(5-fluoropyridin-2-yl)ethylamino)pyrazin-2-ylamino)pyridin-2(1H)-one;
- 2-((1r,4r)-4-(5-methyl-2-(2-oxo-1,2-dihydropyridin-3-ylamino)pyrimidin-4-ylamino)cyclohexyl)acetonitrile;
- 15 (S)-3-(4-(1-(5-fluoropyridin-2-yl)ethylamino)-6-(4-hydroxypiperidin-1-yl)pyrimidin-2-ylamino)pyridin-2(1H)-one;
- 3-[(5-Chloro-4-{[(1S)-1-(5-fluoropyridin-2-yl)ethyl]amino}pyrimidin-2-yl)amino]pyridin-2(1H)-one;
- 20 (S)-3-((4-(1-(5-fluoropyridin-2-yl)ethylamino)pyrimidin-2-yl)methyl)pyridin-2(1H)-one;
- (S)-3-((5-fluoro-4-(1-(5-fluoropyridin-2-yl)ethylamino)-6-morpholinopyrimidin-2-yl)methyl)pyridin-2(1H)-one;
- 3-[(6-{[(1S)-1-(5-Fluoropyridin-2-yl)ethyl]amino}pyridin-2-yl)amino]pyridin-2(1H)-one;
- (S)-3-(5-(6-(1-(5-fluoropyridin-2-yl)ethylamino)-2-(2-oxo-1,2-dihydropyridin-3-ylamino)pyrimidin-4-yl)thiazol-2-yl)benzoic acid;
- 25

or a pharmaceutically acceptable salt, or solvate, or N-oxide, or stereoisomer or deuterated derivative thereof.

Compounds of general formula (I) may be prepared from compounds of formula (II) as illustrated in Scheme 1.



Scheme 1

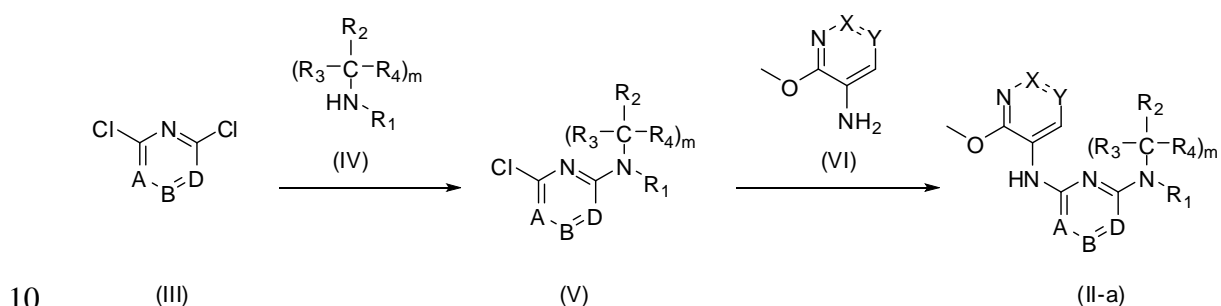
When the defined R groups are susceptible to chemical reaction under the conditions of the hereinbefore described processes or are incompatible with said processes, conventional protecting groups may be used in accordance with standard practice, for example see T. W. Greene and P. G. M. Wuts in 'Protective Groups in Organic Synthesis', 3rd Edition, John Wiley & Sons (1999). It may be that deprotection will form the last step in the synthesis of compounds of formula (I).

The term amino-protecting group refers to a protecting group suitable for preventing undesired reactions at amino nitrogen. Representative amino-protecting groups include, but are not limited to, formyl; acyl groups, for example alkanoyl groups such as acetyl; alkoxycarbonyl groups such as tert-butoxycarbonyl (Boc); arylmethoxycarbonyl groups such as benzyloxycarbonyl (Cbz) and 9-fluorenylmethoxycarbonyl (Fmoc); arylmethyl groups such as benzyl (Bn), trityl (Tr), and 1,1-di-(4'-methoxyphenyl)methyl; silyl groups, such as trimethylsilyl (TMS), tert-butyldimethylsilyl (TBS); trimethylsiloxyethoxymethyl (SEM) and the like.

The term hydroxy-protecting group refers to a protecting group suitable for preventing undesired reactions at a hydroxy group. Representative hydroxy-protecting groups include, but are not limited to, alkyl groups, such as methyl, ethyl, and tert-butyl; acyl groups, for example alkanoyl groups, such as acetyl; arylmethyl groups, such as benzyl (Bn), p-methoxybenzyl (PMB), 9-fluorenylmethyl (Fm), and diphenylmethyl (benzhydryl, DPM); Tetrahydropyranyl ethers (THP ethers) such as methoxy-THP or ethoxy-THP; silyl groups, such as trimethylsilyl (TMS), tert-butyldimethylsilyl (TBS); trimethylsiloxyethoxymethyl (SEM) and the like.

Treatment of compounds of formula (II) with a suitable reagent, such as a mixture of trimethylsilyl chloride and sodium iodide in a solvent such as acetonitrile at temperatures ranging from ambient temperature to reflux or with an aqueous solution  
 5 of hydrogen bromide at 100 °C gives rise to compounds of formula (I).

In the particular case of formula (II) where W = NH, compounds of subformula (II-a) may be prepared by the synthetic approach as shown in Scheme 2:



Scheme 2

Compounds of formula (III) may be reacted with amines of formula (IV), in the presence of a base, such as *N,N*-diisopropylethylamine or triethylamine, in a solvent such as tetrahydrofuran, acetonitrile, ethanol, *n*-butanol, 1-methylpyrrolidin-2-one or *N,N'*-dimethylformamide at temperatures ranging from ambient temperature to 180 °C to furnish compounds of formula (V).

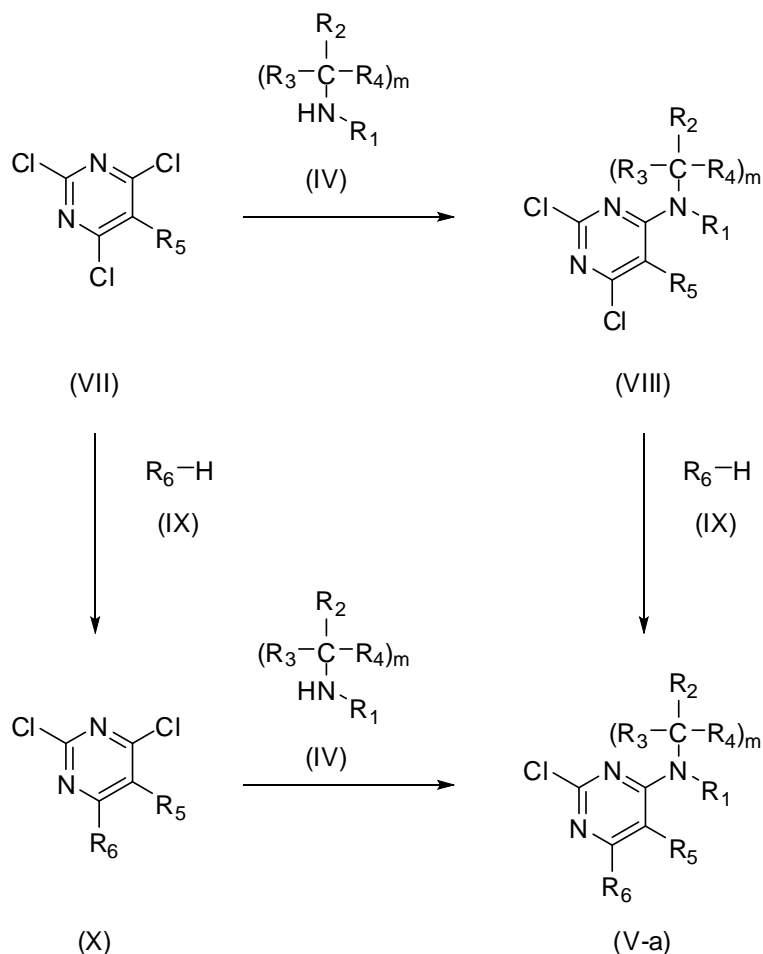
15

Treatment of compounds of formula (V) with amines of formula (VI) in the presence of a suitable catalyst, such as the catalytic species generated from tris (dibenzylideneacetone)dipalladium(0) and 9,9-dimethyl-4,5-bis(diphenylphosphino) xanthene, and a base such as cesium carbonate in a solvent such as 1,4-dioxane at temperatures ranging from 80–120 °C gives rise to compounds of formula (II-a).

20

In the particular case of formula (V) where A = N and B represents a –CR<sub>7</sub> group (R<sub>7</sub> is as defined in the claims section) and D represents a –CR<sub>5</sub> group, compounds of subformula (V-a) may be prepared by the synthetic approach as shown in Scheme 3:

25



Scheme 3

5 Pyrimidines of formula (VII) may be reacted with amines of formula (IV), in the presence of a base, such as *N,N*-diisopropylethylamine in a solvent such as ethanol at temperatures ranging from ambient temperature to reflux to furnish compounds of formula (VIII).

10 Compounds of formula (VIII) when treated with an appropriate nucleophile of formula (IX), such as 4-(*tert*-butyl-dimethylsilanyloxy)piperidine, in the presence of a base, such as cesium carbonate, in a solvent such as *N,N'*-dimethylformamide at temperatures ranging from ambient temperature to 130 °C gives rise to compounds of formula (V-a).

15 In another synthetic pathway, reaction of pyrimidines of formula (VII) with an appropriate nucleophile of formula (IX), such as morpholine, in a solvent such as ethanol at temperatures ranging from -78 °C to ambient temperature gives rise to compounds of formula (X).

Compounds of formula (X) may be converted to compounds of formula (V-a) by treatment with amines of formula (IV) in the presence of a base, such as *N,N'*-

diisopropylethylamine, in a solvent such ethanol or n-butanol, at temperatures ranging from ambient temperature to 130 °C.

- Compounds of formula (I), (II) or (V) in which the residue  $-(R_3-C-R_4)_m-R_2$ ,  $R_5$  or  $R_7$  (in the particular case where  $B = CR_7$  and  $D = CR_5$ ) contains a “protected” heteroatom, such as nitrogen or oxygen, may be “deprotected” by removal of the protecting group to give compounds of formula (I), (II) or (V) in which the residue  $-(R_3-C-R_4)_m-R_2$ ,  $R_5$  or  $R_7$  contains the “deprotected” heteroatom. Typical examples of protecting groups for heteroatoms, such as nitrogen and oxygen, and their removal (deprotection) may be found in several textbooks, for example: *Greene's Protective Groups in Organic Synthesis*, ISBN: 0471697540. Furthermore said “deprotected” heteroatoms may be further functionalized by, for example, alkylation, amidation, sulfonamidation or arylation under standard reaction conditions.
- Compounds of formula (I), (II) or (V) in which the residue  $-(R_3-C-R_4)_m-R_2$ ,  $R_5$  or  $R_7$  (in the particular case where  $B = CR_7$  and  $D = CR_5$ ) contains a carboxylic acid moiety functionalized with an appropriate protecting group such as an ethyl ester, may be deprotected at the carboxylic acid moiety under standard conditions (*Greene's Protective Groups in Organic Synthesis*, ISBN: 0471697540). The corresponding carboxylic acid may then be further functionalized under standard conditions to give the corresponding amides.

Starting compounds are commercially available or may be obtained following the conventional synthetic methods already known in the art.

## EXAMPLES

- The synthesis of the compounds of the invention and of the intermediates for use therein are illustrated by the following Examples (1-26) (including Preparation Examples (Preparations 1-28)) and are given in order to provide a person skilled in the art with a sufficiently clear and complete explanation of the present invention, but should not be considered as limiting of the essential aspects of its subject, as set out in the preceding portions of this description.



## Preparations

### PREPARATION 1

#### (S)-*N*<sup>4</sup>-(1-(5-Fluoropyridin-2-yl)ethyl)-*N*<sup>2</sup>-(2-methoxypyridin-3-yl)pyrimidine-2,4-diamine

##### a) (S)-2-Chloro-*N*-(1-(5-fluoropyridin-2-yl)ethyl)pyrimidin-4-amine

A solution of (S)-1-(5-fluoropyridin-2-yl)ethanamine (prepared as described in WO2006/123113, 235 mg, 1.68 mmol) in tetrahydrofuran (2 mL) was added to a stirred solution of 2,4-dichloropyrimidine (250 mg, 1.68 mmol) in tetrahydrofuran (2 mL) at ambient temperature. A solution of triethylamine (0.23 mL, 1.68 mmol) in tetrahydrofuran (2 mL) was then added dropwise and the reaction mixture was heated overnight at 55 °C. After cooling to ambient temperature, the reaction mixture was diluted with water and extracted twice with ethyl acetate. The combined organic layers were washed with water and brine, dried over magnesium sulfate, filtered and the solvents were evaporated under reduced pressure. The residue was purified by reverse phase chromatography (C-18 silica from Waters<sup>®</sup>, water/acetonitrile/methanol as eluents [0.1% v/v formic acid buffered] 0% to 100%) to give the title compound (43 mg, 10%) as an oil.

LRMS (m/z): 253 (M+1)<sup>+</sup>.

<sup>1</sup>H-NMR δ (CDCl<sub>3</sub>): 1.54 (d, 3H), 5.16 (br s, 1H), 6.16-6.35 (m, 2H), 7.29 (dd, 1H), 7.39 (t, 1H), 7.97 (d, 1H), 8.40 (d, 1H).

##### b) (S)-*N*<sup>4</sup>-(1-(5-Fluoropyridin-2-yl)ethyl)-*N*<sup>2</sup>-(2-methoxypyridin-3-yl)pyrimidine-2,4-diamine

An oven-dried resealable Schlenk tube was charged with (S)-2-chloro-*N*-(1-(5-fluoropyridin-2-yl)ethyl)pyrimidin-4-amine (Preparation 1a, 43 mg, 0.17 mmol), 2-methoxypyridin-3-amine (23 mg, 0.19 mmol), cesium carbonate (111 mg, 0.34 mmol) and 1,4-dioxane (3 mL). The Schlenk tube was subjected to three cycles of evacuation-backfilling with argon then tris(dibenzylideneacetone)dipalladium(0) (16 mg, 0.02 mmol) and 9,9-dimethyl-4,5-bis(diphenylphosphino)xanthene (10 mg, 0.02 mmol) were added. After three further cycles of evacuation-backfilling with argon, the Schlenk tube was capped and then stirred and heated to 100 °C. After 24 hours the mixture was cooled to ambient temperature and the solvent was evaporated under reduced pressure. Ethyl acetate was added and the organic solution was washed with water (x3) and brine, dried (MgSO<sub>4</sub>) and the solvent was evaporated under reduced pressure.

The residue was purified by reverse phase chromatography (C-18 silica from Waters<sup>®</sup>, water/acetonitrile/methanol as eluents [0.1% v/v formic acid buffered] 0% to 100%) to give the title compound (11 mg, 19%) as a solid.

LRMS (m/z): 341 (M+1)<sup>+</sup>.

5

## PREPARATION 2

### **(S)-N<sup>4</sup>-(1-(5-Fluoropyridin-2-yl)ethyl)-N<sup>2</sup>-(2-methoxypyridin-3-yl)-5-methylpyrimidine-2,4-diamine**

#### 10 **a) (S)-2-Chloro-N-(1-(5-fluoropyridin-2-yl)ethyl)-5-methylpyrimidin-4-amine**

A mixture of (S)-1-(5-fluoropyridin-2-yl)ethanamine dihydrochloride (prepared as described in WO2006/123113, 560 mg, 2.63 mmol), 2,4-dichloro-5-methylpyrimidine (620 mg, 2.63 mmol) and diisopropylethylamine (1.4 mL, 7.9 mmol) in n-butanol (1 mL) was stirred and heated for 45 min at 110 °C in a microwave oven. The reaction mixture was cooled to ambient temperature and diluted with ethyl acetate. The organic solution was washed with water and brine, dried (MgSO<sub>4</sub>), filtered and the solvent evaporated under reduced pressure. The residue was purified by flash chromatography (2:1 hexanes/ethyl acetate) to give the title compound (427 mg, 61%) as a yellow oil.

LRMS (m/z): 267 (M+1)<sup>+</sup>.

20 <sup>1</sup>H-NMR δ (CDCl<sub>3</sub>): 1.56 (d, 3H), 1.65 (s, 3H), 5.43 (t, 1H), 6.37 (br s, 1H), 7.28-7.37 (m, 1H), 7.38-7.50 (m, 1H), 7.83 (s, 1H), 8.43 (d, 1H).

#### **b) (S)-N<sup>4</sup>-(1-(5-Fluoropyridin-2-yl)ethyl)-N<sup>2</sup>-(2-methoxypyridin-3-yl)-5-methylpyrimidine-2,4-diamine**

25 Obtained as a yellow oil (69%) from (S)-2-chloro-N-(1-(5-fluoropyridin-2-yl)ethyl)-5-methylpyrimidin-4-amine (Preparation 2a) and 2-methoxypyridin-3-amine following the experimental procedure as described in Preparation 1b.

LRMS (m/z): 355 (M+1)<sup>+</sup>.

30 <sup>1</sup>H-NMR δ (CDCl<sub>3</sub>): 1.60 (d, 3H), 1.65 (s, 3H), 4.02 (s, 3H), 5.40 (q, 1H), 5.77 (d, 1H), 6.86 (dd, 1H), 7.35 (ddd, 2H), 7.70 (dd, 1H), 7.77 (s, 1H), 8.45 (d, 1H), 8.59 (dd, 1H).

## PREPARATION 3

### **(S)-5-Chloro-N<sup>4</sup>-(1-(5-fluoropyridin-2-yl)ethyl)-N<sup>2</sup>-(2-methoxypyridin-3-yl)pyrimidine-2,4-diamine**

35

**a) (S)-2,5-Dichloro-N-(1-(5-fluoropyridin-2-yl)ethyl)pyrimidin-4-amine**

Obtained as a colourless oil (57%) from 2,4,5-trichloropyrimidine and (S)-1-(5-fluoropyridin-2-yl)ethanamine dihydrochloride (prepared as described in WO2006/123113) following the experimental procedure as described in Preparation 2a followed by purification of the crude product by flash chromatography (0-100% ethyl acetate in hexanes).

LRMS (m/z): 287 (M+1)<sup>+</sup>.

<sup>1</sup>H-NMR  $\delta$  (CDCl<sub>3</sub>): 1.55 (d, 3H), 5.33-5.42 (m, 1H), 7.06 (br s, 1H), 7.31 (dd, 1H), 7.40-7.46 (m, 1H), 8.03 (s, 1H), 8.44 (d, 1H).

**b) (S)-5-Chloro-N4-(1-(5-fluoropyridin-2-yl)ethyl)-N2-(2-methoxypyridin-3-yl)pyrimidine-2,4-diamine**

Obtained as a colourless oil (50%) from (S)-2,5-dichloro-N-(1-(5-fluoropyridin-2-yl)ethyl)pyrimidin-4-amine (Preparation 3a) and 2-methoxypyridin-3-amine following the experimental procedure as described in Preparation 1b followed by purification of the crude product by flash chromatography (0-100% ethyl acetate in hexanes).

LRMS (m/z): 375 (M+1)<sup>+</sup>.

<sup>1</sup>H-NMR  $\delta$  (CDCl<sub>3</sub>): 1.61 (d, 3H), 4.02 (s, 3H), 5.30-5.39 (m, 1H), 6.42 (br s, 1H), 6.86 (dd, 1H), 7.28-7.42 (m, 3H), 7.74 (dd, 1H), 7.95 (s, 1H), 8.41-8.56 (m, 1H).

**PREPARATION 4****(S)-N4-(1-(5-Fluoropyridin-2-yl)ethyl)-5-methoxy-N2-(2-methoxypyridin-3-yl)pyrimidine-2,4-diamine****a) (S)-2-Chloro-N-(1-(5-fluoropyridin-2-yl)ethyl)-5-methoxypyrimidin-4-amine**

Obtained as a white solid (91%) from 2,4-dichloro-5-methoxypyrimidine and (S)-1-(5-fluoropyridin-2-yl)ethanamine dihydrochloride (prepared as described in WO2006/123113) following the experimental procedure as described in Preparation 2a followed by purification of the crude product by flash chromatography (0-100% ethyl acetate in hexanes).

LRMS (m/z): 283 (M+1)<sup>+</sup>.

<sup>1</sup>H-NMR  $\delta$  (CDCl<sub>3</sub>): 1.57 (d, 3H), 3.84 (s, 3H), 5.31-5.43 (m, 1H), 6.84 (d, 1H), 7.32-7.47 (m, 2H), 7.52 (s, 1H), 8.43 (d, 1H).

**b) (S)-N4-(1-(5-Fluoropyridin-2-yl)ethyl)-5-methoxy-N2-(2-methoxypyridin-3-yl)pyrimidine-2,4-diamine**

Obtained as a yellow solid (79%) from (S)-2-chloro-*N*-(1-(5-fluoropyridin-2-yl)ethyl)-5-methoxypyrimidin-4-amine (Preparation 4a) and 2-methoxypyridin-3-amine following the experimental procedure as described in Preparation 1b followed by purification of the crude product by flash chromatography (0-100% ethyl acetate in hexanes).

5 LRMS (m/z): 371 (M+1)<sup>+</sup>.

<sup>1</sup>H-NMR  $\delta$  (CDCl<sub>3</sub>): 1.59 (d, 3H), 3.85 (s, 3H), 4.01 (s, 3H), 5.25-5.42 (m, 1H), 6.20 (d, 1H), 6.83 (dd, 1H), 7.20 (s, 1H), 7.26-7.34 (m, 1H), 7.54 (s, 1H), 7.67 (dd, 1H), 8.45 (d, 1H), 8.53 (dd, 1H).

## 10 PREPARATION 5

### **(S)-4-(1-(5-Fluoropyridin-2-yl)ethylamino)-2-(2-methoxypyridin-3-ylamino)pyrimidine-5-carboxamide**

#### **a) (S)-Ethyl 2-chloro-4-(1-(5-fluoropyridin-2-yl)ethylamino)pyrimidine-5-carboxylate**

15

A solution of ethyl 2,4-dichloropyrimidine-5-carboxylate (prepared as described in WO2009/131687, 0.29 g, 1.31 mmol), (S)-1-(5-fluoropyridin-2-yl)ethanamine hydrochloride (prepared as described in WO2006/123113, 0.28 g, 1.59 mmol) and diisopropylethylamine (0.69 mL, 3.96 mmol) in acetonitrile (3 mL) was stirred overnight at ambient temperature. Water was then added and the reaction mixture was extracted with diethyl ether. The organic phase was washed with water and brine, dried (MgSO<sub>4</sub>), filtered and the solvents evaporated under reduced pressure to yield the title compound (0.49 g, 85%) as an oil.

20

LRMS (m/z): 325 (M+1)<sup>+</sup>.

25

<sup>1</sup>H-NMR  $\delta$  (CDCl<sub>3</sub>): 1.41 (t, 3H), 1.58 (d, 3H), 4.39 (q, 2H), 5.42-5.55 (m, 1H), 7.31 (dd, 1H), 7.39 (dd, 1H), 8.49 (d, 1H), 8.69 (s, 1H), 9.37 (d, 1H).

#### **b) (S)-2-Chloro-4-(1-(5-fluoropyridin-2-yl)ethylamino)pyrimidine-5-carboxylic acid**

30

A solution of lithium hydroxide monohydrate (633 mg, 15.09 mmol) in water (6 mL) was added to a solution of (S)-ethyl 2-chloro-4-(1-(5-fluoropyridin-2-yl)ethylamino)pyrimidine-5-carboxylate (Preparation 5a, 490 mg, 1.51 mmol) in a mixture of methanol (6 mL) and tetrahydrofuran (2 mL) and the reaction mixture was stirred at ambient temperature for 3 hours. The solvents were evaporated under reduced pressure and water was added to the resulting residue. The pH was then adjusted to ca. 6 with 2M aqueous hydrochloric acid and the aqueous suspension was extracted with diethyl ether (x3). The organic phase was washed with water and brine, dried (MgSO<sub>4</sub>), filtered and the

35

solvent evaporated under reduced pressure to give the title compound (0.21 g, 41%) as a semi-solid.

LRMS (m/z): 297 (M+1)<sup>+</sup>.

5 **c) (S)-2-(1*H*-Benzo[d][1,2,3]triazol-1-yloxy)-4-(1-(5-fluoropyridin-2-yl)ethylamino)pyrimidine-5-carboxamide**

*N*-(3-Dimethylaminopropyl)-*N'*-ethyl carbodiimide hydrochloride (177 mg, 0.92 mmol) and 1-hydroxybenzotriazole (125 mg, 0.93 mmol) were added to a solution of (S)-2-chloro-4-(1-(5-fluoropyridin-2-yl)ethylamino)pyrimidine-5-carboxylic acid (Preparation 10 5b, 210 mg, 0.62 mmol) in *N,N'*-dimethylformamide (5 mL) and the mixture was stirred for 30 min at ambient temperature. 0.5M Ammonia solution in 1,4-dioxane (3 mL) was then added and the reaction mixture was stirred overnight at ambient temperature. The solvents were evaporated and the resulting residue was taken up in diethyl ether. The organic solution was washed with water and brine, dried (Na<sub>2</sub>SO<sub>4</sub>), filtered and the 15 solvent evaporated under reduced pressure. The residue was purified by reverse phase chromatography (C-18 silica from Waters<sup>®</sup>, water/acetonitrile/methanol as eluents [0.1% v/v formic acid buffered] 0% to 100%) to yield the title compound (30 mg, 12%) as a solid.

LRMS (m/z): 395 (M+1)<sup>+</sup>.

20

**d) (S)-4-(1-(5-Fluoropyridin-2-yl)ethylamino)-2-(2-methoxypyridin-3-ylamino)pyrimidine-5-carboxamide**

A solution of (S)-2-(1*H*-benzo[d][1,2,3]triazol-1-yloxy)-4-(1-(5-fluoropyridin-2-yl) ethyl 25 amino)pyrimidine-5-carboxamide (Preparation 5c, 30 mg, 0.08 mmol), 2-methoxy pyridin-3-amine (14 mg, 0.11 mmol) and p-toluenesulfonic acid hydrate (15 mg, 0.08 mmol) in 1,4-dioxane (3 mL) was heated at 120 °C for 4 hours. The solvent was evaporated under reduced pressure and the resulting residue was purified by reverse phase chromatography (C-18 silica from Waters<sup>®</sup>, water/acetonitrile/methanol as 30 eluents [0.1% v/v formic acid buffered] 0% to 100%) to give the title compound (21 mg, 72%) as a solid.

LRMS (m/z): 384 (M+1)<sup>+</sup>.

PREPARATION 6

**5-Chloro-2-methoxypyridin-3-amine**

35

**a) 5-Chloro-2-methoxy-3-nitropyridine**

A solution of sodium methoxide (0.84 g, 16.6 mmol) in methanol (4 mL) was added dropwise to a solution of 2,5-dichloro-3-nitropyridine (1.00 g, 5.2 mmol) in methanol (10 mL) and the mixture was stirred and heated to reflux. After 7 hours, the mixture was cooled and diluted with water and the precipitate was filtered, washed with water and dried to give the title compound (0.95 g, 97%) as a white solid.

$^1\text{H NMR } \delta$  ( $\text{CDCl}_3$ ): 4.11 (s, 3H), 8.23 (s, 1H), 8.32 (s, 1H).

#### **b) 5-Chloro-2-methoxypyridin-3-amine**

Zinc bromide (0.27 g, 1.2 mmol) and 10% platinum on carbon (0.58 g, 2.97 mmol) were added to a solution of 5-chloro-2-methoxy-3-nitropyridine (Preparation 6a, 1.13 g, 5.99 mmol) in ethyl acetate (20 mL) and the resulting mixture was hydrogenated in a Parr apparatus at 10 psi for 2 hours. The mixture was then filtered through diatomaceous earth (Celite<sup>®</sup>) and the filter cake was washed with ethyl acetate. The combined filtrate and washings were concentrated to give the title compound (0.95 g, 100%) as an oil which was used in the next synthetic step without further purification.

LRMS ( $m/z$ ): 159 ( $M+1$ )<sup>+</sup>.

$^1\text{H NMR } \delta$  ( $\text{CDCl}_3$ ): 3.97 (s, 3H), 6.98 (s, 1H), 7.50 (s, 1H).

#### PREPARATION 7

#### **(S)-N<sup>2</sup>-(5-Chloro-2-methoxypyridin-3-yl)-N<sup>4</sup>-(1-(5-fluoropyridin-2-yl)ethyl)-5-methylpyrimidine-2,4-diamine**

Obtained as a yellow solid (62%) from (S)-2-chloro-N-(1-(5-fluoropyridin-2-yl)ethyl)-5-methylpyrimidin-4-amine (Preparation 2a) and 5-chloro-2-methoxypyridin-3-amine (Preparation 6b) following the experimental procedure as described in Preparation 1b followed by purification of the crude product by flash chromatography (2:1 hexanes/ethyl acetate).

LRMS ( $m/z$ ): 389 ( $M+1$ )<sup>+</sup>.

$^1\text{H-NMR } \delta$  ( $\text{CDCl}_3$ ): 1.62 (d, 3H), 2.06 (br s, 3H), 4.01 (s, 3H), 5.44 (t, 2H), 6.03 (d, 2H), 7.30-7.47 (m, 2H), 7.65 (d, 1H), 7.78 (s, 1H), 8.44 (d, 1H), 8.88 (d, 1H).

#### PREPARATION 8

#### **5-(1-Benzyl-1H-pyrazol-4-yl)-2-methoxypyridin-3-amine**

##### **a) 5-(1-Benzyl-1H-pyrazol-4-yl)-2-methoxy-3-nitropyridine**

An oven-dried resealable Schlenk tube was charged with 5-bromo-2-methoxy-3-nitropyridine (3.58 g, 15.36 mmol), 1-benzyl-4-(4,4,5,5-tetramethyl-1,3,2-dioxaborolan-

2-yl)-1H-pyrazole (5.23 g, 18.43 mmol), potassium carbonate (4.24 g, 30.72 mmol), 1,4-dioxane (50 mL) and water (5 mL). The Schlenk tube was subjected to three cycles of evacuation-backfilling with argon, and tetrakis(triphenylphosphine)palladium(0) (1.77 g, 1.53 mmol) was added. After three further cycles of evacuation-backfilling with argon, the Schlenk tube was sealed and the mixture was stirred and heated in an oil bath to 100 °C. After 3 days, the mixture was cooled, filtered through diatomaceous earth (Celite®) and the filter cake was washed with methylene chloride (300 mL). The combined filtrate and washings were concentrated *in vacuo* and the residue was purified by flash chromatography (20-50% ethyl acetate in hexanes) to give the title compound (3.70 g, 84%) as a yellow solid.

<sup>1</sup>H-NMR  $\delta$  (CDCl<sub>3</sub>): 4.11 (s, 3H), 5.36 (s, 2H), 7.33 (m, 5H), 7.64 (d, 1H), 7.81 (d, 1H), 8.30 (d, 1H), 8.49 (d, 1H).

**b) 5-(1-Benzyl-1H-pyrazol-4-yl)-2-methoxypyridin-3-amine**

A suspension of 5-(1-benzyl-1H-pyrazol-4-yl)-2-methoxy-3-nitropyridine (Preparation 8a, 3.5 g, 11.28 mmol) in acetic acid (50 mL) was added to a cooled (10 °C) suspension of zinc (3.67 g, 56.25 g) in acetic acid (50 mL) and the resulting mixture was stirred at ambient temperature for 1.5 hours. The mixture was filtered and the solid washed with methylene chloride (50 mL). The combined filtrate and washings were evaporated and the residue was purified by flash chromatography (20-40% ethyl acetate in hexanes) to give a brown oil which was treated with a 1:1 mixture of hexanes/diethyl ether (40 mL). The resulting solid was filtered, washed with hexane and dried to yield the title compound (2.33 g, 74%) as a beige solid.

<sup>1</sup>H-NMR  $\delta$  (CDCl<sub>3</sub>): 3.79 (br s, 2H), 3.98 (s, 3H), 5.32 (s, 2H), 6.95 (d, 1H), 7.22-7.40 (m, 5H), 7.52 (d, 1H), 7.68 (d, 1H), 7.72 (d, 1H).

**PREPARATION 9**

**(S)-N4-(1-(5-Fluoropyridin-2-yl)ethyl)-N2-(2-methoxy-5-(1H-pyrazol-4-yl)pyridin-3-yl)-5-methylpyrimidine-2,4-diamine**

**a) (S)-N2-(5-(1-Benzyl-1H-pyrazol-4-yl)-2-methoxypyridin-3-yl)-N4-(1-(5-fluoropyridin-2-yl)ethyl)-5-methylpyrimidine-2,4-diamine**

Obtained as a white foam (69%) from (S)-2-chloro-N-(1-(5-fluoropyridin-2-yl)ethyl)-5-methylpyrimidin-4-amine (Preparation 2a) and 5-(1-benzyl-1H-pyrazol-4-yl)-2-methoxy pyridin-3-amine (Preparation 8b) following the experimental procedure as described in Preparation 1b.

LRMS (m/z): 511 (M+1)<sup>+</sup>.

<sup>1</sup>H-NMR  $\delta$  (CDCl<sub>3</sub>): 1.54 (d, 3H), 2.05 (s, 3H), 4.03 (s, 3H), 5.37 (s, 2H), 5.39-5.52 (m, 1H), 5.97 (d, 1H), 7.18 (dd, 1H), 7.24 (d, 1H), 7.28-7.37 (m, 5H), 7.69 (s, 1H), 7.77 (d, 1H), 7.82 (d, 1H), 7.85 (d, 1H), 8.38 (d, 1H), 8.91 (d, 1H).

5

**b) (S)-N4-(1-(5-Fluoropyridin-2-yl)ethyl)-N2-(2-methoxy-5-(1H-pyrazol-4-yl)pyridin-3-yl)-5-methylpyrimidine-2,4-diamine**

5N Aqueous hydrochloric acid solution (0.126 mL, 0.63 mmol) and 20% palladium hydroxide on carbon (0.07 g, 0.50 mmol) were added to a solution of (S)-N2-(5-(1-benzyl-1H-pyrazol-4-yl)-2-methoxypyridin-3-yl)-N4-(1-(5-fluoropyridin-2-yl)ethyl)-5-methylpyrimidine-2,4-diamine (Preparation 9a, 0.214 g, 0.42 mmol) in a 1:1 mixture of methanol/tetrahydrofuran (4 mL) and the reaction mixture was stirred at 50 °C overnight under a hydrogen atmosphere. Further 5N aqueous hydrochloric acid solution (0.126 mL, 0.63 mmol) and palladium catalyst (0.07 g) were then added and the mixture was stirred overnight under a hydrogen atmosphere. The mixture was then filtered through diatomaceous earth (Celite®) and the filter cake was washed with methanol. The combined filtrate and washings were evaporated and a 1:1 mixture of methanol/tetrahydrofuran (4 mL) was added to the residue. 5N aqueous hydrochloric acid solution (0.126 mL, 0.63 mmol) and 20% palladium hydroxide on carbon (0.07 g, 0.50 mmol) were then added to the resulting solution and the reaction mixture was stirred at 50 °C overnight under a hydrogen atmosphere. The mixture was then filtered through Celite® and the filter cake was washed with methanol. The combined filtrate and washings were evaporated to give the title compound (0.166 g, 70%) as a white foam that was used in the next synthetic step without further purification.

25

LRMS (m/z): 421 (M+1)<sup>+</sup>.

<sup>1</sup>H-NMR  $\delta$  (CDCl<sub>3</sub>): 1.49 (d, 3H), 2.15 (s, 3H), 4.02 (s, 3H), 5.25-5.28 (m, 1H), 7.07 (dd, 1H), 7.32-7.34 (m, 1H), 7.59 (d, 1H), 7.82 (s, 2H), 8.08 (d, 1H), 8.36 (d, 1H), 8.41 (d, 1H).

30

**PREPARATION 10**

**3-[(4-(4-[(*Tert*-butyl(dimethyl)silyl]oxy)piperidin-1-yl)-6-[(1S)-1-(5-fluoropyridin-2-yl)ethyl]amino]pyrimidin-2-yl)amino]pyridin-2(1H)-one**

**a) 2,6-Dichloro-N-[(1S)-1-(5-fluoropyridin-2-yl)ethyl]pyrimidin-4-amine**

35

(S)-1-(5-Fluoropyridin-2-yl)ethanamine hydrochloride (prepared as described in WO2006/123113, 1.05 g, 4.91 mmol) and *N,N'*-diisopropylethylamine (2.80 mL, 16.36 mmol) were added to a solution of 2,4,6-trichloropyrimidine (0.75 g, 4.09 mmol) in



ethanol (15 mL) and the resulting mixture was stirred and heated to 80 °C in a sealed tube for 1 hour. After cooling to ambient temperature, water was added and the resulting mixture was extracted with ethyl acetate (x3). The combined organic layers were washed with water and brine, dried (MgSO<sub>4</sub>), filtered and the solvent evaporated under reduced pressure. The residue was purified by flash chromatography (hexanes to 1:1 hexanes/ethyl acetate) to give the title compound (0.66 g, 57%) as a white solid.

<sup>1</sup>H-NMR δ (DMSO-*d*<sub>6</sub>): 1.45 (d, 3H), 5.18-5.27 (m, 1H), 6.63 (s, 1H), 7.46 (dd, 1H), 7.70 (td, 1H), 8.53 (d, 1H), 8.70 (d, 1H).

**b) 6-(4-[[*Tert*-butyl(dimethyl)silyl]oxy]piperidin-1-yl)-2-chloro-*N*-[(1*S*)-1-(5-fluoropyridin-2-yl)ethyl]pyrimidin-4-amine**

A mixture of 2,6-dichloro-*N*-[(1*S*)-1-(5-fluoropyridin-2-yl)ethyl]pyrimidin-4-amine (Preparation 10a, 0.66 g, 2.31 mmol), 4-(*tert*-butyl-dimethylsilylanyloxy)piperidine (prepared as described in WO2004/006926, 0.60 g, 2.77 mmol) and cesium carbonate (1.13 g, 3.46 mmol) in *N,N'*-dimethylformamide (15 mL) was stirred and heated to 130 °C in a sealed tube for 2 hours. After cooling to ambient temperature, water was added and the resulting mixture was extracted with ethyl acetate (x3). The combined organic extract was washed with water and brine, dried (MgSO<sub>4</sub>), filtered and the solvent was evaporated under reduced pressure. The residue was purified by flash chromatography (hexanes to 6:4 hexanes/ethyl acetate) to give the title compound (0.53 g, 50%) as a white solid.

<sup>1</sup>H-NMR δ (DMSO-*d*<sub>6</sub>): 0.04 (s, 6H), 0.85 (s, 9H), 1.02-1.36 (m, 2H), 1.40 (d, 3H), 1.48-1.65 (m, 2H), 3.11-3.29 (m, 2H), 3.74-3.94 (m, 3H), 5.03 (m, 1H), 5.84 (s, 1H), 7.37 (dd, 1H), 7.64 (td, 1H), 7.79 (d, 1H), 8.47 (d, 1H).

**c) 6-(4-[[*Tert*-butyl(dimethyl)silyl]oxy]piperidin-1-yl)-*N*<sup>4</sup>-[(1*S*)-1-(5-fluoropyridin-2-yl)ethyl]-*N*<sup>2</sup>-(2-methoxypyridin-3-yl)pyrimidine-2,4-diamine**

Obtained as a white solid (59%) from 6-(4-[[*tert*-butyl(dimethyl)silyl]oxy]piperidin-1-yl)-2-chloro-*N*-[(1*S*)-1-(5-fluoropyridin-2-yl)ethyl]pyrimidin-4-amine (Preparation 10b) and 2-methoxypyridin-3-amine following the experimental procedure as described in Preparation 1b followed by purification of the crude product by flash chromatography (10-40% ethyl acetate/hexanes).

<sup>1</sup>H-NMR δ (CDCl<sub>3</sub>): 0.09 (s, 6H), 0.91 (s, 9H), 1.52 (d, 3H), 1.67-1.84 (m, 2H), 3.45 (m, 2H), 3.92 (m, 1H), 3.98 (s, 3H), 3.96-4.14 (m, 2H), 4.90 (m, 1H), 5.01 (s, 1H), 5.16 (d, 1H), 6.60 (s, 1H), 6.82 (dd, 1H), 7.34 (dd, 2H), 7.70 (dd, 1H), 8.27 (dd, 1H), 8.40 (s, 1H).

**d) 3-[(4-(4-[(*Tert*-butyl(dimethyl)silyl]oxy)piperidin-1-yl)-6-[(1*S*)-1-(5-fluoropyridin-2-yl)ethyl]amino}pyrimidin-2-yl)amino]pyridin-2(1*H*)-one**

Trimethylsilyl chloride (0.285 mL, 2.25 mmol) and sodium iodide (337 mg, 2.25 mmol) were added to a stirred solution of 6-(4-[(*tert*-butyl(dimethyl)silyl]oxy)piperidin-1-yl)-*N*<sup>4</sup>-[(1*S*)-1-(5-fluoropyridin-2-yl)ethyl]-*N*<sup>2</sup>-(2-methoxypyridin-3-yl)pyrimidine-2,4-diamine (Preparation 10c, 415 mg, 0.75 mmol) in acetonitrile (5 mL) and the reaction mixture was heated at 80 °C for 4.5 hours. After cooling to ambient temperature, water was added and the mixture was extracted with ethyl acetate (x3). The pH was then adjusted to ca. 6 with 2M aqueous sodium hydroxide solution and the aqueous phase was extracted with ethyl acetate (x3). The combined organic extract was washed with water and brine, dried (MgSO<sub>4</sub>), filtered and the solvent evaporated under reduced pressure to give the title compound (0.52 g, 100%) as a brown oil which was used in the next synthetic step without further purification.

LRMS (m/z): 539 (M+1)<sup>+</sup>.

**PREPARATION 11**

**(*S*)-5-Fluoro-*N*<sup>4</sup>-(1-(5-fluoropyridin-2-yl)ethyl)-*N*<sup>2</sup>-(2-methoxypyridin-3-yl)-6-morpholinopyrimidine-2,4-diamine**

**a) 4-(2,6-Dichloro-5-fluoropyrimidin-4-yl)morpholine**

A solution of morpholine (1.5 mL, 17.05 mmol) in ethanol (25 mL) was added to a cooled (-20 °C) solution of 2,4,6-trichloro-5-fluoropyrimidine (3.00 g, 14.93 mmol) in ethanol (150 mL) and the resulting mixture was stirred at -20 °C for 30 minutes and at ambient temperature for 3 hours. The solvent was evaporated under reduced pressure and the residue was partitioned between water and methylene chloride. The organic layer was separated, dried and the solvent evaporated under reduced pressure. The resulting white solid was triturated with ethanol, then filtered and dried to give the title compound (2.0 g, 53%).

LRMS (m/z): 252/254 (M+1)<sup>+</sup>.

<sup>1</sup>H-NMR δ (CDCl<sub>3</sub>): 3.77-3.80 (m, 4H), 3.82-3.85 (m, 4H).

**b) (*S*)-2-Chloro-5-fluoro-*N*-(1-(5-fluoropyridin-2-yl)ethyl)-6-morpholinopyrimidin-4-amine**

A mixture of 4-(2,6-dichloro-5-fluoropyrimidin-4-yl)morpholine (Preparation 11a, 1.18 g, 4.68 mmol), (*S*)-1-(5-fluoropyridin-2-yl)ethanamine hydrochloride (prepared as described in WO2006/123113, 1.00 g, 4.69 mmol) and *N,N'*-diisopropylethylamine (3.27 mL, 18.77 mmol) in *n*-butanol (20 mL) was heated at 130 °C for two days. The

solvent was evaporated under reduced pressure and the residue was purified by flash chromatography (0-5% ethyl acetate in hexanes to 5:94:1 ethyl acetate/hexanes/triethylamine) to give the title compound (0.700 g, 42%) as one major regioisomer. The chemical structures of both regioisomers were confirmed by NMR experiments (gHSQCAD and gHMBCAD).

LRMS (m/z): 356/358 (M+1)<sup>+</sup>.

<sup>1</sup>H-NMR  $\delta$  (CDCl<sub>3</sub>): 1.54 (3H, dd), 3.60-3.75 (8H, m), 5.17-5.37 (1H, m), 6.07 (1H, br d), 7.24-7.32 (1H, m), 7.36-7.42 (1H, m), 8.42 (1H, t)

**c) (S)-5-Fluoro-N4-(1-(5-fluoropyridin-2-yl)ethyl)-N2-(2-methoxypyridin-3-yl)-6-morpholinopyrimidine-2,4-diamine**

Obtained (69%) from (S)-2-chloro-5-fluoro-N-(1-(5-fluoropyridin-2-yl)ethyl)-6-morpholinopyrimidin-4-amine (Preparation 11b) and 2-methoxypyridin-3-amine following the experimental procedure as described in Preparation 1b followed by purification of the crude product by flash chromatography (0-20% methanol in dichloromethane).

LRMS (m/z): 444 (M+1)<sup>+</sup>.

<sup>1</sup>H-NMR  $\delta$  (CDCl<sub>3</sub>): 1.58 (3H, s), 3.63 (4H, m), 3.77 (4H, m), 4.02 (3H, s), 5.30 (1H, m), 5.65 (1H, br d), 6.83 (1H, dd), 7.10 (1H, s), 7.33 (2H, m), 7.68 (1H, dd), 8.42 (1H, dd).

**PREPARATION 12**

**N-[(1S)-1-(5-Fluoropyridin-2-yl)ethyl]-N'-(2-methoxypyridin-3-yl)pyrazine-2,6-diamine**

**a) 6-Chloro-N-[(1S)-1-(5-fluoropyridin-2-yl)ethyl]pyrazin-2-amine**

*N,N'*-Diisopropylethylamine (2.50 mL, 14.35 mmol) was added dropwise to a solution of 2,6-dichloropyrazine (525 mg, 3.52 mmol) and (S)-1-(5-fluoropyridin-2-yl)ethanamine hydrochloride (prepared as described in WO2006/123113, 750 mg, 3.52 mmol) in 1-methylpyrrolidin-2-one (4 mL) and the resulting mixture was stirred and heated for 6 hours at 180 °C in a microwave oven. After cooling to ambient temperature, the solvent was evaporated under reduced pressure and the residue was purified by flash chromatography (7:3 hexanes/ethyl acetate) to give the title compound (520 g, 57%) as a brown oil.

LRMS (m/z): 253 (M+1)<sup>+</sup>.

<sup>1</sup>H-NMR  $\delta$  (CDCl<sub>3</sub>): 1.54 (d, 3H), 5.14 (m, 1H), 5.97 (d, 1H), 7.29-7.42 (m, 2H), 7.78 (d, 2H), 8.42 (d, 1H).

**b) *N*-[(1*S*)-1-(5-Fluoropyridin-2-yl)ethyl]-*N'*-(2-methoxypyridin-3-yl)pyrazine-2,6-diamine**

Obtained as a yellow solid (64%) from 6-chloro-*N*-[(1*S*)-1-(5-fluoropyridin-2-yl)ethyl]pyrazin-2-amine (Preparation 12a) and 2-methoxypyridin-3-amine following the experimental procedure as described in Preparation 1b followed by purification of the crude product by flash chromatography (95:5 chloroform/methanol).

LRMS (m/z): 341 (M+1)<sup>+</sup>.

<sup>1</sup>H-NMR δ (CDCl<sub>3</sub>): 1.59 (d, 3H), 4.03 (s, 3H), 5.05 (m, 1H), 5.35 (d, 1H), 6.85 (m, 1H) 7.34 (m, 3H), 7.39 (s, 1H), 7.48 (s, 1H), 7.73 (m, 2H).

PREPARATION 13

**(*S*)-*N*2-(1-(5-Fluoropyridin-2-yl)ethyl)-*N*6-(2-methoxypyridin-3-yl)pyridine-2,6-diamine**

**a) (*S*)-6-Chloro-*N*-(1-(5-fluoropyridin-2-yl)ethyl)pyridin-2-amine**

(*S*)-1-(5-Fluoropyridin-2-yl)ethanamine hydrochloride (prepared as described in WO2006/123113, 0.291 g, 1.37 mmol) was added to a solution of 2,6-dichloropyridine (0.203 g, 1.38 mmol) in *N,N'*-diisopropylethylamine (1.2 mL, 6.89 mmol) and the resulting mixture was stirred and heated to reflux for two days. The solvent was evaporated under reduced pressure and the residue was purified by flash chromatography (0-10% ethyl acetate in hexanes) to yield the title compound (127 mg, 36%) as a yellow solid.

LRMS (m/z): 252 (M+1)<sup>+</sup>.

<sup>1</sup>H-NMR δ (CDCl<sub>3</sub>): 1.53 (d, 3H), 4.87-5.04 (m, 1H), 5.55 (d, 1H), 6.18 (d, 1H), 6.56 (d, 1H), 7.27 (dd, 1H), 7.32-7.45 (m, 2H), 8.34-8.43 (m, 1H).

**b) (*S*)-*N*2-(1-(5-Fluoropyridin-2-yl)ethyl)-*N*6-(2-methoxypyridin-3-yl)pyridine-2,6-diamine**

Obtained as an orange oil (90%) from (*S*)-6-chloro-*N*-(1-(5-fluoropyridin-2-yl)ethyl)pyridin-2-amine (Preparation 13a) and 2-methoxypyridin-3-amine following the experimental procedure as described in Preparation 1b followed by purification of the crude product by flash chromatography (0-100% ethyl acetate in hexanes).

LRMS (m/z): 340 (M+1)<sup>+</sup>.

<sup>1</sup>H-NMR δ (CDCl<sub>3</sub>): 1.57 (d, 3H), 4.01 (s, 3H), 4.93-5.06 (m, 1H), 5.06 (d, 1H), 5.84 (d, 1H), 6.01-6.13 (m, 1H), 6.74 (s, 1H), 6.83 (dd, 1H), 7.19-7.27 (m, 1H), 7.28-7.43 (m, 2H), 7.68 (dd, 1H), 8.38 (dd, 1H), 8.40-8.44 (m, 1H).

PREPARATION 14**2-((1*r*,4*r*)-4-Aminocyclohexyl)acetonitrile****5 a) *Tert*-Butyl (1*r*,4*r*)-4-(hydroxymethyl)cyclohexylcarbamate**

Di-*tert*-butyl dicarbonate (3.04 g, 13.9 mmol) was added to a stirred solution of ((1*r*,4*r*)-4-aminocyclohexyl)methanol (1.50 g, 11.6 mmol) in tetrahydrofuran (20 mL). After stirring overnight at ambient temperature, the mixture was evaporated and partitioned between ethyl acetate and water. The organic layer was separated, washed with water and brine, dried (MgSO<sub>4</sub>) and evaporated. The residue was treated with hexanes and the suspension was filtered to give the title compound (2.11 g, 79%) as a white solid.

LRMS (m/z): 228 (M-H)<sup>+</sup>.

<sup>1</sup>H NMR δ (DMSO-*d*<sub>6</sub>): 0.84-0.95 (m, 2H), 1.05-1.18 (m, 2H), 1.20-1.29 (m, 2H), 1.40 (s, 9H), 1.71-1.80 (m, 3H), 3.14 (m, 1H), 3.21 (t, 2H), 4.41 (t, 1H), 6.73 (d, 1H).

**b) ((1*r*,4*r*)-4-(*Tert*-Butoxycarbonylamino)cyclohexyl)methyl 4-methylbenzene-sulfonate**

A solution of 4-methylbenzene-1-sulfonyl chloride (2.28 g, 11.96 mmol) in dichloromethane was added to a solution of *tert*-butyl (1*r*,4*r*)-4-(hydroxymethyl)cyclohexylcarbamate (Preparation 14a, 2.11 g, 9.2 mmol) and triethylamine (1.59 mL, 11.4 mmol) in dichloromethane (50 mL) and the resulting mixture was stirred overnight at ambient temperature. The mixture was washed with 1M aqueous sodium hydroxide solution and the organic layer was dried (MgSO<sub>4</sub>), the solvent was evaporated and the residue was purified by flash chromatography (diethyl ether/hexanes) to give the title compound (2.91 g, 83%) as a white solid.

LRMS (m/z): 382 (M-H)<sup>+</sup>.

<sup>1</sup>H NMR δ (CDCl<sub>3</sub>): 0.90-1.12 (m, 4H), 1.43 (s, 3H), 1.78 (dd, 2H), 1.99 (d, 2H), 3.34 (m, 1H), 3.46 (t, 1H), 3.81 (d, 2H), 4.37 (m, 1H), 7.34 (d, 2H), 7.77 (d, 2H).

**c) *Tert*-Butyl (1*r*,4*r*)-4-(cyanomethyl)cyclohexylcarbamate**

Sodium cyanide (0.38 g, 7.8 mmol) was added to a solution of ((1*r*,4*r*)-4-(*tert*-butoxycarbonylamino)cyclohexyl)methyl 4-methylbenzene-sulfonate (Preparation 14b, 1.00 g, 2.6 mmol) in dimethylsulphoxide (10 mL) and the mixture was stirred and heated to 55 °C. After stirring for 20 hours, the mixture was diluted with ethyl acetate and washed with saturated aqueous potassium carbonate solution, water and brine, dried (MgSO<sub>4</sub>) and evaporated. The residue was purified by flash chromatography

(100% dichloromethane to 95:5 dichloromethane/methanol) to give the title compound (0.450 g, 72%) as a white solid.

LRMS (m/z): 239 (M+H)<sup>+</sup>.

<sup>1</sup>H NMR  $\delta$  (CDCl<sub>3</sub>): 1.06-1.25 (m, 4H), 1.44 (s, 9H), 1.65 (m, 1H), 1.90 (d, 2H),  
2.06 (d, 2H), 2.25 (d, 2H), 3.39 (m, 1H), 4.38 (m, 1H).

**d) 2-((1*r*,4*r*)-4-Aminocyclohexyl)acetonitrile hydrochloride**

A mixture of *tert*-butyl (1*r*,4*r*)-4-(cyanomethyl)cyclohexylcarbamate (Preparation 14c, 0.348 g, 1.46 mmol) and 4M hydrogen chloride solution in 1,4-dioxane (3.65 mL) was stirred overnight at ambient temperature. The solvent was evaporated *in vacuo* and the residue was treated with diethyl ether. The resultant suspension was filtered to give the title compound (0.226 g, 89%) as a white solid.

LRMS (m/z): 139 (M+H)<sup>+</sup>.

<sup>1</sup>H NMR  $\delta$  (DMSO-*d*<sub>6</sub>): 1.14 (ddd, 2H), 1.37 (ddd, 2H), 1.60 (m, 1H), 1.83 (d, 2H), 1.99 (d, 2H), 2.50 (d, 2H), 2.94 (m, 1H), 8.08 (br s, 2H).

PREPARATION 15

**2-((1*r*, 4*r*)-4-(2-(2-Methoxypyridin-3-yl)amino)-5-methylpyrimidin-4-yl)amino) cyclohexyl)acetonitrile**

**a) 2-((1*r*, 4*r*)-4-(2-Chloro-5-methylpyrimidin-4-yl)amino)cyclohexyl)acetonitrile**

*N,N'*-Diisopropylethylamine (0.72 mL, 4.13 mmol) was added dropwise to a stirred solution of 2,4-dichloro-5-methylpyrimidine (187 mg, 1.15 mmol) and 2-((1*r*,4*r*)-4-aminocyclohexyl) acetonitrile hydrochloride (Preparation 14d, 200 mg, 1.15 mmol) in *N,N'*-dimethylformamide (1.5 mL) and the resulting mixture was stirred and heated for 3 hours at 90 °C. After cooling to ambient temperature, water was added and the resulting mixture was extracted with ethyl acetate. The organic phase was washed with water and brine, dried (MgSO<sub>4</sub>), filtered and the solvent was evaporated under reduced pressure. The residue was purified by flash chromatography (2:1 hexanes/ethyl acetate) to give the title compound (140 g, 46%) as a solid.

LRMS (m/z): 265 (M+1)<sup>+</sup>.

<sup>1</sup>H-NMR  $\delta$  (CDCl<sub>3</sub>): 1.15-1.40 (m, 4H), 1.72 (m, 1H), 1.97 (m, 5H), 2.19 (m, 2H), 2.31 (d, 2H), 4.05 (m, 1H), 4.46 (bd, 1H), 7.81 (s, 1H).

**b) 2-((1*r*, 4*r*)-4-(2-(2-Methoxypyridin-3-yl)amino)-5-methylpyrimidin-4-yl)amino)cyclohexyl)acetonitrile**

Obtained as a white solid (48%) from 2-((1*r*, 4*r*)-4-(2-chloro-5-methylpyrimidin-4-yl)amino)cyclohexyl)acetonitrile (Preparation 15a) and 2-methoxypyridin-3-amine following the experimental procedure as described in Preparation 1b followed by purification of the crude product by flash chromatography (hexanes/diethyl ether).

LRMS (*m/z*): 353 (*M*+1)<sup>+</sup>.

<sup>1</sup>H-NMR δ (CDCl<sub>3</sub>): 1.20-1.45 (m, 4H), 1.76 (m, 1H), 1.99 (m, 5H), 2.27 (d, 2H), 2.35 (d, 2H), 4.03 (m, 4H), 4.34 (bd, 1H), 6.87 (dd, 1H), 7.71 (dd, 1H), 7.74 (d, 1H), 8.70 (dd, 1H).

PREPARATION 16

**((1*r*,4*r*)-4-(1,3-dioxoisindolin-2-yl)cyclohexyl)methanesulfonyl chloride**

**a) (1*r*,4*r*)-Ethyl 4-aminocyclohexanecarboxylate hydrochloride**

Concentrated aqueous hydrochloric acid (7 mL) was added to a suspension of (1*r*,4*r*)-4-aminocyclohexanecarboxylic acid (6.32 g, 35.2 mmol) in ethanol (100 mL) and the mixture was stirred and heated to 60 °C. After 20 hours, the mixture was evaporated *in vacuo* and the residue was co-evaporated with further ethanol and then toluene to give the title compound (7.20 g, 99%) as a white solid.

<sup>1</sup>H NMR δ (DMSO-*d*<sub>6</sub>): 1.17 (t, 3H), 1.26-1.46 (m, 4H), 1.87-1.98 (m, 4H), 2.23 (m, 1H), 2.95 (m, 1H), 4.04 (q, 2H), 8.06 (br s, 3H).

**b) ((1*r*,4*r*)-4-Aminocyclohexyl)methanol**

A suspension of (1*r*,4*r*)-ethyl 4-aminocyclohexanecarboxylate hydrochloride (Preparation 16a, 7.20 g, 34.7 mmol) in tetrahydrofuran (200 mL) was added portion wise to a cooled (ice-bath), stirred 1M solution of lithium aluminium hydride in tetrahydrofuran (69 mL, 69.0 mmol). After 1 hour, the ice-bath was removed and the mixture was stirred at ambient temperature for 1 hour then allowed to stand overnight. The stirred mixture was cooled in an ice bath and water (6.9 mL), 15% aqueous sodium hydroxide solution (21 mL) and water (21 mL) were added dropwise sequentially with due care. After additional 30 minutes of agitation at ambient temperature, the mixture was filtered through a plug of Celite® and the filter cake was washed with tetrahydrofuran. The combined filtrate and washings were evaporated to give the title compound (4.50 g, 100%) as a white solid.

$^1\text{H}$  NMR  $\delta$  (DMSO- $d_6$ ): 0.78-1.01 (m, 4H), 1.23 (m, 1H), 1.65-1.75 (m, 4H), 2.41 (m, 1H), 3.18 (d, 2H), 4.36 (br s, 1H).

**c) 2-((1r,4r)-4-(Hydroxymethyl)cyclohexyl)isoindoline-1,3-dione**

5 Triethylamine (4.46 mL, 32.0 mmol) was added to a suspension of ((1r,4r)-4-aminocyclohexyl)methanol (Preparation 16b, 1.00 g, 7.74 mmol) and isobenzofuran-1,3-dione (1.15 g, 7.76 mmol) in toluene (50 mL) and the mixture was stirred and heated to 50 °C. After 20 hours, the mixture was evaporated and the residue was taken up in ethyl acetate and washed with 2M aqueous sodium hydroxide solution, water,  
10 brine, dried ( $\text{MgSO}_4$ ) and evaporated to give the title compound (1.68 g, 84%) as a white solid.

LRMS (m/z): 260 ( $\text{M}+1$ ) $^+$ .

$^1\text{H}$  NMR  $\delta$  ( $\text{CDCl}_3$ ): 1.15 (dq, 1H), 1.31 (t, 1H), 1.64 (m, 1H), 1.81 (m, 2H), 1.96 (m, 2H), 2.30 (dq, 1H), 3.52 (t, 2H), 4.13 (tt, 1H), 7.70 (m, 2H), 7.82 (m, 2H).

15

**d) ((1r,4r)-4-(1,3-Dioxoisindolin-2-yl)cyclohexyl)methyl methanesulfonate**

Methanesulphonyl chloride (0.31 mL, 4.01 mmol) was added dropwise to a stirred, cooled (ice bath) solution of 2-((1r,4r)-4-(hydroxymethyl)cyclohexyl)isoindoline-1,3-dione (Preparation 16c, 1.00 g, 3.86 mmol) and triethylamine (0.59 mL, 4.23 mmol) in  
20 dichloromethane (20 mL). After 20 hours, the mixture was concentrated *in vacuo* and the residue was partitioned between ethyl acetate and water. The organic layer was separated, washed with saturated aqueous sodium hydrogen carbonate solution and brine, dried ( $\text{MgSO}_4$ ) and evaporated to give the title compound (1.25 g, 96%) as a white solid.

25 LRMS (m/z): 338 ( $\text{M}+1$ ) $^+$ .

$^1\text{H}$  NMR  $\delta$  ( $\text{CDCl}_3$ ): 1.24 (m, 2H), 1.80-2.02 (m, 5H), 2.32 (dq, 2H), 3.04 (s, 3H), 4.08-4.18 (m, 3H), 7.71 (m, 2H), 7.83 (m, 2H).

**e) S-((1r,4r)-4-(1,3-Dioxoisindolin-2-yl)cyclohexyl)methyl ethanethioate**

30 A mixture of ((1r,4r)-4-(1,3-dioxoisindolin-2-yl)cyclohexyl)methyl methanesulfonate (Preparation 16d, 1.25 g, 3.70 mmol) and potassium thioacetate (1.27 g, 11.1 mmol) in *N,N*-dimethylformamide (15 mL) was stirred and heated to 50 °C. After 4 hours, the mixture was diluted with water and extracted with ethyl acetate. The organic layer was washed with water and brine, dried ( $\text{MgSO}_4$ ) and evaporated to give the title compound  
35 (1.13 g, 96%) as a white solid.

LRMS (m/z): 318 ( $\text{M}+1$ ) $^+$ .



$^1\text{H}$  NMR  $\delta$  ( $\text{CDCl}_3$ ): 1.15 (dq, 2H), 1.64 (m, 1H), 1.76 (m, 2H), 1.96 (m, 2H), 2.27 (dq, 2H), 2.36 (s, 3H), 2.85 (d, 2H), 4.11 (tt, 1H), 7.70 (m, 2H), 7.81 (m, 2H).

**f) ((1r,4r)-4-(1,3-Dioxoisindolin-2-yl)cyclohexyl)methanesulfonic acid**

30% Aqueous hydrogen peroxide (0.88 mL, 8.6 mmol) was added dropwise over 7 minutes to a stirred suspension of *S*-((1r,4r)-4-(1,3-dioxoisindolin-2-yl)cyclohexyl)methylethanethioate (Preparation 16e, 0.50 g, 1.6 mmol) in formic acid (4 mL). A highly exothermic reaction ensued forming a solution which then rapidly deposited a solid. After 1 hour, the mixture was concentrated *in vacuo* and the residue was triturated with diethyl ether to give a solid which was filtered and dried to give the title compound (0.46 g, 90%) as a white solid.

LRMS ( $m/z$ ): 322 ( $M-1$ ) $^+$ .

$^1\text{H}$  NMR  $\delta$  ( $\text{DMSO}-d_6$ ): 1.03 (m, 2H), 1.68 (m, 3H), 2.08 (m, 4H), 2.38 (d, 2H), 3.94 (m, 1H), 7.80-7.86 (m, 4H).

**g) ((1r,4r)-4-(1,3-Dioxoisindolin-2-yl)cyclohexyl)methanesulfonyl chloride**

Thionyl chloride (0.27 mL, 3.63 mmol) was added to a mixture of ((1r,4r)-4-(1,3-dioxoisindolin-2-yl)cyclohexyl)methanesulfonic acid (Preparation 16f, 0.333 g, 1.03 mmol) in dichloromethane (5 mL) and *N,N*-dimethylformamide (0.1 mL) and the mixture was stirred and heated to 40 °C in a Schlenk tube. After 4 hours, the mixture was cooled and evaporated and the residue was taken up in ethyl acetate. The organic extract was washed with saturated aqueous sodium hydrogen carbonate solution and brine, dried ( $\text{MgSO}_4$ ) and evaporated to give the title compound (0.294 g, 84%) as a white solid.

$^1\text{H}$  NMR  $\delta$  ( $\text{DMSO}-d_6$ ): 1.04 (m, 2H), 1.68 (m, 3H), 2.08 (m, 4H), 2.41 (d, 2H), 3.94 (m, 1H), 7.79-7.86 (m, 4H).

**h) ((1r,4r)-4-(1,3-Dioxoisindolin-2-yl)cyclohexyl)methanesulfonyl chloride (alternative preparation)**

2M Aqueous hydrochloric acid (3.3 mL) was added to a cooled (ice bath), stirred suspension of *S*-((1r,4r)-4-(1,3-dioxoisindolin-2-yl)cyclohexyl)methyl ethanethioate (Preparation 16e, 2.05 g, 6.5 mmol) in acetonitrile (18 mL). *N*-Chlorosuccinimide (3.45 g, 25.8 mmol) was added portion wise to the above mixture after which the ice-bath was removed. An exothermic reaction ensued and the temperature was maintained at < 20 °C by periodic cooling in an ice-water bath. A homogenous solution formed followed by precipitation of a white solid. After 20 minutes, the thick mixture was diluted with water and extracted with ethyl acetate. The organic extract was washed with

saturated aqueous sodium hydrogen carbonate solution and brine, dried (MgSO<sub>4</sub>) and evaporated to give the title compound (2.53 g, ca. 85% by <sup>1</sup>H NMR) as a white solid pure enough to be used as such in subsequent reactions.

## 5 PREPARATION 17

### **1-(((1*r*,4*r*)-4-Aminocyclohexyl)methylsulfonyl)piperidin-3-ol**

#### **a) 2-(((1*r*,4*r*)-4-((3-Hydroxypiperidin-1-ylsulfonyl)methyl)cyclohexyl)isoindoline-1,3-dione**

- 10 Piperidin-3-ol (0.89 g, 8.80 mmol) was added to a stirred solution of ((1*r*,4*r*)-4-(1,3-dioxoisoindolin-2-yl)cyclohexyl)methanesulfonyl chloride (Preparation 16g, 1.00 g, 2.49 mmol) in dichloromethane (20 mL). After 1 hour, the mixture was concentrated *in vacuo* and the resulting residue was partitioned between water and ethyl acetate. The organic layer was separated, washed with brine, dried (MgSO<sub>4</sub>) and evaporated to give the title  
15 compound (0.98 g, 97%) as a white solid.

LRMS (m/z): 407 (M+1)<sup>+</sup>.

<sup>1</sup>H NMR δ (CDCl<sub>3</sub>): 1.24 (dq, 2H), 1.55-1.69 (m, 3H), 1.75-1.95 (m, 4H), 2.08-2.20 (m, 2H), 2.35 (dq, 2H), 2.83 (m, 2H), 3.07 (dd, 1H), 3.17 (m, 1H), 3.32 (m, 1H), 3.50 (dd, 1H), 3.89 (m, 1H), 4.12 (tt, 1H), 7.71 (m, 2H), 7.83 (m, 2H).

20

#### **b) 1-(((1*r*,4*r*)-4-Aminocyclohexyl)methylsulfonyl)piperidin-3-ol hydrochloride salt**

- Hydrazine (0.44 mL, 9.0 mmol) was added to a stirred suspension of 2-(((1*r*,4*r*)-4-((3-hydroxypiperidin-1-ylsulfonyl)methyl)cyclohexyl)isoindoline-1,3-dione (Preparation 17a, 0.98 g, 2.4 mmol) in ethanol (45 mL) and the mixture was heated to 60 °C. After 6  
25 hours, the mixture was cooled and evaporated. The solid residue was treated with 2M aqueous hydrochloric acid (20 mL) and filtered. The filtrate was lyophilized to give the title compound (0.74 g, 98%) as an off-white solid.

LRMS (m/z): 277 (M+1)<sup>+</sup>.

- 30 <sup>1</sup>H NMR δ (DMSO-*d*<sub>6</sub>): 1.06-1.45 (m, 6H), 1.65-2.00 (m, 6H), 2.57 (m, 1H), 2.76 (m, 1H), 2.90 (m, 2H), 3.30 (m, 1H), 3.47 (m, 2H), 8.02 (br s, 3H) (remaining 2 protons hidden under residual solvent peak).

## PREPARATION 18

### **1-(((1*r*,4*r*)-4-(2-(2-Methoxypyridin-3-ylamino)pyrimidin-4-ylamino)cyclohexyl)**

- 35 **methylsulfonyl)piperidin-3-ol**

**a) 1-(((1*r*,4*r*)-4-(2-Chloropyrimidin-4-ylamino)cyclohexyl)methylsulfonyl)piperidin-3-ol**

*N,N'*-Diisopropylethylamine (0.51 mL, 2.95 mmol) and 2,4-dichloropyrimidine (0.200 g, 1.34 mmol) were added to a suspension of 1-(((1*r*,4*r*)-4-aminocyclohexyl)methylsulfonyl) piperidin-3-ol hydrochloride salt (Preparation 17b, 0.408 g, 1.48 mmol) in *N,N'*-dimethylformamide (5 mL) in a Kimble vial. The vial was sealed and the suspension was shaken and heated to 90 °C overnight. After cooling to ambient temperature, the reaction mixture was diluted with water and extracted with methylene chloride. The organic layer was washed with water and brine, dried (MgSO<sub>4</sub>) and the solvent was evaporated under reduced pressure. The crude product was purified by flash chromatography (0-5% methanol in methylene chloride) to give the title compound (0.118 g, 21%) as an oil.

<sup>1</sup>H NMR δ (CDCl<sub>3</sub>): 1.30 (m, 4H) 1.61 (m, 2H) 1.80-2.20 (m, 8H), 2.81 (m, 2H), 3.02 (dd, 1H), 3.11 (m, 1H), 3.30 (m, 1H), 3.50 (dd, 1H), 3.91 (m, 1H), 5.02 (s, 1H), 6.21 (d, 1H), 8.04 (m, 1H).

**b) 1-(((1*r*,4*r*)-4-(2-(2-Methoxypyridin-3-ylamino)pyrimidin-4-ylamino)cyclohexyl)methylsulfonyl)piperidin-3-ol**

Obtained as a solid (56%) from 1-(((1*r*,4*r*)-4-(2-chloropyrimidin-4-ylamino)cyclohexyl)methylsulfonyl)piperidin-3-ol (Preparation 18a) and 2-methoxypyridin-3-amine following the experimental procedure as described in Preparation 1b followed by purification of the crude product by flash chromatography (0-5% methanol in methylene chloride).

<sup>1</sup>H NMR δ (CDCl<sub>3</sub>): 1.24-1.30 (m, 4H), 1.55-1.62 (m, 2H), 1.84-2.25 (m, 8H), 2.82 (m, 2H), 3.03 (dd, 1H), 3.11 (m, 1H), 3.30 (m, 1H), 3.51 (dd, 1H), 3.88 (m, 1H), 4.02 (s, 3H), 4.73 (s, 1H), 5.84 (d, 1H), 6.84 (dd, 1H), 7.37 (s, 1H), 7.73 (d, 1H), 7.92 (d, 1H), 8.70 (d, 1H).

**PREPARATION 19**

**(*R*)-3-(4-(Piperidin-3-ylamino)pyrimidin-2-ylamino)pyridin-2(1*H*)-one**

**a) (*R*)-*Tert*-butyl 3-(2-chloropyrimidin-4-ylamino)piperidine-1-carboxylate**

A solution of 2,4-dichloropyrimidine (2.0 g, 13.4 mmol), (*R*)-*tert*-butyl 3-aminopiperidine-1-carboxylate (2.7 g, 13.5 mmol) and *N,N'*-diisopropylethylamine (2.3 mL, 13.4 mmol) in *N,N'*-dimethylformamide (15 mL) was stirred and heated overnight at 90 °C. After cooling to ambient temperature, water was added and the resulting mixture was extracted with ethyl acetate. The organic phase was washed with water and brine, dried (MgSO<sub>4</sub>), filtered and the solvent was evaporated under reduced pressure. The

residue was purified by flash chromatography (2:1 hexanes/ethyl acetate) to give the title compound (2.87 g, 68%) as a yellow oil.

LRMS (m/z): 313 (M+1)<sup>+</sup>.

<sup>1</sup>H-NMR δ (CDCl<sub>3</sub>): 1.45 (s, 9H), 1.54-1.81 (m, 4H), 1.94 (br s, 1H), 3.05-3.59 (m, 3H), 3.72 (br s, 1H), 5.13-5.31 (m, 1H), 6.28 (br s, 1H), 8.04 (br s, 1H).

**b) (*R*)-*Tert*-butyl 3-(2-(2-methoxypyridin-3-ylamino)pyrimidin-4-ylamino)piperidine-1-carboxylate**

Obtained as a white solid (43%) from (*R*)-*tert*-butyl 3-(2-chloropyrimidin-4-ylamino)piperidine-1-carboxylate (Preparation 19a) and 2-methoxypyridin-3-amine following the experimental procedure as described in Preparation 1b followed by purification of the crude product by reverse phase chromatography (C-18 silica from Waters<sup>®</sup>, water/acetonitrile/methanol as eluents [0.1% v/v formic acid buffered] 0% to 100%).

LRMS (m/z): 401 (M+1)<sup>+</sup>.

<sup>1</sup>H-NMR δ (CDCl<sub>3</sub>): 1.44 (s, 9H), 1.54-1.81 (m, 2H), 1.86-2.03 (m, 1H), 2.95 (m, 2H), 3.16-3.39 (m, 2H), 3.50 (m, 1H), 3.82 (d, 1H), 4.02 (s, 3H), 5.03 (m, 1H), 5.91 (d, 1H), 6.87 (dd, 1H), 7.77 (dd, 1H), 7.93 (d, 1H), 8.23 (s, 1H), 8.57 (d, 1H).

**c) (*R*)-3-(4-(Piperidin-3-ylamino)pyrimidin-2-ylamino)pyridin-2(1*H*)-one**

A suspension of (*R*)-*tert*-butyl 3-(2-(2-methoxypyridin-3-ylamino)pyrimidin-4-ylamino)piperidine-1-carboxylate (Preparation 19b, 340 mg, 0.85 mmol) in 48% aqueous hydrogen bromide solution (2.9 mL, 25.46 mmol) was stirred and heated at 100 °C for 4 hours. After cooling to ambient temperature the solid that formed was filtered and dried to give the hydrobromide salt of the title compound (243 mg, 100%) as an off-white solid.

LRMS (m/z): 287 (M+1)<sup>+</sup>.

<sup>1</sup>H-NMR δ (DMSO-*d*<sub>6</sub>): 1.58 (d, 1H), 1.75-1.97 (m, 2H), 2.07 (dd, 1H), 2.86-3.10 (m, 2H), 3.24 (d, 1H), 3.31-3.50 (m, 1H), 4.33 (dd, 1H), 6.34 (d, 1H), 6.45 (t, 1H), 7.25 (br s, 1H), 8.00 (d, 1H), 8.20 (d, 1H), 8.78-8.92 (m, 1H), 8.94-9.08 (m, 1H), 9.32 (d, 1H), 9.76 (s, 1H), 12.19 (br s, 1H).

**PREPARATION 20**

**(*R*)-3-(5-Methyl-4-(piperidin-3-ylamino)pyrimidin-2-ylamino)pyridin-2(1*H*)-one**

**a) (*R*)-*Tert*-butyl 3-(2-chloro-5-methylpyrimidin-4-ylamino)piperidine-1-carboxylate**

Obtained as an oil (100%) from 2,4-dichloro-5-methylpyrimidine and (*R*)-*tert*-butyl 3-aminopiperidine-1-carboxylate following the experimental procedure as described in Preparation 19a.

LRMS (m/z): 327 (M+1)<sup>+</sup>.

**b) (*R*)-*Tert*-butyl 3-(2-(2-methoxyppyridin-3-ylamino)-5-methylpyrimidin-4-ylamino)piperidine-1-carboxylate**

Obtained as a solid (36%) from (*R*)-*tert*-butyl 3-(2-chloro-5-methylpyrimidin-4-ylamino)piperidine-1-carboxylate (Preparation 20a) and 2-methoxyppyridin-3-amine following the experimental procedure as described in Preparation 1b followed by purification of the crude product by reverse phase chromatography (C-18 silica from Waters<sup>®</sup>, water/acetonitrile/methanol as eluents [0.1% v/v formic acid buffered] 0% to 100%).

LRMS (m/z): 415 (M+1)<sup>+</sup>.

**c) (*R*)-3-(5-Methyl-4-(piperidin-3-ylamino)pyrimidin-2-ylamino)pyridin-2(1*H*)-one**

Obtained as hydrobromide salt (63%) from (*R*)-*tert*-butyl 3-(2-(2-methoxyppyridin-3-ylamino)-5-methylpyrimidin-4-ylamino)piperidine-1-carboxylate (Preparation 20b) following the experimental procedure as described in Preparation 19c.

LRMS (m/z): 381 (M+1)<sup>+</sup>.

**PREPARATION 21**

**2,4-Dichloro-5-fluoropyrimidine**

To a stirred mixture of 5-fluoropyrimidine-2,4(1*H*,3*H*)-dione (3.0 g, 23 mmol) and phosphorous pentachloride (14.41 g, 69 mmol) was added phosphorous oxychloride (12.6 mL, 130 mmol). The reaction mixture was stirred and heated to reflux for 5 hours and then cooled to ambient temperature and stirred overnight. The mixture was carefully poured onto ice/water (600 mL) and then stirred for 1 hour. Sodium chloride was added and the product was extracted into dichloromethane. The combined organic layer was dried (MgSO<sub>4</sub>), filtered and evaporated to give the title compound (84%) as a yellow solid.

LRMS (m/z): 167 (M+1)<sup>+</sup>.

<sup>1</sup>H-NMR δ (CDCl<sub>3</sub>): 8.49 (s, 1H).

**PREPARATION 22**

**(*R*)-3-(5-Fluoro-4-(piperidin-3-ylamino)pyrimidin-2-ylamino)pyridin-2(1*H*)-one****a) (*R*)-*Tert*-butyl 3-(2-chloro-5-fluoropyrimidin-4-ylamino)piperidine-1-carboxylate**

Obtained as an oil (100%) from 2,4-dichloro-5-fluoropyrimidine (Preparation 21) and

- 5 (*R*)-*tert*-butyl 3-aminopiperidine-1-carboxylate following the experimental procedure as described in Preparation 19a.

LRMS (m/z): 331 (M+1)<sup>+</sup>.

**b) (*R*)-*Tert*-butyl 3-(5-fluoro-2-(2-methoxypyridin-3-ylamino)pyrimidin-4-ylamino)****10 piperidine-1-carboxylate**

Obtained as a solid (32%) from (*R*)-*tert*-butyl 3-(2-chloro-5-fluoropyrimidin-4-ylamino) piperidine-1-carboxylate (Preparation 22a) and 2-methoxypyridin-3-amine following the experimental procedure as described in Preparation 1b followed by purification of the crude product by reverse phase chromatography (C-18 silica from Waters<sup>®</sup>,  
15 water/acetonitrile/methanol as eluents [0.1% v/v formic acid buffered] 0% to 100%).

LRMS (m/z): 419 (M+1)<sup>+</sup>.

**c) (*R*)-3-(5-Fluoro-4-(piperidin-3-ylamino)pyrimidin-2-ylamino)pyridin-2(1*H*)-one**

Obtained as hydrobromide salt (94%) from (*R*)-*tert*-butyl 3-(5-fluoro-2-(2-methoxy pyridin-3-ylamino)pyrimidin-4-ylamino)piperidine-1-carboxylate (Preparation 22b)  
20 following the experimental procedure as described in Preparation 19c.

LRMS (m/z): 385 (M+1)<sup>+</sup>.

**PREPARATION 23****25 (*R*)-5-Chloro-3-(5-methyl-4-(piperidin-3-ylamino)pyrimidin-2-ylamino)pyridin-2(1*H*)-one****a) (*R*)-*Tert*-butyl 3-(2-(5-chloro-2-methoxypyridin-3-ylamino)-5-methylpyrimidin-4-ylamino)piperidine-1-carboxylate**

- 30 Obtained as a solid (14%) from (*R*)-*tert*-butyl 3-(2-chloro-5-methylpyrimidin-4-ylamino) piperidine-1-carboxylate (Preparation 20a) and 5-chloro-2-methoxypyridin-3-amine (Preparation 6b) following the experimental procedure as described in Preparation 1b followed by purification of the crude product by reverse phase chromatography (C-18 silica from Waters<sup>®</sup>, water/acetonitrile/methanol as eluents [0.1% v/v formic acid  
35 buffered] 0% to 100%).

LRMS (m/z): 449 (M+1)<sup>+</sup>.

**b) (*R*)-5-Chloro-3-(5-methyl-4-(piperidin-3-ylamino)pyrimidin-2-ylamino)pyridin-2(1*H*)-one**

Obtained as hydrobromide salt (73%) from (*R*)-*tert*-butyl 3-(2-(5-chloro-2-methoxy pyridin-3-ylamino)-5-methylpyrimidin-4-ylamino)piperidine-1-carboxylate (Preparation

5 23a) following the experimental procedure as described in Preparation 19c.

LRMS (*m/z*): 335 (*M*+1)<sup>+</sup>.

PREPARATION 24

**(*R*)-3-(5-Fluoro-4-morpholino-6-(piperidin-3-ylamino)pyrimidin-2-ylamino)pyridin-2(1*H*)-one**

**a) (*R*)-*tert*-Butyl 3-(2-chloro-5-fluoro-6-morpholinopyrimidin-4-ylamino)piperidine-1-carboxylate**

(*R*)-*tert*-Butyl 3-aminopiperidine-1-carboxylate (1.60 g, 7.99 mmol) was added to a  
 15 solution of 4-(2,6-dichloro-5-fluoropyrimidin-4-yl)morpholine (Preparation 11a, 1.01 g, 4.00 mmol) in ethanol (48 mL) and the resulting mixture was stirred and heated to reflux for 3 days. After cooling to ambient temperature, the solvent was evaporated under reduced pressure and the residue was partitioned between water and methylene chloride. The organic layer was separated, washed with water, dried (MgSO<sub>4</sub>) and the  
 20 solvent evaporated under reduced pressure. The residue was purified by flash chromatography (0-100% ethyl acetate in hexanes) to give the title compound (0.810 g, 47%) as a white foam.

LRMS (*m/z*): 416 (*M*+1)<sup>+</sup>.

<sup>1</sup>H-NMR δ (CDCl<sub>3</sub>): 1.44 (s, 9H), 1.62-1.70 (m, 2H), 1.85-1.90 (m, 1H), 3.40-  
 25 3.41 (m, 3H), 3.63-3.66 (m, 4H), 3.74-3.77 (m, 4H), 4.08-4.13 (m, 2H), 4.86 (br s, 1H).

**b) (*R*)-*tert*-Butyl 3-(5-fluoro-2-(2-methoxypyridin-3-ylamino)-6-morpholino pyrimidin-4-ylamino)piperidine-1-carboxylate**

Obtained as a white foam (87%) from (*R*)-*tert*-butyl 3-(2-chloro-5-fluoro-6-morpholino pyrimidin-4-ylamino)piperidine-1-carboxylate (Preparation 24a) and 2-methoxypyridin-3-amine following the experimental procedure as described in Preparation 1b followed by purification of the crude product by flash chromatography (0-100% ethyl acetate in hexanes).

LRMS (*m/z*): 504 (*M*+1)<sup>+</sup>.

$^1\text{H-NMR}$   $\delta$  ( $\text{CDCl}_3$ ): 1.43 (s, 9H), 1.63-1.79 (m, 3H), 1.93-2.01 (m, 1H), 3.22-3.34 (m, 3H), 3.49-3.55 (m, 1H), 3.61-3.64 (m, 4H), 3.77-3.81 (m, 4H), 4.70 (br s, 1H), 6.86 (dd, 1H), 7.15 (s, 1H), 7.69 (dd, 1H), 8.57 (dd, 1H).

5 **c) (*R*)-3-(5-Fluoro-4-morpholino-6-(piperidin-3-ylamino)pyrimidin-2-ylamino)pyridin-2(1*H*)-one**

A mixture of (*R*)-*tert*-butyl 3-(5-fluoro-2-(2-methoxypyridin-3-ylamino)-6-morpholino pyrimidin-4-ylamino)piperidine-1-carboxylate (Preparation 24b, 0.099 g, 0.30 mmol) and a 4N solution of hydrogen chloride in 1,4-dioxane (70 mL) was stirred at ambient  
10 temperature for 3 hours. The solvent was evaporated under reduced pressure and the residue was partitioned between ethyl acetate and a saturated aqueous solution of sodium hydrogencarbonate. The organic layer was separated and the aqueous phase was washed with ethyl acetate (X2). The combined organic extracts were dried ( $\text{Na}_2\text{SO}_4$ ) and the solvent evaporated under reduced pressure to give the title  
15 compound (0.088 g, 93%) as a yellow foam that was used in the next synthetic step without further purification.

LRMS ( $m/z$ ): 390 ( $M+1$ ) $^+$ .

PREPARATION 25

20 **(*R*)-*tert*-Butyl 3-(2-chloro-5-methyl-6-morpholinopyrimidin-4-ylamino)piperidine-1-carboxylate and (*R*)-*tert*-butyl 3-(4-chloro-5-methyl-6-morpholinopyrimidin-2-ylamino)piperidine-1-carboxylate**

**a) 4-(2,6-Dichloro-5-methylpyrimidin-4-yl)morpholine**

25 Obtained as the major isomer (white solid, 47%) from 2,4,6-trichloro-5-methyl pyrimidine and morpholine following the experimental procedure as described in Preparation 11a followed by purification of the crude product by flash chromatography (0-100% ethyl acetate in hexanes).

LRMS ( $m/z$ ): 249 ( $M+1$ ) $^+$ .

30  $^1\text{H-NMR}$   $\delta$  ( $\text{CDCl}_3$ ): 2.22 (s, 3H), 3.43-3.52 (m, 4H), 3.73-3.83 (m, 4H).

**b) (*R*)-*tert*-Butyl 3-(2-chloro-5-methyl-6-morpholinopyrimidin-4-ylamino)piperidine-1-carboxylate and (*R*)-*tert*-butyl 3-(4-chloro-5-methyl-6-morpholinopyrimidin-2-ylamino)piperidine-1-carboxylate**

35 Obtained from 4-(2,6-dichloro-5-methylpyrimidin-4-yl)morpholine (Preparation 25a) and (*R*)-*tert*-butyl 3-aminopiperidine-1-carboxylate following the experimental procedure as described in Preparation 24a followed by purification by flash chromatography (0-100%



ethyl acetate in hexanes). The chemical structures of the two regioisomers were assigned based on NMR nOe studies: (*R*)-*tert*-butyl 3-(2-chloro-5-methyl-6-morpholinopyrimidin-4-ylamino)piperidine-1-carboxylate was obtained as the minor isomer (25%, orange foam) and (*R*)-*tert*-butyl 3-(4-chloro-5-methyl-6-morpholinopyrimidin-2-ylamino)piperidine-1-carboxylate was obtained as the major isomer (59%, colourless oil).

(*R*)-*tert*-Butyl 3-(2-chloro-5-methyl-6-morpholinopyrimidin-4-ylamino)piperidine-1-carboxylate (minor isomer):

LRMS (*m/z*): 413 (*M*+1)<sup>+</sup>.

<sup>1</sup>H-NMR δ (CDCl<sub>3</sub>): 1.43 (s, 9H), 1.59-1.71 (m, 4H), 1.89 (m, 3H), 3.21 (m, 4H), 3.30-3.64 (m, 4H), 3.78 (m, 4H), 4.16 (br s, 1H).

(*R*)-*tert*-Butyl 3-(4-chloro-5-methyl-6-morpholinopyrimidin-2-ylamino)piperidine-1-carboxylate (major isomer):

LRMS (*m/z*): 413 (*M*+1)<sup>+</sup>.

<sup>1</sup>H-NMR δ (CDCl<sub>3</sub>): 1.41 (s, 9H), 1.55 (m, 2H), 1.73 (m, 1H), 1.90 (m, 1H), 2.10 (s, 2H), 2.16 (s, 3H), 3.33 (m, 4H), 3.86 (m, 4H), 4.89 (br s, 1H).

## PREPARATION 26

**(*R*)-3-(5-Methyl-4-morpholino-6-(piperidin-3-ylamino)pyrimidin-2-ylamino)pyridin-2(1*H*)-one**

**a) (*R*)-*tert*-Butyl 3-(2-(2-methoxypyridin-3-ylamino)-5-methyl-6-morpholino pyrimidin-4-ylamino)piperidine-1-carboxylate**

Obtained as an orange foam (79%) from (*R*)-*tert*-butyl 3-(2-chloro-5-methyl-6-morpholinopyrimidin-4-ylamino)piperidine-1-carboxylate (Preparation 25b) and 2-methoxypyridin-3-amine following the experimental procedure as described in Preparation 1b followed by purification of the crude product by flash chromatography (0-100% ethyl acetate in hexanes).

LRMS (*m/z*): 500 (*M*+1)<sup>+</sup>.

<sup>1</sup>H-NMR δ (CDCl<sub>3</sub>): 1.23-1.28 (m, 1H), 1.58 (s, 3H), 1.73 (m, 3H), 1.90 (s, 3H), 3.20 (t, 4H), 3.43 (m, 4H), 3.83 (t, 4H), 4.03 (s, 3H), 4.13 (br s, 1H), 6.87 (dd, 1H), 7.21 (br s, 1H), 7.68 (dd, 1H), 8.73 (dd, 1H).

**b) (*R*)-3-(5-Methyl-4-morpholino-6-(piperidin-3-ylamino)pyrimidin-2-ylamino)pyridin-2(1*H*)-one**

Methanol was added to a stirred mixture of (*R*)-*tert*-butyl 3-(2-(2-methoxypyridin-3-ylamino)-5-methyl-6-morpholinopyrimidin-4-ylamino)piperidine-1-carboxylate (Preparation 26a, 0.212 g, 0.42 mmol) and 4N solution of hydrogen chloride in 1,4-dioxane (4 mL) in a sealed tube at ambient temperature until a clear solution was formed. After stirring for an additional 3 hours, further 4N hydrogen chloride solution in 1,4-dioxane (3 mL) was added and the resulting mixture was stirred and heated at 40 °C overnight. The solvents were evaporated under reduced pressure and the residue was partitioned between ethyl acetate and an saturated aqueous solution of sodium hydrogencarbonate. The organic layer was separated and the aqueous phase was washed with ethyl acetate (X2). The combined organic extracts were dried (Na<sub>2</sub>SO<sub>4</sub>) and the solvent evaporated under reduced pressure to give the title compound (0.082 g, 37%) as an orange foam that was used in the next synthetic step without further purification.

LRMS (m/z): 386 (M+1)<sup>+</sup>.

#### PREPARATION 27

##### **(*R*)-3-(5-Methyl-6-morpholino-2-(piperidin-3-ylamino)pyrimidin-4-ylamino)pyridin-2(1*H*)-one**

##### **a) (*R*)-*tert*-Butyl 3-(4-(2-methoxypyridin-3-ylamino)-5-methyl-6-morpholino pyrimidin-2-ylamino)piperidine-1-carboxylate**

Obtained as a yellow oil (60%) from (*R*)-*tert*-butyl 3-(4-chloro-5-methyl-6-morpholinopyrimidin-2-ylamino)piperidine-1-carboxylate (Preparation 25b) and 2-methoxypyridin-3-amine following the experimental procedure as described in Preparation 1b followed by purification of the crude product by flash chromatography (0-100% ethyl acetate in hexanes).

LRMS (m/z): 500 (M+1)<sup>+</sup>.

<sup>1</sup>H-NMR δ (CDCl<sub>3</sub>): 1.40 (9H, br s), 1.52-1.80 (4H, m), 2.05 (3H, s), 3.22 (6H, s), 3.60 (2H, m), 3.78-3.95 (5H, m), 4.05 (3H, s), 4.70 (1H, br d), 6.88 (2H, m), 7.73 (1H, dd), 8.73 (1H, dd).

##### **b) (*R*)-3-(5-Methyl-6-morpholino-2-(piperidin-3-ylamino)pyrimidin-4-ylamino)pyridin-2(1*H*)-one**

A mixture of (*R*)-*tert*-butyl 3-(4-(2-methoxypyridin-3-ylamino)-5-methyl-6-morpholino pyrimidin-2-ylamino)piperidine-1-carboxylate (Preparation 27a, 0.523 g, 1.05 mmol) and a 4N solution of hydrogen chloride in 1,4-dioxane (10 mL) was stirred at ambient temperature for 3 days. The solvent was evaporated and the residue was partitioned

between ethyl acetate and water. Solid potassium carbonate was added to the aqueous phase until a basic pH was reached and the aqueous solution was extracted with methylene chloride (X3). The combined organic extracts were dried (Na<sub>2</sub>SO<sub>4</sub>) and the solvent was evaporated under reduced pressure to give the title compound (0.110 g, 23%) as a yellow solid that was used in the next synthetic step without further purification.

LRMS (m/z): 386 (M+1)<sup>+</sup>.

<sup>1</sup>H-NMR δ (CDCl<sub>3</sub>): 1.50-1.83 (4H, m), 2.08 (3H, s), 2.57-2.75 (2H, m), 2.87-2.95 (2H, m), 3.17-3.30 (4H, m), 3.71 (1H, s), 3.75-3.84 (4H, m), 4.85 (1H, br d), 6.34 (1H, t), 6.91 (1H, dd), 8.64 (1H, dd)

#### PREPARATION 28

##### **(*R*)-5-Chloro-3-(5-methyl-6-morpholino-2-(piperidin-3-ylamino)pyrimidin-4-ylamino)pyridin-2(1*H*)-one**

##### **a) (*R*)-*tert*-Butyl 3-(4-(5-chloro-2-methoxypyridin-3-ylamino)-5-methyl-6-morpholinopyrimidin-2-ylamino)piperidine-1-carboxylate**

Obtained as a yellow foam (83%) from (*R*)-*tert*-butyl 3-(4-chloro-5-methyl-6-morpholinopyrimidin-2-ylamino)piperidine-1-carboxylate (Preparation 25b) and 5-chloro-2-methoxypyridin-3-amine (Preparation 6b) following the experimental procedure as described in Preparation 1b followed by purification of the crude product by flash chromatography (0-100% ethyl acetate in hexanes).

LRMS (m/z): 534/536 (M+1)<sup>+</sup>.

<sup>1</sup>H-NMR δ (CDCl<sub>3</sub>): 1.39 (9H, br s), 1.60-1.80 (4H, m), 2.05 (3H, s), 3.20 (4H, s), 3.20-3.35 (2H, m), 3.50-3.60 (2H, m), 3.80 (4H, m), 3.92 (1H, br s), 4.05 (3H, s), 6.85 (1H, s), 7.65 (1H, d), 8.88 (1H, br s).

##### **b) (*R*)-5-Chloro-3-(5-methyl-6-morpholino-2-(piperidin-3-ylamino)pyrimidin-4-ylamino)pyridin-2(1*H*)-one**

Methanol was added to a mixture of (*R*)-*tert*-butyl 3-(4-(5-chloro-2-methoxypyridin-3-ylamino)-5-methyl-6-morpholinopyrimidin-2-ylamino)piperidine-1-carboxylate (Preparation 28a, 0.332 g, 0.62 mmol) and a 4N solution of hydrogen chloride in 1,4-dioxane (6 mL) at ambient temperature until a clear solution was formed. After 3 days, solvents were evaporated and the residue was partitioned between ethyl acetate and a saturated aqueous solution of sodium hydrogencarbonate. The organic layer was separated and the aqueous phase was washed with ethyl acetate (X2). The combined organic extracts were dried (Na<sub>2</sub>SO<sub>4</sub>) and the solvent evaporated under reduced

pressure to give the title compound (0.175 g, 63%) as a yellow solid that was used in the next synthetic step without further purification.

LRMS (m/z): 420/422 (M+1)<sup>+</sup>.

<sup>1</sup>H-NMR δ (CDCl<sub>3</sub>): 1.57 (2H, m), 1.80 (2H, m), 2.07 (3H, s), 2.60-2.80 (2H, m),  
 2.90-3.00 (2H, m), 3.17-3.33 (4H, m), 3.76-3.84 (4H, m), 3.90 (1H, m), 4.90 (1H,  
 br d), 6.95 (1H, d), 7.68 (1H, s), 8.71 (1H, s).

## Examples

### EXAMPLE 1

#### **(S)-3-(4-(1-(5-fluoropyridin-2-yl)ethylamino)pyrimidin-2-ylamino)pyridin-2(1H)-one**

A suspension of (S)-N<sup>4</sup>-(1-(5-fluoropyridin-2-yl)ethyl)-N<sup>2</sup>-(2-methoxypyridin-3-yl)pyrimidine-2,4-diamine (Preparation 1b, 11 mg, 0.03 mmol) in 48% aqueous hydrogen bromide solution (2 mL) was stirred and heated to 100 °C for 5 hours. After cooling to ambient temperature, the reaction mixture was diluted with water and extracted with dichloromethane. The pH of the aqueous phase was then adjusted to ca. 8 with 2M aqueous sodium hydroxide solution and extracted (x3) with dichloromethane. The combined organic extracts were washed with water and brine, dried (MgSO<sub>4</sub>), filtered and the solvent evaporated under reduced pressure to yield the title compound (4 mg, 38%) as a solid.

LRMS (m/z): 327 (M+1)<sup>+</sup>.

<sup>1</sup>H-NMR δ (CDCl<sub>3</sub>): 1.57 (d, 3H), 5.19 (br s, 1H), 5.79 (d, 1H), 5.91 (d, 1H), 6.32 (d, 1H), 6.93 (dd, 1H), 7.29-7.47 (m, 3H), 7.96 (d, 2H), 8.43 (d, 2H), 11.76 (br s, 1H).

### EXAMPLE 2

#### **(S)-3-(4-(1-(5-fluoropyridin-2-yl)ethylamino)-5-methylpyrimidin-2-ylamino)pyridin-2(1H)-one**

Trimethylsilyl chloride (0.20 mL, 1.58 mmol) and sodium iodide (235 mg, 1.57 mmol) were added to a stirred solution of (S)-N<sup>4</sup>-(1-(5-fluoropyridin-2-yl)ethyl)-N<sup>2</sup>-(2-methoxypyridin-3-yl)-5-methylpyrimidine-2,4-diamine (Preparation 2b, 185 mg, 0.52 mmol) in acetonitrile (5 mL) and the mixture was stirred and heated at 80 °C for 45 min. After cooling to ambient temperature, the mixture was concentrated and treated with saturated aqueous sodium thiosulphate solution. After stirring for 10 minutes, the

precipitate was filtered, washed with water and diethyl ether and dried to give the title compound (179 mg, 100%) as a solid.

LRMS (m/z): 341 (M+1)<sup>+</sup>.

<sup>1</sup>H-NMR  $\delta$  (DMSO-*d*<sub>6</sub>): 1.63 (d, 3H), 2.14 (s, 3H), 5.22-5.47 (m, 1H), 6.17-6.31 (m, 1H), 7.06 (br s, 1H), 7.55 (dd, 1H), 7.71 (br s, 1H), 7.87 (s, 2H), 7.96 (d, 2H), 8.60 (br s, 1H), 11.98 (br s, 1H).

### EXAMPLE 3

#### **3-[(5-chloro-4-[(1*S*)-1-(5-fluoropyridin-2-yl)ethyl]amino}pyrimidin-2-yl)amino]pyridin-2(1*H*)-one**

A mixture of (*S*)-5-chloro-*N*4-(1-(5-fluoropyridin-2-yl)ethyl)-*N*2-(2-methoxypyridin-3-yl)pyrimidine-2,4-diamine (Preparation 3b, 0.184 g, 0.49 mmol) and 48% aqueous hydrogen bromide solution (1.6 mL) was heated to 100 °C for 3 hours. The solvent was evaporated under reduced pressure and the residue was treated with a saturated aqueous solution of potassium carbonate and then extracted with ethyl acetate (X3). The combined organic extracts were dried (Na<sub>2</sub>SO<sub>4</sub>) and the solvent evaporated to yield the title compound (0.154 g, 91%) as a white solid.

LRMS (m/z): 361 (M+1)<sup>+</sup>.

<sup>1</sup>H-NMR  $\delta$  (CDCl<sub>3</sub>): 1.60 (d, 3H), 5.33-5.37 (m, 1H), 6.28-6.33 (m, 1H), 6.43 (d, 1H), 6.92 (d, 1H), 7.31-7.45 (m, 2H), 7.98 (s, 1H), 8.02 (s, 1H), 8.35 (dd, 1H), 8.46 (d, 1H), 11.07 (br s, 1H).

### EXAMPLE 4

#### **3-[(4-[(1*S*)-1-(5-fluoropyridin-2-yl)ethyl]amino}-5-methoxypyrimidin-2-yl)amino]pyridin-2(1*H*)-one**

Obtained as a white solid (33%) from (*S*)-*N*4-(1-(5-fluoropyridin-2-yl)ethyl)-5-methoxy-*N*2-(2-methoxypyridin-3-yl)-pyrimidine-2,4-diamine (Preparation 4b) following the experimental procedure as described in Example 3.

LRMS (m/z): 357 (M+1)<sup>+</sup>.

<sup>1</sup>H-NMR  $\delta$  (CDCl<sub>3</sub>): 1.58 (d, 3H), 3.85 (s, 3H), 5.42-5.26 (m, 1H), 6.21 (d, 1H), 6.29 (dd, 1H), 6.90 (dd, 1H), 7.56 (s, 1H), 7.41-7.29 (m, 2H), 7.85 (br s, 1H), 8.38 (dd, 1H), 8.45 (d, 1H), 12.03 (s, 1H).

### EXAMPLE 5

**3-[(4-[(1*S*)-1-(5-fluoropyridin-2-yl)ethyl]amino)-5-hydroxypyrimidin-2-yl]amino]pyridin-2(1*H*)-one**

A mixture of (S)-*N*<sup>4</sup>-(1-(5-fluoropyridin-2-yl)ethyl)-5-methoxy-*N*<sup>2</sup>-(2-methoxypyridin-3-yl)pyrimidine-2,4-diamine (Preparation 4b, 0.200 g, 0.54 mmol) and 48% aqueous hydrogen bromide solution (1.8 mL) was stirred and heated to 100 °C overnight. The solvent was evaporated under reduced pressure and the residue was treated with a saturated aqueous solution of potassium carbonate and then extracted with ethyl acetate (X3). Concentrated aqueous hydrogen chloride solution was then added to the aqueous solution until an acidic pH was reached and the white solid that formed was filtered and dried to give the title compound (0.047 g, 25%).

LRMS (m/z): 343 (M+1)<sup>+</sup>.

<sup>1</sup>H-NMR δ (CD<sub>3</sub>OD): 1.68 (d, 3H), 5.37-5.44 (m, 1H), 6.34-6.49 (m, 1H), 7.15 (d, 1H), 7.35 (s, 1H), 7.43-7.67 (m, 2H), 8.05 (d, 1H), 8.48 (d, 1H).

**EXAMPLE 6**

**(S)-4-(1-(5-fluoropyridin-2-yl)ethylamino)-2-(2-oxo-1,2-dihydropyridin-3-ylamino)pyrimidine-5-carboxamide**

Obtained as a white solid (60%) from (S)-4-(1-(5-fluoropyridin-2-yl)ethylamino)-2-(2-methoxypyridin-3-ylamino)pyrimidine-5-carboxamide (Preparation 5d) following the experimental procedure as described in Example 2.

LRMS (m/z): 370 (M+1)<sup>+</sup>.

**EXAMPLE 7**

**(S)-5-chloro-3-(4-(1-(5-fluoropyridin-2-yl)ethylamino)-5-methylpyrimidin-2-ylamino)pyridin-2(1*H*)-one**

Obtained as a brownish solid (98%) from (S)-*N*<sup>2</sup>-(5-chloro-2-methoxypyridin-3-yl)-*N*<sup>4</sup>-(1-(5-fluoropyridin-2-yl)ethyl)-5-methylpyrimidine-2,4-diamine (Preparation 7) following the experimental procedure as described in Example 2.

LRMS (m/z): 375 (M+1)<sup>+</sup>.

<sup>1</sup>H-NMR δ (DMSO-*d*<sub>6</sub>): 1.70 (d, 3H), 2.17 (s, 3H), 5.47 (t, 1H), 7.40 (d, 2H), 7.59 (dd, 2H), 7.78 (td, 1H), 7.98 (s, 1H), 8.08 (d, 1H), 8.57 (d, 1H), 8.67-8.81 (m, 1H), 9.48 (br s, 1H).

**EXAMPLE 8**

**3-[(4-[(1*S*)-1-(5-fluoropyridin-2-yl)ethyl]amino)-5-methylpyrimidin-2-yl]amino]-5-(1*H*-pyrazol-4-yl)pyridin-2(1*H*)-one**

Obtained as a white solid (7%) from (S)-*N*4-(1-(5-fluoropyridin-2-yl)ethyl)-*N*2-(2-methoxy-5-(1*H*-pyrazol-4-yl)pyridin-3-yl)-5-methylpyrimidine-2,4-diamine (Preparation 9b) following the experimental procedure as described in Example 3 followed by purification of the crude product by reverse phase chromatography (C-18 silica from Waters<sup>®</sup>, water/acetonitrile/methanol as eluents [0.1% v/v formic acid buffered] 0% to 100%).

LRMS (m/z): 407 (M+1)<sup>+</sup>.

<sup>1</sup>H-NMR δ (CD<sub>3</sub>OD): 1.63 (d, 3H), 2.10 (s, 3H), 4.63 (s, 1H), 5.47-5.67 (m, 1H), 7.18 (d, 1H), 7.40 (dd, 1H), 7.44-7.54 (m, 1H), 7.74 (s, 1H), 7.96 (s, 2H), 8.33 (s, 1H), 8.66 (d, 1H).

**EXAMPLE 9**

**3-[(4-[(1*S*)-1-(5-Fluoropyridin-2-yl)ethyl]amino)-6-(4-hydroxypiperidin-1-yl)pyrimidin-2-yl]amino]pyridin-2(1*H*)-one**

Tetrabutylammonium fluoride (1M solution in tetrahydrofuran, 4.82mL, 4.82 mmol) was added to a suspension of 3-[(4-(4-[(*tert*-butyl(dimethyl)silyl]oxy)piperidin-1-yl)-6-[(1*S*)-1-(5-fluoropyridin-2-yl)ethyl]amino)pyrimidin-2-yl]amino]pyridin-2(1*H*)-one (Preparation 10d, 520 mg, 0.96 mmol) in tetrahydrofuran (5 mL) and the mixture was stirred and heated to 70 °C for 4 hours. After cooling to ambient temperature, the mixture was partitioned between water and ethyl acetate. The aqueous layer was washed with ethyl acetate (x3) and the combined organic extract was washed with water, dried (Na<sub>2</sub>SO<sub>4</sub>) and the solvents were evaporated under reduced pressure. The residue was treated with diethyl ether and the solid that formed was filtered, washed with diethyl ether and purified by reverse phase chromatography (C-18 silica from Waters<sup>®</sup>, water/acetonitrile/methanol as eluents [0.1% v/v formic acid buffered] 0% to 100%) to give the title compound (19 mg, 5%) as a yellow solid.

LRMS (m/z): 426 (M+1)<sup>+</sup>.

<sup>1</sup>H-NMR δ (DMSO-*d*<sub>6</sub>): 1.15-1.36 (m, 2H), 1.46 (d, 3H), 1.66 (m, 2H), 3.63 (m, 1H), 4.07 (m, 2H), 4.99 (m, 1H), 5.45 (s, 1H), 6.17 (t, 1H), 6.63 (m, 1H), 6.86 (d, 1H), 7.42 (dd, 1H), 7.54-7.62 (m, 2H), 7.96 (dd, 1H), 8.44 (d, 1H).

**EXAMPLE 10**

**3-[(5-fluoro-4-[(1*S*)-1-(5-fluoropyridin-2-yl)ethyl]amino)-6-morpholin-4-ylpyrimidin-2-yl]amino]pyridin-2(1*H*)-one**

Trimethylsilyl chloride (0.147 mL, 1.16 mmol) and sodium iodide (174 mg, 1.16 mmol) were added to a stirred solution of (*S*)-5-fluoro-*N*4-(1-(5-fluoropyridin-2-yl)ethyl)-*N*2-(2-methoxypyridin-3-yl)-6-morpholinopyrimidine-2,4-diamine (Preparation 11c, 172 mg, 0.39 mmol) in acetonitrile (3 mL) and the mixture was stirred and heated at 80 °C for 1 hour. After cooling to ambient temperature, the mixture was concentrated and treated with water. After stirring for 10 minutes, the precipitate was filtered, washed with water and dried to give 0.065 g of a brown solid. Concentrated aqueous sodium hydroxide solution was added to the aqueous phase until a basic pH was reached and the basic aqueous solution was then extracted with methylene chloride (X3). The combined organic extracts were dried (MgSO<sub>4</sub>) and the solvent was evaporated under reduced pressure to give an additional quantity of solid material (0.096 g). The combined solids were dissolved in methylene chloride and washed with saturated aqueous potassium carbonate solution. The organic layer was separated, dried (MgSO<sub>4</sub>) and the solvent was evaporated under reduced pressure to yield the title compound (0.134 g, 77%) as a brown solid.

LRMS (m/z): 430 (M+1)<sup>+</sup>.

<sup>1</sup>H-NMR δ (CDCl<sub>3</sub>): 1.57 (3H, d), 3.64 (4H, m), 3.78 (4H, m), 5.29 (1H, m), 5.63 (1H, br d), 6.89 (1H, dd), 7.32-7.37 (2H, m), 7.76 (1H, s), 8.18 (1H, dd), 8.44 (1H, d), 11.39 (1H, br s)

**EXAMPLE 11**

**3-[(6-[(1*S*)-1-(5-Fluoropyridin-2-yl)ethyl]amino)pyrazin-2-yl]amino]pyridin-2(1*H*)-one**

A suspension of *N*-[(1*S*)-1-(5-fluoropyridin-2-yl)ethyl]-*N*-(2-methoxypyridin-3-yl)pyrazine-2,6-diamine (Preparation 12b, 100 mg, 0.29 mmol) in 48% aqueous hydrogen bromide solution (1 mL) was stirred and heated at 100 °C for 3 hours. After cooling to ambient temperature, the solvent was evaporated under reduced pressure. The residue was treated with acetonitrile and the solid that formed was filtered and dried to give the hydrobromide salt of the title compound (98 mg, 68%) as a yellow solid.

LRMS (m/z): 327 (M+1)<sup>+</sup>.

<sup>1</sup>H-NMR δ (DMSO-*d*<sub>6</sub>): 1.52 (d, 3H), 5.04 (m, 1H), 6.13 (m, 1H), 7.01 (d, 1H), 7.40 (s, 1H), 7.49 (m, 1H), 7.70 (m, 1H), 7.78 (s, 1H), 7.93 (d, 1H), 8.57 (d, 1H), 9.18 (s, 1H), 11.92 (br s, 1H)



**EXAMPLE 12****3-[(6-[(1*S*)-1-(5-fluoropyridin-2-yl)ethyl]amino)pyridin-2-yl]amino]pyridin-2(1*H*)-one**

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Obtained as a brown foam (96%) from (*S*)-*N*2-(1-(5-fluoropyridin-2-yl)ethyl)-*N*6-(2-methoxypyridin-3-yl)pyridine-2,6-diamine (Preparation 13b) following the experimental procedure as described in Example 3.

LRMS (*m/z*): 326 (*M*+1)<sup>+</sup>.

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<sup>1</sup>H-NMR δ (CDCl<sub>3</sub>): 1.58 (d, 3H), 4.93-5.04 (m, 1H), 5.08 (d, 1H), 5.85 (d, 1H), 6.09 (d, 1H), 6.23-6.30 (m, 1H), 6.85 (dd, 1H), 7.27-7.42 (m, 2H), 7.53 (s, 1H), 8.30 (dd, 1H), 8.44 (d, 1H), 11.17 (br s, 1H).

**EXAMPLE 13**

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**2-((1*r*, 4*r*)-4-(5-Methyl-2-(2-oxo-1,2-dihydropyridin-3-ylamino)pyrimidin-4-ylamino)cyclohexyl)acetonitrile**

Trimethylsilyl chloride (97 μL, 0.77 mmol) and sodium iodide (115 mg, 0.77 mmol) were added to a solution of 2-((1*r*, 4*r*)-4-(2-(2-methoxypyridin-3-ylamino)-5-methylpyrimidin-4-ylamino)cyclohexyl)acetonitrile (Preparation 15b, 90 mg, 0.26 mmol) in acetonitrile (15 mL) and the mixture was stirred and heated at 80 °C for 1 hour. After cooling to ambient temperature, water was added and the resulting suspension was stirred at ambient temperature for 20 min. The solid that formed was filtered, washed with acetonitrile and dried to give the title compound (45 mg, 52%) as a white solid.

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LRMS (*m/z*): 339 (*M*+1)<sup>+</sup>.

<sup>1</sup>H-NMR δ (DMSO-*d*<sub>6</sub>): 1.21 (dd, 4H), 1.50 (dd, 4H), 1.67 (m, 1H), 1.80-2.20 (m, 5H), 3.93 (m, 1H), 6.30 (m, 1H), 7.82 (s, 1H), 8.21 (m, 1H), 9.45 (s, 1H), 12.15 (bd, 1H).

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**EXAMPLE 14****3-({4-[(*trans*-4-[(3-hydroxypiperidin-1-yl)sulfonyl]methyl}cyclohexyl)amino]pyrimidin-2-yl}amino)pyridin-2(1*H*)-one**

Obtained as a solid (47%) from 1-(((1*r*,4*r*)-4-(2-(2-methoxypyridin-3-ylamino)pyrimidin-4-ylamino)cyclohexyl)methylsulfonyl)piperidin-3-ol (Preparation 18b) following the experimental procedure as described in Example 2 followed by purification of the crude

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product by reverse phase chromatography (C-18 silica from Waters<sup>®</sup>, water/acetonitrile/methanol as eluents [0.1% v/v formic acid buffered] 0% to 100%).

<sup>1</sup>H-NMR  $\delta$  (DMSO-*d*<sub>6</sub>): 1.21-1.50 (m, 6H), 1.70-2.10 (m, 8H), 2.45-3.50 (m, 6H), 3.73 (m, 1H), 5.01 (d, 1H), 5.97 (d, 1H), 6.23 (m, 1H), 6.94 (d, 1H), 7.29 (s, 1H), 7.69 (s, 1H), 7.79 (m, 1H), 8.36 (d, 1H).

#### EXAMPLE 15

##### **(*R*)-3-Oxo-3-(3-(2-(2-oxo-1,2-dihydropyridin-3-ylamino)pyrimidin-4-ylamino)piperidin-1-yl)propanenitrile**

Triethylamine (33  $\mu$ L, 0.24 mmol) and 3-[(2,5-dioxopyrrolidin-1-yl)oxy]-3-oxopropane nitrile (prepared as described in BE875054(A1), 51 mg, 0.28 mmol) were added to a solution of (*R*)-3-(4-(piperidin-3-ylamino)pyrimidin-2-ylamino)pyridin-2(1*H*)-one (Preparation 19c, 67 mg, 0.23 mmol) in dichloromethane (3 mL). The reaction mixture was stirred at ambient temperature for 24 hours and solvent was evaporated. Water was added and the mixture was extracted with dichloromethane. The organic layer was dried (MgSO<sub>4</sub>), evaporated under reduced pressure and the residue was purified by reverse phase chromatography (C-18 silica from Waters<sup>®</sup>, water/acetonitrile/methanol as eluents [0.1% v/v formic acid buffered] 0% to 100%) to give the title compound (11 mg, 12%) as a solid.

LRMS (*m/z*): 354 (*M*+1)<sup>+</sup>.

<sup>1</sup>H-NMR  $\delta$  (DMSO-*d*<sub>6</sub>): 1.55 (d, 1H), 1.74 (m, 1H), 1.95 (m, 1H), 2.13-2.34 (m, 1H), 3.08 (m, 2H), 3.48-3.80 (m, 1H), 3.86 (m, 1H), 4.05 (d, 1H), 4.27 (m, 1H), 6.03 (d, 1H), 6.07-6.17 (m, 1H), 6.17-6.30 (m, 1H), 6.93 (br s, 1H), 7.22-7.47 (m, 1H), 7.73 (s, 1H), 7.83-7.95 (m, 1H), 8.32 (br s, 1H), 11.84 (br s, 1H).

#### EXAMPLE 16

##### **(*R*)-3-(3-(5-Methyl-2-(2-oxo-1,2-dihydropyridin-3-ylamino)pyrimidin-4-ylamino)piperidin-1-yl)-3-oxopropanenitrile**

Obtained as a solid (15%) from (*R*)-3-(5-methyl-4-(piperidin-3-ylamino)pyrimidin-2-ylamino)pyridin-2(1*H*)-one (Preparation 20c) following the experimental procedure as described in Example 5.

LRMS (*m/z*): 368 (*M*+1)<sup>+</sup>.

<sup>1</sup>H-NMR  $\delta$  (CDCl<sub>3</sub>): 1.14-1.40 (m, 1H), 1.57-1.78 (m, 2H), 1.99 (br s, 3H), 2.59 (m, 2H), 3.10-3.33 (m, 1H), 3.42-3.69 (m, 2H), 3.76-4.35 (m, 2H), 4.55-5.01 (m,

1H), 6.11-6.41 (m, 1H), 6.75-7.01 (m, 1H), 7.70-7.92 (m, 1H), 8.08 (m, 2H), 8.30-8.53 (m, 1H), 11.18 (br s, 1H).

#### EXAMPLE 17

##### 5 **(R)-3-(3-(5-Fluoro-2-(2-oxo-1,2-dihydropyridin-3-ylamino)pyrimidin-4-ylamino)piperidin-1-yl)-3-oxopropanenitrile**

Obtained as a solid (45%) from (R)-3-(5-fluoro-4-(piperidin-3-ylamino)pyrimidin-2-ylamino)pyridin-2(1H)-one (Preparation 22c) following the experimental procedure as described in Example 15.

LRMS (m/z): 372 (M+1)<sup>+</sup>.

<sup>1</sup>H-NMR  $\delta$  (CDCl<sub>3</sub>): 1.59-1.98 (m, 2H), 3.17-3.33 (m, 1H), 3.33-3.42 (m, 1H), 3.46-3.63 (m, 2H), 3.90 (d, 1H), 4.04 (d, 1H), 4.13-4.22 (m, 1H), 4.27 (d, 1H), 4.91 (m, 1H), 6.31-6.47 (m, 1H), 6.98 (dd, 1H), 7.86 (d, 1H), 7.91 (d, 1H), 8.00 (s, 1H), 8.11 (s, 1H), 8.50 (d, 1H).

#### EXAMPLE 18

##### 20 **(R)-3-(4-(1-(4H-1,2,4-Triazol-3-yl)piperidin-3-ylamino)-5-fluoropyrimidin-2-ylamino)pyridin-2(1H)-one**

A mixture of (R)-3-(5-fluoro-4-(piperidin-3-ylamino)pyrimidin-2-ylamino)pyridin-2(1H)-one (Preparation 22c, 50 mg, 0.16 mmol) and 3-bromo-4H-1,2,4-triazole (prepared as described in *J. Med. Chem.* 2004, 47(19), 4645, 12.2 mg, 0.08 mmol) was stirred and heated overnight at 150 °C. The reaction mixture was cooled to ambient temperature and diluted with methanol. Diethyl ether was then added and the precipitate that formed was filtered. The filtrate was concentrated under reduced pressure and the resulting semisolid was suspended in diethyl ether and filtered to yield the title compound (12 mg, 40%) as a yellow solid.

LRMS (m/z): 372 (M+1)<sup>+</sup>.

<sup>1</sup>H-NMR  $\delta$  (DMSO-*d*<sub>6</sub>): 1.61 (m, 2H), 1.73-1.86 (m, 1H), 1.88-2.06 (m, 2H), 2.83 (m, 4H), 3.09 (m, 1H), 3.23 (m, 1H), 3.80 (m, 2H), 4.07 (br s, 3H), 4.30 (br s, 1H), 6.07 (t, 2H), 6.27 (t, 1H), 6.85-7.05 (m, 2H), 7.36-7.68 (m, 3H), 7.73-7.89 (m, 2H), 8.03 (d, 1H), 8.10-8.35 (m, 3H), 8.78 (br s, 1H), 11.87 (br s, 2H), 12.57 (br s, 1H), 13.05 (br s, 1H).

#### EXAMPLE 19

**(*R*)-3-(3-(2-(5-Chloro-2-oxo-1,2-dihydropyridin-3-ylamino)-5-methylpyrimidin-4-ylamino)piperidin-1-yl)-3-oxopropanenitrile**

Obtained as a solid (8%) from (*R*)-5-chloro-3-(5-methyl-4-(piperidin-3-ylamino)pyrimidin-2-ylamino)pyridin-2(1*H*)-one (Preparation 23b) following the experimental procedure as described in Example 15.

LRMS (*m/z*): 402 (*M*+1)<sup>+</sup>.

<sup>1</sup>H-NMR δ (DMSO-*d*<sub>6</sub>): 1.67 (t, 2H), 1.78-1.90 (m, 1H), 2.02 (s, 3H), 2.63-2.78 (m, 1H), 3.04 (dd, 1H), 3.68-3.85 (m, 1H), 3.95-4.20 (m, 2H), 4.32 (d, 1H), 4.50 (d, 1H), 6.71 (dd, 1H), 7.19 (d, 1H), 7.77 (s, 1H), 7.87 (d, 1H), 8.23 (s, 1H), 8.38 (d, 1H), 12.21 (br s, 1H).

**EXAMPLE 20**

**3-[(3*R*)-3-({5-fluoro-6-morpholin-4-yl-2-[(2-oxo-1,2-dihydropyridin-3-yl)amino]pyrimidin-4-yl}amino)piperidin-1-yl]-3-oxopropanenitrile**

Obtained as a brown solid (34%) from (*R*)-3-(5-fluoro-4-morpholino-6-(piperidin-3-ylamino)pyrimidin-2-ylamino)pyridin-2(1*H*)-one (Preparation 24c) following the experimental procedure as described in Example 15 followed by purification of the crude product by flash chromatography (0-100% ethyl acetate in hexanes then 0-20% methanol in ethyl acetate).

LRMS (*m/z*): 457 (*M*+1)<sup>+</sup>.

<sup>1</sup>H-NMR δ (CD<sub>3</sub>OD): 1.25-1.29 (m, 1H), 1.64-1.71 (m, 2H), 1.87 (m, 1H), 2.09-2.16 (m, 2H), 2.75-2.82 (m, 1H); 2.91-2.99 (m, 1H), 3.05-3.20 (m, 1H), 3.59-3.61 (m, 4H), 3.77 (m, 4H), 3.84-3.92 (m, 1H), 4.21 (d, 1H), 4.62 (s, 2H), 6.37-6.46 (m, 1H), 6.92-6.98 (m, 1H), 8.37-8.43 (m, 1H).

**EXAMPLE 21**

**3-[(3*R*)-3-({5-methyl-6-morpholin-4-yl-2-[(2-oxo-1,2-dihydropyridin-3-yl)amino]pyrimidin-4-yl}amino)piperidin-1-yl]-3-oxopropanenitrile formate salt**

Obtained as a yellow solid (17%) from (*R*)-3-(5-methyl-4-morpholino-6-(piperidin-3-ylamino)pyrimidin-2-ylamino)-pyridin-2(1*H*)-one (Preparation 26b) following the experimental procedure as described in Example 15 followed by purification of the crude product by reverse phase chromatography (C-18 silica from Waters<sup>®</sup>, water/acetonitrile/methanol as eluents [0.1% v/v formic acid buffered] 0% to 100%).

LRMS (m/z): 453 (M+1)<sup>+</sup>.

<sup>1</sup>H-NMR δ (CDCl<sub>3</sub>): 1.60-1.68 (m, 1H), 1.74-1.81 (m, 1H), 1.86 (s, 3H), 1.97-2.06 (m, 1H), 3.13 (m, 1H), 3.18 (t, 4H), 3.42 (s, 1H), 3.48 (s, 1H), 3.78 (t, 4H), 3.97 (m, 1H), 4.03 (m, 1H), 4.18 (d, 1H), 6.25-6.31 (m, 1H), 6.92 (dd, 1H), 7.78 (s, 1H), 8.39 (dd, 1H).

#### EXAMPLE 22

##### **3-[(3*R*)-3-({5-methyl-4-morpholin-4-yl-6-[(2-oxo-1,2-dihydropyridin-3-yl)amino]pyrimidin-2-yl}amino)piperidin-1-yl]-3-oxopropanenitrile**

Obtained as a green solid (70%) from (*R*)-3-(5-methyl-6-morpholino-2-(piperidin-3-ylamino)pyrimidin-4-ylamino)pyridin-2(1*H*)-one (Preparation 27b) following the experimental procedure as described in Example 15 followed by purification of the crude product by flash chromatography (0-20% methanol in dichloromethane).

LRMS (m/z): 453 (M+1)<sup>+</sup>.

<sup>1</sup>H-NMR δ (CDCl<sub>3</sub>): 1.55-1.85 (4H, m), 2.11 (3H, s), 3.15-3.25 (4H, m), 3.35 (2H, d), 3.55 (2H, m), 3.80-3.95 (6H, m), 4.67 (1H, br d), 6.38 (1H, dt), 6.95 (1H, m), 7.73 (1H, s), 8.53 (1H, br dd), 10.88 (1H, br s).

#### EXAMPLE 23

##### **3-[(3*R*)-3-({4-[(5-chloro-2-oxo-1,2-dihydropyridin-3-yl)amino]-5-methyl-6-morpholin-4-yl}pyrimidin-2-yl)amino)piperidin-1-yl]-3-oxopropanenitrile**

Obtained as a white solid (54%) from (*R*)-5-chloro-3-(5-methyl-6-morpholino-2-(piperidin-3-ylamino)pyrimidin-4-ylamino)pyridin-2(1*H*)-one (Preparation 28b) following the experimental procedure as described in Example 15.

LRMS (m/z): 487/489 (M+1)<sup>+</sup>.

<sup>1</sup>H-NMR δ (DMSO-*d*<sub>6</sub>): 1.53 (2H, m), 1.77 (2H, m), 1.97 (3H, s), 2.42-2.54 (4H, m), 3.05-3.17 (4H, m), 3.60-3.77 (6H, m), 4.04 (1H, m), 6.75 (1H, br dd), 7.15 (1H, br dd), 7.75 (1H, s), 8.53 (1H, br s), 12.25 (1H, br s)

Following a similar procedure to that described above, the following compounds were obtained:

#### EXAMPLE 24

**3-[(3*R*)-3-({5-chloro-2-[(2-oxo-1,2-dihydropyridin-3-yl)amino]pyrimidin-4-yl)amino}piperidin-1-yl]-3-oxopropanenitrile**

#### EXAMPLE 25

5 **3-[(4-[(1*S*)-1-(5-Fluoropyridin-2-yl)ethyl]amino}pyrimidin-2-yl)methyl]pyridin-2(1*H*)-one**

#### EXAMPLE 26

10 **3-(5-{6-[(1*S*)-1-(5-Fluoropyridin-2-yl)ethyl]amino}-2-[(2-oxo-1,2-dihydropyridin-3-yl)amino]pyrimidin-4-yl)-1,3-thiazol-2-yl)benzoic acid**

### PHARMACOLOGICAL ACTIVITY

#### 15 **In vitro JAK kinase Assays**

Compounds were screened for their ability to inhibit JAK1, JAK2 and JAK3 using the assays as indicated below.

The catalytic domains of human JAK1 (aa 850-1154), JAK2 (aa 826-1132), JAK3 (aa 795-1124) and Tyk2 (aa 871-1187) were expressed as N-terminal GST-fusion proteins using a baculovirus expression system and were purchased from Carna Biosciences. The enzymatic activity was assayed using as substrate a biotinylated peptide, poly (GT)-Biotin (CisBio). The peptide concentration in the reactions was 60 nM for JAK1, 20 nM for JAK2, 140 nM for JAK3 and 50 nM for Tyk2. The degree of phosphorylation was detected by TR-FRET (time-resolved fluorescence energy transfer).

IC<sub>50</sub>s of compounds were measured for each kinase in a reaction mixture containing the enzyme, ATP and the peptide in 8 mM MOPS (pH 7.0), 10 mM MgCl<sub>2</sub>, 0.05% β-mercaptoethanol, 0.45 mg/ml BSA. The ATP concentration in the reactions was 3 μM for JAK1, 0.2 μM for JAK2, 0.6 μM for JAK3 and 1.8 μM for Tyk2. The enzymatic reactions took place for 30 minutes at room temperature. Then, the reactions were stopped with 20 μL of quench detection buffer (50 mM HEPES, 0.5 M KF, EDTA 0.25 M, 0.1% (w/v) BSA, pH 7.5) containing 0.115 μg/mL of anti-phosphoTyr (PT66)-Cryptate (CisBio) and a variable concentration of SA-XL665 (CisBio) to keep the SA-B ratio constant. Incubate for 3 h and read on Victor 2V spectrofluorometer (PerkinElmer) set to read fluorescence resonance energy transfer.

Some of the acronyms used above have the following meaning:

AA: aminoacids

GST: glutathione-S-transferase

MOPS: 3-(N-morpholino)propane sulfonic acid

BSA: bovine serum albumin

5 ATP: adenosine tri-phosphate

EDTA: ethylenediaminetetraacetic acid

HEPES: 4-(2-hydroxyethyl)-1-piperazineethanesulfonic acid

SA-XL665: Streptavidin (biotin-binding tetrameric protein isolated from *Streptomyces avidinii*) XL665

10

Table 1 depicts IC<sub>50</sub> values for certain exemplary compounds described in the invention. In Table 1, "A" represents an IC<sub>50</sub> value of less than 0.1 μM (100 nM), "B" represents an IC<sub>50</sub> value in the range of 0.1 μM (100 nM) to 1 μM (1000 nM), and C represents an IC<sub>50</sub> value higher than 1 μM (1000 nM).

15

Table 1

Example No.	IC <sub>50</sub> JAK3 (μM)	IC <sub>50</sub> JAK2 (μM)	IC <sub>50</sub> JAK1 (μM)
<b>4</b>	A	A	A
<b>5</b>	A	A	A
<b>6</b>	A	A	B
<b>7</b>	A	A	A
<b>11</b>	A	A	A
<b>12</b>	A	A	B
<b>13</b>	A	A	A
<b>14</b>	B	A	C
<b>17</b>	A	A	A
<b>18</b>	A	A	B
<b>20</b>	A	A	A
<b>22</b>	A	A	A

20

It can be seen from Table 1 that the compounds of formula (I) are potent inhibitors of JAK1, JAK2 and JAK3 kinases. Preferred pyridin-2(1H)-one derivatives of the invention possess an IC<sub>50</sub> value for the inhibition of JAK1, JAK2 and JAK3 kinases (determined as defined above) of less than 1 μM (1000 nM), preferably of less than 0.5 μM (500 nM), more preferably of less than 0.2 μM (200 nM) for each Janus Kinase.

The invention is also directed to a compound of the invention as described herein for use in the treatment of the human or animal body by therapy. Compounds of the invention intended for pharmaceutical use may be administered as crystalline or amorphous products, or mixtures thereof. They may be obtained, for example, as solid plugs, powders, or films by methods such as precipitation, crystallization, freeze drying, spray drying, or evaporative drying. Microwave or radio frequency drying may be used for this purpose.

## 10 Combinations

The pyridin-2(1H)-one derivatives defined herein may also be combined with other active compounds in the treatment of a pathological condition or disease susceptible to amelioration by inhibition of Janus Kinases.

15

The combinations of the invention can optionally comprise one or more additional active substances which are known to be useful in the treatment of myeloproliferative disorders (such as polycythemia vera, essential thrombocythemia or myelofibrosis), leukemia, lymphoid malignancies and solid tumors; bone marrow and organ transplant rejection; immune-mediated diseases and inflammatory diseases, more in particular wherein the pathological condition or disease is selected from rheumatoid arthritis, multiple sclerosis, inflammatory bowel disease, dry eye, uveitis, allergic conjunctivitis, allergic rhinitis, asthma, chronic obstructive pulmonary disease (COPD), atopic dermatitis and psoriasis, such as (a) Dihydrofolate reductase inhibitors, such as Methotrexate or CH-1504; (b) Dihydroorotate dehydrogenase (DHODH) inhibitors such as leflunomide, teriflunomide, or the compounds described in the International Patent Application Nos. WO2008/077639 and WO2009/021696; (c) Immunomodulators such as Glatiramer acetate (Copaxone), Laquinimod or Imiquimod; (d) Inhibitors of DNA synthesis and repair, such as Mitoxantrone or Cladribine; (e) Immunosuppressants, such as Imuran (azathioprine) or Purinethol (6-mercaptopurine or 6-MP); (f) Anti-alpha 4 integrin antibodies, such as Natalizumab (Tysabri); (g) Alpha 4 integrin antagonists such as R-1295, TBC-4746, CDP-323, ELND-002, Finategrast or TMC-2003; (h) Corticoids and glucocorticoids such as prednisone or methylprednisolone, fluticasone, mometasone, budesonide, ciclesonide or beta-metasone; (i) Fumaric acid esters, such as BG-12; (j) Anti-tumor necrosis factor-alpha (Anti-TNF-alpha), such as Infliximab, Adalimumab, or Certolizumab pegol; (k) Soluble Tumor necrosis factor-alpha (TNF-

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alpha) receptors such as Etanercept; (l) Anti-CD20 (lymphocyte protein) monoclonal antibodies such as Rituximab, Ocrelizumab Ofatumumab or TRU-015; (m) Anti-CD52 (lymphocyte protein) monoclonal antibodies such as alemtuzumab; (n) Anti-CD25 (lymphocyte protein) such as daclizumab; (o) Anti-CD88 (lymphocyte protein), such as

5 eculizumab or pexelizumab; (p) Anti-Interleukin 6 Receptor (IL-6R), such as tocilizumab; (q) Anti-Interleukin 12 Receptor (IL-12R) / Interleukin 23 Receptor (IL-23R), such as ustekinumab; (r) Calcineurin inhibitors such as cyclosporine A or tacrolimus; (s) Inosine-monophosphate dehydrogenase (IMPDH) inhibitors, such as mycophenolate mophetyl, ribavirin, mizoribine or mycophenolic acid; (t) Cannabinoid receptor agonists

10 such as Sativex; (u) Chemokine CCR1 antagonists such as MLN-3897 or PS-031291; (v) Chemokine CCR2 antagonists such as INCB-8696; (w) Necrosis factor-kappaB (NF-kappaB or NFKB) Activation Inhibitors such as Sulfasalazine, Iguratimod or MLN-0415; (x) Adenosine A<sub>2A</sub> agonists, such as ATL-313, ATL-146e, CGS-21680, Regadenoson or UK-432,097; (y) Sphingosine-1 (S1P) phosphate receptor agonists

15 such as fingolimod, BAF-312, or ACT128800; (z) Sphingosine-1 (S1P) liase inhibitors such as LX2931; (aa) Spleen tyrosine kinase (Syk) inhibitors, such as R-112; (bb) Protein Kinase Inhibitors (PKC) inhibitors, such as NVP-AEB071; (cc) Anti-cholinergic agents such as tiotropium or acclidinium; (dd) Beta adrenergic agonists such as formoterol, indacaterol or abediterol (LAS100977); (ee) Compounds having bifunctional

20 Muscarinic Antagonist-Beta2 Agonist activity (MABAs); (ff) Histamine 1 (H1) receptor antagonists, such as azelastine or ebastine; (gg) Chemoattractant receptor homologous molecule expressed on TH<sub>2</sub> cells (CRTH2) inhibitors, such as OC-459, AZD-1981, ACT-129968, QAV-680; (hh) Vitamin D derivatives like calcipotriol (Daivonex); (ii) Anti-inflammatory agents, such as non-steroidal anti-inflammatory drugs

25 (NSAIDs) or selective cyclooxygenase-2 (COX-2) inhibitors such as aceclofenac, diclofenac, ibuprofen, naproxen, apricoxib, celecoxib, cimicoxib, deracoxib, etoricoxib, lumiracoxib, parecoxib sodium, rofecoxib, selenocoxib-1 or valdecoxib; (jj) Anti-allergic agents; (kk) Anti-viral agents; (ll) Phosphodiesterase (PDE) III inhibitors; (mm) Phosphodiesterase (PDE) IV inhibitors such as roflumilast or GRC-4039; (nn) Dual

30 Phosphodiesterase (PDE) III/IV inhibitors; (oo) Xanthine derivatives, such as theophylline or theobromine; (pp) p38 Mitogen-Activated Protein Kinase (p38 MAPK) Inhibitors such as ARRY-797; (qq) Mitogen-activated extracellular signal regulated kinase kinase (MEK) inhibitor, such as ARRY-142886 or ARRY-438162; (rr) Phosphoinositide 3-Kinases (PI3Ks) inhibitors; (ss) Interferons comprising Interferon

35 beta 1a such as Avonex from Biogen Idec, CinnoVex from CinnaGen and Rebif from EMD Serono, and Interferon beta 1b such as Betaferon from Schering and Betaseron from Berlex; and (tt) Interferon alpha such as Sumiferon MP.

Specific examples of suitable corticoids and glucocorticoids that can be combined with the JAK inhibitors of the present invention are prednisolone, methylprednisolone, dexamethasone, dexamethasone cipeclate, naflocort, deflazacort, halopredone  
 5 acetate, budesonide, beclomethasone dipropionate, hydrocortisone, triamcinolone acetonide, fluocinolone acetonide, fluocinonide, clocortolone pivalate, methylprednisolone aceponate, dexamethasone palmitoate, tipredane, hydrocortisone aceponate, prednicarbate, alclometasone dipropionate, halometasone, methylprednisolone suleptanate, mometasone furoate, rimexolone, prednisolone  
 10 farnesylate, ciclesonide, butixocort propionate, RPR-106541, deprodone propionate, fluticasone propionate, fluticasone furoate, halobetasol propionate, loteprednol etabonate, betamethasone butyrate propionate, flunisolide, prednisone, dexamethasone sodium phosphate, triamcinolone, betamethasone 17-valerate, betamethasone, betamethasone dipropionate, hydrocortisone acetate, hydrocortisone  
 15 sodium succinate, prednisolone sodium phosphate and hydrocortisone probutate.

Specific examples of suitable Syk kinase inhibitors that can be combined with the JAK inhibitors of the present invention are fosfaminib (from Rigel), R-348 (from Rigel), R-343 (from Rigel), R-112 (from Rigel), piceatannol, 2-(2-Aminoethylamino)-4-[3-  
 20 (trifluoromethyl)phenylamino] pyrimidine-5-carboxamide, R-091 (from Rigel), 6-[5-Fluoro-2-(3,4,5-trimethoxyphenylamino)pyrimidin-4-ylamino]-2,2-dimethyl-3,4-dihydro-2H-pyrido[3,2-b][1,4]oxazin-3-one benzenesulfonate (R-406 from Rigel), 1-(2,4,6-Trihydroxyphenyl)-2-(4-methoxyphenyl)ethan-1-one, N-[4-[6-(Cyclobutylamino)-9H-purin-2-ylamino]phenyl]-N-methylacetamide (QAB-205 from Novartis), 2-[7-(3,4-  
 25 Dimethoxyphenyl)imidazo[1,2-c]pyrimidin-5-ylamino]pyridine-3-carboxamide dihydrochloride (BAY-61-3606 from Bayer) and AVE-0950 (from Sanofi-Aventis).

Specific examples of suitable M3 antagonists (anticholinergics) that can be combined with the JAK inhibitors of the present invention are tiotropium salts, oxitropium salts,  
 30 flutropium salts, ipratropium salts, glycopyrronium salts, trospium salts, zamifenacin, revatropate, espatropate, darotropium bromide, CI-923, NPC-14695, BEA-2108, 3-[2-Hydroxy-2,2-bis(2-thienyl)acetoxy]-1-(3-phenoxypropyl)-1-azoniabicyclo[2.2.2]octane salts (in particular acridinium salts, more preferably acridinium bromide), 1-(2-Phenylethyl)-3-(9H-xanthen-9-ylcarbonyloxy)-1-azoniabicyclo[2.2.2]octane salts, 2-oxo-  
 35 1,2,3,4-tetrahydroquinazoline-3-carboxylic acid endo-8-methyl-8-azabicyclo[3.2.1]oct-3-yl ester salts (DAU-5884), 3-(4-Benzylpiperazin-1-yl)-1-cyclobutyl-1-hydroxy-1-phenylpropan-2-one (NPC-14695), N-[1-(6-Aminopyridin-2-ylmethyl)piperidin-4-yl]-

2(R)-[3,3-difluoro-1(R)-cyclopentyl]-2-hydroxy-2-phenylacetamide (J-104135), 2(R)-Cyclopentyl-2-hydroxy-N-[1-[4(S)-methylhexyl]piperidin-4-yl]-2-phenylacetamide (J-106366), 2(R)-Cyclopentyl-2-hydroxy-N-[1-(4-methyl-3-pentenyl)-4-piperidyl]-2-phenylacetamide (J-104129), 1-[4-(2-Aminoethyl)piperidin-1-yl]-2(R)-[3,3-difluorocyclopent-1(R)-yl]-2-hydroxy-2-phenylethan-1-one (Banyu-280634), N-[N-[2-[N-[1-(Cyclohexylmethyl)piperidin-3(R)-ylmethyl]carbamoylethyl]carbamoylethyl]-3,3,3-triphenylpropionamide (Banyu CPTP), 2(R)-Cyclopentyl-2-hydroxy-2-phenylacetic acid 4-(3-azabicyclo[3.1.0]hex-3-yl)-2-butynyl ester (Ranbaxy 364057), 3(R)-[4,4-Bis(4-fluorophenyl)-2-oxoimidazolidin-1-yl]-1-methyl-1-[2-oxo-2-(3-thienyl)ethyl]pyrrolidinium iodide, N-[1-(3-Hydroxybenzyl)-1-methylpiperidinium-3(S)-yl]-N-[N-[4-(isopropoxycarbonyl)phenyl]carbamoylethyl]-L-tyrosinamide trifluoroacetate, UCB-101333, Merck's OrM3, 7-endo-(2-hydroxy-2,2-diphenylacetoxy)-9,9-dimethyl-3-oxa-9-azoniatricyclo[3.3.1.0(2,4)]nonane salts, 3(R)-[4,4-Bis(4-fluorophenyl)-2-oxoimidazolidin-1-yl]-1-methyl-1-(2-phenylethyl)pyrrolidinium iodide, trans-4-[2-[Hydroxy-2,2-(dithien-2-yl)acetoxy]-1-methyl-1-(2-phenoxyethyl)piperidinium bromide from Novartis (412682), 7-(2,2-diphenylpropionyloxy)-7,9,9-trimethyl-3-oxa-9-azoniatricyclo[3.3.1.0\*2,4\*]nonane salts, 7-hydroxy-7,9,9-trimethyl-3-oxa-9-azoniatricyclo[3.3.1.0\*2,4\*]nonane 9-methyl-9H-fluorene-9-carboxylic acid ester salts, all of them optionally in the form of their racemates, their enantiomers, their diastereomers and mixtures thereof, and optionally in the form of their pharmacologically-compatible acid addition salts. Among the salts chlorides, bromides, iodides and methanesulphonates are preferred.

Specific examples of suitable beta adrenergic agonists ( $\beta$ 2-agonists) that can be combined with the JAK inhibitors of the present invention are are terbutaline sulphate, eformoterol fumarate, formoterol fumarate, bambuterol, ibuterol, isoprenaline hydrochloride, dopexamine, metaprotenerol, tulobuterol, procaterol hydrochloride, sibenadet hydrochloride, mabuterol hydrochloride, albuterol sulphate, salbutamol sulphate, salmefamol, salmeterol xinafoate, carmoterol hydrochloride, (R)-albuterol hydrochloride, Levalbuterol hydrochloride; Levosalbutamol hydrochloride; (-)-Salbutamol hydrochloride, formoterol, (R,R)-Formoterol tartrate; Arformoterol tartrate, sulfonterol, Bedoradrine sulphate, Indacaterol, Trantinterol hydrochloride, Milveterol hydrochloride, Olodaterol, fenoterol hydrobromide, rimoterol hydrobromide, riproterol hydrochloride, Vilanterol broxaterol, pirbuterol hydrochloride, bitolterol mesylate, clenbuterol hydrochloride, AZD-3199, GSK-159802; GSK-597901, GSK-678007, GSK-961081; 4-[2-[3-(1H-Benzimidazol-1-yl)-1,1-dimethylpropylamino]-1-hydroxyethyl]-2-(4-methoxybenzylamino)phenol, 1-[2H-5-hydroxy-3-oxo-4H-1,4-benzoxazin-8-yl]-2-[3-(4-

N,N-dimethylaminophenyl)-2-methyl-2-propylamino]ethanol, 1-[2H-5-hydroxy-3-oxo-4H-1,4-benzoxazin-8-yl]-2-[3-(4-dimethoxyphenyl)-2-methyl-2-propylamino]ethanol, 1-[2H-5-hydroxy-3-oxo-4H-1,4-benzoxazin-8-yl]-2-[3-(4-n-butyloxyphenyl)-2-methyl-2-propylamino]ethanol, KUL-1248, HOKU-81, SM-110444, RP-58802B, abediterol (LAS 100977) and compounds described in PCT patent applications Nos. WO 2007/124898, WO 2006/122788A1, WO 2008/046598, WO 2008095720, WO 2009/068177 and WO 2010/072354.

Specific examples of suitable Phosphodiesterase IV (PDE IV) inhibitors that can be combined with the JAK inhibitors of the present invention are benafentrine dimaleate, etazolate, denbufylline, rolipram, cipamfylline, zardaverine, arofylline, filaminast, tielukast, tofomilast, piclamilast, tolafentrine, mesopram, drotaverine hydrochloride, lirimilast, roflumilast, cilomilast, oglemilast, apremilast, tetomilast, filaminast, (R)-(+)-4-[2-(3-Cyclopentyloxy-4-methoxyphenyl)-2-phenylethyl]pyridine (CDP-840), N-(3,5-Dichloro-4-pyridinyl)-2-[1-(4-fluorobenzyl)-5-hydroxy-1H-indol-3-yl]-2-oxoacetamide (GSK-842470), 9-(2-Fluorobenzyl)-N6-methyl-2-(trifluoromethyl)adenine (NCS-613), N-(3,5-Dichloro-4-pyridinyl)-8-methoxyquinoline-5-carboxamide (D-4418), 3-[3-(Cyclopentyloxy)-4-methoxybenzyl]-6-(ethylamino)-8-isopropyl-3H-purine hydrochloride (V-11294A), 6-[3-(N,N-Dimethylcarbamoyl)phenylsulfonyl]-4-(3-methoxyphenylamino)-8-methylquinoline-3-carboxamide hydrochloride (GSK-256066), 4-[6,7-Diethoxy-2,3-bis(hydroxymethyl)naphthalen-1-yl]-1-(2-methoxyethyl)pyridin-2(1H)-one (T-440), (-)-trans-2-[3'-[3-(N-Cyclopropylcarbamoyl)-4-oxo-1,4-dihydro-1,8-naphthyridin-1-yl]-3-fluorobiphenyl-4-yl]cyclopropanecarboxylic acid, MK-0873, CDC-801, UK-500001, BLX-914, 2-carbomethoxy-4-cyano-4-(3-cyclopropylmethoxy-4-difluoromethoxyphenyl)cyclohexan-1-one, cis [4-cyano-4-(3-cyclopropylmethoxy-4-difluoromethoxyphenyl)cyclohexan-1-ol, 5(S)-[3-(Cyclopentyloxy)-4-methoxyphenyl]-3(S)-(3-methylbenzyl)piperidin-2-one (IPL-455903), ONO-6126 (Eur Respir J 2003, 22(Suppl. 45): Abst 2557) and the compounds claimed in the PCT patent applications number WO 03/097613, WO 2004/058729, WO 2005/049581, WO 2005/123693, WO 2005/123692, and WO 2010/069504.

Examples of suitable Phosphoinositide 3-Kinases (PI3Ks) inhibitors that can be combined with the JAK inhibitors of the present invention are 2-Methyl-2-[4-[3-methyl-2-oxo-8-(3-quinolinyl)-2,3-dihydro-1H-imidazo[4,5-c]quinolin-1-yl]phenyl]propanenitrile (BEZ-235 from Novartis), CAL-101 (from Calistoga Pharmaceuticals) and N-Ethyl-N'-[3-(3,4,5-trimethoxyphenylamino)pyrido[2,3-b]pyrazin-6-yl]thiourea (AEZS-126 from Aeterna Zentaris).

The compounds of formula (I) and the combinations of the invention may be used in the treatment of myeloproliferative disorders, leukemia, lymphoid malignancies and solid tumors; bone marrow and organ transplant rejection; immune-mediated diseases and inflammatory diseases, wherein the use of a JAK inhibitor is expected to have a beneficial effect, for example rheumatoid arthritis, multiple sclerosis, inflammatory bowel disease (such as ulcerative colitis or Crohn's disease), dry eye, uveitis, allergic conjunctivitis, allergic rhinitis, asthma, chronic obstructive pulmonary disease (COPD), atopic dermatitis and psoriasis.

The active compounds in the combination product may be administered together in the same pharmaceutical composition or in different compositions intended for separate, simultaneous, concomitant or sequential administration by the same or a different route.

It is contemplated that all active agents would be administered at the same time, or very close in time. Alternatively, one or two actives could be administered in the morning and the other (s) later in the day. Or in another scenario, one or two actives could be administered twice daily and the other (s) once daily, either at the same time as one of the twice-a-day dosing occurred, or separately. Preferably at least two, and more preferably all, of the actives would be administered together at the same time. Preferably, at least two, and more preferably all actives would be administered as an admixture.

The invention is also directed to a combination product of the compounds of the invention together with one or more other therapeutic agents for use in the treatment of a pathological condition or disease susceptible to amelioration by inhibition of Janus Kinases (JAK), in particular wherein the pathological condition or disease is selected from myeloproliferative disorders, leukemia, lymphoid malignancies and solid tumors; bone marrow and organ transplant rejection; immune-mediated diseases and inflammatory diseases, more in particular wherein the pathological condition or disease is selected from rheumatoid arthritis, multiple sclerosis, inflammatory bowel disease, dry eye, uveitis, allergic conjunctivitis, allergic rhinitis, asthma, chronic obstructive pulmonary disease (COPD), atopic dermatitis and psoriasis.

The invention also encompasses the use of a combination of the compounds of the invention together with one or more other therapeutic agents for the manufacture of a formulation or medicament for treating these diseases.

- 5 Also described is a method of treatment of a pathological condition or disease susceptible to amelioration by inhibition of Janus Kinases (JAK), in particular wherein the pathological condition or disease is selected from myeloproliferative disorders, leukemia, lymphoid malignancies and solid tumors; bone marrow and organ transplant rejection; immune-mediated diseases and inflammatory diseases, more in particular
- 10 wherein the pathological condition or disease is selected from rheumatoid arthritis, multiple sclerosis, inflammatory bowel disease, dry eye, uveitis, allergic conjunctivitis, allergic rhinitis, asthma, chronic obstructive pulmonary disease (COPD), atopic dermatitis and psoriasis; comprising administering a therapeutically effective amount of a combination of the compounds of the invention together with one or more other
- 15 therapeutic agents.

- The active compounds in the combinations of the invention may be administered by any suitable route, depending on the nature of the disorder to be treated, e.g. orally (as syrups, tablets, capsules, lozenges, controlled-release preparations, fast-dissolving
- 20 preparations, etc); topically (as creams, ointments, lotions, nasal sprays or aerosols, etc); by injection (subcutaneous, intradermic, intramuscular, intravenous, etc.) or by inhalation (as a dry powder, a solution, a dispersion, etc).

- The active compounds in the combination, i.e. the pyridin-2(1H)-one derivatives of the invention, and the other optional active compounds may be administered together in
- 25 the same pharmaceutical composition or in different compositions intended for separate, simultaneous, concomitant or sequential administration by the same or a different route.

- 30 Also described is a kit of parts comprising a pyridin-2(1H)-one derivative of the invention together with instructions for simultaneous, concurrent, separate or sequential use in combination with another active compound useful in the treatment of myeloproliferative disorders, leukemia, lymphoid malignancies and solid tumors; bone marrow and organ transplant rejection; immune-mediated diseases and inflammatory
- 35 diseases, more in particular useful in the treatment of rheumatoid arthritis, multiple sclerosis, inflammatory bowel disease, dry eye, uveitis, allergic conjunctivitis, allergic

rhinitis, asthma, chronic obstructive pulmonary disease (COPD), atopic dermatitis and psoriasis.

Also described is a package comprising a pyridin-2(1H)-one derivative of the invention  
 5 and another active compound useful in the treatment of myeloproliferative disorders, leukemia, lymphoid malignancies and solid tumors; bone marrow and organ transplant rejection; immune-mediated diseases and inflammatory diseases, more in particular useful in the treatment of rheumatoid arthritis, multiple sclerosis, inflammatory bowel disease, dry eye, uveitis, allergic conjunctivitis, allergic rhinitis, asthma, chronic  
 10 obstructive pulmonary disease (COPD), atopic dermatitis and psoriasis.

### **Pharmaceutical Compositions**

15 Pharmaceutical compositions according to the present invention comprise the compounds of the invention in association with a pharmaceutically acceptable diluent or carrier.

As used herein, the term pharmaceutical composition refers to a mixture of one or  
 20 more of the compounds described herein, or physiologically/pharmaceutically acceptable salts, solvates, N-oxides, stereoisomers, deuterated derivatives thereof or prodrugs thereof, with other chemical components, such as physiologically/pharmaceutically acceptable carriers and excipients. The purpose of a pharmaceutical composition is to facilitate administration of a compound to an  
 25 organism.

As used herein, a physiologically/pharmaceutically acceptable diluent or carrier refers to a carrier or diluent that does not cause significant irritation to an organism and does not abrogate the biological activity and properties of the administered compound.  
 30

The invention further provides pharmaceutical compositions comprising the compounds of the invention in association with a pharmaceutically acceptable diluent or carrier together with one or more other therapeutic agents for use in the treatment of a pathological condition or disease susceptible to amelioration by inhibition of Janus  
 35 Kinases (JAK), such as the ones previously described.

The invention is also directed to pharmaceutical compositions of the invention for use in the treatment of a pathological condition or disease susceptible to amelioration by inhibition of Janus Kinases (JAK), in particular wherein the pathological condition or disease is selected from myeloproliferative disorders, leukemia, lymphoid malignancies and solid tumors; bone marrow and organ transplant rejection; immune-mediated diseases and inflammatory diseases, more in particular wherein the pathological condition or disease is selected from rheumatoid arthritis, multiple sclerosis, inflammatory bowel disease, dry eye, uveitis, allergic conjunctivitis, allergic rhinitis, asthma, chronic obstructive pulmonary disease (COPD), atopic dermatitis and psoriasis. The invention also encompasses the use of a pharmaceutical composition of the invention for the manufacture of a medicament for treating these diseases.

Also described is a method of treatment of a pathological condition or disease susceptible to amelioration by inhibition of Janus Kinases (JAK), in particular wherein the pathological condition or disease is selected from myeloproliferative disorders, leukemia, lymphoid malignancies and solid tumors; bone marrow and organ transplant rejection; immune-mediated diseases and inflammatory diseases, more in particular wherein the pathological condition or disease is selected from rheumatoid arthritis, multiple sclerosis, inflammatory bowel disease, dry eye, uveitis, allergic conjunctivitis, allergic rhinitis, asthma, chronic obstructive pulmonary disease (COPD), atopic dermatitis and psoriasis, comprising administering a therapeutically effective amount of a pharmaceutical composition of the invention.

The present invention also provides pharmaceutical compositions which comprise, as an active ingredient, at least a compound of formula (I) or a pharmaceutically acceptable salt thereof in association with a pharmaceutically acceptable excipient such as a carrier or diluent. The active ingredient may comprise 0.001% to 99% by weight, preferably 0.01% to 90% by weight, of the composition depending upon the nature of the formulation and whether further dilution is to be made prior to application. Preferably the compositions are made up in a form suitable for oral, inhalation, topical, nasal, rectal, percutaneous or injectable administration.

Pharmaceutical compositions suitable for the delivery of compounds of the invention and methods for their preparation will be readily apparent to those skilled in the art. Such compositions and methods for their preparation can be found, for example, in Remington: The Science and Practice of Pharmacy, 21st Edition, Lippincott Williams & Wilkins, Philadelphia, Pa., 2001.



The pharmaceutically acceptable excipients which are admixed with the active compound or salts of such compound, to form the compositions of this invention are well-known per se and the actual excipients used depend inter alia on the intended method of administering the compositions. Examples, without limitation, of excipients include calcium carbonate, calcium phosphate, various sugars and types of starch, cellulose derivatives, gelatin, vegetable oils and polyethylene glycols.

Additional suitable carriers for formulations of the compounds of the present invention can be found in Remington: The Science and Practice of Pharmacy, 21st Edition, Lippincott Williams & Wilkins, Philadelphia, Pa., 2001.

#### i) Oral Administration

The compounds of the invention may be administered orally (peroral administration; *per os* (latin)). Oral administration involve swallowing, so that the compound is absorbed from the gut and delivered to the liver via the portal circulation (hepatic first pass metabolism) and finally enters the gastrointestinal (GI) tract.

Compositions for oral administration may take the form of tablets, retard tablets, sublingual tablets, capsules, inhalation aerosols, inhalation solutions, dry powder inhalation, or liquid preparations, such as mixtures, solutions, elixirs, syrups or suspensions, all containing the compound of the invention; such preparations may be made by methods well-known in the art. The active ingredient may also be presented as a bolus, electuary or paste.

Where the composition is in the form of a tablet, any pharmaceutical carrier routinely used for preparing solid formulations may be used. Examples of such carriers include magnesium stearate, talc, gelatine, acacia, stearic acid, starch, lactose and sucrose.

A tablet may be made by compression or moulding, optionally with one or more accessory ingredients. Compressed tablets may be prepared by compressing in a suitable machine the active ingredient in a free-flowing form such as a powder or granules, optionally mixed with a binder, lubricant, inert diluent, lubricating, surface active or dispersing agent.

Moulded tablets may be made by moulding in a suitable machine a mixture of the powdered compound moistened with an inert liquid diluent. The tablets may optionally

be coated or scored and may be formulated so as to provide slow or controlled release of the active ingredient therein.

For tablet dosage forms, depending on dose, the drug may make up from 1 wt% to 80 wt% of the dosage form, more typically from 5 wt% to 60 wt% of the dosage form. In addition to the drug, tablets generally contain a disintegrant. Examples of disintegrants include sodium starch glycolate, sodium carboxymethyl cellulose, calcium carboxymethyl cellulose, croscarmellose sodium, crospovidone, polyvinylpyrrolidone, methyl cellulose, microcrystalline cellulose, lower alkyl- substituted hydroxypropyl cellulose, starch, pregelatinized starch and sodium alginate. Generally, the disintegrant will comprise from 1 wt% to 25 wt%, preferably from 5 wt% to 20 wt% of the dosage form.

Binders are generally used to impart cohesive qualities to a tablet formulation. Suitable binders include microcrystalline cellulose, gelatin, sugars, polyethylene glycol, natural and synthetic gums, polyvinylpyrrolidone, pregelatinized starch, hydroxypropyl cellulose and hydroxypropyl methylcellulose. Tablets may also contain diluents, such as lactose (monohydrate, spray-dried monohydrate, anhydrous and the like), mannitol, xylitol, dextrose, sucrose, sorbitol, microcrystalline cellulose, starch and dibasic calcium phosphate dihydrate. Tablets may also optionally include surface active agents, such as sodium lauryl sulfate and polysorbate 80, and glidants such as silicon dioxide and talc. When present, surface active agents are typically in amounts of from 0.2 wt% to 5 wt% of the tablet, and glidants typically from 0.2 wt% to 1 wt% of the tablet.

Tablets also generally contain lubricants such as magnesium stearate, calcium stearate, zinc stearate, sodium stearyl fumarate, and mixtures of magnesium stearate with sodium lauryl sulphate. Lubricants generally are present in amounts from 0.25 wt% to 10 wt%, preferably from 0.5 wt% to 3 wt% of the tablet. Other conventional ingredients include anti-oxidants, colorants, flavoring agents, preservatives and taste-masking agents.

Exemplary tablets contain up to about 80 wt% drug, from about 10 wt% to about 90 wt% binder, from about 0 wt% to about 85 wt% diluent, from about 2 wt% to about 10 wt% disintegrant, and from about 0.25 wt% to about 10 wt% lubricant. Tablet blends may be compressed directly or by roller to form tablets. Tablet blends or portions of blends may alternatively be wet-, dry-, or melt-granulated, melt congealed, or extruded

before tableting. The final formulation may include one or more layers and may be coated or uncoated; or encapsulated.

The formulation of tablets is discussed in detail in "Pharmaceutical Dosage Forms:

5 Tablets, Vol. 1 ", by H. Lieberman and L. Lachman, Marcel Dekker, N.Y., 1980.

Where the composition is in the form of a capsule, any routine encapsulation is suitable, for example using the aforementioned carriers in a hard gelatine capsule.

Where the composition is in the form of a soft gelatine capsule any pharmaceutical  
10 carrier routinely used for preparing dispersions or suspensions may be considered, for example aqueous gums, celluloses, silicates or oils, and are incorporated in a soft gelatine capsule.

Solid formulations for oral administration may be formulated to be immediate and/or  
15 modified release. Modified release formulations include delayed-, sustained-, pulsed-, controlled-, targeted and programmed release.

Suitable modified release formulations are described in U.S. Patent No. 6,106,864.

Details of other suitable release technologies such as high energy dispersions and  
20 osmotic and coated particles can be found in Verma et al, Pharmaceutical Technology On-line, 25(2), 1-14 (2001). The use of chewing gum to achieve controlled release is described in WO 00/35298. The disclosures of these references are incorporated herein by reference in their entireties.

25 Liquid formulations include suspensions, solutions, syrups and elixirs. Such formulations may be used as fillers in soft or hard capsules and typically include a carrier, for example, water, ethanol, polyethylene glycol, propylene glycol, methylcellulose, or a suitable oil, and one or more emulsifying agents and/or suspending agents. The solutions may be aqueous solutions of a soluble salt or other  
30 derivative of the active compound in association with, for example, sucrose to form a syrup. The suspensions may comprise an insoluble active compound of the invention or a pharmaceutically acceptable salt thereof in association with water, together with a suspending agent or flavouring agent. Liquid formulations may also be prepared by the reconstitution of a solid, for example, from a sachet.

35

## ii) Oral mucosal administration

The compounds of the invention can also be administered via the oral mucosal. Within the oral mucosal cavity, delivery of drugs is classified into three categories: (a) sublingual delivery, which is systemic delivery of drugs through the mucosal membranes lining the floor of the mouth, (b) buccal delivery, which is drug administration through the mucosal membranes lining the cheeks (buccal mucosa), and (c) local delivery, which is drug delivery into the oral cavity.

Pharmaceutical products to be administered via the oral mucosal can be designed using mucoadhesive, quick dissolve tablets and solid lozenge formulations, which are formulated with one or more mucoadhesive (bioadhesive) polymers (such as hydroxy propyl cellulose, polyvinyl pyrrolidone, sodium carboxymethyl cellulose, hydroxy propyl methyl cellulose, hydroxy ethyl cellulose, polyvinyl alcohol, polyisobutylene or polyisoprene); and oral mucosal permeation enhancers (such as butanol, butyric acid, propranolol, sodium lauryl sulphate and others)

### iii) Inhaled administration

The compounds of the invention can also be administered by inhalation, typically in the form of a dry powder (either alone, as a mixture, for example, in a dry blend with lactose, or as a mixed component particle, for example, mixed with phospholipids, such as phosphatidylcholine) from a dry powder inhaler or as an aerosol spray from a pressurized container, pump, spray, atomizer (preferably an atomizer using electrohydrodynamics to produce a fine mist), or nebulizer, with or without the use of a suitable propellant, such as 1,1,1,2-tetrafluoroethane or 1,1,1,2,3,3,3-heptafluoropropane. For intranasal use, the powder may include a bioadhesive agent, for example, chitosan or cyclodextrin.

Dry powder compositions for topical delivery to the lung by inhalation may, for example, be presented in capsules and cartridges of for example gelatine or blisters of for example laminated aluminium foil, for use in an inhaler or insufflator. Formulations generally contain a powder mix for inhalation of the compound of the invention and a suitable powder base (carrier substance) such as lactose or starch. Use of lactose is preferred. Each capsule or cartridge may generally contain between 0.001-50 mg, more preferably 0.01-5 mg of active ingredient or the equivalent amount of a pharmaceutically acceptable salt thereof. Alternatively, the active ingredient (s) may be presented without excipients.

Packaging of the formulation may be suitable for unit dose or multi-dose delivery. In the case of multi-dose delivery, the formulation can be pre-metered or metered in use. Dry

powder inhalers are thus classified into three groups: (a) single dose, (b) multiple unit dose and (c) multi dose devices.

For inhalers of the first type, single doses have been weighed by the manufacturer into small containers, which are mostly hard gelatine capsules. A capsule has to be taken

Next, the capsule has to be opened or perforated with pins or cutting blades in order to allow part of the inspiratory air stream to pass through the capsule for powder

entrainment or to discharge the powder from the capsule through these perforations by means of centrifugal force during inhalation. After inhalation, the emptied capsule has to be removed from the inhaler again. Mostly, disassembling of the inhaler is necessary for inserting and removing the capsule, which is an operation that can be difficult and burdensome for some patients.

Other drawbacks related to the use of hard gelatine capsules for inhalation powders are (a) poor protection against moisture uptake from the ambient air, (b) problems with opening or perforation after the capsules have been exposed previously to extreme relative humidity, which causes fragmentation or indenture, and (c) possible inhalation of capsule fragments. Moreover, for a number of capsule inhalers, incomplete expulsion has been reported (e. g. Nielsen et al, 1997).

Some capsule inhalers have a magazine from which individual capsules can be transferred to a receiving chamber, in which perforation and emptying takes place, as described in WO 92/03175. Other capsule inhalers have revolving magazines with capsule chambers that can be brought in line with the air conduit for dose discharge (e. g. WO91/02558 and GB 2242134). They comprise the type of multiple unit dose inhalers together with blister inhalers, which have a limited number of unit doses in supply on a disk or on a strip.

Blister inhalers provide better moisture protection of the medicament than capsule inhalers. Access to the powder is obtained by perforating the cover as well as the blister foil, or by peeling off the cover foil. When a blister strip is used instead of a disk, the number of doses can be increased, but it is inconvenient for the patient to replace an empty strip. Therefore, such devices are often disposable with the incorporated dose system, including the technique used to transport the strip and open the blister pockets.

Multi-dose inhalers do not contain pre-measured quantities of the powder formulation. They consist of a relatively large container and a dose measuring principle that has to be operated by the patient. The container bears multiple doses that are isolated individually from the bulk of powder by volumetric displacement. Various dose measuring principles exist, including rotatable membranes (Ex. EP0069715) or disks (Ex. GB 2041763; EP 0424790; DE 4239402 and EP 0674533), rotatable cylinders (Ex. EP 0166294; GB 2165159 and WO 92/09322) and rotatable frustums (Ex. WO 92/00771), all having cavities which have to be filled with powder from the container. Other multi dose devices have measuring slides (Ex. US 5201308 and WO 97/00703) or measuring plungers with a local or circumferential recess to displace a certain volume of powder from the container to a delivery chamber or an air conduit (Ex. EP 0505321, WO 92/04068 and WO 92/04928), or measuring slides such as the Genuair® (formerly known as Novolizer SD2FL), which is described the following patent applications Nos: WO97/000703, WO03/000325 and WO2006/008027.

Reproducible dose measuring is one of the major concerns for multi dose inhaler devices.

The powder formulation has to exhibit good and stable flow properties, because filling of the dose measuring cups or cavities is mostly under the influence of the force of gravity.

For reloaded single dose and multiple unit dose inhalers, the dose measuring accuracy and reproducibility can be guaranteed by the manufacturer. Multi dose inhalers on the other hand, can contain a much higher number of doses, whereas the number of handlings to prime a dose is generally lower.

Because the inspiratory air stream in multi-dose devices is often straight across the dose measuring cavity, and because the massive and rigid dose measuring systems of multi dose inhalers can not be agitated by this inspiratory air stream, the powder mass is simply entrained from the cavity and little de-agglomeration is obtained during discharge.

Consequently, separate disintegration means are necessary. However in practice, they are not always part of the inhaler design. Because of the high number of doses in multi-dose devices, powder adhesion onto the inner walls of the air conduits and the de-agglomeration means must be minimized and/or regular cleaning of these parts must

be possible, without affecting the residual doses in the device. Some multi dose inhalers have disposable drug containers that can be replaced after the prescribed number of doses has been taken (Ex. WO 97/000703). For such semi-permanent multi dose inhalers with disposable drug containers, the requirements to prevent drug accumulation are even stricter.

Apart from applications through dry powder inhalers the compositions of the invention can be administered in aerosols which operate via propellant gases or by means of so-called atomisers, via which solutions of pharmacologically-active substances can be sprayed under high pressure so that a mist of inhalable particles results. The advantage of these atomisers is that the use of propellant gases can be completely dispensed with. Such atomiser is the Respimat® which is described, for example, in PCT Patent Applications Nos. WO 91/14468 and WO 97/12687, reference here is being made to the contents thereof.

Spray compositions for topical delivery to the lung by inhalation may for example be formulated as aqueous solutions or suspensions or as aerosols delivered from pressurised packs, such as a metered dose inhaler, with the use of a suitable liquefied propellant. Aerosol compositions suitable for inhalation can be either a suspension or a solution and generally contain the active ingredient (s) and a suitable propellant such as a fluorocarbon or hydrogen-containing chlorofluorocarbon or mixtures thereof, particularly hydrofluoroalkanes, e. g. dichlorodifluoromethane, trichlorofluoromethane, dichlorotetra-fluoroethane, especially 1,1, 1, 2-tetrafluoroethane, 1,1, 1,2, 3,3, 3-heptafluoro-n-propane or a mixture thereof. Carbon dioxide or other suitable gas may also be used as propellant.

The aerosol composition may be excipient free or may optionally contain additional formulation excipients well known in the art such as surfactants (eg. oleic acid or lecithin) and cosolvents (eg. ethanol). Pressurised formulations will generally be retained in a canister (eg. an aluminium canister) closed with a valve (eg. a metering valve) and fitted into an actuator provided with a mouthpiece.

Medicaments for administration by inhalation desirably have a controlled particle size. The optimum particle size for inhalation into the bronchial system is usually 1-10  $\mu\text{m}$ , preferably 2-5  $\mu\text{m}$ . Particles having a size above 20  $\mu\text{m}$  are generally too large when inhaled to reach the small airways. To achieve these particle sizes the particles of the active ingredient as produced may be size reduced by conventional means eg by

micronisation. The desired fraction may be separated out by air classification or sieving. Preferably, the particles will be crystalline.

Achieving high dose reproducibility with micronised powders is difficult because of their poor flowability and extreme agglomeration tendency. To improve the efficiency of dry powder compositions, the particles should be large while in the inhaler, but small when discharged into the respiratory tract. Thus, an excipient such as lactose or glucose is generally employed. The particle size of the excipient will usually be much greater than the inhaled medicament within the present invention. When the excipient is lactose it will typically be present as milled lactose, preferably crystalline alpha lactose monohydrate.

Pressurized aerosol compositions will generally be filled into canisters fitted with a valve, especially a metering valve. Canisters may optionally be coated with a plastics material e. g. a fluorocarbon polymer as described in W096/32150. Canisters will be fitted into an actuator adapted for buccal delivery.

#### iv) Nasal mucosal administration

The compounds of the invention may also be administered via the nasal mucosal.

Typical compositions for nasal mucosa administration are typically applied by a metering, atomizing spray pump and are in the form of a solution or suspension in an inert vehicle such as water optionally in combination with conventional excipients such as buffers, anti-microbials, tonicity modifying agents and viscosity modifying agents.

#### v) Parenteral Administration

The compounds of the invention may also be administered directly into the blood stream, into muscle, or into an internal organ. Suitable means for parenteral administration include intravenous, intraarterial, intraperitoneal, intrathecal, intraventricular, intraurethral, intrasternal, intracranial, intramuscular and subcutaneous. Suitable devices for parenteral administration include needle (including microneedle) injectors, needle-free injectors and infusion techniques.

Parenteral formulations are typically aqueous solutions which may contain excipients such as salts, carbohydrates and buffering agents (preferably to a pH of from 3 to 9), but, for some applications, they may be more suitably formulated as a sterile non-aqueous solution or as a dried form to be used in conjunction with a suitable vehicle such as sterile, pyrogen-free water.



The preparation of parenteral formulations under sterile conditions, for example, by lyophilization, may readily be accomplished using standard pharmaceutical techniques well known to those skilled in the art. The solubility of compounds of the invention used in the preparation of parenteral solutions may be increased by the use of appropriate formulation techniques, such as the incorporation of solubility-enhancing agents.

Formulations for parenteral administration may be formulated to be immediate and/or modified release. Modified release formulations include delayed-, sustained-, pulsed-, controlled-, targeted and programmed release. Thus compounds of the invention may be formulated as a solid, semi-solid, or thixotropic liquid for administration as an implanted depot providing modified release of the active compound. Examples of such formulations include drug-coated stents and PGLA microspheres.

#### vi) Topical Administration

The compounds of the invention may also be administered topically to the skin or mucosa, that is, dermally or transdermally. Typical formulations for this purpose include gels, hydrogels, lotions, solutions, creams, ointments, dusting powders, dressings, foams, films, skin patches, wafers, implants, sponges, fibers, bandages and microemulsions. Liposomes may also be used. Typical carriers include alcohol, water, mineral oil, liquid petrolatum, white petrolatum, glycerin, polyethylene glycol and propylene glycol. Penetration enhancers may be incorporated; see, for example, J Pharm Sci, 88 (10), 955-958 by Finnin and Morgan (October 1999). Other means of topical administration include delivery by electroporation, iontophoresis, phonophoresis, sonophoresis and microneedle or needle-free injection.

Formulations for topical administration may be formulated to be immediate and/or modified release. Modified release formulations include delayed-, sustained-, pulsed-, controlled-, targeted and programmed release.

#### vii) Rectal/Intravaginal Administration

Compounds of the invention may be administered rectally or vaginally, for example, in the form of a suppository, pessary, or enema. Cocoa butter is a traditional suppository base, but various alternatives may be used as appropriate. Formulations for rectal/vaginal administration may be formulated to be immediate and/or modified release. Modified release formulations include delayed-, sustained-, pulsed-, controlled-, targeted and programmed release.

viii) Ocular Administration

Compounds of the invention may also be administered directly to the eye or ear, typically in the form of drops of a micronized suspension or solution in isotonic, pH-adjusted, sterile saline. Other formulations suitable for ocular and aural administration include ointments, biodegradable (e.g. absorbable gel sponges, collagen) and nonbiodegradable (e.g. silicone) implants, wafers, lenses and particulate or vesicular systems, such as niosomes or liposomes. A polymer such as crossed-linked polyacrylic acid, polyvinylalcohol, hyaluronic acid, a cellulosic polymer, for example, hydroxypropylmethylcellulose, hydroxyethylcellulose, or methyl cellulose, or a heteropolysaccharide polymer, for example, gelatin gum, may be incorporated together with a preservative, such as benzalkonium chloride. Such formulations may also be delivered by iontophoresis.

Formulations for ocular/aural administration may be formulated to be immediate and/or modified release. Modified release formulations include delayed-, sustained-, pulsed-, controlled-, targeted, or programmed release.

ix) Other Technologies

Compounds of the invention may be combined with soluble macromolecular entities, such as cyclodextrin and suitable derivatives thereof or polyethylene glycol-containing polymers, in order to improve their solubility, dissolution rate, taste-masking, bioavailability and/or stability for use in any of the aforementioned modes of administration.

The amount of the active compound administered will be dependent on the subject being treated, the severity of the disorder or condition, the rate of administration, the disposition of the compound and the discretion of the prescribing physician. However, an effective dosage is typically in the range of 0.01-3000 mg, more preferably 0.5-1000 mg of active ingredient or the equivalent amount of a pharmaceutically acceptable salt thereof per day. Daily dosage may be administered in one or more treatments, preferably from 1 to 4 treatments, per day.

Preferably, the pharmaceutical compositions of the invention are made up in a form suitable for oral, inhalation or topical administration, being particularly preferred oral or inhalation administration.

The pharmaceutical formulations may conveniently be presented in unit dosage form and may be prepared by any of the methods well known in the art of pharmacy.

Preferably the composition is in unit dosage form, for example a tablet, capsule or metered aerosol dose, so that the patient may administer a single dose.

- 5 The amount of each active which is required to achieve a therapeutic effect will, of course, vary with the particular active, the route of administration, the subject under treatment, and the particular disorder or disease being treated.

The following preparations forms are cited as formulation examples:

## 10 Formulation Examples

Formulation Example 1 (Oral suspension)

Ingredient	Amount
Active Compound	3 mg
Citric acid	0,5 g
Sodium chloride	2,0 g
Methyl paraben	0,1 g
Granulated sugar	25 g
Sorbitol (70% solution)	11 g
Veegum K	1,0 g
Flavoring	0,02 g
Dye	0,5 mg
Distilled water	q.s. to 100 mL

Formulation Example 2 (Hard gelatine capsule for oral administration)

15

Ingredient	Amount
Active Compound	1 mg

Lactose	150 mg
Magnesium stearate	3 mg

Formulation Example 3 (Gelatin cartridge for inhalation)

<b>Ingredient</b>	<b>Amount</b>
Active Compound (micronized)	0,2 mg
Lactose	25 mg

5 Formulation Example 4 (Formulation for inhalation with a DPI)

<b>Ingredient</b>	<b>Amount</b>
Active Compound (micronized)	15 mg
Lactose	3000 mg

Formulation Example 5 (Formulation for a MDI)

<b>Ingredient</b>	<b>Amount</b>
Active Compound (micronized)	10 g
1,1,1,2,3,3,3-heptafluoro-n-propane	q.s. to 200 mL

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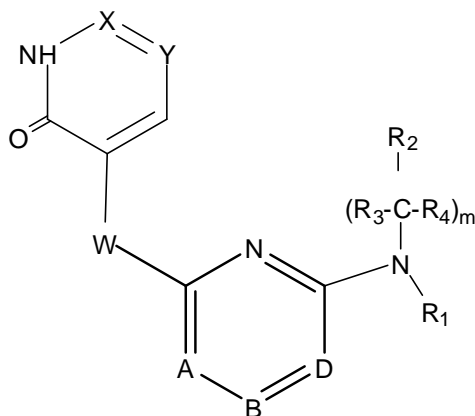
Modifications, which do not affect, alter, change or modify the essential aspects of the compounds, combinations or pharmaceutical compositions described, are included within the scope of the present invention.

15

## Claims

1. A compound of formula (I), or a pharmaceutically acceptable salt, or solvate, or N-oxide, or stereoisomer or deuterated derivative thereof:

5



Formula (I)

10 wherein,

m is 0, 1, 2 or 3;

15 X and Y each independently represent a nitrogen atom or a  $-CR_6$  group, wherein at least one of X and Y represents a  $-CR_6$  group;

A and B each independently represent a nitrogen atom or a  $-CR_7$  group, wherein at least one of A and B represents a  $-CR_7$  group;

20 D represents a nitrogen atom or a  $-CR_5$  group, wherein when one of A and B represents a nitrogen atom, D represents a  $-CR_5$  group;

W represents a linker selected from a  $-NR_8-$  group, a  $-(CR_9R_{10})-$  group,  $-O-$  or  $-S-$ ;

25  $R_1$  represents a hydrogen atom, a linear or branched  $C_1-C_6$  alkyl group, a  $C_1-C_4$  haloalkyl group, a  $C_1-C_4$  hydroxyalkyl group, a  $C_1-C_4$  alkoxy group, a  $C_3-C_{10}$  cycloalkyl group, a  $C_3-C_{10}$  cycloalkenyl group, a monocyclic or bicyclic  $C_6-C_{14}$  aryl group, a 5- to 14- membered heteroaryl group containing at least one heteroatom selected from O, S

and N, or a 5- to 14- membered heterocyclyl group containing at least one heteroatom selected from O, S and N,

wherein the cycloalkyl, cycloalkenyl, aryl, heteroaryl, and heterocyclyl groups are unsubstituted or substituted by one or more substituents selected from a  
 5 halogen atom, a cyano group, a linear or branched C<sub>1</sub>-C<sub>6</sub> alkyl group, a C<sub>1</sub>-C<sub>4</sub> haloalkyl group, a C<sub>1</sub>-C<sub>4</sub> hydroxyalkyl group, a C<sub>1</sub>-C<sub>4</sub> alkylsulfonyl group, a C<sub>3</sub>-C<sub>7</sub> cycloalkyl group, a phenyl group, a pyridyl group, a pyrimidinyl group or a piperidyl group;

10 R<sub>2</sub> and R<sub>7</sub> each independently represent a hydrogen atom, a halogen atom, a cyano group, a linear or branched C<sub>1</sub>-C<sub>6</sub> alkyl group, a C<sub>1</sub>-C<sub>4</sub> haloalkyl group, a C<sub>1</sub>-C<sub>4</sub> hydroxyalkyl group, a C<sub>3</sub>-C<sub>10</sub> cycloalkyl group, a C<sub>3</sub>-C<sub>10</sub> cycloalkenyl group, a monocyclic or bicyclic C<sub>6</sub>-C<sub>14</sub> aryl group, a 5- to 14- membered heteroaryl group containing at least one heteroatom selected from O, S and N, a 5- to 14- membered  
 15 heterocyclyl group containing at least one heteroatom selected from O, S and N, or a bicyclyl group which is a monocyclic C<sub>6</sub>-C<sub>9</sub> aryl or 5- to 9- membered heteroaryl group fused to a 5- to 9- membered cycloalkyl or heterocyclyl group, said heteroaryl or heterocyclyl group containing at least one heteroatom selected from O, S and N,

wherein the cycloalkyl, cycloalkenyl, aryl, heteroaryl, and heterocyclyl groups,  
 20 and the bicyclyl group which is a monocyclic C<sub>6</sub>-C<sub>9</sub> aryl or 5- to 9- membered heteroaryl group fused to a 5- to 9- membered cycloalkyl or heterocyclyl group are unsubstituted or substituted by one or more substituents selected from a halogen atom; a cyano group; a linear or branched C<sub>1</sub>-C<sub>6</sub> alkyl group; a C<sub>1</sub>-C<sub>4</sub> haloalkyl group; a C<sub>1</sub>-C<sub>4</sub> hydroxyalkyl group; a C<sub>3</sub>-C<sub>7</sub> cycloalkyl group; a  
 25 monocyclic or bicyclic C<sub>6</sub>-C<sub>14</sub> aryl group; a 5- to 14- membered heteroaryl group containing at least one heteroatom selected from O, S and N; a 5- to 14- membered heterocyclyl group containing at least one heteroatom selected from O, S and N; a -(CH<sub>2</sub>)<sub>1-3</sub>CN group; a -(CH<sub>2</sub>)<sub>n</sub>OR<sub>11</sub> group; a -NR<sub>11</sub>R<sub>12</sub> group; a -NR<sub>11</sub>C(O)-(CH<sub>2</sub>)<sub>n</sub>-R<sub>12</sub> group; a -NR<sub>11</sub>C(O)-(CH<sub>2</sub>)<sub>n</sub>-NR<sub>12</sub>R<sub>13</sub> group;  
 30 a -C(O)-(CH<sub>2</sub>)<sub>1-3</sub>-CN group; a -C(O)-(CH<sub>2</sub>)<sub>n</sub>-R<sub>11</sub> group; a -(CH<sub>2</sub>)<sub>n</sub>-C(O)-(CH<sub>2</sub>)<sub>n</sub>-NR<sub>11</sub>R<sub>12</sub> group; a -(CH<sub>2</sub>)<sub>n</sub>-S(O)<sub>2</sub>(CH<sub>2</sub>)<sub>n</sub>R<sub>11</sub> group; a -(CH<sub>2</sub>)<sub>n</sub>-S(O)<sub>2</sub>(CH<sub>2</sub>)<sub>n</sub>NR<sub>11</sub>R<sub>12</sub> group; a -NR<sub>11</sub>S(O)<sub>2</sub>(CH<sub>2</sub>)<sub>n</sub>R<sub>12</sub> group or a -NR<sub>11</sub>S(O)<sub>2</sub>(CH<sub>2</sub>)<sub>n</sub>NR<sub>12</sub>R<sub>13</sub> group; wherein each n' and n are 0, 1 or 2; said monocyclic or bicyclic C<sub>6</sub>-C<sub>14</sub> aryl group being unsubstituted or further substituted by one or more carboxyl  
 35 groups;

R<sub>3</sub> and R<sub>4</sub> each independently represent a hydrogen atom, a C<sub>1</sub>-C<sub>4</sub> haloalkyl group, a C<sub>1</sub>-C<sub>4</sub> hydroxyalkyl group or a linear or branched C<sub>1</sub>-C<sub>6</sub> alkyl group, which alkyl group is unsubstituted or substituted by one or more substituents selected from a C<sub>1</sub>-C<sub>4</sub> alkoxy group, a cyano group, a C<sub>3</sub>-C<sub>7</sub> cycloalkyl group, a phenyl group, a pyridyl group, a pyrimidinyl group or a piperidyl group;

R<sub>5</sub> and R<sub>6</sub> each independently represents a hydrogen atom, a halogen atom, a cyano group, a linear or branched C<sub>1</sub>-C<sub>6</sub> alkyl group, a C<sub>1</sub>-C<sub>4</sub> haloalkyl group, a C<sub>1</sub>-C<sub>4</sub> hydroxyalkyl group, a C<sub>3</sub>-C<sub>10</sub> cycloalkyl group, a C<sub>3</sub>-C<sub>10</sub> cycloalkenyl group, a monocyclic or bicyclic C<sub>6</sub>-C<sub>14</sub> aryl group, a 5- to 14- membered heteroaryl group containing at least one heteroatom selected from O, S and N, a 5- to 14- membered heterocyclyl group containing at least one heteroatom selected from O, S and N, a -(CH<sub>2</sub>)<sub>n</sub>OR<sub>11</sub> group; a -NR<sub>11</sub>R<sub>12</sub> group; a -NR<sub>11</sub>C(O)-(CH<sub>2</sub>)<sub>n</sub>-R<sub>12</sub> group; a -NR<sub>11</sub>C(O)-(CH<sub>2</sub>)<sub>n</sub>-NR<sub>12</sub>R<sub>13</sub> group; a -C(O)-(CH<sub>2</sub>)<sub>1-3</sub>-CN group; a -C(O)-(CH<sub>2</sub>)<sub>n</sub>-R<sub>11</sub> group; a -C(O)-(CH<sub>2</sub>)<sub>n</sub>-NR<sub>11</sub>R<sub>12</sub> group; a -S(O)<sub>2</sub>(CH<sub>2</sub>)<sub>n</sub>R<sub>11</sub> group; a -S(O)<sub>2</sub>(CH<sub>2</sub>)<sub>n</sub>NR<sub>11</sub>R<sub>12</sub> group; a -NR<sub>11</sub>S(O)<sub>2</sub>(CH<sub>2</sub>)<sub>n</sub>R<sub>12</sub> group or a -NR<sub>11</sub>S(O)<sub>2</sub>(CH<sub>2</sub>)<sub>n</sub>NR<sub>12</sub>R<sub>13</sub> group; wherein each n is 0, 1 or 2;

wherein the cycloalkyl, cycloalkenyl, aryl, heteroaryl, and heterocyclyl groups are unsubstituted or substituted by one or more substituents selected from a halogen atom, a cyano group, a linear or branched C<sub>1</sub>-C<sub>6</sub> alkyl group, a C<sub>1</sub>-C<sub>4</sub> haloalkyl group, a C<sub>1</sub>-C<sub>4</sub> hydroxyalkyl group, a C<sub>3</sub>-C<sub>7</sub> cycloalkyl, a phenyl group, a pyridyl group, a pyrimidinyl group, a piperidyl group or a -C(O)-(CH<sub>2</sub>)<sub>n</sub>-NR<sub>11</sub>R<sub>12</sub> group; wherein n is 0, 1 or 2;

R<sub>8</sub>, R<sub>9</sub> and R<sub>10</sub> each independently represent a hydrogen atom, a C<sub>1</sub>-C<sub>4</sub> haloalkyl group, a C<sub>1</sub>-C<sub>4</sub> hydroxyalkyl group or a linear or branched C<sub>1</sub>-C<sub>6</sub> alkyl group, which alkyl group is unsubstituted or substituted by one or more substituents selected from a C<sub>1</sub>-C<sub>4</sub> alkoxy group, a cyano group, a C<sub>3</sub>-C<sub>7</sub> cycloalkyl group, a phenyl group, a pyridyl group, a pyrimidinyl group or a piperidyl group;

R<sub>11</sub>, R<sub>12</sub> and R<sub>13</sub> each independently represent a hydrogen atom; a C<sub>1</sub>-C<sub>4</sub> haloalkyl group; a C<sub>1</sub>-C<sub>4</sub> hydroxyalkyl group; a 5-to 9- membered heterocyclyl group containing one, two or three heteroatoms selected from O, S and N, which heterocyclyl group is unsubstituted or substituted by one or more substituents selected from a halogen atom, a hydroxyl group, a linear or branched C<sub>1</sub>-C<sub>4</sub> alkyl group, a C<sub>1</sub>-C<sub>4</sub> haloalkyl group or a C<sub>1</sub>-C<sub>4</sub> hydroxyalkyl group; or linear or branched C<sub>1</sub>-C<sub>6</sub> alkyl group, which alkyl group is unsubstituted or substituted by one or more substituents selected from a C<sub>1</sub>-C<sub>4</sub> alkoxy

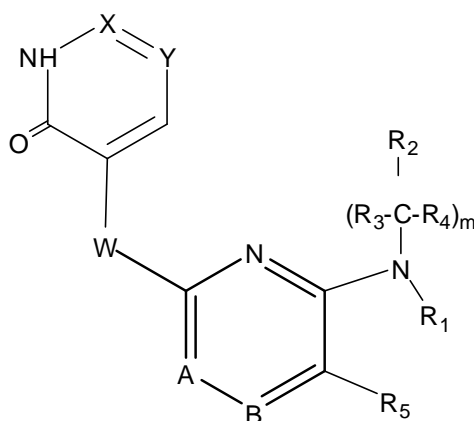
group, a cyano group, a C<sub>3</sub>-C<sub>7</sub> cycloalkyl group, a phenyl group, a pyridyl group, a pyrimidinyl group or a piperidyl group;

wherein the compound of formula (I) is other than:

- 5 a) 3-[[5-Chloro-2-[[2,5-dimethyl-4-(piperidin-4-yl)phenyl]amino]pyrimidin-4-yl]amino]pyridin-2(1H)-one; and
  - b) 2-[7-[[5-Chloro-4-[(2-oxo-1,2-dihydropyridin-3-yl)amino]pyrimidin-2-yl]amino]-8-methoxy-1,2,4,5-tetrahydrobenzo[d]azepin-3-yl]-N,N-dimethylacetamide.
- 10 2. A compound according to claim 1,  
wherein m, X, Y, W, A, B, D and R<sub>1</sub> to R<sub>13</sub> are as defined in claim 1; and wherein when D represents a nitrogen atom, A and B represent a -CR<sub>7</sub> group, m is 0, R<sub>2</sub> is other than a substituted 2,3,4,5-tetrahydro-1H-benzo[d]azepine group or a phenyl group substituted by a piperidinyl group.

15

3. A compound according to claim 1 or claim 2 of formula (I'):



20

Formula (I')

wherein,

m is 0 or an integer from 1 to 3;

25

X and Y each independently represent a nitrogen atom or a -CR<sub>6</sub> group, wherein at least one of X and Y represents a -CR<sub>6</sub> group;



A and B each independently represent a nitrogen atom or a  $-CR_7$  group, wherein at least one of A and B represents a  $-CR_7$  group;

W represents a linker selected from a  $-NR_8-$  group, a  $-(CR_9R_{10})-$  group,  $-O-$  or  $-S-$ ;

5

$R_1$  represents a hydrogen atom, a linear or branched  $C_1-C_6$  alkyl group, a  $C_1-C_4$  haloalkyl group, a  $C_1-C_4$  hydroxyalkyl group, a  $C_1-C_4$  alkoxy group, a  $C_3-C_{10}$  cycloalkyl group, a  $C_3-C_{10}$  cycloalkenyl group, a monocyclic or bicyclic  $C_6-C_{14}$  aryl group, a 5- to 14- membered heteroaryl group containing at least one heteroatom selected from O, S and N, or a 5- to 14- membered heterocyclyl group containing at least one heteroatom selected from O, S and N,

10

wherein the cycloalkyl, cycloalkenyl, aryl, heteroaryl, and heterocyclyl groups are unsubstituted or substituted by one or more substituents selected from a halogen atom, a cyano group, a linear or branched  $C_1-C_6$  alkyl group, a  $C_1-C_4$  haloalkyl group, a  $C_1-C_4$  hydroxyalkyl group, a  $C_1-C_4$  alkylsulfonyl group, a  $C_3-C_7$  cycloalkyl group, a phenyl group, a pyridyl group, a pyrimidinyl group or a piperidyl group;

15

$R_2$  and  $R_7$  each independently represent a hydrogen atom, a halogen atom, a cyano group, a linear or branched  $C_1-C_6$  alkyl group, a  $C_1-C_4$  haloalkyl group, a  $C_1-C_4$  hydroxyalkyl group, a  $C_3-C_{10}$  cycloalkyl group, a  $C_3-C_{10}$  cycloalkenyl group, a monocyclic or bicyclic  $C_6-C_{14}$  aryl group, a 5- to 14- membered heteroaryl group containing at least one heteroatom selected from O, S and N, a 5- to 14- membered heterocyclyl group containing at least one heteroatom selected from O, S and N, or a bicyclyl group which is a monocyclic  $C_6-C_9$  aryl or 5- to 9- membered heteroaryl group fused to a 5- to 9- membered cycloalkyl or heterocyclyl group, said heteroaryl or heterocyclyl group containing at least one heteroatom selected from O, S and N,

20

25

wherein the cycloalkyl, cycloalkenyl, aryl, heteroaryl, and heterocyclyl groups, and the bicyclyl group which is a monocyclic  $C_6-C_9$  aryl or 5- to 9- membered heteroaryl group fused to a 5- to 9- membered cycloalkyl or heterocyclyl group are unsubstituted or substituted by one or more substituents selected from a halogen atom; a cyano group; a linear or branched  $C_1-C_6$  alkyl group; a  $C_1-C_4$  haloalkyl group; a  $C_1-C_4$  hydroxyalkyl group; a  $C_3-C_7$  cycloalkyl group; a monocyclic or bicyclic  $C_6-C_{14}$  aryl group; a 5- to 14- membered heteroaryl group containing at least one heteroatom selected from O, S and N; a 5- to 14- membered heterocyclyl group containing at least one heteroatom selected from O, S and N; a  $-(CH_2)_{1-3}CN$  group; a  $-(CH_2)_nOR_{11}$  group; a  $-NR_{11}R_{12}$  group;

30

35

a -NR<sub>11</sub>C(O)-(CH<sub>2</sub>)<sub>n</sub>-R<sub>12</sub> group; a -NR<sub>11</sub>C(O)-(CH<sub>2</sub>)<sub>n</sub>-NR<sub>12</sub>R<sub>13</sub> group;  
 a -C(O)-(CH<sub>2</sub>)<sub>1-3</sub>-CN group; a -C(O)-(CH<sub>2</sub>)<sub>n</sub>-R<sub>11</sub> group; a -C(O)-(CH<sub>2</sub>)<sub>n</sub>-NR<sub>11</sub>R<sub>12</sub>  
 group; a -S(O)<sub>2</sub>(CH<sub>2</sub>)<sub>n</sub>R<sub>11</sub> group; a -S(O)<sub>2</sub>(CH<sub>2</sub>)<sub>n</sub>NR<sub>11</sub>R<sub>12</sub> group;  
 a -NR<sub>11</sub>S(O)<sub>2</sub>(CH<sub>2</sub>)<sub>n</sub>R<sub>12</sub> group or a -NR<sub>11</sub>S(O)<sub>2</sub>(CH<sub>2</sub>)<sub>n</sub>NR<sub>12</sub>R<sub>13</sub> group; wherein  
 5 each n is 0, 1 or 2; said monocyclic or bicyclic C<sub>6</sub>-C<sub>14</sub> aryl group being  
 unsubstituted or further substituted by one or more carboxyl groups.

R<sub>3</sub> and R<sub>4</sub> each independently represent a hydrogen atom, a C<sub>1</sub>-C<sub>4</sub> haloalkyl group, a  
 C<sub>1</sub>-C<sub>4</sub> hydroxyalkyl group or a linear or branched C<sub>1</sub>-C<sub>6</sub> alkyl group, which alkyl group is  
 10 unsubstituted or substituted by one or more substituents selected from a C<sub>1</sub>-C<sub>4</sub> alkoxy  
 group, a cyano group, a C<sub>3</sub>-C<sub>7</sub> cycloalkyl group, a phenyl group, a pyridyl group, a  
 pyrimidinyl group or a piperidyl group;

R<sub>5</sub> and R<sub>6</sub> each independently represent a hydrogen atom, a halogen atom, a cyano  
 15 group, a linear or branched C<sub>1</sub>-C<sub>6</sub> alkyl group, a C<sub>1</sub>-C<sub>4</sub> haloalkyl group, a C<sub>1</sub>-C<sub>4</sub>  
 hydroxyalkyl group, a C<sub>3</sub>-C<sub>10</sub> cycloalkyl group, a C<sub>3</sub>-C<sub>10</sub> cycloalkenyl group, a  
 monocyclic or bicyclic C<sub>6</sub>-C<sub>14</sub> aryl group, a 5- to 14- membered heteroaryl group  
 containing at least one heteroatom selected from O, S and N, a 5- to 14- membered  
 heterocyclyl group containing at least one heteroatom selected from O, S and N,  
 20 a -(CH<sub>2</sub>)<sub>n</sub>OR<sub>11</sub> group; a -NR<sub>11</sub>R<sub>12</sub> group; a -NR<sub>11</sub>C(O)-(CH<sub>2</sub>)<sub>n</sub>-R<sub>12</sub> group;  
 a -NR<sub>11</sub>C(O)-(CH<sub>2</sub>)<sub>n</sub>-NR<sub>12</sub>R<sub>13</sub> group; a -C(O)-(CH<sub>2</sub>)<sub>1-3</sub>-CN group; a -C(O)-(CH<sub>2</sub>)<sub>n</sub>-R<sub>11</sub>  
 group; a -C(O)-(CH<sub>2</sub>)<sub>n</sub>-NR<sub>11</sub>R<sub>12</sub> group; a -S(O)<sub>2</sub>(CH<sub>2</sub>)<sub>n</sub>R<sub>11</sub> group; a -S(O)<sub>2</sub>(CH<sub>2</sub>)<sub>n</sub>NR<sub>11</sub>R<sub>12</sub>  
 group; a -NR<sub>11</sub>S(O)<sub>2</sub>(CH<sub>2</sub>)<sub>n</sub>R<sub>12</sub> group or a -NR<sub>11</sub>S(O)<sub>2</sub>(CH<sub>2</sub>)<sub>n</sub>NR<sub>12</sub>R<sub>13</sub> group; wherein  
 each n is 0, 1 or 2;

25 wherein the cycloalkyl, cycloalkenyl, aryl, heteroaryl, and heterocyclyl groups  
 are unsubstituted or substituted by one or more substituents selected from a  
 halogen atom, a cyano group, a linear or branched C<sub>1</sub>-C<sub>6</sub> alkyl group, a C<sub>1</sub>-C<sub>4</sub>  
 haloalkyl group, a C<sub>1</sub>-C<sub>4</sub> hydroxyalkyl group, a C<sub>3</sub>-C<sub>7</sub> cycloalkyl, a phenyl group,  
 a pyridyl group, a pyrimidinyl group, a piperidyl group or  
 30 a -C(O)-(CH<sub>2</sub>)<sub>n</sub>-NR<sub>11</sub>R<sub>12</sub> group; wherein n is 0, 1 or 2;

R<sub>8</sub>, R<sub>9</sub> and R<sub>10</sub> each independently represent a hydrogen atom, a C<sub>1</sub>-C<sub>4</sub> haloalkyl  
 group, a C<sub>1</sub>-C<sub>4</sub> hydroxyalkyl group or a linear or branched C<sub>1</sub>-C<sub>6</sub> alkyl group, which alkyl  
 group is unsubstituted or substituted by one or more substituents selected from a C<sub>1</sub>-C<sub>4</sub>  
 35 alkoxy group, a cyano group, a C<sub>3</sub>-C<sub>7</sub> cycloalkyl group, a phenyl group, a pyridyl group,  
 a pyrimidinyl group or a piperidyl group;

R<sub>11</sub>, R<sub>12</sub> and R<sub>13</sub> each independently represent a hydrogen atom, a C<sub>1</sub>-C<sub>4</sub> haloalkyl group, a C<sub>1</sub>-C<sub>4</sub> hydroxyalkyl group or a linear or branched C<sub>1</sub>-C<sub>6</sub> alkyl group, which alkyl group is unsubstituted or substituted by one or more substituents selected from a C<sub>1</sub>-C<sub>4</sub> alkoxy group, a cyano group, a C<sub>3</sub>-C<sub>7</sub> cycloalkyl group, a phenyl group, a pyridyl group, a pyrimidinyl group or a piperidyl group.

4. A compound according to any one of the preceding claims, wherein W represents a linker selected from a -NR<sub>8</sub>- group or a -(CR<sub>9</sub>R<sub>10</sub>)- group wherein R<sub>8</sub>, R<sub>9</sub> and R<sub>10</sub> are as defined in claim 1.

5. A compound according to any one of the preceding claims wherein W represents a -NR<sub>8</sub>- group wherein R<sub>8</sub> is as defined in claim 1.

6. A compound according to any one of the preceding claims, wherein R<sub>1</sub> represents a hydrogen atom, a linear or branched C<sub>1</sub>-C<sub>6</sub> alkyl group, a C<sub>1</sub>-C<sub>4</sub> haloalkyl group, a C<sub>1</sub>-C<sub>4</sub> hydroxyalkyl group, a C<sub>3</sub>-C<sub>7</sub> cycloalkyl group, a phenyl group, a pyridyl group, a pyrimidinyl group or a piperidyl group.

7. A compound according to any one of the preceding claims, wherein R<sub>1</sub> represents a hydrogen atom, a linear or branched C<sub>1</sub>-C<sub>4</sub> alkyl group, a C<sub>1</sub>-C<sub>4</sub> haloalkyl group, a C<sub>1</sub>-C<sub>4</sub> hydroxyalkyl group, a C<sub>3</sub>-C<sub>7</sub> cycloalkyl group, a phenyl group or a pyridyl group.

8. A compound according to any one of the preceding claims, wherein R<sub>1</sub> represents a hydrogen atom, a linear or branched C<sub>1</sub>-C<sub>3</sub> alkyl group, a C<sub>1</sub>-C<sub>3</sub> haloalkyl group or a C<sub>1</sub>-C<sub>3</sub> hydroxyalkyl group.

9. A compound according to any one of the preceding claims, wherein R<sub>1</sub> represents a hydrogen atom.

10. A compound according to any one of claims 1, 2, and 4 to 9, wherein R<sub>2</sub> represents a linear or branched C<sub>1</sub>-C<sub>6</sub> alkyl group, a C<sub>1</sub>-C<sub>4</sub> haloalkyl group, a C<sub>1</sub>-C<sub>4</sub> hydroxyalkyl group, a C<sub>3</sub>-C<sub>7</sub> cycloalkyl group, a monocyclic or bicyclic C<sub>6</sub>-C<sub>10</sub> aryl group, a 5- to 7-membered heteroaryl group containing one, two or three heteroatoms selected from O, S and N, a 5- to 7- membered heterocyclyl group containing one, two or three heteroatoms selected from O, S and N,

wherein the cycloalkyl, cycloalkenyl, aryl, heteroaryl, and heterocyclyl groups are unsubstituted or substituted by one or more substituents selected from a halogen atom; a cyano group; a linear or branched C<sub>1</sub>-C<sub>6</sub> alkyl group; a C<sub>1</sub>-C<sub>4</sub> haloalkyl group; a C<sub>1</sub>-C<sub>4</sub> hydroxyalkyl group; a C<sub>3</sub>-C<sub>7</sub> cycloalkyl group; a  
 5 monocyclic or bicyclic C<sub>6</sub>-C<sub>14</sub> aryl group; a 5- to 14- membered heteroaryl group containing at least one heteroatom selected from O, S and N; a 5- to 14- membered heterocyclyl group containing at least one heteroatom selected from O, S and N; a -(CH<sub>2</sub>)<sub>1-3</sub>CN group; a -(CH<sub>2</sub>)<sub>n</sub>OR<sub>11</sub> group; a -NR<sub>11</sub>R<sub>12</sub> group; a -NR<sub>11</sub>C(O)-(CH<sub>2</sub>)<sub>n</sub>-R<sub>12</sub> group; a -NR<sub>11</sub>C(O)-(CH<sub>2</sub>)<sub>n</sub>-NR<sub>12</sub>R<sub>13</sub> group;  
 10 a -C(O)-(CH<sub>2</sub>)<sub>1-3</sub>-CN group; a -C(O)-(CH<sub>2</sub>)<sub>n</sub>-R<sub>11</sub> group; a -(CH<sub>2</sub>)<sub>n</sub>-C(O)-(CH<sub>2</sub>)<sub>n</sub>-NR<sub>11</sub>R<sub>12</sub> group; a -(CH<sub>2</sub>)<sub>n</sub>-S(O)<sub>2</sub>(CH<sub>2</sub>)<sub>n</sub>R<sub>11</sub> group; a -(CH<sub>2</sub>)<sub>n</sub>-S(O)<sub>2</sub>(CH<sub>2</sub>)<sub>n</sub>NR<sub>11</sub>R<sub>12</sub> group; a -NR<sub>11</sub>S(O)<sub>2</sub>(CH<sub>2</sub>)<sub>n</sub>R<sub>12</sub> group or a -NR<sub>11</sub>S(O)<sub>2</sub>(CH<sub>2</sub>)<sub>n</sub>NR<sub>12</sub>R<sub>13</sub> group; wherein each n' and n are 0, 1 or 2; and wherein R<sub>11</sub>, R<sub>12</sub> and R<sub>13</sub> are as defined in claim 1 and said monocyclic or bicyclic C<sub>6</sub>-C<sub>14</sub> aryl group is unsubstituted or  
 15 further substituted by one or more carboxyl groups.

11. A compound according to claim 3, wherein R<sub>2</sub> represents a linear or branched C<sub>1</sub>-C<sub>6</sub> alkyl group, a C<sub>1</sub>-C<sub>4</sub> haloalkyl group, a C<sub>1</sub>-C<sub>4</sub> hydroxyalkyl group, a C<sub>3</sub>-C<sub>7</sub> cycloalkyl group, a monocyclic or bicyclic C<sub>6</sub>-C<sub>10</sub> aryl group, a 5- to 7- membered heteroaryl group  
 20 containing one, two or three heteroatoms selected from O, S and N, a 5- to 7- membered heterocyclyl group containing one, two or three heteroatoms selected from O, S and N,

wherein the cycloalkyl, cycloalkenyl, aryl, heteroaryl, and heterocyclyl groups are unsubstituted or substituted by one or more substituents selected from a  
 25 halogen atom; a cyano group; a linear or branched C<sub>1</sub>-C<sub>6</sub> alkyl group; a C<sub>1</sub>-C<sub>4</sub> haloalkyl group; a C<sub>1</sub>-C<sub>4</sub> hydroxyalkyl group; a C<sub>3</sub>-C<sub>7</sub> cycloalkyl group; a monocyclic or bicyclic C<sub>6</sub>-C<sub>14</sub> aryl group; a 5- to 14- membered heteroaryl group containing at least one heteroatom selected from O, S and N; a 5- to 14- membered heterocyclyl group containing at least one heteroatom selected from  
 30 O, S and N; a -(CH<sub>2</sub>)<sub>1-3</sub>CN group; a -(CH<sub>2</sub>)<sub>n</sub>OR<sub>11</sub> group; a -NR<sub>11</sub>R<sub>12</sub> group; a -NR<sub>11</sub>C(O)-(CH<sub>2</sub>)<sub>n</sub>-R<sub>12</sub> group; a -NR<sub>11</sub>C(O)-(CH<sub>2</sub>)<sub>n</sub>-NR<sub>12</sub>R<sub>13</sub> group; a -C(O)-(CH<sub>2</sub>)<sub>1-3</sub>-CN group; a -C(O)-(CH<sub>2</sub>)<sub>n</sub>-R<sub>11</sub> group; a -C(O)-(CH<sub>2</sub>)<sub>n</sub>-NR<sub>11</sub>R<sub>12</sub> group; a -S(O)<sub>2</sub>(CH<sub>2</sub>)<sub>n</sub>R<sub>11</sub> group; a -S(O)<sub>2</sub>(CH<sub>2</sub>)<sub>n</sub>NR<sub>11</sub>R<sub>12</sub> group; a -NR<sub>11</sub>S(O)<sub>2</sub>(CH<sub>2</sub>)<sub>n</sub>R<sub>12</sub> group or a -NR<sub>11</sub>S(O)<sub>2</sub>(CH<sub>2</sub>)<sub>n</sub>NR<sub>12</sub>R<sub>13</sub> group; wherein  
 35 each n is 0, 1 or 2; and wherein R<sub>11</sub>, R<sub>12</sub> and R<sub>13</sub> are as defined in claim 1 and said monocyclic or bicyclic C<sub>6</sub>-C<sub>14</sub> aryl group is unsubstituted or further substituted by one or more carboxyl groups.

12. A compound according to any one of the preceding claims, wherein  $R_3$  and  $R_4$  each independently represent a hydrogen atom or a linear or branched  $C_1$ - $C_6$  alkyl group, which alkyl group is unsubstituted or substituted by a  $C_1$ - $C_2$  alkoxy group.

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13. A compound according to any one of the preceding claims, wherein  $R_3$  and  $R_4$  each independently represent a hydrogen atom or a linear or branched  $C_1$ - $C_3$  alkyl group.

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14. A compound according to any one of the preceding claims, wherein  $R_3$  and  $R_4$  each independently represent a hydrogen atom or a methyl group.

15. A compound according to any one of the preceding claims, wherein  $R_5$  represents a hydrogen atom, a halogen atom, a cyano group, a linear or branched  $C_1$ - $C_4$  alkyl group, a  $C_1$ - $C_4$  haloalkyl group, a  $C_1$ - $C_4$  hydroxyalkyl group, a  $C_3$ - $C_7$  cycloalkyl group, a  $-(CH_2)_nOR_{11}$  group, a  $-NR_{11}R_{12}$  group, a  $-NR_{11}C(O)-(CH_2)_n-R_{12}$  group, a  $-NR_{11}C(O)-(CH_2)_n-NR_{12}R_{13}$  group, a  $-C(O)-(CH_2)_{1-3}-CN$  group, a  $-C(O)-(CH_2)_n-R_{11}$  group, a  $-C(O)-(CH_2)_n-NR_{11}R_{12}$  group, a  $-S(O)_2(CH_2)_nR_{11}$  group, a  $-S(O)_2(CH_2)_nNR_{11}R_{12}$  group, a  $-NR_{11}S(O)_2(CH_2)_nR_{12}$  group or a  $-NR_{11}S(O)_2(CH_2)_nNR_{12}R_{13}$  group; wherein each  $n$  is 0, 1 or 2; and wherein  $R_{11}$ ,  $R_{12}$  and  $R_{13}$  each independently represent a hydrogen atom or a linear or branched  $C_1$ - $C_3$  alkyl group.

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16. A compound according to any one of the preceding claims, wherein  $R_6$  represents a hydrogen atom, a halogen atom, a cyano group, a linear or branched  $C_1$ - $C_4$  alkyl group, a  $C_1$ - $C_4$  haloalkyl group, a  $C_1$ - $C_4$  hydroxyalkyl group, a  $C_3$ - $C_7$  cycloalkyl group, a monocyclic or bicyclic  $C_6$ - $C_{10}$  aryl group, a 5- to 7- membered heteroaryl group containing one, two or three heteroatoms selected from O, S and N, or a 5- to 7- membered heterocyclyl group containing one, two or three heteroatoms selected from O, S and N,

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wherein the cycloalkyl, aryl, heteroaryl and heterocyclyl groups are unsubstituted or substituted by one, two or three substituents selected from a halogen atom, a cyano group, a linear or branched  $C_1$ - $C_6$  alkyl group, a  $C_1$ - $C_4$  haloalkyl group, a  $C_1$ - $C_4$  hydroxyalkyl group, a  $C_3$ - $C_7$  cycloalkyl, a phenyl group, a pyridyl group, a pyrimidinyl group, a piperidyl group, or

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a  $-C(O)-(CH_2)_n-NR_{11}R_{12}$  group; wherein  $n$  is 0, 1 or 2; and wherein  $R_{11}$  and  $R_{12}$  each independently represent a hydrogen atom or a linear or branched  $C_1$ - $C_3$  alkyl group.

17. A compound according to any one of the preceding claims, wherein  $R_7$  represents a hydrogen atom, a halogen atom, a cyano group, a linear or branched  $C_1$ - $C_4$  alkyl group, a  $C_1$ - $C_4$  haloalkyl group, a  $C_1$ - $C_4$  hydroxyalkyl group, a  $C_3$ - $C_7$  cycloalkyl group, a  
 5 monocyclic or bicyclic  $C_6$ - $C_{10}$  aryl group, a 5- to 7- membered heteroaryl group containing one, two or three heteroatoms selected from O, S and N, a 5- to 7- membered heterocyclyl group containing one, two or three heteroatoms selected from O, S and N,

wherein the cycloalkyl, aryl, heteroaryl and heterocyclyl groups are

10 unsubstituted or substituted by one, two or three substituents selected from a halogen atom, a cyano group, a linear or branched  $C_1$ - $C_6$  alkyl group, a  $C_1$ - $C_4$  haloalkyl group, a  $C_1$ - $C_4$  hydroxyalkyl group, a  $C_3$ - $C_7$  cycloalkyl group, a phenyl group, a phenyl group substituted by a carboxyl group, a pyridyl group, a pyrimidinyl group, a piperidyl group, a  $-(CH_2)_{1-3}CN$  group,

15 a  $-(CH_2)_nOR_{11}$  group, a  $-NR_{11}R_{12}$  group, a  $-NR_{11}C(O)-(CH_2)_n-R_{12}$  group, a  $-NR_{11}C(O)-(CH_2)_n-NR_{12}R_{13}$  group, a  $-C(O)-(CH_2)_{1-3}-CN$  group, a  $-C(O)-(CH_2)_n-R_{11}$  group, a  $-C(O)-(CH_2)_n-NR_{11}R_{12}$  group, a  $-S(O)_2(CH_2)_nR_{11}$  group, a  $-S(O)_2(CH_2)_nNR_{11}R_{12}$  group, a  $-NR_{11}S(O)_2(CH_2)_nR_{12}$  group or a  $-NR_{11}S(O)_2(CH_2)_nNR_{12}R_{13}$  group; wherein each  $n$  is 0, 1 or 2; and wherein  $R_{11}$ ,  
 20  $R_{12}$  and  $R_{13}$  each independently represent a hydrogen atom or a linear or branched  $C_1$ - $C_3$  alkyl group.

18. A compound according to any one of the preceding claims, wherein  $R_8$  represents a hydrogen atom or a linear or branched  $C_1$ - $C_6$  alkyl group, which alkyl group is  
 25 unsubstituted or substituted by a  $C_1$ - $C_2$  alkoxy group.

19. A compound according to any one of the preceding claims, wherein  $R_8$  represents a hydrogen atom or a linear or branched  $C_1$ - $C_3$  alkyl group.

20. A compound according to any one of the preceding claims, wherein  $R_8$  represents a hydrogen atom.

21. A compound according to claim 1, wherein:

35  $m$  is 0, 1 or 2;

X is a nitrogen atom and Y is a  $-CR_6$  group; or Y is a nitrogen atom and X is a  $-CR_6$  group; or both X and Y are a  $-CR_6$  group;

- 5 A is a nitrogen atom, B is a  $-CR_7$  group and D is a  $-CR_5$  group; or B is a nitrogen atom, A is a  $-CR_7$  group and D is a  $-CR_5$  group; or both A and B are a  $-CR_7$  group and D is nitrogen atom or a  $-CR_5$  group;

W represents a linker selected from a  $-NR_8-$  group or a  $-(CR_9R_{10})-$  group;

- 10  $R_1$  represents a hydrogen atom, a linear or branched  $C_1$ - $C_6$  alkyl group, a  $C_1$ - $C_4$  haloalkyl group, a  $C_1$ - $C_4$  hydroxyalkyl group, a  $C_3$ - $C_7$  cycloalkyl group, a phenyl group, a pyridyl group, a pyrimidinyl group or a piperidyl group;

- 15  $R_2$  represents a linear or branched  $C_1$ - $C_6$  alkyl group, a  $C_1$ - $C_4$  haloalkyl group, a  $C_1$ - $C_4$  hydroxyalkyl group, a  $C_3$ - $C_7$  cycloalkyl group, a monocyclic or bicyclic  $C_6$ - $C_{10}$  aryl group, a 5- to 7- membered heteroaryl group containing one, two or three heteroatoms selected from O, S and N, a 5- to 7- membered heterocyclyl group containing one, two or three heteroatoms selected from O, S and N,

- 20 wherein the cycloalkyl, cycloalkenyl, aryl, heteroaryl, and heterocyclyl groups are unsubstituted or substituted by one or more substituents selected from a halogen atom; a cyano group; a linear or branched  $C_1$ - $C_6$  alkyl group; a  $C_1$ - $C_4$  haloalkyl group; a  $C_1$ - $C_4$  hydroxyalkyl group; a  $C_3$ - $C_7$  cycloalkyl group; a monocyclic or bicyclic  $C_6$ - $C_{14}$  aryl group; a 5- to 14- membered heteroaryl group containing at least one heteroatom selected from O, S and N; a 5- to 14- membered heterocyclyl group containing at least one heteroatom selected from  
25 O, S and N; a  $-(CH_2)_{1-3}CN$  group; a  $-(CH_2)_nOR_{11}$  group; a  $-NR_{11}R_{12}$  group; a  $-NR_{11}C(O)-(CH_2)_n-R_{12}$  group; a  $-NR_{11}C(O)-(CH_2)_n-NR_{12}R_{13}$  group; a  $-C(O)-(CH_2)_{1-3}-CN$  group; a  $-C(O)-(CH_2)_n-R_{11}$  group; a  $-(CH_2)_{n'}-C(O)-(CH_2)_n-NR_{11}R_{12}$  group; a  $-(CH_2)_{n'}-S(O)_2(CH_2)_nR_{11}$  group; a  $-(CH_2)_{n'}-S(O)_2(CH_2)_nNR_{11}R_{12}$   
30 group; a  $-NR_{11}S(O)_2(CH_2)_nR_{12}$  group or a  $-NR_{11}S(O)_2(CH_2)_nNR_{12}R_{13}$  group; wherein each  $n'$  and  $n$  are 0, 1 or 2 and said monocyclic or bicyclic  $C_6$ - $C_{14}$  aryl group is unsubstituted or further substituted by one or more carboxyl groups.

- 35  $R_3$  and  $R_4$  each independently represent a hydrogen atom or a linear or branched  $C_1$ - $C_6$  alkyl group, which alkyl group is unsubstituted or substituted by a  $C_1$ - $C_2$  alkoxy group;

R<sub>5</sub> represents a hydrogen atom, a halogen atom, a cyano group, a linear or branched C<sub>1</sub>-C<sub>4</sub> alkyl group, a C<sub>1</sub>-C<sub>4</sub> haloalkyl group, a C<sub>1</sub>-C<sub>4</sub> hydroxyalkyl group, a C<sub>3</sub>-C<sub>7</sub> cycloalkyl group, a -(CH<sub>2</sub>)<sub>n</sub>OR<sub>11</sub> group, a -NR<sub>11</sub>R<sub>12</sub> group, a -NR<sub>11</sub>C(O)-(CH<sub>2</sub>)<sub>n</sub>-R<sub>12</sub> group, a -NR<sub>11</sub>C(O)-(CH<sub>2</sub>)<sub>n</sub>-NR<sub>12</sub>R<sub>13</sub> group, a -C(O)-(CH<sub>2</sub>)<sub>1-3</sub>-CN group,  
 5 a -C(O)-(CH<sub>2</sub>)<sub>n</sub>-R<sub>11</sub> group, a -C(O)-(CH<sub>2</sub>)<sub>n</sub>-NR<sub>11</sub>R<sub>12</sub> group, a -S(O)<sub>2</sub>(CH<sub>2</sub>)<sub>n</sub>R<sub>11</sub> group, a -S(O)<sub>2</sub>(CH<sub>2</sub>)<sub>n</sub>NR<sub>11</sub>R<sub>12</sub> group, a -NR<sub>11</sub>S(O)<sub>2</sub>(CH<sub>2</sub>)<sub>n</sub>R<sub>12</sub> group or a -NR<sub>11</sub>S(O)<sub>2</sub>(CH<sub>2</sub>)<sub>n</sub>NR<sub>12</sub>R<sub>13</sub> group; wherein each n is 0, 1 or 2;

R<sub>6</sub> represents a hydrogen atom, a halogen atom, a cyano group, a linear or branched  
 10 C<sub>1</sub>-C<sub>4</sub> alkyl group, a C<sub>1</sub>-C<sub>4</sub> haloalkyl group, a C<sub>1</sub>-C<sub>4</sub> hydroxyalkyl group, a C<sub>3</sub>-C<sub>7</sub> cycloalkyl group, a monocyclic or bicyclic C<sub>6</sub>-C<sub>10</sub> aryl group, a 5- to 7- membered heteroaryl group containing one, two or three heteroatoms selected from O, S and N, a 5- to 7- membered heterocyclyl group containing one, two or three heteroatoms selected from O, S and N,  
 15 wherein the cycloalkyl, aryl, heteroaryl and heterocyclyl groups are unsubstituted or substituted by one, two or three substituents selected from a halogen atom, a cyano group, a linear or branched C<sub>1</sub>-C<sub>6</sub> alkyl group, a C<sub>1</sub>-C<sub>4</sub> haloalkyl group, a C<sub>1</sub>-C<sub>4</sub> hydroxyalkyl group, a C<sub>3</sub>-C<sub>7</sub> cycloalkyl, a phenyl group, a pyridyl group, a pyrimidinyl group, a piperidyl group, or  
 20 a -C(O)-(CH<sub>2</sub>)<sub>n</sub>-NR<sub>11</sub>R<sub>12</sub> group; wherein n is 0, 1 or 2

R<sub>7</sub> represents a hydrogen atom, a halogen atom, a cyano group, a linear or branched C<sub>1</sub>-C<sub>4</sub> alkyl group, a C<sub>1</sub>-C<sub>4</sub> haloalkyl group, a C<sub>1</sub>-C<sub>4</sub> hydroxyalkyl group, a C<sub>3</sub>-C<sub>7</sub> cycloalkyl group, a monocyclic or bicyclic C<sub>6</sub>-C<sub>10</sub> aryl group, a 5- to 7- membered  
 25 heteroaryl group containing one, two or three heteroatoms selected from O, S and N, a 5- to 7- membered heterocyclyl group containing one, two or three heteroatoms selected from O, S and N,  
 wherein the cycloalkyl, aryl, heteroaryl and heterocyclyl groups are unsubstituted or substituted by one, two or three substituents selected from a  
 30 halogen atom, a cyano group, a linear or branched C<sub>1</sub>-C<sub>6</sub> alkyl group, a C<sub>1</sub>-C<sub>4</sub> haloalkyl group, a C<sub>1</sub>-C<sub>4</sub> hydroxyalkyl group, a C<sub>3</sub>-C<sub>7</sub> cycloalkyl group, a phenyl group, a phenyl group substituted by a carboxyl group, a pyridyl group, a pyrimidinyl group, a piperidyl group, a -(CH<sub>2</sub>)<sub>1-3</sub>CN group,  
 a -(CH<sub>2</sub>)<sub>n</sub>OR<sub>11</sub> group, a -NR<sub>11</sub>R<sub>12</sub> group, a -NR<sub>11</sub>C(O)-(CH<sub>2</sub>)<sub>n</sub>-R<sub>12</sub> group,  
 35 a -NR<sub>11</sub>C(O)-(CH<sub>2</sub>)<sub>n</sub>-NR<sub>12</sub>R<sub>13</sub> group, a -C(O)-(CH<sub>2</sub>)<sub>1-3</sub>-CN group, a -C(O)-(CH<sub>2</sub>)<sub>n</sub>-R<sub>11</sub> group, a -C(O)-(CH<sub>2</sub>)<sub>n</sub>-NR<sub>11</sub>R<sub>12</sub> group, a -S(O)<sub>2</sub>(CH<sub>2</sub>)<sub>n</sub>R<sub>11</sub> group, a -S(O)<sub>2</sub>(CH<sub>2</sub>)<sub>n</sub>NR<sub>11</sub>R<sub>12</sub> group, a -NR<sub>11</sub>S(O)<sub>2</sub>(CH<sub>2</sub>)<sub>n</sub>R<sub>12</sub> group or



a  $-NR_{11}S(O)_2(CH_2)_nNR_{12}R_{13}$  group; wherein each n is 0, 1 or 2;

$R_8$  represents a hydrogen atom or a linear or branched  $C_1$ - $C_6$  alkyl group, which alkyl group is unsubstituted or substituted by a  $C_1$ - $C_2$  alkoxy group;

5

$R_9$  and  $R_{10}$  each independently represent a hydrogen atom or a linear or branched  $C_1$ - $C_3$  alkyl group;

$R_{11}$ ,  $R_{12}$  and  $R_{13}$  each independently represent a hydrogen atom, a linear or branched  $C_1$ - $C_3$  alkyl group, or a 5- to 7- membered heterocyclyl group containing one, two or three heteroatoms selected from O, S and N, which heterocyclyl group is unsubstituted or substituted by one, two or three substituents selected from a halogen atom, a hydroxyl group, a linear or branched  $C_1$ - $C_4$  alkyl group, a  $C_1$ - $C_4$  haloalkyl group or a  $C_1$ - $C_4$  hydroxyalkyl group.

15

22. A compound according to claim 21, wherein:

m is 0, 1 or 2;

20 both X and Y represents a  $-CR_6$  group;

A is a nitrogen atom, B is a  $-CR_7$  group and D is a  $-CR_5$  group; or B is a nitrogen atom, A is a  $-CR_7$  group and D is a  $-CR_5$  group; or both A and B are a  $-CR_7$  group and D is nitrogen atom or a  $-CR_5$  group;

25

W represents a linker selected from a  $-NR_8-$  group or a  $-(CR_9R_{10})-$  group;

$R_1$  represents a hydrogen atom, a linear or branched  $C_1$ - $C_6$  alkyl group, a  $C_1$ - $C_4$  haloalkyl group, a  $C_1$ - $C_4$  hydroxyalkyl group, a  $C_3$ - $C_7$  cycloalkyl group, a phenyl group, a pyridyl group, a pyrimidinyl group or a piperidyl group;

30

$R_2$  represents a linear or branched  $C_1$ - $C_6$  alkyl group, a  $C_1$ - $C_4$  haloalkyl group, a  $C_1$ - $C_4$  hydroxyalkyl group, a  $C_3$ - $C_7$  cycloalkyl group, a monocyclic or bicyclic  $C_6$ - $C_{10}$  aryl group, a 5- to 7- membered heteroaryl group containing one, two or three heteroatoms selected from O, S and N, a 5- to 7- membered heterocyclyl group containing one, two or three heteroatoms selected from O, S and N,

35

wherein the cycloalkyl, cycloalkenyl, aryl, heteroaryl, and heterocyclyl groups are unsubstituted or substituted by one or more substituents selected from a halogen atom; a cyano group; a linear or branched C<sub>1</sub>-C<sub>6</sub> alkyl group; a C<sub>1</sub>-C<sub>4</sub> haloalkyl group; a C<sub>1</sub>-C<sub>4</sub> hydroxyalkyl group; a C<sub>3</sub>-C<sub>7</sub> cycloalkyl group; a  
 5 monocyclic or bicyclic C<sub>6</sub>-C<sub>14</sub> aryl group; a 5- to 14- membered heteroaryl group containing at least one heteroatom selected from O, S and N; a 5- to 14- membered heterocyclyl group containing at least one heteroatom selected from O, S and N; a -(CH<sub>2</sub>)<sub>1-3</sub>CN group; a -(CH<sub>2</sub>)<sub>n</sub>OR<sub>11</sub> group; a -NR<sub>11</sub>R<sub>12</sub> group; a -NR<sub>11</sub>C(O)-(CH<sub>2</sub>)<sub>n</sub>-R<sub>12</sub> group; a -NR<sub>11</sub>C(O)-(CH<sub>2</sub>)<sub>n</sub>-NR<sub>12</sub>R<sub>13</sub> group;  
 10 a -C(O)-(CH<sub>2</sub>)<sub>1-3</sub>-CN group; a -C(O)-(CH<sub>2</sub>)<sub>n</sub>-R<sub>11</sub> group; a -(CH<sub>2</sub>)<sub>n</sub>-C(O)-(CH<sub>2</sub>)<sub>n</sub>-NR<sub>11</sub>R<sub>12</sub> group; a -(CH<sub>2</sub>)<sub>n</sub>-S(O)<sub>2</sub>(CH<sub>2</sub>)<sub>n</sub>R<sub>11</sub> group; a -(CH<sub>2</sub>)<sub>n</sub>-S(O)<sub>2</sub>(CH<sub>2</sub>)<sub>n</sub>NR<sub>11</sub>R<sub>12</sub> group; a -NR<sub>11</sub>S(O)<sub>2</sub>(CH<sub>2</sub>)<sub>n</sub>R<sub>12</sub> group or a -NR<sub>11</sub>S(O)<sub>2</sub>(CH<sub>2</sub>)<sub>n</sub>NR<sub>12</sub>R<sub>13</sub> group; wherein each n' and n are 0, 1 or 2 and said monocyclic or bicyclic C<sub>6</sub>-C<sub>14</sub> aryl group is unsubstituted or further substituted by one or more carboxyl groups;

15 R<sub>3</sub> and R<sub>4</sub> each independently represent a hydrogen atom or a linear or branched C<sub>1</sub>-C<sub>6</sub> alkyl group, which alkyl group is unsubstituted or substituted by a C<sub>1</sub>-C<sub>2</sub> alkoxy group;

R<sub>5</sub> represents a hydrogen atom, a halogen atom, a cyano group, a linear or branched  
 20 C<sub>1</sub>-C<sub>4</sub> alkyl group, a C<sub>1</sub>-C<sub>4</sub> haloalkyl group, a C<sub>1</sub>-C<sub>4</sub> hydroxyalkyl group, a C<sub>3</sub>-C<sub>7</sub> cycloalkyl group, a -(CH<sub>2</sub>)<sub>n</sub>OR<sub>11</sub> group, a -NR<sub>11</sub>R<sub>12</sub> group, a -NR<sub>11</sub>C(O)-(CH<sub>2</sub>)<sub>n</sub>-R<sub>12</sub> group, a -NR<sub>11</sub>C(O)-(CH<sub>2</sub>)<sub>n</sub>-NR<sub>12</sub>R<sub>13</sub> group, a -C(O)-(CH<sub>2</sub>)<sub>1-3</sub>-CN group, a -C(O)-(CH<sub>2</sub>)<sub>n</sub>-R<sub>11</sub> group, a -C(O)-(CH<sub>2</sub>)<sub>n</sub>-NR<sub>11</sub>R<sub>12</sub> group, a -S(O)<sub>2</sub>(CH<sub>2</sub>)<sub>n</sub>R<sub>11</sub> group, a -S(O)<sub>2</sub>(CH<sub>2</sub>)<sub>n</sub>NR<sub>11</sub>R<sub>12</sub> group, a -NR<sub>11</sub>S(O)<sub>2</sub>(CH<sub>2</sub>)<sub>n</sub>R<sub>12</sub> group or  
 25 a -NR<sub>11</sub>S(O)<sub>2</sub>(CH<sub>2</sub>)<sub>n</sub>NR<sub>12</sub>R<sub>13</sub> group; wherein each n is 0, 1 or 2;

R<sub>6</sub> represents a hydrogen atom, a halogen atom, a cyano group, a linear or branched C<sub>1</sub>-C<sub>4</sub> alkyl group, a C<sub>1</sub>-C<sub>4</sub> haloalkyl group, a C<sub>1</sub>-C<sub>4</sub> hydroxyalkyl group, a C<sub>3</sub>-C<sub>7</sub> cycloalkyl group, a monocyclic or bicyclic C<sub>6</sub>-C<sub>10</sub> aryl group, a 5- to 7- membered  
 30 heteroaryl group containing one, two or three heteroatoms selected from O, S and N, a 5- to 7- membered heterocyclyl group containing one, two or three heteroatoms selected from O, S and N,

wherein the cycloalkyl, aryl, heteroaryl and heterocyclyl groups are unsubstituted or substituted by one, two or three substituents selected from a  
 35 halogen atom, a cyano group, a linear or branched C<sub>1</sub>-C<sub>6</sub> alkyl group, a C<sub>1</sub>-C<sub>4</sub> haloalkyl group, a C<sub>1</sub>-C<sub>4</sub> hydroxyalkyl group, a C<sub>3</sub>-C<sub>7</sub> cycloalkyl, a phenyl group, a pyridyl group, a pyrimidinyl group, a piperidyl group, or

a  $-\text{C}(\text{O})-(\text{CH}_2)_n-\text{NR}_{11}\text{R}_{12}$  group; wherein n is 0, 1 or 2

R<sub>7</sub> represents a hydrogen atom, a halogen atom, a cyano group, a linear or branched C<sub>1</sub>-C<sub>4</sub> alkyl group, a C<sub>1</sub>-C<sub>4</sub> haloalkyl group, a C<sub>1</sub>-C<sub>4</sub> hydroxyalkyl group, a C<sub>3</sub>-C<sub>7</sub> cycloalkyl group, a monocyclic or bicyclic C<sub>6</sub>-C<sub>10</sub> aryl group, a 5- to 7- membered heteroaryl group containing one, two or three heteroatoms selected from O, S and N, a 5- to 7- membered heterocyclyl group containing one, two or three heteroatoms selected from O, S and N,

wherein the cycloalkyl, aryl, heteroaryl and heterocyclyl groups are

unsubstituted or substituted by one, two or three substituents selected from a halogen atom, a cyano group, a linear or branched C<sub>1</sub>-C<sub>6</sub> alkyl group, a C<sub>1</sub>-C<sub>4</sub> haloalkyl group, a C<sub>1</sub>-C<sub>4</sub> hydroxyalkyl group, a C<sub>3</sub>-C<sub>7</sub> cycloalkyl group, a phenyl group, a phenyl group substituted by a carboxyl group, a pyridyl group, a pyrimidinyl group, a piperidyl group, a  $-(\text{CH}_2)_{1-3}\text{CN}$  group,

a  $-(\text{CH}_2)_n\text{OR}_{11}$  group, a  $-\text{NR}_{11}\text{R}_{12}$  group, a  $-\text{NR}_{11}\text{C}(\text{O})-(\text{CH}_2)_n-\text{R}_{12}$  group, a  $-\text{NR}_{11}\text{C}(\text{O})-(\text{CH}_2)_n-\text{NR}_{12}\text{R}_{13}$  group, a  $-\text{C}(\text{O})-(\text{CH}_2)_{1-3}-\text{CN}$  group, a  $-\text{C}(\text{O})-(\text{CH}_2)_n-\text{R}_{11}$  group, a  $-\text{C}(\text{O})-(\text{CH}_2)_n-\text{NR}_{11}\text{R}_{12}$  group, a  $-\text{S}(\text{O})_2(\text{CH}_2)_n\text{R}_{11}$  group, a  $-\text{S}(\text{O})_2(\text{CH}_2)_n\text{NR}_{11}\text{R}_{12}$  group, a  $-\text{NR}_{11}\text{S}(\text{O})_2(\text{CH}_2)_n\text{R}_{12}$  group or a  $-\text{NR}_{11}\text{S}(\text{O})_2(\text{CH}_2)_n\text{NR}_{12}\text{R}_{13}$  group; wherein each n is 0, 1 or 2;

R<sub>8</sub> represents a hydrogen atom or a linear or branched C<sub>1</sub>-C<sub>6</sub> alkyl group, which alkyl group is unsubstituted or substituted by a C<sub>1</sub>-C<sub>2</sub> alkoxy group;

R<sub>9</sub> and R<sub>10</sub> each independently represent a hydrogen atom or a linear or branched C<sub>1</sub>-C<sub>3</sub> alkyl group;

R<sub>11</sub>, R<sub>12</sub> and R<sub>13</sub> each independently represent a hydrogen atom, a linear or branched C<sub>1</sub>-C<sub>3</sub> alkyl group, or a 5- to 7- membered heterocyclyl group containing one, two or three heteroatoms selected from O, S and N, which heterocyclyl group is unsubstituted or substituted by one, two or three substituents selected from a halogen atom, a hydroxyl group, a linear or branched C<sub>1</sub>-C<sub>4</sub> alkyl group, a C<sub>1</sub>-C<sub>4</sub> haloalkyl group or a C<sub>1</sub>-C<sub>4</sub> hydroxyalkyl group.

23. A compound according to claim 22, wherein:

m is 0 or 1;

both X and Y represents a  $-CR_6$  group;

A is a nitrogen atom, B is a  $-CR_7$  group and D is a  $-CR_5$  group; or B is a nitrogen atom, A is a  $-CR_7$  group and D is a  $-CR_5$  group; or both A and B are a  $-CR_7$  group and D is  
 5 nitrogen atom or a  $-CR_5$  group;

W represents a linker selected from a  $-NR_8-$  group or a  $-(CR_9R_{10})-$  group;

$R_1$  represents a hydrogen atom, a linear or branched  $C_1-C_3$  alkyl group, a  $C_1-C_3$   
 10 haloalkyl group or a  $C_1-C_3$  hydroxyalkyl group;

$R_2$  represents a linear or branched  $C_1-C_6$  alkyl group, a  $C_1-C_4$  haloalkyl group, a  $C_1-C_4$  hydroxyalkyl group, a  $C_3-C_7$  cycloalkyl group, a phenyl group, a pyridyl group, a pyrimidinyl group, a triazolyl group, a thiazolyl group, a pyrrolidinyl group or a piperidyl  
 15 group;

wherein the cycloalkyl, phenyl, pyridyl, pyrimidinyl, triazolyl, thiazolyl, pyrrolidinyl or piperidyl groups are unsubstituted or substituted by one, two or three substituents selected from a halogen atom, a cyano group, a linear or branched  $C_1-C_6$  alkyl group, a  $C_1-C_4$  haloalkyl group, a  $C_1-C_4$  hydroxyalkyl  
 20 group, a  $C_3-C_7$  cycloalkyl group, a phenyl group, a phenyl group substituted by a carboxyl group, a pyridyl group, a triazolyl group, a thiazolyl group, a pyrimidinyl group, a piperidyl group, a  $-(CH_2)_nOR_{11}$  group, a  $-NR_{11}R_{12}$  group, a  $-NR_{11}C(O)-(CH_2)_n-R_{12}$  group, a  $-NR_{11}C(O)-(CH_2)_n-NR_{12}R_{13}$  group, a  $-C(O)-(CH_2)_{1-3}-CN$  group, a  $-C(O)-(CH_2)_n-R_{11}$  group, a  $-(CH_2)_n-C(O)-(CH_2)_n-$   
 25  $NR_{11}R_{12}$  group; a  $-(CH_2)_{n'}-S(O)_2(CH_2)_nR_{11}$  group; a  $-(CH_2)_{n'}-S(O)_2(CH_2)_nNR_{11}R_{12}$  group; a  $-NR_{11}S(O)_2(CH_2)_nR_{12}$  group or a  $-NR_{11}S(O)_2(CH_2)_nNR_{12}R_{13}$  group; wherein each  $n'$  and  $n$  are 0, 1 or 2;

$R_3$  and  $R_4$  each independently represent a hydrogen atom or a linear or branched  $C_1-C_3$   
 30 alkyl group;

$R_5$  represents a hydrogen atom, a halogen atom, a cyano group, a linear or branched  $C_1-C_3$  alkyl group, a  $C_1-C_4$  haloalkyl group, a  $C_1-C_4$  hydroxyalkyl group, a  $C_3-C_7$  cycloalkyl group, a  $-(CH_2)_{1-3}CN$  group, a  $-(CH_2)_nOR_{11}$  group, a  $-NR_{11}R_{12}$  group,  
 35 a  $-NR_{11}C(O)-(CH_2)_n-R_{12}$  group, a  $-NR_{11}C(O)-(CH_2)_n-NR_{12}R_{13}$  group, a  $-C(O)-(CH_2)_{1-3}-CN$  group, a  $-C(O)-(CH_2)_n-R_{11}$  group, a  $-C(O)-(CH_2)_n-NR_{11}R_{12}$  group, a  $-S(O)_2(CH_2)_nR_{11}$  group, a  $-S(O)_2(CH_2)_nNR_{11}R_{12}$  group, a  $-NR_{11}S(O)_2(CH_2)_nR_{12}$  group or

a  $-\text{NR}_{11}\text{S}(\text{O})_2(\text{CH}_2)_n\text{NR}_{12}\text{R}_{13}$  group; wherein each n is 0, 1 or 2;

$\text{R}_6$  represents a hydrogen atom, a halogen atom, a cyano group, a linear or branched  $\text{C}_1$ - $\text{C}_3$  alkyl group, a  $\text{C}_1$ - $\text{C}_4$  haloalkyl group, a  $\text{C}_1$ - $\text{C}_4$  hydroxyalkyl group, a  $\text{C}_3$ - $\text{C}_7$  cycloalkyl group, a phenyl group, a pyridyl group, a pyrimidinyl group, a pyrazolyl group, a pyrrolidinyl group, a piperidyl group, a tetrahydropyranyl group or a morpholinyl group;

$\text{R}_7$  represents a hydrogen atom, a halogen atom, a cyano group, a linear or branched  $\text{C}_1$ - $\text{C}_3$  alkyl group, a  $\text{C}_1$ - $\text{C}_4$  haloalkyl group, a  $\text{C}_1$ - $\text{C}_4$  hydroxyalkyl group, a  $\text{C}_3$ - $\text{C}_7$  cycloalkyl group, a phenyl group, a pyridyl group, a pyrimidinyl group, a triazolyl group, a thiazolyl group, a pyrrolidinyl group, a piperidyl group, a tetrahydropyranyl group or a morpholinyl group;

wherein the cycloalkyl, phenyl, pyridyl, pyrimidinyl, triazolyl, thiazolyl, pyrrolidinyl, piperidyl, tetrahydropyranyl or morpholinyl groups are unsubstituted or substituted by one, two or three substituents selected from a halogen atom, a linear or branched  $\text{C}_1$ - $\text{C}_6$  alkyl group, a  $\text{C}_1$ - $\text{C}_4$  haloalkyl group, a  $\text{C}_1$ - $\text{C}_4$  hydroxyalkyl group, a  $\text{C}_3$ - $\text{C}_7$  cycloalkyl group, a phenyl group, a phenyl group substituted by a carboxyl group, a pyridyl group, a triazolyl group, a thiazolyl group, a pyrimidinyl group, a piperidyl group, a  $-(\text{CH}_2)_n\text{OR}_{11}$  group, a  $-\text{NR}_{11}\text{R}_{12}$  group, a  $-\text{NR}_{11}\text{C}(\text{O})-(\text{CH}_2)_n-\text{R}_{12}$  group, a  $-\text{NR}_{11}\text{C}(\text{O})-(\text{CH}_2)_n-\text{NR}_{12}\text{R}_{13}$  group, a  $-\text{C}(\text{O})-(\text{CH}_2)_{1-3}-\text{CN}$  group, a  $-\text{C}(\text{O})-(\text{CH}_2)_n-\text{R}_{12}$  group, a  $-\text{C}(\text{O})-(\text{CH}_2)_n-\text{NR}_{11}\text{R}_{12}$  group, a  $-\text{S}(\text{O})_2(\text{CH}_2)_n\text{R}_{12}$  group, a  $-\text{S}(\text{O})_2(\text{CH}_2)_n\text{NR}_{11}\text{R}_{12}$  group, a  $-\text{NR}_{11}\text{S}(\text{O})_2(\text{CH}_2)_n\text{R}_{12}$  group or a  $-\text{NR}_{11}\text{S}(\text{O})_2(\text{CH}_2)_n\text{NR}_{12}\text{R}_{13}$  group; wherein each n is 0, 1 or 2;

$\text{R}_8$  represents a hydrogen atom or a linear or branched  $\text{C}_1$ - $\text{C}_3$  alkyl group;

$\text{R}_9$  and  $\text{R}_{10}$  each independently represent a hydrogen atom or a linear or branched  $\text{C}_1$ - $\text{C}_3$  alkyl group;

$\text{R}_{11}$ ,  $\text{R}_{12}$  and  $\text{R}_{13}$  each independently represent a hydrogen atom or a linear or branched  $\text{C}_1$ - $\text{C}_3$  alkyl group, or a 5- to 7- membered heterocyclyl group containing one, two or three heteroatoms selected from O, S and N, which heterocyclyl group is unsubstituted or substituted by one, two or three substituents selected from a halogen atom, a hydroxyl group, a linear or branched  $\text{C}_1$ - $\text{C}_4$  alkyl group, a  $\text{C}_1$ - $\text{C}_4$  haloalkyl group or a  $\text{C}_1$ - $\text{C}_4$  hydroxyalkyl group.

24. A compound according to any one of claims 21 to 23, wherein W represents a -NR<sub>8</sub>- group.

5 25. A compound according to claim 1, wherein:

m is 0 or 1;

both X and Y represents a -CR<sub>6</sub> group;

10

A is a nitrogen atom, B is a -CR<sub>7</sub> group and D is a -CR<sub>5</sub> group; or B is a nitrogen atom, A is a -CR<sub>7</sub> group and D is a -CR<sub>5</sub> group; or both A and B are a -CR<sub>7</sub> group and D is nitrogen atom or a -CR<sub>5</sub> group;

15 W represents a -NH- group or a -CH<sub>2</sub>- group;

R<sub>1</sub> represents a hydrogen atom;

R<sub>2</sub> represents a cyclohexyl group, a pyridyl group or a piperidyl group,

20

wherein the cyclohexyl, pyridyl and piperidyl and groups are unsubstituted or substituted by one, two or three substituents selected from a halogen atom, a triazolyl group, a -(CH<sub>2</sub>)<sub>1-3</sub>CN group, -C(O)-(CH<sub>2</sub>)<sub>1-3</sub>-CN group or a -(CH<sub>2</sub>)-S(O)<sub>2</sub>-pyrimidinyl group, which pyrimidinyl is unsubstituted or substituted by one, two or three hydroxyl groups;

25

R<sub>3</sub> and R<sub>4</sub> each independently represent a hydrogen atom or a methyl group;

R<sub>5</sub> represents a hydrogen atom, a halogen atom, a hydroxyl group, a linear or branched C<sub>1</sub>-C<sub>3</sub> alkyl group, a -OCH<sub>3</sub> group or a -C(O)-(CH<sub>2</sub>)<sub>n</sub>-NR<sub>11</sub>R<sub>12</sub> group; wherein n is 0 or 1;

30

and wherein R<sub>11</sub> and R<sub>12</sub> independently represent a hydrogen atom or a linear or branched C<sub>1</sub>-C<sub>3</sub> alkyl group;

R<sub>6</sub> represents a hydrogen atom, a halogen atom or a pyrazolyl group;

35

R<sub>7</sub> represents a hydrogen atom, piperidyl group, a thiazolyl group or a morpholinyl group;

wherein the piperidyl, thiazolyl and morpholinyl groups are unsubstituted or substituted by one or two substituents selected from a hydroxyl group or a benzoic acid.

5 26. A compound according to claim 25, wherein W represents a -NH- group.

27. A compound according to claim 3, wherein:

m is 0, 1 or 2;

10

X is a nitrogen atom and Y is a -CR<sub>6</sub> group; or Y is a nitrogen atom and X is a -CR<sub>6</sub> group; or both X and Y are a -CR<sub>6</sub> group;

15

A is a nitrogen atom and B is a -CR<sub>7</sub> group; or B is a nitrogen atom and A is a -CR<sub>7</sub> group; or both A and B are a -CR<sub>7</sub> group;

W represents a linker selected from a -NR<sub>8</sub>- group or a -(CR<sub>9</sub>R<sub>10</sub>)- group;

20

R<sub>1</sub> represents a hydrogen atom, a linear or branched C<sub>1</sub>-C<sub>6</sub> alkyl group, a C<sub>1</sub>-C<sub>4</sub> haloalkyl group, a C<sub>1</sub>-C<sub>4</sub> hydroxyalkyl group, a C<sub>3</sub>-C<sub>7</sub> cycloalkyl group, a phenyl group, a pyridyl group, a pyrimidinyl group or a piperidyl group;

25

R<sub>2</sub> represents a linear or branched C<sub>1</sub>-C<sub>6</sub> alkyl group, a C<sub>1</sub>-C<sub>4</sub> haloalkyl group, a C<sub>1</sub>-C<sub>4</sub> hydroxyalkyl group, a C<sub>3</sub>-C<sub>7</sub> cycloalkyl group, a monocyclic or bicyclic C<sub>6</sub>-C<sub>10</sub> aryl group, a 5- to 7- membered heteroaryl group containing one, two or three heteroatoms selected from O, S and N, a 5- to 7- membered heterocyclyl group containing one, two or three heteroatoms selected from O, S and N,

30

wherein the cycloalkyl, cycloalkenyl, aryl, heteroaryl, and heterocyclyl groups are unsubstituted or substituted by one or more substituents selected from a halogen atom; a cyano group; a linear or branched C<sub>1</sub>-C<sub>6</sub> alkyl group; a C<sub>1</sub>-C<sub>4</sub> haloalkyl group; a C<sub>1</sub>-C<sub>4</sub> hydroxyalkyl group; a C<sub>3</sub>-C<sub>7</sub> cycloalkyl group; a monocyclic or bicyclic C<sub>6</sub>-C<sub>14</sub> aryl group; a 5- to 14- membered heteroaryl group containing at least one heteroatom selected from O, S and N; a 5- to 14- membered heterocyclyl group containing at least one heteroatom selected from O, S and N; a -(CH<sub>2</sub>)<sub>1-3</sub>CN group; a -(CH<sub>2</sub>)<sub>n</sub>OR<sub>11</sub> group; a -NR<sub>11</sub>R<sub>12</sub> group; a -NR<sub>11</sub>C(O)-(CH<sub>2</sub>)<sub>n</sub>-R<sub>12</sub> group; a -NR<sub>11</sub>C(O)-(CH<sub>2</sub>)<sub>n</sub>-NR<sub>12</sub>R<sub>13</sub> group;

35

a -C(O)-(CH<sub>2</sub>)<sub>1-3</sub>-CN group; a -C(O)-(CH<sub>2</sub>)<sub>n</sub>-R<sub>11</sub> group; a -C(O)-(CH<sub>2</sub>)<sub>n</sub>-NR<sub>11</sub>R<sub>12</sub> group; a -S(O)<sub>2</sub>(CH<sub>2</sub>)<sub>n</sub>R<sub>11</sub> group; a -S(O)<sub>2</sub>(CH<sub>2</sub>)<sub>n</sub>NR<sub>11</sub>R<sub>12</sub> group;  
 a -NR<sub>11</sub>S(O)<sub>2</sub>(CH<sub>2</sub>)<sub>n</sub>R<sub>12</sub> group or a -NR<sub>11</sub>S(O)<sub>2</sub>(CH<sub>2</sub>)<sub>n</sub>NR<sub>12</sub>R<sub>13</sub> group; wherein  
 each n is 0, 1 or 2 and said monocyclic or bicyclic C<sub>6</sub>-C<sub>14</sub> aryl group is  
 5 unsubstituted or further substituted by one or more carboxyl groups.

R<sub>3</sub> and R<sub>4</sub> each independently represent a hydrogen atom or a linear or branched C<sub>1</sub>-C<sub>6</sub> alkyl group, which alkyl group is unsubstituted or substituted by a C<sub>1</sub>-C<sub>2</sub> alkoxy group;

10 R<sub>5</sub> represents a hydrogen atom, a halogen atom, a cyano group, a linear or branched C<sub>1</sub>-C<sub>4</sub> alkyl group, a C<sub>1</sub>-C<sub>4</sub> haloalkyl group, a C<sub>1</sub>-C<sub>4</sub> hydroxyalkyl group, a C<sub>3</sub>-C<sub>7</sub> cycloalkyl group, a -(CH<sub>2</sub>)<sub>n</sub>OR<sub>11</sub> group, a -NR<sub>11</sub>R<sub>12</sub> group, a -NR<sub>11</sub>C(O)-(CH<sub>2</sub>)<sub>n</sub>-R<sub>12</sub> group, a -NR<sub>11</sub>C(O)-(CH<sub>2</sub>)<sub>n</sub>-NR<sub>12</sub>R<sub>13</sub> group, a -C(O)-(CH<sub>2</sub>)<sub>1-3</sub>-CN group,  
 a -C(O)-(CH<sub>2</sub>)<sub>n</sub>-R<sub>11</sub> group, a -C(O)-(CH<sub>2</sub>)<sub>n</sub>-NR<sub>11</sub>R<sub>12</sub> group, a -S(O)<sub>2</sub>(CH<sub>2</sub>)<sub>n</sub>R<sub>11</sub> group,  
 15 a -S(O)<sub>2</sub>(CH<sub>2</sub>)<sub>n</sub>NR<sub>11</sub>R<sub>12</sub> group, a -NR<sub>11</sub>S(O)<sub>2</sub>(CH<sub>2</sub>)<sub>n</sub>R<sub>12</sub> group or  
 a -NR<sub>11</sub>S(O)<sub>2</sub>(CH<sub>2</sub>)<sub>n</sub>NR<sub>12</sub>R<sub>13</sub> group; wherein each n is 0, 1 or 2;

R<sub>6</sub> represents a hydrogen atom, a halogen atom, a cyano group, a linear or branched C<sub>1</sub>-C<sub>4</sub> alkyl group, a C<sub>1</sub>-C<sub>4</sub> haloalkyl group, a C<sub>1</sub>-C<sub>4</sub> hydroxyalkyl group, a C<sub>3</sub>-C<sub>7</sub> cycloalkyl group, a monocyclic or bicyclic C<sub>6</sub>-C<sub>10</sub> aryl group, a 5- to 7- membered  
 20 heteroaryl group containing one, two or three heteroatoms selected from O, S and N, a 5- to 7- membered heterocyclyl group containing one, two or three heteroatoms selected from O, S and N,

wherein the cycloalkyl, aryl, heteroaryl and heterocyclyl groups are  
 25 unsubstituted or substituted by one, two or three substituents selected from a halogen atom, a cyano group, a linear or branched C<sub>1</sub>-C<sub>6</sub> alkyl group, a C<sub>1</sub>-C<sub>4</sub> haloalkyl group, a C<sub>1</sub>-C<sub>4</sub> hydroxyalkyl group, a C<sub>3</sub>-C<sub>7</sub> cycloalkyl, a phenyl group, a pyridyl group, a pyrimidinyl group, a piperidyl group, or  
 a -C(O)-(CH<sub>2</sub>)<sub>n</sub>-NR<sub>11</sub>R<sub>12</sub> group; wherein n is 0, 1 or 2

30 R<sub>7</sub> represents a hydrogen atom, a halogen atom, a cyano group, a linear or branched C<sub>1</sub>-C<sub>4</sub> alkyl group, a C<sub>1</sub>-C<sub>4</sub> haloalkyl group, a C<sub>1</sub>-C<sub>4</sub> hydroxyalkyl group, a C<sub>3</sub>-C<sub>7</sub> cycloalkyl group, a monocyclic or bicyclic C<sub>6</sub>-C<sub>10</sub> aryl group, a 5- to 7- membered heteroaryl group containing one, two or three heteroatoms selected from O, S and N, a  
 35 5- to 7- membered heterocyclyl group containing one, two or three heteroatoms selected from O, S and N,



wherein the cycloalkyl, aryl, heteroaryl and heterocyclyl groups are unsubstituted or substituted by one, two or three substituents selected from a halogen atom, a cyano group, a linear or branched C<sub>1</sub>-C<sub>6</sub> alkyl group, a C<sub>1</sub>-C<sub>4</sub> haloalkyl group, a C<sub>1</sub>-C<sub>4</sub> hydroxyalkyl group, a C<sub>3</sub>-C<sub>7</sub> cycloalkyl group, a phenyl group, a phenyl group substituted by a carboxyl group, a pyridyl group, a pyrimidinyl group, a piperidyl group, a -(CH<sub>2</sub>)<sub>1-3</sub>CN group, a -(CH<sub>2</sub>)<sub>n</sub>OR<sub>11</sub> group, a -NR<sub>11</sub>R<sub>12</sub> group, a -NR<sub>11</sub>C(O)-(CH<sub>2</sub>)<sub>n</sub>-R<sub>12</sub> group, a -NR<sub>11</sub>C(O)-(CH<sub>2</sub>)<sub>n</sub>-NR<sub>12</sub>R<sub>13</sub> group, a -C(O)-(CH<sub>2</sub>)<sub>1-3</sub>-CN group, a -C(O)-(CH<sub>2</sub>)<sub>n</sub>-R<sub>11</sub> group, a -C(O)-(CH<sub>2</sub>)<sub>n</sub>-NR<sub>11</sub>R<sub>12</sub> group, a -S(O)<sub>2</sub>(CH<sub>2</sub>)<sub>n</sub>R<sub>11</sub> group, a -S(O)<sub>2</sub>(CH<sub>2</sub>)<sub>n</sub>NR<sub>11</sub>R<sub>12</sub> group, a -NR<sub>11</sub>S(O)<sub>2</sub>(CH<sub>2</sub>)<sub>n</sub>R<sub>12</sub> group or a -NR<sub>11</sub>S(O)<sub>2</sub>(CH<sub>2</sub>)<sub>n</sub>NR<sub>12</sub>R<sub>13</sub> group; wherein each n is 0, 1 or 2;

R<sub>8</sub> represents a hydrogen atom or a linear or branched C<sub>1</sub>-C<sub>6</sub> alkyl group, which alkyl group is unsubstituted or substituted by a C<sub>1</sub>-C<sub>2</sub> alkoxy group;

R<sub>9</sub> and R<sub>10</sub> each independently represent a hydrogen atom or a linear or branched C<sub>1</sub>-C<sub>3</sub> alkyl group;

R<sub>11</sub>, R<sub>12</sub> and R<sub>13</sub> each independently represent a hydrogen atom or a linear or branched C<sub>1</sub>-C<sub>3</sub> alkyl group.

28. A compound according to claim 27, wherein:

m is 0 or 1;

both X and Y represents a -CR<sub>6</sub> group;

A is a nitrogen atom and B is a -CR<sub>7</sub> group; or B is a nitrogen atom and A is a -CR<sub>7</sub> group; or both A and B are a -CR<sub>7</sub> group;

W represents a linker selected from a -NR<sub>8</sub>- group or a -(CR<sub>9</sub>R<sub>10</sub>)- group;

R<sub>1</sub> represents a hydrogen atom, a linear or branched C<sub>1</sub>-C<sub>3</sub> alkyl group, a C<sub>1</sub>-C<sub>3</sub> haloalkyl group or a C<sub>1</sub>-C<sub>3</sub> hydroxyalkyl group;

R<sub>2</sub> represents a linear or branched C<sub>1</sub>-C<sub>6</sub> alkyl group, a C<sub>1</sub>-C<sub>4</sub> haloalkyl group, a C<sub>1</sub>-C<sub>4</sub> hydroxyalkyl group, a C<sub>3</sub>-C<sub>7</sub> cycloalkyl group, a phenyl group, a pyridyl group, a

pyrimidinyl group, a triazolyl group, a thiazolyl group, a pyrrolidinyl group or a piperidyl group;

wherein the cycloalkyl, phenyl, pyridyl, pyrimidinyl, triazolyl, thiazolyl, pyrrolidinyl or piperidyl groups are unsubstituted or substituted by one, two or three substituents selected from a halogen atom, a cyano group, a linear or branched C<sub>1</sub>-C<sub>6</sub> alkyl group, a C<sub>1</sub>-C<sub>4</sub> haloalkyl group, a C<sub>1</sub>-C<sub>4</sub> hydroxyalkyl group, a C<sub>3</sub>-C<sub>7</sub> cycloalkyl group, a phenyl group, a phenyl group substituted by a carboxyl group, a pyridyl group, a triazolyl group, a thiazolyl group, a pyrimidinyl group, a piperidyl group, a -(CH<sub>2</sub>)<sub>n</sub>OR<sub>11</sub> group, a -NR<sub>11</sub>R<sub>12</sub> group, a -NR<sub>11</sub>C(O)-(CH<sub>2</sub>)<sub>n</sub>-R<sub>12</sub> group, a -NR<sub>11</sub>C(O)-(CH<sub>2</sub>)<sub>n</sub>-NR<sub>12</sub>R<sub>13</sub> group, a -C(O)-(CH<sub>2</sub>)<sub>1-3</sub>-CN group, a -C(O)-(CH<sub>2</sub>)<sub>n</sub>-R<sub>11</sub> group, a -C(O)-(CH<sub>2</sub>)<sub>n</sub>-NR<sub>11</sub>R<sub>12</sub> group, a -S(O)<sub>2</sub>(CH<sub>2</sub>)<sub>n</sub>R<sub>11</sub> group, a -S(O)<sub>2</sub>(CH<sub>2</sub>)<sub>n</sub>NR<sub>11</sub>R<sub>12</sub> group, a -NR<sub>11</sub>S(O)<sub>2</sub>(CH<sub>2</sub>)<sub>n</sub>R<sub>12</sub> group or a -NR<sub>11</sub>S(O)<sub>2</sub>(CH<sub>2</sub>)<sub>n</sub>NR<sub>12</sub>R<sub>13</sub> group; wherein each n is 0, 1 or 2;

R<sub>3</sub> and R<sub>4</sub> each independently represent a hydrogen atom or a linear or branched C<sub>1</sub>-C<sub>3</sub> alkyl group;

R<sub>5</sub> represents a hydrogen atom, a halogen atom, a cyano group, a linear or branched C<sub>1</sub>-C<sub>3</sub> alkyl group, a C<sub>1</sub>-C<sub>4</sub> haloalkyl group, a C<sub>1</sub>-C<sub>4</sub> hydroxyalkyl group, a C<sub>3</sub>-C<sub>7</sub> cycloalkyl group, a -(CH<sub>2</sub>)<sub>1-3</sub>CN group, a -(CH<sub>2</sub>)<sub>n</sub>OR<sub>11</sub> group, a -NR<sub>11</sub>R<sub>12</sub> group, a -NR<sub>11</sub>C(O)-(CH<sub>2</sub>)<sub>n</sub>-R<sub>12</sub> group, a -NR<sub>11</sub>C(O)-(CH<sub>2</sub>)<sub>n</sub>-NR<sub>12</sub>R<sub>13</sub> group, a -C(O)-(CH<sub>2</sub>)<sub>1-3</sub>-CN group, a -C(O)-(CH<sub>2</sub>)<sub>n</sub>-R<sub>11</sub> group, a -C(O)-(CH<sub>2</sub>)<sub>n</sub>-NR<sub>11</sub>R<sub>12</sub> group, a -S(O)<sub>2</sub>(CH<sub>2</sub>)<sub>n</sub>R<sub>11</sub> group, a -S(O)<sub>2</sub>(CH<sub>2</sub>)<sub>n</sub>NR<sub>11</sub>R<sub>12</sub> group, a -NR<sub>11</sub>S(O)<sub>2</sub>(CH<sub>2</sub>)<sub>n</sub>R<sub>12</sub> group or a -NR<sub>11</sub>S(O)<sub>2</sub>(CH<sub>2</sub>)<sub>n</sub>NR<sub>12</sub>R<sub>13</sub> group; wherein each n is 0, 1 or 2;

R<sub>6</sub> represents a hydrogen atom, a halogen atom, a cyano group, a linear or branched C<sub>1</sub>-C<sub>3</sub> alkyl group, a C<sub>1</sub>-C<sub>4</sub> haloalkyl group, a C<sub>1</sub>-C<sub>4</sub> hydroxyalkyl group, a C<sub>3</sub>-C<sub>7</sub> cycloalkyl group, a phenyl group, a pyridyl group, a pyrimidinyl group, a pyrrolidinyl group, a piperidyl group, a tetrahydropyranyl group or a morpholinyl group;

R<sub>7</sub> represents a hydrogen atom, a halogen atom, a cyano group, a linear or branched C<sub>1</sub>-C<sub>3</sub> alkyl group, a C<sub>1</sub>-C<sub>4</sub> haloalkyl group, a C<sub>1</sub>-C<sub>4</sub> hydroxyalkyl group, a C<sub>3</sub>-C<sub>7</sub> cycloalkyl group, a phenyl group, a pyridyl group, a pyrimidinyl group, a triazolyl group, a thiazolyl group, a pyrrolidinyl group, a piperidyl group, a tetrahydropyranyl group or a morpholinyl group;

wherein the cycloalkyl, phenyl, pyridyl, pyrimidinyl, triazolyl, thiazolyl, pyrrolidinyl, piperidyl, tetrahydropyranyl or morpholinyl groups are unsubstituted or substituted by one, two or three substituents selected from a halogen atom, a linear or branched C<sub>1</sub>-C<sub>6</sub> alkyl group, a C<sub>1</sub>-C<sub>4</sub> haloalkyl group, a C<sub>1</sub>-C<sub>4</sub> hydroxyalkyl group, a C<sub>3</sub>-C<sub>7</sub> cycloalkyl group, a phenyl group, a phenyl group substituted by a carboxyl group, a pyridyl group, a triazolyl group, a thiazolyl group, a pyrimidinyl group, a piperidyl group, a -(CH<sub>2</sub>)<sub>n</sub>OR<sub>11</sub> group, a -NR<sub>11</sub>R<sub>12</sub> group, a -NR<sub>11</sub>C(O)-(CH<sub>2</sub>)<sub>n</sub>-R<sub>12</sub> group, a -NR<sub>11</sub>C(O)-(CH<sub>2</sub>)<sub>n</sub>-NR<sub>12</sub>R<sub>13</sub> group, a -C(O)-(CH<sub>2</sub>)<sub>1-3</sub>-CN group, a -C(O)-(CH<sub>2</sub>)<sub>n</sub>-R<sub>12</sub> group, a -C(O)-(CH<sub>2</sub>)<sub>n</sub>-NR<sub>11</sub>R<sub>12</sub> group, a -S(O)<sub>2</sub>(CH<sub>2</sub>)<sub>n</sub>R<sub>12</sub> group, a -S(O)<sub>2</sub>(CH<sub>2</sub>)<sub>n</sub>NR<sub>11</sub>R<sub>12</sub> group, a -NR<sub>11</sub>S(O)<sub>2</sub>(CH<sub>2</sub>)<sub>n</sub>R<sub>12</sub> group or a -NR<sub>11</sub>S(O)<sub>2</sub>(CH<sub>2</sub>)<sub>n</sub>NR<sub>12</sub>R<sub>13</sub> group; wherein each n is 0, 1 or 2;

R<sub>8</sub> represents a hydrogen atom or a linear or branched C<sub>1</sub>-C<sub>3</sub> alkyl group;

R<sub>9</sub> and R<sub>10</sub> each independently represent a hydrogen atom or a linear or branched C<sub>1</sub>-C<sub>3</sub> alkyl group;

R<sub>11</sub>, R<sub>12</sub> and R<sub>13</sub> each independently represent a hydrogen atom or a linear or branched C<sub>1</sub>-C<sub>3</sub> alkyl group.

29. A compound according to claim 3, wherein:

m is 0 or 1;

both X and Y represents a -CR<sub>6</sub> group;

A is a nitrogen atom and B is a -CR<sub>7</sub> group; or B is a nitrogen atom and A is a -CR<sub>7</sub> group; or both A and B are a -CR<sub>7</sub> group;

W represents a -NH- group or a -CH<sub>2</sub>- group;

R<sub>1</sub> represents a hydrogen atom;

R<sub>2</sub> represents a cyclohexyl group, a pyridyl group or a piperidyl group, wherein the cyclohexyl, pyridyl and piperidyl groups are unsubstituted or substituted by one, two or three substituents selected from a halogen atom,

a triazolyl group, a  $-(CH_2)_{1-3}CN$  group or  $-C(O)-(CH_2)_{1-3}-CN$  group;

$R_3$  and  $R_4$  each independently represent a hydrogen atom or a methyl group;

- 5  $R_5$  represents a hydrogen atom, a halogen atom, a linear or branched  $C_1-C_3$  alkyl group or a  $-C(O)-(CH_2)_n-NR_{11}R_{12}$  group; wherein  $n$  is 0 or 1; and wherein  $R_{11}$  and  $R_{12}$  independently represent a hydrogen atom or a linear or branched  $C_1-C_3$  alkyl group;

$R_6$  represents a hydrogen atom or a halogen atom;

10

$R_7$  represents a hydrogen atom, piperidyl group, a thiazolyl group or a morpholinyl group;

wherein the piperidyl, thiazolyl and morpholinyl groups are unsubstituted or substituted by one or two substituents selected from a hydroxy group or a

15

benzoic acid.

30. A compound according to claim 1 which is one of:

(S)-3-(4-(1-(5-fluoropyridin-2-yl)ethylamino)pyrimidin-2-ylamino)pyridin-2(1H)-one;

(S)-3-(4-(1-(5-fluoropyridin-2-yl)ethylamino)-5-methylpyrimidin-2-ylamino)pyridin-2(1H)-one;

20

(S)-3-(5-chloro-4-(1-(5-fluoropyridin-2-yl)ethylamino)pyrimidin-2-ylamino)pyridin-2(1H)-one;

(S)-3-(4-(1-(5-fluoropyridin-2-yl)ethylamino)-5-methoxypyrimidin-2-ylamino)pyridin-2(1H)-one;

25

(S)-3-(4-(1-(5-fluoropyridin-2-yl)ethylamino)-5-hydroxypyrimidin-2-ylamino)pyridin-2(1H)-one;

(S)-4-(1-(5-fluoropyridin-2-yl)ethylamino)-2-(2-oxo-1,2-dihydropyridin-3-ylamino)pyrimidine-5-carboxamide;

(S)-5-chloro-3-(4-(1-(5-fluoropyridin-2-yl)ethylamino)-5-methylpyrimidin-2-ylamino)pyridin-2(1H)-one;

30

(S)-3-(4-(1-(5-fluoropyridin-2-yl)ethylamino)-5-methylpyrimidin-2-ylamino)-5-(1H-pyrazol-4-yl)pyridin-2(1H)-one;

(S)-3-(4-(1-(5-fluoropyridin-2-yl)ethylamino)-6-(4-hydroxypiperidin-1-yl)pyrimidin-2-ylamino)pyridin-2(1H)-one;

35

(S)-3-(5-fluoro-4-(1-(5-fluoropyridin-2-yl)ethylamino)-6-morpholinopyrimidin-2-ylamino)pyridin-2(1H)-one;

(S)-3-(6-(1-(5-fluoropyridin-2-yl)ethylamino)pyrazin-2-ylamino)pyridin-2(1H)-one;

- (S)-3-(6-(1-(5-fluoropyridin-2-yl)ethylamino)pyridin-2-ylamino)pyridin-2(1H)-one;  
 2-((1r,4r)-4-(5-methyl-2-(2-oxo-1,2-dihydropyridin-3-ylamino)pyrimidin-4-ylamino)cyclohexyl)acetonitrile;  
 3-(4-((1r,4r)-4-((3-hydroxypiperidin-1-ylsulfonyl)methyl)cyclohexylamino)pyrimidin-2-ylamino)pyridin-2(1H)-one;  
 5 (R)-3-oxo-3-(3-(2-(2-oxo-1,2-dihydropyridin-3-ylamino)pyrimidin-4-ylamino)piperidin-1-yl)propanenitrile;  
 (R)-3-(3-(5-methyl-2-(2-oxo-1,2-dihydropyridin-3-ylamino)pyrimidin-4-ylamino)piperidin-1-yl)-3-oxopropanenitrile;  
 10 (R)-3-(3-(5-fluoro-2-(2-oxo-1,2-dihydropyridin-3-ylamino)pyrimidin-4-ylamino)piperidin-1-yl)-3-oxopropanenitrile;  
 (R)-3-(4-(1-(4H-1,2,4-triazol-3-yl)piperidin-3-ylamino)-5-fluoropyrimidin-2-ylamino)pyridin-2(1H)-one;  
 (R)-3-(3-(2-(5-chloro-2-oxo-1,2-dihydropyridin-3-ylamino)-5-methylpyrimidin-4-ylamino)piperidin-1-yl)-3-oxopropanenitrile;  
 15 (R)-3-(3-(5-fluoro-6-morpholino-2-(2-oxo-1,2-dihydropyridin-3-ylamino)pyrimidin-4-ylamino)piperidin-1-yl)-3-oxopropanenitrile;  
 (R)-3-(3-(5-methyl-6-morpholino-2-(2-oxo-1,2-dihydropyridin-3-ylamino)pyrimidin-4-ylamino)piperidin-1-yl)-3-oxopropanenitrile;  
 20 (R)-3-(3-(5-methyl-4-morpholino-6-(2-oxo-1,2-dihydropyridin-3-ylamino)pyrimidin-2-ylamino)piperidin-1-yl)-3-oxopropanenitrile;  
 (R)-3-(3-(4-(5-chloro-2-oxo-1,2-dihydropyridin-3-ylamino)-5-methyl-6-morpholinopyrimidin-2-ylamino)piperidin-1-yl)-3-oxopropanenitrile;  
 (R)-3-(3-(5-chloro-2-(2-oxo-1,2-dihydropyridin-3-ylamino)pyrimidin-4-ylamino)piperidin-1-yl)-3-oxopropanenitrile;  
 25 3-[(4-[(1S)-1-(5-Fluoropyridin-2-yl)ethyl]amino)pyrimidin-2-yl)methyl]pyridin-2(1H)-one;  
 (S)-3-(5-(6-(1-(5-fluoropyridin-2-yl)ethylamino)-2-(2-oxo-1,2-dihydropyridin-3-ylamino)pyrimidin-4-yl)thiazol-2-yl)benzoic acid;  
 30 or a pharmaceutically acceptable salt, or solvate, or N-oxide, or stereoisomer or deuterated derivative thereof.
31. A compound as defined in any one of claims 1 to 30, for use in the treatment of the human or animal body by therapy.

32. A compound as defined in any one of claims 1 to 30, for use in the treatment of a pathological condition or disease susceptible to amelioration by inhibition of Janus Kinases.

5 33. A compound for use according to claim 32, wherein the pathological condition or disease is selected from myeloproliferative disorders, leukemia, lymphoid malignancies and solid tumors; bone marrow and organ transplant rejection; immune-mediated diseases and inflammatory diseases.

10 34. A compound for use according to claim 32 or 33, wherein the pathological condition or disease is selected from rheumatoid arthritis, multiple sclerosis, inflammatory bowel disease, dry eye, uveitis, allergic conjunctivitis, allergic rhinitis, asthma, chronic obstructive pulmonary disease (COPD), atopic dermatitis and psoriasis.

15 35. A pharmaceutical composition comprising a compound as defined in any one of claims 1 to 30 in association with a pharmaceutically acceptable diluent or carrier.

36. Use of a compound as defined in any one of claims 1 to 30, for the manufacture of a medicament for the treatment of a pathological condition or disease as defined in any  
20 one of claims 32 to 34.

37. A combination product comprising (i) a compound as defined in any one of claims 1 to 30; and (ii) another compound selected from:

- |    |    |   |
|----|----|---|
| 25 | a) | Dihydrofolate reductase inhibitors;                           |
|    | b) | Dihydroorotate dehydrogenase (DHODH) inhibitors;              |
|    | c) | Immunomodulators;   |
|    | d) | Inhibitors of DNA synthesis and repair;                       |
|    | e) | Immunosuppressants;   |
| 30 | f) | Anti-alpha 4 integrin antibodies;                             |
|    | g) | Alpha 4 integrin antagonists;                                 |
|    | h) | Corticoids and glucocorticoids;                               |
|    | i) | Fumaric acid esters;  |
|    | j) | Anti-tumor necrosis factor-alpha (Anti-TNF-alpha) antibodies; |
| 35 | k) | Soluble Tumor necrosis factor-alpha (TNF-alpha) receptors;    |
|    | l) | Anti-CD20 (lymphocyte protein) monoclonal antibodies;         |
|    | m) | Anti-CD52 (lymphocyte protein) monoclonal antibodies;         |

- n) Anti-CD25 (lymphocyte protein) monoclonal antibodies;
- o) Anti-CD88 (lymphocyte protein) monoclonal antibodies;
- p) Anti-Interleukin 6 Receptor (IL-6R) monoclonal antibodies;
- q) Anti-Interleukin 12 Receptor (IL-12R) / Interleukin 23 Receptor (IL-23R) monoclonal antibodies;
- r) Calcineurin inhibitors;
- s) Inosine-monophosphate dehydrogenase (IMPDH) inhibitors;
- t) Cannabinoid receptor agonists;
- u) Chemokine CCR1 antagonists;
- v) Chemokine CCR2 antagonists;
- w) Necrosis factor-kappaB (NF-kappaB or NFKB) Activation Inhibitors;
- x) Adenosine A<sub>2A</sub> agonists;
- y) Sphingosine-1 (S1P) phosphate receptor agonists;
- z) Sphingosine-1 (S1P) liase inhibitors;
- aa) Spleen tyrosine kinase (Syk) inhibitors;
- bb) Protein Kinase Inhibitors (PKC) inhibitors;
- cc) Anti-cholinergic agents;
- dd) Beta adrenergic agonists;
- ee) Compounds having bifunctional Muscarinic Antagonist-Beta2 Agonist activity (MABAs);
- ff) Histamine 1 (H1) receptor antagonists;
- gg) Chemoattractant receptor homologous molecule expressed on TH<sub>2</sub> cells (CRTH2) inhibitors;
- hh) Vitamin D derivatives;
- ii) Anti-inflammatory agents;
- jj) Anti-allergic agents;
- kk) Anti-viral agents;
- ll) Phosphodiesterase (PDE) III inhibitors;
- mm) Phosphodiesterase (PDE) IV inhibitors;
- nn) Dual Phosphodiesterase (PDE) III/IV inhibitors;
- oo) Xanthine derivatives;
- pp) p38 Mitogen-Activated Protein Kinase (p38 MAPK) Inhibitors;
- qq) Mitogen-activated extracellular signal regulated kinase kinase (MEK) inhibitor;
- rr) Phosphoinositide 3-Kinases (PI3Ks) inhibitors;
- ss) Interferons; and
- tt) Interferon alpha.

38. A combination product as defined in claim 37, wherein:

- a) the dyhydrofolate reductase inhibitor is methotrexate, or CH-1504;
- 5 b) the DHODH inhibitors are selected from leflunomide and teriflunomide;
- c) the immunomodulators are selected from Glatiramer acetate, Laquinimod and Imiquimod;
- 10 d) the inhibitors of DNA synthesis and repair are selected from Mitoxantrone and Cladribine;
- e) the immunosuppressants are selected from azathioprine or 6-mercaptopurine;
- f) the anti-alpha 4 integrin antibody is Natalizumab;
- 15 g) the alpha 4 integrin antagonists are selected from R-1295, TB-4746, CDP-323, ELND-002 and Finategrast;
- h) the corticoids and glucocorticoids are selected from prednisone; methylprednisolone, fluticasone, mometasone, budesonide, ciclesonide and beta-metasone,
- i) the fumaric acid esters is dimethyl fumarate;
- 20 j) the anti-TNF alpha antibodies are selected from Infliximab; Adalimumab, and Certolizumab pegol;
- k) the soluble TNF alpha receptors is Etanercept;
- l) the anti-CD20 monoclonal antibodies are selected from Rituximab; Ocrelizumab, Ofatumumab; and TRU-015;
- 25 m) the anti-CD52 monoclonal antibody is alemtuzumab;
- n) the anti-CD25 monoclonal antibody is daclizumab;
- o) the anti-CD88 monoclonal antibodies are selected from eculizumab and pexilizumab;
- p) the anti-interlukin 6 receptor monoclonal antibody is tocilizumab;



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- q) the anti-IL12R /IL23R monoclonal antibody is ustekinumab;
- r) the calcineurin inhibitors are selected from cyclosporine A and tacrolimus;
- s) the IMPDH inhibitors are selected from mycophenolate mophetyl, ribavirin, mizoribine and mycophenolic acid;
- t) the cannabinoid receptor agonists is Nabiximols;
- u) the chemokine CCR1 antagonists are selected from MLN-3897 and PS-031291;
- v) the chemokine CCR2 antagonist is INCB-8696;
- 10
- w) the NF-kappaB activation inhibitor is selected from Sulfasalazine, Iguratimod and MLN-0415;
- x) the adenosine A<sub>2A</sub> agonists are selected from ATL-313, ATL-146e, CGS-21680, Regadenoson and UK-432,097;
- 15
- y) the S1P receptor agonists are selected from fingolimod BAF-312, or ACT12880;
- z) the S1P liase inhibitor is LX2931;
- aa) the syk inhibitor is R-112;
- bb) the PKC inhibitor is NVP-AEB071;
- cc) the anti-cholinergic agent is selected from tiotropium and aclidinium;
- 20
- dd) the beta adrenergic agonist is selected from formoterol, indacaterol and abediterol;
- ee) the H1 receptor antagonists are selected from azelastine or ebastine;
- 25
- ff) the CRTH2 inhibitors are selected from OC-459, AZD-1981, ACT-129968 and QAV-680;
- gg) the vitamin D derivative is calcipotriol;

- hh) the anti-inflammatory agents are selected from non-steroidal anti-inflammatory drugs (NSAIDs) or selective cyclooxygenase-2 (COX-2) inhibitors;
- ii) the Phosphodiesterase IV inhibitors is roflumilast or GRC-4039;
- 5 jj) the xanthine derivatives are selected from theophylline and theobromine;
- kk) the p38 MAPK inhibitor is ARRY-797;
- ll) the MEK inhibitor is ARRY-142886 or ARRY-438162;
- mm) the interferons are selected from Interferon beta 1a and Interferon beta 1b; and
- 10 nn) the Interferon alpha is Sumiferon MP.

39. The combination product of claim 38, wherein the COX-2 inhibitors are selected from aceclofenac, diclofenac, ibuprofen, naproxen, apricoxib, celecoxib, cimicoxib, deracoxib, etoricoxib, lumiracoxib, parecoxib sodium, rofecoxib, selenocoxib-1 and valdecoxib.

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40. A combination product according to any one of claims 37 to 39 which is for simultaneous, separate or sequential use in the treatment of the human or animal body.

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41. Use of (i) a compound as defined in any one of claims 1 to 30, and (ii) another compound selected from:

- a) Dihydrofolate reductase inhibitors;
- 25 b) Dihydroorotate dehydrogenase (DHODH) inhibitors;
- c) Immunomodulators;
- d) Inhibitors of DNA synthesis and repair;
- e) Immunosuppressants;

- f) Anti-alpha 4 integrin antibodies;
- g) Alpha 4 integrin antagonists;
- h) Corticoids and glucocorticoids;
- i) Fumaric acid esters;
- 5 j) Anti-tumor necrosis factor-alpha (Anti-TNF-alpha) antibodies;
- k) Soluble Tumor necrosis factor-alpha (TNF-alpha) receptors;
- l) Anti-CD20 (lymphocyte protein) monoclonal antibodies;
- m) Anti-CD52 (lymphocyte protein) monoclonal antibodies;
- n) Anti-CD25 (lymphocyte protein) monoclonal antibodies;
- 10 o) Anti-CD88 (lymphocyte protein) monoclonal antibodies;
- p) Anti-Interleukin 6 Receptor (IL-6R) monoclonal antibodies;
- q) Anti-Interleukin 12 Receptor (IL-12R) / Interleukin 23 Receptor (IL-23R) monoclonal antibodies;
- r) Calcineurin inhibitors;
- 15 s) Inosine-monophosphate dehydrogenase (IMPDH) inhibitors;
- t) Cannabinoid receptor agonists;
- u) Chemokine CCR1 antagonists;
- v) Chemokine CCR2 antagonists;
- w) Necrosis factor-kappaB (NF-kappaB or NFkB) Activation Inhibitors;
- 20 x) Adenosine A<sub>2A</sub> agonists;
- y) Sphingosine-1 (S1P) phosphate receptor agonists;
- z) Sphingosine-1 (S1P) liase inhibitors;
- aa) Spleen tyrosine kinase (Syk) inhibitors;

bb) Protein Kinase Inhibitors (PKC) inhibitors;

cc) Anti-cholinergic agents;

dd) Beta adrenergic agonists;

ee) Compounds having bifunctional Muscarinic Antagonist-Beta2

5 Agonist activity (MABAs);

ff) Histamine 1 (H1) receptor antagonists;

gg) Chemoattractant receptor homologous molecule expressed on TH<sub>2</sub>  
cells (CRTH2) inhibitors;

hh) Vitamin D derivatives;

10 ii) Anti-inflammatory agents,;

jj) Anti-allergic agents;

kk) Anti-viral agents;

ll) Phosphodiesterase (PDE) III inhibitors;

mm) Phosphodiesterase (PDE) IV inhibitors;

15 nn) Dual Phosphodiesterase (PDE) III/IV inhibitors;

oo) Xanthine derivatives;

pp) p38 Mitogen-Activated Protein Kinase (p38 MAPK) Inhibitors;

qq) Mitogen-activated extracellular signal regulated kinase kinase (MEK)  
inhibitor;

20 rr) Phosphoinositide 3-Kinases (PI3Ks) inhibitors;

ss) Interferons

tt) Interferon alpha;

in the manufacture of a medicament for simultaneously, separately or sequentially treating a disease or condition of the human or animal body.

42. The use of claim 41 wherein:

- 5           a)       the dyhydrofolate reductase inhibitor is methotrexate, or CH-1504;
- b)       the DHODH inhibitors are selected from leflunomide and  
                  teriflunomide;
- c)       the immunomodulators are selected from Glatiramer acetate,  
                  Laquinimod and Imiquimod;
- 10          d)       the inhibitors of DNA synthesis and repair are selected from  
                  Mitoxantrone and Cladribine;
- e)       the immunosuppressants are selected from azathioprine or 6-  
                  mercaptopurine;
- f)       the anti-alpha 4 integrin antibody is Natalizumab;
- 15          g)       the alpha 4 integrin antagonists are selected from R-1295, TB-  
                  4746, CDP-323, ELND-002 and Finategrast;
- h)       the corticoids and glucocorticoids are selected from prednisone;  
                  methylprednisolone, fluticasone, mometasone, budesonide,  
                  ciclesonide and beta-metasone,
- 20          i)       the fumaric acid esters is dimethyl fumarate;
- j)       the anti-TNF alpha antibodies are selected from Infliximab;  
                  Adalimumab, and Certolizumab pegol;
- k)       the soluble TNF alpha receptors is Etanercept;
- l)       the anti-CD20 monoclonal antibodies are selected from Rituximab;  
25                Ocrelizumab, Ofatumumab; and TRU-015;
- m)       the anti-CD52 monoclonal antibody is alemtuzumab;
- n)       the anti-CD25 monoclonal antibody is daclizumab;

- o) the anti-CD88 monoclonal antibodies are selected from eculizumab and pexelizumab;
- p) the anti-interlukin 6 receptor monoclonal antibody is tocilizumab;
- q) the anti-IL12R /IL23R monoclonal antibody is ustekinumab;
- 5 r) the calcineurin inhibitors are selected from cyclosporine A and tacrolimus;
- s) the IMPDH inhibitors are selected from mycophenolate mophetyl, ribavirin, mizoribine and mycophenolic acid;
- t) the cannabinoid receptor agonists is Nabiximols;
- 10 u) the chemokine CCR1 antagonists are selected from MLN-3897 and PS-031291;
- v) the chemokine CCR2 antagonist is INCB-8696;
- w) the NF-kappaB activation inhibitor is selected from Sulfasalazine, Iguratimod and MLN-0415;
- 15 x) the adenosine A<sub>2A</sub> agonists are selected from ATL-313, ATL-146e, CGS-21680, Regadenoson and UK-432,097;
- y) the S1P receptor agonists are selected from fingolimod BAF-312, or ACT12880;
- z) the S1P liase inhibitor is LX2931;
- 20 aa) the syk inhibitor is R-112;
- bb) the PKC inhibitor is NVP-AEB071;
- cc) the anti-cholinergic agent is selected from tiotropium and aclidinium;
- dd) the beta adrenergic agonist is selected from formoterol, indacaterol and abediterol;
- 25 ee) the H1 receptor antagonists are selected from azelastine or ebastine;

- ff) the CRTH2 inhibitors are selected from OC-459, AZD-1981, ACT-129968 and QAV-680;
- gg) the vitamin D derivative is calcipotriol;
- hh) the anti-inflammatory agents are selected from non-steroidal anti-inflammatory drugs (NSAIDs) or selective cyclooxygenase-2 (COX-2) inhibitors;
- ii) the Phosphodiesterase IV inhibitors is roflumilast or GRC-4039;
- jj) the xanthine derivatives are selected from theophylline and theobromine;
- kk) the p38 MAPK inhibitor is ARRY-797;
- ll) the MEK inhibitor is ARRY-142886 or ARRY-438162;
- mm) the interferons are selected from Interferon beta 1a and Interferon beta 1b; and
- nn) the Interferon alpha is Sumiferon MP.

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43. The use of claim 42, wherein the COX-2 inhibitors are selected from aceclofenac, diclofenac, ibuprofen, naproxen, apricoxib, celecoxib, cimicoxib, deracoxib, etoricoxib, lumiracoxib, parecoxib sodium, rofecoxib, selenocoxib-1 and valdecoxib.

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44. A compound of formula (I) or a pharmaceutically acceptable salt, or solvate, or N-oxide, or stereoisomer thereof, as claimed in any one of claims 1 to 34, substantially as herein described with reference to any example thereof.

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45. A pharmaceutical composition as claimed in claim 35, substantially as herein described with reference to any example thereof.

46. A use as claimed in any one of claims 36 and 41 to 43, substantially as herein described with reference to any example thereof.

47. A combination product as claimed in any one of claims 37 to 39, substantially as  
5 herein described with reference to any example thereof.