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(54) Title: NEW PYRAZOLE DERIVATIVES AS NIK INHIBITORS

(57) **Abstract:** The present invention relates to pharmaceutical agents useful for therapy and/or prophylaxis in a mammal, and in particular to inhibitors of NF- $\kappa$ B-inducing kinase (NIK - also known as MAP3K14) useful for treating diseases such as cancer, inflammatory disorders, metabolic disorders and autoimmune disorders. The invention is also directed to pharmaceutical compositions comprising such compounds, to processes to prepare such compounds and compositions, and to the use of such compounds or pharmaceutical compositions for the prevention or treatment of diseases such as cancer, inflammatory disorders, metabolic disorders including obesity and diabetes, and autoimmune disorders.

## NEW PYRAZOLE DERIVATIVES AS NIK INHIBITORS

### **FIELD OF THE INVENTION**

The present invention relates to pharmaceutical agents useful for therapy and/or prophylaxis in a mammal, and in particular to inhibitors of NF- $\kappa$ B-inducing kinase (NIK - also known as MAP3K14) useful for treating diseases such as cancer, inflammatory disorders, metabolic disorders including obesity and diabetes, and autoimmune disorders. The invention is also directed to pharmaceutical compositions comprising such compounds, to processes to prepare such compounds and compositions, and to the use of such compounds or pharmaceutical compositions for the prevention or treatment of diseases such as cancer, inflammatory disorders, metabolic disorders including obesity and diabetes, and autoimmune disorders.

### **BACKGROUND OF THE INVENTION**

The present invention relates to pharmaceutical agents useful for therapy and/or prophylaxis in a mammal, and in particular to inhibitors of NF- $\kappa$ B-inducing kinase (NIK - also known as MAP3K14) useful for treating diseases such as cancer and inflammatory disorders. Nuclear factor-kappa B (NF- $\kappa$ B) is a transcription factor regulating the expression of various genes involved in the immune response, cell proliferation, apoptosis, and carcinogenesis. NF- $\kappa$ B dependent transcriptional activation is a tightly controlled signaling pathway, through sequential events including phosphorylation and protein degradation. NIK is a serine/threonine kinase which regulates NF- $\kappa$ B pathway activation. There are two NF- $\kappa$ B signaling pathways, the canonical and the non-canonical. NIK has a role in both but has been shown to be indispensable for the non-canonical signaling pathway where it phosphorylates IKK $\alpha$ , leading to the partial proteolysis of p100; liberating p52 which then heterodimerizes with RelB, translocates to the nucleus and mediates gene expression. The non-canonical pathway is activated by only a handful of ligands such as CD40 ligands, B-cell activating factor (BAFF), lymphotoxin  $\beta$  receptor ligands and TNF-related weak inducer of apoptosis (TWEAK) and NIK has been shown to be required for activation of the pathway by these ligands. Because of its key role, NIK expression is tightly regulated. Under normal non-stimulated conditions NIK protein levels are very low, this is due to its interaction with a range of TNF receptor associated factors (TRAF), which are ubiquitin ligases and result in degradation of NIK. It is believed that when the non-canonical pathway is stimulated by ligands, the activated receptors now compete for TRAFs, dissociating the TRAF-NIK complexes and thereby increasing the levels of NIK. (Thu and Richmond, *Cytokine Growth F. R.* **2010**, *21*, 213-226)

Research has shown that blocking the NF- $\kappa$ B signaling pathway in cancer cells can cause cells to stop proliferating, to die and to become more sensitive to the action of other anti-cancer therapies. A role for NIK has been shown in the pathogenesis of both hematological malignancies and solid tumours.

5

The NF- $\kappa$ B pathway is dysregulated in multiple myeloma due to a range of diverse genetic abnormalities that lead to the engagement of the canonical and non-canonical pathways (Annuziata *et al. Cancer Cell* **2007**, *12*, 115-130; Keats *et al. ibid* **2007**, *12*, 131-144; Demchenko *et al. Blood* **2010**, *115*, 3541-3552). Myeloma patient samples 10 frequently have increased levels of NIK activity. This can be due to chromosomal amplification, translocations (that result in NIK proteins that have lost TRAF binding domains), mutations (in the TRAF binding domain of NIK) or TRAF loss of function mutations. Researchers have shown that myeloma cell lines can be dependent on NIK for proliferation; in these cell lines if NIK activity is reduced by either shRNA or 15 compound inhibition, this leads to a failure in NF- $\kappa$ B signaling and the induction of cell death (Annuziata 2007).

In a similar manner, mutations in TRAF and increased levels of NIK have also been seen in samples from Hodgkin lymphoma (HL) patients. Once again proliferation of cell lines derived from HL patients is susceptible to inhibition of NIK function by both 20 shRNA and compounds (Ranuncolo *et al. Blood* First Edition Paper, 2012, DOI 10.1182/blood-2012-01-405951).

NIK levels are also enhanced in adult T cell leukemia (ATL) cells and targeting NIK with shRNA reduced ATL growth in vivo (Saitoh *et al. Blood* **2008**, *111*, 5118-5129).

It has been demonstrated that the API2-MALT1 fusion oncoprotein created by the 25 recurrent translocation t(11;18)(q21;q21) in mucosa-associated lymphoid tissue (MALT) lymphoma induces proteolytic cleavage of NF- $\kappa$ B-inducing kinase (NIK) at arginine 325. NIK cleavage generates a C-terminal NIK fragment that retains kinase activity and is resistant to proteasomal degradation (due to loss of TRAF binding region). The presence of this truncated NIK leads to constitutive non-canonical NF- $\kappa$ B 30 signaling, enhanced B cell adhesion, and apoptosis resistance. Thus NIK inhibitors could represent a new treatment approach for refractory t(11;18)-positive MALT lymphoma (Rosebeck *et al. Science* **2011**, *331*, 468-472).

NIK aberrantly accumulates in diffuse large B-cell lymphoma (DLBCL) cells due to 35 constitutive activation of B-cell activation factor (BAFF) through interaction with autochthonous B-lymphocyte stimulator (BLyS) ligand. NIK accumulation in human DLBCL cell lines and patient tumor samples suggested that constitutive NIK kinase activation is likely to be a key signaling mechanism involved in abnormal lymphoma

tumor cell proliferation. Growth assays showed that using shRNA to inhibit NIK kinase protein expression in GCB- and ABC-like DLBCL cells decreased lymphoma cell growth *in vitro*, implicating NIK-induced NF-κB pathway activation as having a significant role in DLBCL proliferation (Pham *et al. Blood* **2011**, *117*, 200-210).

5 As mentioned a role of NIK in tumour cell proliferation is not restricted to hematological cells, there are reports that NIK protein levels are stabilised in some pancreatic cancer cell lines and as seen in blood cells proliferation of these pancreatic cancer lines are susceptible to NIK siRNA treatment (Nishina *et al. Biochem. Biophys. Res. Co.* **2009**, *388*, 96-101). Constitutive activation of NF-κB, is preferentially 10 involved in the proliferation of basal-like subtype breast cancer cell lines, including elevated NIK protein levels in specific lines (Yamamoto *et al. Cancer Sci.* **2010**, *101*, 2391-2397). In melanoma tumours, tissue microarray analysis of NIK expression revealed that there was a statistically significant elevation in NIK expression when compared with benign tissue. Moreover, shRNA techniques were used to knock-down 15 NIK, the resultant NIK-depleted melanoma cell lines exhibited decreased proliferation, increased apoptosis, delayed cell cycle progression and reduced tumor growth in a mouse xenograft model (Thu *et al. Oncogene* **2011**, 1-13). A wealth of evidence showed that NF-κB is often constitutively activated in non-small cell lung cancer tissue specimens and cell lines. Depletion of NIK by RNAi induced apoptosis and affected 20 efficiency of anchorage-independent NSCLC cell growth.

In addition research has shown that NF-κB controls the expression of many genes involved in inflammation and that NF-κB signalling is found to be chronically active in many inflammatory diseases, such as rheumatoid arthritis, inflammatory bowel disease, 25 sepsis and others. Thus pharmaceutical agents capable of inhibiting NIK and thereby reducing NF-κB signaling pathway can have a therapeutic benefit for the treatment of diseases and disorders for which over-activation of NF-κB signaling is observed.

Dysregulated NF-κB activity is associated with colonic inflammation and cancer, and it 30 has been shown that Nlrp12 deficient mice were highly susceptible to colitis and colitis-associated colon cancer. In this context work showed that NLRP12 functions as a negative regulator of the NF-κB pathway through its interaction and regulation of NIK and TRAF3, and as a checkpoint of critical pathways associated with inflammation and inflammation-associated tumorigenesis (Allen *et al. Immunity* **2012**, 35 *36*, 742-754).

Tumor necrosis factor (TNF)- $\alpha$ , is secreted in response to inflammatory stimuli in diseases such as rheumatoid arthritis and inflammatory bowel disease. In a series of experiments in colonic epithelial cells and mouse embryonic fibroblasts, TNF- $\alpha$

5 mediates both apoptosis and inflammation, stimulating an inflammatory cascade through the non-canonical pathway of NF- $\kappa$ B activation, leading to increased nuclear RelB and p52. TNF- $\alpha$  induced the ubiquitination of TRAFs, which interacts with NIK, leading to increased levels of phospho-NIK (Bhattacharyya *et al. J Biol. Chem.* **2011**, 285, 39511-39522).

Inflammatory responses are a key component of chronic obstructive pulmonary disease (COPD) as such it has been shown that NIK plays a key role in exacerbating the disease following infection with the Gram-negative bacterium nontypeable *Hemophilus influenza* (Shuto *et al. PNAS* **2001**, 98, 8774-8779). Likewise cigarette smoke (CS) contains numerous reactive oxygen/nitrogen species, reactive aldehydes, and quinones, which are considered to be some of the most important causes of the pathogenesis of chronic inflammatory lung diseases, such as COPD and lung cancer. Increased levels of NIK and p-IKK $\alpha$  have been observed in peripheral lungs of smokers and patients 10 with COPD. In addition it has been shown that endogenous NIK is recruited to promoter sites of pro-inflammatory genes to induce post-translational modification of histones, thereby modifying gene expression profiles, in response to CS or TNF $\alpha$  (Chung *et al. PLoS ONE* **2011**, 6(8): e23488. doi:10.1371/journal.pone.0023488). A shRNA screen was used in an *in vitro* model of oxidative stress induced cell death (as a 15 model of COPD) to interrogate a human druggable genome siRNA library in order to identify genes that modulate the cellular response to stress. NIK was one of the genes identified in this screen as a potential new therapeutic target to modulate epithelial 20 identification of genes that modulate the cellular response to stress. NIK was one of the genes identified in this screen as a potential new therapeutic target to modulate epithelial apoptosis in chronic lung diseases (Wixted *et al. Toxicol. In Vitro* **2010**, 24, 310-318).

25 Diabetic individuals can be troubled by a range of additional manifestations associated with inflammation. One such complication is cardiovascular disease and it has been shown that there are elevated levels of p-NIK, p-IKK- $\alpha/\beta$  and p-I $\kappa$ B- $\alpha$  in diabetic aortic tissues (Bitar *et al. Life Sci.* **2010**, 86, 844-853). In a similar manner, NIK has been shown to regulate proinflammatory responses of renal proximal tubular epithelial cells 30 via mechanisms involving TRAF3. This suggests a role for NF- $\kappa$ B noncanonical pathway activation in modulating diabetes-induced inflammation in renal tubular epithelium (Zhao *et al. Exp. Diabetes Res.* **2011**, 1-9). The same group has shown that NIK plays a critical role in noncanonical NF- $\kappa$ B pathway activation, induced skeletal muscle insulin resistance *in vitro*, suggesting that NIK could be an important 35 therapeutic target for the treatment of insulin resistance associated with inflammation in obesity and type 2 diabetes (Choudhary *et al. Endocrinology* **2011**, 152, 3622-3627).

NF- $\kappa$ B is an important component of both autoimmunity and bone destruction in rheumatoid arthritis (RA). Mice lacking functional NIK have no peripheral lymph nodes, defective B and T cells, and impaired receptor activator of NF- $\kappa$ B ligand-stimulated osteoclastogenesis. Aya *et al.* (*J. Clin. Invest.* **2005**, *115*, 1848-1854)

5 investigated the role of NIK in murine models of inflammatory arthritis using Nik $^{--}$  mice. The serum transfer arthritis model was initiated by preformed antibodies and required only intact neutrophil and complement systems in recipients. While Nik $^{--}$  mice had inflammation equivalent to that of Nik $^{++}$  controls, they showed significantly less periarticular osteoclastogenesis and less bone erosion. In contrast, Nik $^{--}$  mice  
10 were completely resistant to antigen-induced arthritis (AIA), which requires intact antigen presentation and lymphocyte function but not lymph nodes. Additionally, transfer of Nik $^{++}$  splenocytes or T cells to Rag2 $^{--}$  mice conferred susceptibility to AIA, while transfer of Nik $^{--}$  cells did not. Nik $^{--}$  mice were also resistant to a  
15 genetic, spontaneous form of arthritis, generated in mice expressing both the KRN T cell receptor and H-2g7. The same group used transgenic mice with OC-lineage expression of NIK lacking its TRAF3 binding domain (NT3), to demonstrate that constitutive activation of NIK drives enhanced osteoclastogenesis and bone resorption, both in basal conditions and in response to inflammatory stimuli (Yang *et al.* *PLoS One* **2010**, *5*, 1-9, e15383). Thus this group concluded that NIK is important in the immune  
20 and bone-destructive components of inflammatory arthritis and represents a possible therapeutic target for these diseases.

It has also been hypothesized that manipulating levels of NIK in T cells may have therapeutic value. Decreasing NIK activity in T cells might significantly ameliorate  
25 autoimmune and alloresponses, like GVHD (Graft Versus Host Disease) and transplant rejection, without crippling the immune system as severely as do inhibitors of canonical NF- $\kappa$ B activation.

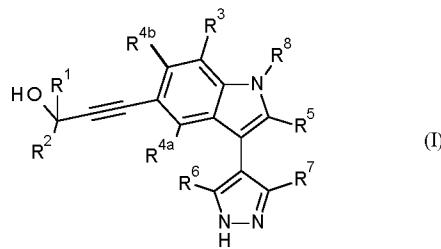
WO2010/042337 describes novel 6-azaindole aminopyrimidine derivatives having NIK inhibitory activity.

WO2009/158011 describes alkynyl alcohols as kinase inhibitors.

WO2012/123522 describes 6,5-heterocyclic propargylic alcohol compounds and uses therefor.

### 35 **DESCRIPTION OF THE INVENTION**

The present invention concerns novel compounds of Formula (I):



and tautomers and stereoisomeric forms thereof, wherein

R<sup>1</sup> is selected from the group of hydrogen; C<sub>1-4</sub>alkyl; and C<sub>1-4</sub>alkyl substituted with one or more fluoro substituents;

5 R<sup>2</sup> is selected from the group of hydrogen; C<sub>1-4</sub>alkyl; C<sub>1-4</sub>alkyl substituted with one or more fluoro substituents; C<sub>3-6</sub>cycloalkyl; and Het<sup>1</sup>;

Het<sup>1</sup> is a heteroaryl selected from the group of thienyl, thiazolyl, pyrrolyl, oxazolyl, pyrazolyl, imidazolyl, oxadiazolyl, isoxazolyl, isothiazolyl, pyridinyl and pyrimidinyl each of which may be optionally substituted with one or two substituents independently

10 selected from halogen and C<sub>1-4</sub>alkyl;

or R<sup>1</sup> and R<sup>2</sup> together with the carbon atom to which they are attached form a C<sub>3-6</sub>cycloalkyl or a Het<sup>2</sup> group; wherein

Het<sup>2</sup> is a heterocyclyl selected from the group of piperidinyl, tetrahydropyranyl, pyrrolidinyl, tetrahydrofuran, azetidinyl and oxetanyl, each of which may be

15 optionally substituted with one C<sub>1-4</sub>alkyl; or Het<sup>2</sup> is 2-oxo-3-pyrrolidinyl optionally substituted with one C<sub>1-4</sub>alkyl;

R<sup>3</sup> is selected from the group of hydrogen; halogen; cyano; C<sub>1-4</sub>alkyl; and C<sub>1-4</sub>alkyl substituted with one or more fluoro substituents;

R<sup>4a</sup> is selected from the group of hydrogen and halogen;

20 R<sup>4b</sup> is selected from the group of hydrogen and halogen;

R<sup>5</sup> is selected from the group of hydrogen; cyano; C<sub>1-4</sub>alkyl; C<sub>1-4</sub>alkyl substituted with one or more fluoro substituents; C<sub>1-4</sub>alkyl substituted with one substituent selected from the group of -NR<sup>5a</sup>R<sup>5b</sup>, -OC<sub>1-4</sub>alkyl and Het<sup>3</sup>; wherein

R<sup>5a</sup> and R<sup>5b</sup> are each independently selected from the group of hydrogen and C<sub>1-4</sub>alkyl;

25 Het<sup>3</sup> is a heterocyclyl selected from the group of piperidinyl, morpholinyl, piperazinyl, tetrahydropyranyl, pyrrolidinyl, tetrahydrofuran, azetidinyl and oxetanyl, each of

which may be optionally substituted with one or two substituents selected from fluoro, C<sub>1-4</sub>alkyl, -OC<sub>1-4</sub>alkyl, C<sub>3-6</sub>cycloalkyl and C<sub>1-4</sub>alkyl substituted with one or more fluoro substituents;

R<sup>6</sup> is selected from the group of hydrogen and halogen;

5 R<sup>7</sup> is selected from the group of hydrogen; halogen; cyano; C<sub>1-4</sub>alkyl; C<sub>1-4</sub>alkyl substituted with one or more fluoro substituents; and -NR<sup>7a</sup>R<sup>7b</sup>; wherein

R<sup>7a</sup> and R<sup>7b</sup> are each independently selected from hydrogen and C<sub>1-4</sub>alkyl;

R<sup>8</sup> is selected from the group of hydrogen; -SO<sub>2</sub>C<sub>1-6</sub>alkyl; Het<sup>4</sup>; R<sup>9</sup>;

C<sub>1-6</sub>alkyl optionally substituted with one or more substituents independently selected

10 from the group of (i) Ar<sup>1</sup> and (ii) Het<sup>5</sup>; and

C<sub>2-6</sub>alkyl substituted with one or more substituents independently selected from the group of

(iii) fluoro,

(iv) -NR<sup>8a</sup>R<sup>8b</sup>,

15 (v) -NR<sup>8c</sup>C(=O)R<sup>8d</sup>,

(vi) -NR<sup>8c</sup>C(=O)NR<sup>8a</sup>R<sup>8b</sup>,

(vii) -NR<sup>8c</sup>C(=O)OR<sup>8e</sup>,

(viii) -NR<sup>8c</sup>S(=O)<sub>2</sub>NR<sup>8a</sup>R<sup>8b</sup>,

(ix) -NR<sup>8c</sup>S(=O)<sub>2</sub>R<sup>8d</sup>,

20 (x) -OR<sup>8f</sup>,

(xi) -OC(=O)NR<sup>8a</sup>R<sup>8b</sup>,

(xii) -C(=O)NR<sup>8a</sup>R<sup>8b</sup>,

(xiii) -S(O)<sub>2</sub>R<sup>8d</sup>, and

(xiv) -S(O)<sub>2</sub>NR<sup>8a</sup>R<sup>8b</sup>;

25 R<sup>8a</sup>, R<sup>8b</sup>, R<sup>8c</sup> and R<sup>8f</sup> are each independently selected from the group of hydrogen; C<sub>1-6</sub>alkyl; C<sub>3-6</sub>cycloalkyl; and C<sub>2-6</sub>alkyl substituted with one substituent selected from -NR<sup>8x</sup>R<sup>8y</sup>, -OH, and -OC<sub>1-4</sub>alkyl;

R<sup>8d</sup> is selected from the group of C<sub>1-6</sub>alkyl, which may be optionally substituted with one substituent selected from -NR<sup>8x</sup>R<sup>8y</sup>, -OH, and -OC<sub>1-4</sub>alkyl; and C<sub>3-6</sub>cycloalkyl;

30 R<sup>8e</sup> is selected from the group of C<sub>1-6</sub>alkyl; C<sub>3-6</sub>cycloalkyl; and C<sub>2-6</sub>alkyl substituted with one substituent selected from -NR<sup>8x</sup>R<sup>8y</sup>, -OH, and -OC<sub>1-4</sub>alkyl;

wherein R<sup>8x</sup> and R<sup>8y</sup> are each independently selected from hydrogen and C<sub>1-4</sub>alkyl;

R<sup>9</sup> is C<sub>3-6</sub>cycloalkyl optionally substituted with one or two substituents independently selected from fluoro, C<sub>1-4</sub>alkyl, -OC<sub>1-4</sub>alkyl,

$C_{1-4}$ alkyl substituted with one  $-OC_{1-4}$ alkyl,

and  $C_{1-4}$ alkyl substituted with one or more fluoro substituents;

Ar<sup>1</sup> is selected from the group of phenyl, thienyl, thiazolyl, pyrrolyl, oxazolyl, pyrazolyl, imidazolyl, isoxazolyl, isothiazolyl, pyridinyl, pyrimidinyl, pyridazinyl and pyrazinyl, each of which may be optionally substituted with one or two substituents independently selected from halogen, cyano,  $C_{1-4}$ alkyl,  $C_{1-4}$ alkyl substituted with one or more fluoro substituents,  $-OC_{1-4}$ alkyl, and  $-OC_{1-4}$ alkyl substituted with one or more fluoro substituents;

Het<sup>4</sup> is a heterocyclyl, bound through any available carbon atom, selected from the

group of piperidinyl, tetrahydropyranyl, pyrrolidinyl, tetrahydrofuranyl, azetidinyl and oxetanyl, each of which may be optionally substituted with one or two substituents independently selected from fluoro,  $C_{1-4}$ alkyl,  $-OC_{1-4}$ alkyl,  $C_{3-6}$ cycloalkyl,  $C_{1-4}$ alkyl substituted with one  $-OC_{1-4}$ alkyl,  $C_{1-4}$ alkyl substituted with one or more fluoro substituents, and  $C_{1-4}$ alkyl substituted with one  $C_{3-6}$ cycloalkyl;

Het<sup>5</sup> is a heterocyclyl selected from the group of morpholinyl, piperidinyl, piperazinyl, tetrahydropyranyl, pyrrolidinyl, tetrahydrofuranyl, azetidinyl and oxetanyl, each of which may be optionally substituted with one or two substituents independently selected from fluoro,  $C_{1-4}$ alkyl,  $-OC_{1-4}$ alkyl,  $C_{3-6}$ cycloalkyl,  $C_{1-4}$ alkyl substituted with one  $-OC_{1-4}$ alkyl,  $C_{1-4}$ alkyl substituted with one or more fluoro substituents, and

$C_{1-4}$ alkyl substituted with one  $C_{3-6}$ cycloalkyl;

and the pharmaceutically acceptable salts, and the solvates thereof.

## DETAILED DESCRIPTION OF THE INVENTION

The term 'halo' or 'halogen' as used herein represents fluoro, chloro, bromo and iodo.

The prefix ' $C_{x-y}$ ' (where x and y are integers) as used herein refers to the number of carbon atoms in a given group. Thus, a  $C_{1-6}$ alkyl group contains from 1 to 6 carbon atoms, a  $C_{3-6}$ cycloalkyl group contains from 3 to 6 carbon atoms, and so on.

The term ' $C_{1-4}$ alkyl' as used herein as a group or part of a group represents a straight or branched chain saturated hydrocarbon radical having from 1 to 4 carbon atoms, such as methyl, ethyl, *n*-propyl, isopropyl, *n*-butyl, *s*-butyl, *t*-butyl and the like.

The term ' $C_{1-6}$ alkyl' as used herein as a group or part of a group represents a straight or branched chain saturated hydrocarbon radical having from 1 to 6 carbon atoms such as the groups defined for  $C_{1-4}$ alkyl and *n*-pentyl, *n*-hexyl, 2-methylbutyl and the like.

The term ' $C_{2-6}$ alkyl' as used herein as a group or part of a group represents a straight or branched chain saturated hydrocarbon radical having from 2 to 6 carbon atoms such as

ethyl, *n*-propyl, isopropyl, *n*-butyl, *s*-butyl, *t*-butyl, *n*-pentyl, *n*-hexyl, 2-methylbutyl and the like.

The term ‘C<sub>3-6</sub>cycloalkyl’ as used herein as a group or part of a group represents cyclic saturated hydrocarbon radicals having from 3 to 6 carbon atoms such as cyclopropyl, 5 cyclobutyl, cyclopentyl or cyclohexyl.

The term ‘C<sub>1-6</sub>alkyl substituted with one or more substituents’ as used herein as a group or part of a group refers to a C<sub>1-6</sub>alkyl group as defined herein wherein one or more than one hydrogen atom is replaced with another group. The term therefore includes monosubstitutedC<sub>1-6</sub>alkyl and also polysubstitutedC<sub>1-6</sub>alkyl. There may be one, two, 10 three or more hydrogen atoms replaced with a substituent, so the fully or partially substituted C<sub>1-6</sub>alkyl may have one, two, three or more substituents. Examples of such groups wherein the substituent is for example, fluoro include fluoromethyl, difluoromethyl, trifluoromethyl, fluoroethyl, trifluoroethyl and the like.

In general, whenever the term “substituted” is used in the present invention, it is meant, 15 unless otherwise is indicated or is clear from the context, to indicate that one or more hydrogens, in particular from 1 to 4 hydrogens, more in particular from 1 to 3 hydrogens, preferably 1 or 2 hydrogens, more preferably 1 hydrogen, on the atom or radical indicated in the expression using “substituted” are replaced with a selection from the indicated group, provided that the normal valency is not exceeded, and that 20 the substitution results in a chemically stable compound, i.e. a compound that is sufficiently robust to survive isolation to a useful degree of purity from a reaction mixture, and formulation into a therapeutic agent.

Combinations of substituents and/or variables are permissible only if such combinations result in chemically stable compounds. "Stable compound" is meant to 25 indicate a compound that is sufficiently robust to survive isolation to a useful degree of purity from a reaction mixture, and formulation into a therapeutic agent.

C(O) or C(=O) represents a carbonyl moiety.

S(O)<sub>2</sub> or SO<sub>2</sub> represents a sulfonyl moiety.

Substituents covered by the term “Het<sup>x</sup>” (where x is an integer), “heterocycl” or

30 “heteroaryl” may be attached to the remainder of the molecule of Formula (I) through any available ring carbon or heteroatom as appropriate, if not otherwise specified.

“Ar<sup>1</sup>” may be attached to the remainder of the molecule of Formula (I) through any available ring carbon atom or through a ‘NH’ group (e.g. in pyrrolyl, pyrazolyl, imidazolyl) as appropriate, if not otherwise specified.

Whenever substituents are represented by chemical structure, “---” represents the bond of attachment to the remainder of the molecule of Formula (I).

When any variable occurs more than one time in any constituent, each definition is independent.

5 When any variable occurs more than one time in any formula (e.g. Formula (I)), each definition is independent.

The term “subject” as used herein, refers to an animal, preferably a mammal (e.g. cat, dog, primate or human), more preferably a human, who is or has been the object of treatment, observation or experiment.

10 The term “therapeutically effective amount” as used herein, means that amount of active compound or pharmaceutical agent that elicits the biological or medicinal response in a tissue system, animal or human that is being sought by a researcher, veterinarian, medicinal doctor or other clinician, which includes alleviation or reversal of the symptoms of the disease or disorder being treated.

15 The term “composition” is intended to encompass a product comprising the specified ingredients in the specified amounts, as well as any product which results, directly or indirectly, from combinations of the specified ingredients in the specified amounts.

The term “treatment”, as used herein, is intended to refer to all processes wherein there may be a slowing, interrupting, arresting or stopping of the progression of a disease, but 20 does not necessarily indicate a total elimination of all symptoms.

The term “compound(s) of the (present) invention” or “compound(s) according to the (present) invention” as used herein, is meant to include the compounds of Formula (I) and the pharmaceutically acceptable salts, and the solvates thereof.

25 As used herein, any chemical formula with bonds shown only as solid lines and not as solid wedged or hashed wedged bonds, or otherwise indicated as having a particular configuration (e.g. *R*, *S*) around one or more atoms, contemplates each possible stereoisomer, or mixture of two or more stereoisomers.

Hereinbefore and hereinafter, the term “compound(s) of Formula (I)” is meant to include the tautomers thereof and the stereoisomeric forms thereof.

30 The terms “stereoisomers”, “stereoisomeric forms” or “stereochemically isomeric forms” hereinbefore or hereinafter are used interchangeably.

The invention includes all stereoisomers of the compounds of the invention either as a pure stereoisomer or as a mixture of two or more stereoisomers.

Enantiomers are stereoisomers that are non-superimposable mirror images of each other. A 1:1 mixture of a pair of enantiomers is a racemate or racemic mixture.

Atropisomers (or atropoisomers) are stereoisomers which have a particular spatial configuration, resulting from a restricted rotation about a single bond, due to large

5 steric hindrance. All atropisomeric forms of the compounds of Formula (I) are intended to be included within the scope of the present invention.

Diastereomers (or diastereoisomers) are stereoisomers that are not enantiomers, i.e. they are not related as mirror images. If a compound contains a double bond, the substituents may be in the *E* or the *Z* configuration.

10 Substituents on bivalent cyclic (partially) saturated radicals may have either the *cis*- or *trans*-configuration; for example if a compound contains a disubstituted cycloalkyl group, the substituents may be in the *cis* or *trans* configuration.

Therefore, the invention includes enantiomers, atropisomers, diastereomers, racemates, *E* isomers, *Z* isomers, *cis* isomers, *trans* isomers and mixtures thereof, whenever

15 chemically possible.

The meaning of all those terms, i.e. enantiomers, atropisomers, diastereomers, racemates, *E* isomers, *Z* isomers, *cis* isomers, *trans* isomers and mixtures thereof are known to the skilled person.

The absolute configuration is specified according to the Cahn-Ingold-Prelog system.

20 The configuration at an asymmetric atom is specified by either *R* or *S*. Resolved stereoisomers whose absolute configuration is not known can be designated by (+) or (-) depending on the direction in which they rotate plane polarized light. For instance, resolved enantiomers whose absolute configuration is not known can be designated by (+) or (-) depending on the direction in which they rotate plane polarized light.

25 When a specific stereoisomer is identified, this means that said stereoisomer is substantially free, i.e. associated with less than 50%, preferably less than 20%, more preferably less than 10%, even more preferably less than 5%, in particular less than 2% and most preferably less than 1%, of the other stereoisomers. Thus, when a compound of Formula (I) is for instance specified as (*R*), this means that the compound is

30 substantially free of the (*S*) isomer; when a compound of Formula (I) is for instance specified as *E*, this means that the compound is substantially free of the *Z* isomer; when a compound of Formula (I) is for instance specified as *cis*, this means that the compound is substantially free of the *trans* isomer.

Some of the compounds according to Formula (I) may also exist in their tautomeric

35 form. Such forms in so far as they may exist, although not explicitly indicated in the

above Formula (I) are intended to be included within the scope of the present invention. It follows that a single compound may exist in both stereoisomeric and tautomeric form.

For use in medicine, the salts of the compounds of this invention refer to non-toxic 5 "pharmaceutically acceptable salts". Other salts may, however, be useful in the preparation of compounds according to this invention or of their pharmaceutically acceptable salts. Suitable pharmaceutically acceptable salts of the compounds include acid addition salts which may, for example, be formed by mixing a solution of the compound with a solution of a pharmaceutically acceptable acid such as hydrochloric 10 acid, sulfuric acid, fumaric acid, maleic acid, succinic acid, acetic acid, benzoic acid, citric acid, tartaric acid, carbonic acid or phosphoric acid.

Conversely, said salt forms can be converted into the free base form by treatment with an appropriate base.

Furthermore, where the compounds of the invention carry an acidic moiety, suitable 15 pharmaceutically acceptable salts thereof may include alkali metal salts, e.g., sodium or potassium salts; alkaline earth metal salts, e.g., calcium or magnesium salts; and salts formed with suitable organic ligands, e.g., quaternary ammonium salts.

Representative acids which may be used in the preparation of pharmaceutically acceptable salts include, but are not limited to, the following: acetic acid, 2,2-dichloroacetic acid, acylated amino acids, adipic acid, alginic acid, ascorbic acid, L-aspartic acid, benzenesulfonic acid, benzoic acid, 4-acetamidobenzoic acid, (+)-camphoric acid, camphorsulfonic acid, capric acid, caproic acid, caprylic acid, cinnamic acid, citric acid, cyclamic acid, ethane-1,2-disulfonic acid, ethanesulfonic acid, 2-hydroxy-ethanesulfonic acid, formic acid, fumaric acid, galactaric acid, gentisic acid, glucoheptonic acid, D-gluconic acid, D-glucoronic acid, L-glutamic acid, beta-oxo-glutaric acid, glycolic acid, hippuric acid, hydrobromic acid, hydrochloric acid, (+)-L-lactic acid, (±)-DL-lactic acid, lactobionic acid, maleic acid, (-)-L-malic acid, malonic acid, (±)-DL-mandelic acid, methanesulfonic acid, naphthalene-2-sulfonic acid, naphthalene-1,5-disulfonic acid, 1-hydroxy-2-naphthoic acid, nicotinic acid, nitric acid, oleic acid, orotic acid, oxalic acid, palmitic acid, pamoic acid, phosphoric acid, L-pyroglutamic acid, salicylic acid, 4-amino-salicylic acid, sebacic acid, stearic acid, succinic acid, sulfuric acid, tannic acid, (+)-L-tartaric acid, thiocyanic acid, p-toluenesulfonic acid, trifluoromethylsulfonic acid, and undecylenic acid.

Representative bases which may be used in the preparation of pharmaceutically acceptable salts include, but are not limited to, the following: ammonia, L-arginine, benethamine, benzathine, calcium hydroxide, choline, dimethylethanolamine,

diethanolamine, diethylamine, 2-(diethylamino)-ethanol, ethanolamine, ethylenediamine, *N*-methyl-glucamine, hydrabamine, 1*H*-imidazole, L-lysine, magnesium hydroxide, 4-(2-hydroxyethyl)-morpholine, piperazine, potassium hydroxide, 1-(2-hydroxyethyl)-pyrrolidine, secondary amine, sodium hydroxide, triethanolamine, 5 tromethamine and zinc hydroxide.

Conversely, said salt forms can be converted into the free acid forms by treatment with an appropriate acid.

The term solvate comprises the solvent addition forms as well as the salts thereof, which the compounds of Formula (I) are able to form. Examples of such solvent 10 addition forms are e.g. hydrates, alcoholates and the like.

In the framework of this application, an element, in particular when mentioned in relation to a compound according to Formula (I), comprises all isotopes and isotopic mixtures of this element, either naturally occurring or synthetically produced, either with natural abundance or in an isotopically enriched form. Radiolabelled compounds 15 of Formula (I) may comprise a radioactive isotope selected from the group of  $^2\text{H}$  (D),  $^3\text{H}$ ,  $^{11}\text{C}$ ,  $^{18}\text{F}$ ,  $^{122}\text{I}$ ,  $^{123}\text{I}$ ,  $^{125}\text{I}$ ,  $^{131}\text{I}$ ,  $^{75}\text{Br}$ ,  $^{76}\text{Br}$ ,  $^{77}\text{Br}$  and  $^{82}\text{Br}$ . Preferably, the radioactive isotope is selected from the group of  $^2\text{H}$ ,  $^3\text{H}$ ,  $^{11}\text{C}$  and  $^{18}\text{F}$ . More preferably, the radioactive isotope is  $^2\text{H}$ . In particular, deuterated compounds are intended to be included within the scope of the present invention.

20

The present invention relates in particular to compounds of Formula (I) as defined herein, and tautomers and stereoisomeric forms thereof, wherein

$\text{R}^1$  is selected from the group of hydrogen;  $\text{C}_{1-4}\text{alkyl}$ ; and  $\text{C}_{1-4}\text{alkyl}$  substituted with one or more fluoro substituents;

25  $\text{R}^2$  is selected from the group of hydrogen;  $\text{C}_{1-4}\text{alkyl}$ ;  $\text{C}_{1-4}\text{alkyl}$  substituted with one or more fluoro substituents;  $\text{C}_{3-6}\text{cycloalkyl}$ ; and  $\text{Het}^1$ ;

$\text{Het}^1$  is a heteroaryl selected from the group of thienyl, thiazolyl, pyrrolyl, oxazolyl, pyrazolyl, imidazolyl, oxadiazolyl, isoxazolyl, isothiazolyl, and pyrimidinyl, each of which may be optionally substituted with one or two substituents independently 30 selected from halogen and  $\text{C}_{1-4}\text{alkyl}$ ;

or  $\text{R}^1$  and  $\text{R}^2$  together with the carbon atom to which they are attached form a  $\text{C}_{3-6}\text{cycloalkyl}$ ; wherein

$R^3$  is selected from the group of hydrogen; halogen; cyano;  $C_{1-4}$ alkyl; and  $C_{1-4}$ alkyl substituted with one or more fluoro substituents;

$R^{4a}$  is selected from the group of hydrogen and halogen;

$R^{4b}$  is selected from the group of hydrogen and halogen;

5  $R^5$  is selected from the group of hydrogen;

$R^6$  is selected from the group of hydrogen;

$R^7$  is selected from the group of hydrogen; halogen; cyano;  $C_{1-4}$ alkyl;  $C_{1-4}$ alkyl substituted with one or more fluoro substituents; and  $-NR^{7a}R^{7b}$ ; wherein

$R^{7a}$  and  $R^{7b}$  are each independently selected from hydrogen and  $C_{1-4}$ alkyl;

10  $R^8$  is selected from the group of hydrogen;  $-SO_2C_{1-6}$ alkyl;  $Het^4$ ;  $R^9$ ;  $C_{1-6}$ alkyl optionally substituted with one or more substituents independently selected from the group of (i)  $Ar^1$  and (ii)  $Het^5$ ; and  $C_{2-6}$ alkyl substituted with one or more  $-OR^{8f}$  substituents;

$R^{8f}$  is selected from the group of hydrogen and  $C_{1-6}$ alkyl;

$R^9$  is  $C_{3-6}$ cycloalkyl optionally substituted with one or two substituents independently

15 selected from fluoro,  $C_{1-4}$ alkyl,  $-OC_{1-4}$ alkyl,

$C_{1-4}$ alkyl substituted with one  $-OC_{1-4}$ alkyl,

and  $C_{1-4}$ alkyl substituted with one or more fluoro substituents;

$Ar^1$  is selected from the group of phenyl, thienyl, thiazolyl, pyrrolyl, oxazolyl, pyrazolyl, imidazolyl, isoxazolyl, isothiazolyl, pyridinyl, pyrimidinyl, pyridazinyl and 20 pyrazinyl, each of which may be optionally substituted with one or two substituents independently selected from halogen, cyano,  $C_{1-4}$ alkyl,  $C_{1-4}$ alkyl substituted with one or more fluoro substituents,  $-OC_{1-4}$ alkyl, and  $-OC_{1-4}$ alkyl substituted with one or more fluoro substituents;

$Het^4$  is a heterocyclyl, bound through any available carbon atom, selected from the

25 group of piperidinyl, tetrahydropyranyl, pyrrolidinyl, tetrahydrofuran, azetidinyl and oxetanyl, each of which may be optionally substituted with one or two substituents independently selected from fluoro,  $C_{1-4}$ alkyl,  $-OC_{1-4}$ alkyl,  $C_{3-6}$ cycloalkyl,  $C_{1-4}$ alkyl substituted with one  $-OC_{1-4}$ alkyl, and  $C_{1-4}$ alkyl substituted with one or more fluoro substituents;

30  $Het^5$  is a heterocyclyl selected from the group of morpholinyl, piperidinyl, piperazinyl, tetrahydropyranyl, pyrrolidinyl, tetrahydrofuran, azetidinyl and oxetanyl, each of which may be optionally substituted with one or two substituents independently

selected from fluoro, C<sub>1-4</sub>alkyl, -OC<sub>1-4</sub>alkyl, C<sub>1-4</sub>alkyl substituted with one -OC<sub>1-4</sub>alkyl, and C<sub>1-4</sub>alkyl substituted with one or more fluoro substituents; and the pharmaceutically acceptable salts, and the solvates thereof.

5 The present invention relates in particular to compounds of Formula (I) as defined herein, and tautomers and stereoisomeric forms thereof, wherein

R<sup>1</sup> is selected from the group of hydrogen; C<sub>1-4</sub>alkyl; and C<sub>1-4</sub>alkyl substituted with one or more fluoro substituents;

10 R<sup>2</sup> is selected from the group of hydrogen; C<sub>1-4</sub>alkyl; C<sub>1-4</sub>alkyl substituted with one or more fluoro substituents; C<sub>3-6</sub>cycloalkyl; and Het<sup>1</sup>;

Het<sup>1</sup> is a heteroaryl selected from the group of thienyl, thiazolyl, pyrrolyl, oxazolyl, pyrazolyl, imidazolyl, oxadiazolyl, isoxazolyl, and isothiazolyl, each of which may be optionally substituted with one or two substituents independently selected from halogen and C<sub>1-4</sub>alkyl;

15 or R<sup>1</sup> and R<sup>2</sup> together with the carbon atom to which they are attached form a C<sub>3-6</sub>cycloalkyl; wherein

R<sup>3</sup> is selected from the group of hydrogen; halogen; cyano; C<sub>1-4</sub>alkyl; and C<sub>1-4</sub>alkyl substituted with one or more fluoro substituents;

R<sup>4a</sup> is selected from the group of hydrogen and halogen;

20 R<sup>4b</sup> is selected from the group of hydrogen and halogen;

R<sup>5</sup> is selected from the group of hydrogen;

R<sup>6</sup> is selected from the group of hydrogen;

R<sup>7</sup> is selected from the group of hydrogen; halogen; cyano; C<sub>1-4</sub>alkyl; C<sub>1-4</sub>alkyl substituted with one or more fluoro substituents; and -NR<sup>7a</sup>R<sup>7b</sup>; wherein

25 R<sup>7a</sup> and R<sup>7b</sup> are each independently selected from hydrogen and C<sub>1-4</sub>alkyl;

R<sup>8</sup> is selected from the group of hydrogen; -SO<sub>2</sub>C<sub>1-6</sub>alkyl; Het<sup>4</sup>; R<sup>9</sup>; C<sub>1-6</sub>alkyl optionally substituted with one or more substituents independently selected from the group of (i) Ar<sup>1</sup> and (ii) Het<sup>5</sup>; and C<sub>2-6</sub>alkyl substituted with one or more -OR<sup>8f</sup> substituents;

R<sup>8f</sup> is selected from the group of hydrogen and C<sub>1-6</sub>alkyl;

$R^9$  is  $C_{3-6}$ cycloalkyl optionally substituted with one or two substituents independently selected from fluoro,  $C_{1-4}$ alkyl,  $-OC_{1-4}$ alkyl,  $C_{1-4}$ alkyl substituted with one  $-OC_{1-4}$ alkyl, and  $C_{1-4}$ alkyl substituted with one or more fluoro substituents;

5  $Ar^1$  is selected from the group of phenyl, thienyl, thiazolyl, pyrrolyl, oxazolyl, pyrazolyl, imidazolyl, isoxazolyl, isothiazolyl, pyridinyl, pyrimidinyl, pyridazinyl and pyrazinyl, each of which may be optionally substituted with one or two substituents independently selected from halogen, cyano,  $C_{1-4}$ alkyl,  $C_{1-4}$ alkyl substituted with one or more fluoro substituents,  $-OC_{1-4}$ alkyl, and  $-OC_{1-4}$ alkyl substituted with one or more fluoro substituents;

10  $Het^4$  is a heterocyclyl, bound through any available carbon atom, selected from the group of piperidinyl, tetrahydropyranyl, pyrrolidinyl, tetrahydrofuranyl, azetidinyl and oxetanyl, each of which may be optionally substituted with one or two substituents independently selected from fluoro,  $C_{1-4}$ alkyl,  $-OC_{1-4}$ alkyl,  $C_{3-6}$ cycloalkyl,  $C_{1-4}$ alkyl substituted with one  $-OC_{1-4}$ alkyl, and  $C_{1-4}$ alkyl substituted with one or more fluoro substituents;

15  $Het^5$  is a heterocyclyl selected from the group of morpholinyl, piperidinyl, piperazinyl, tetrahydropyranyl, pyrrolidinyl, tetrahydrofuranyl, azetidinyl and oxetanyl, each of which may be optionally substituted with one or two substituents independently selected from fluoro,  $C_{1-4}$ alkyl,  $-OC_{1-4}$ alkyl,  $C_{1-4}$ alkyl substituted with one  $-OC_{1-4}$ alkyl, and  $C_{1-4}$ alkyl substituted with one or more fluoro substituents;

20 and the pharmaceutically acceptable salts, and the solvates thereof.

The present invention relates in particular to compounds of Formula (I) as defined

25 herein, and tautomers and stereoisomeric forms thereof, wherein

$R^1$  is selected from the group of  $C_{1-4}$ alkyl;

$R^2$  is selected from the group of  $C_{1-4}$ alkyl;  $C_{3-6}$ cycloalkyl; and  $Het^1$ ;

$Het^1$  is a heteroaryl selected from the group of thiazolyl, oxadiazolyl, isoxazolyl, and pyrimidinyl, each of which may be optionally substituted with one or two  $C_{1-4}$ alkyl substituents;

30 or  $R^1$  and  $R^2$  together with the carbon atom to which they are attached form a  $C_{3-6}$ cycloalkyl;

$R^3$  is selected from the group of hydrogen; halogen; cyano; and  $C_{1-4}$ alkyl substituted with one or more fluoro substituents;

35  $R^{4a}$  is hydrogen;

$R^{4b}$  is selected from the group of hydrogen and halogen;

R<sup>5</sup> is hydrogen;

R<sup>6</sup> is hydrogen;

R<sup>7</sup> is selected from the group of hydrogen; halogen; C<sub>1-4</sub>alkyl; C<sub>1-4</sub>alkyl substituted with one or more fluoro substituents; and -NR<sup>7a</sup>R<sup>7b</sup>; wherein

5 R<sup>7a</sup> and R<sup>7b</sup> are each independently selected from hydrogen;

R<sup>8</sup> is selected from the group of hydrogen; Het<sup>4</sup>; C<sub>1-6</sub>alkyl optionally substituted with one or more Het<sup>5</sup> substituents; and C<sub>2-6</sub>alkyl substituted with one or more -OR<sup>8f</sup> substituents;

R<sup>8f</sup> is selected from the group of hydrogen and C<sub>1-6</sub>alkyl;

10 Het<sup>4</sup> is a heterocyclyl, bound through any available carbon atom, selected from the group of piperidinyl and azetidinyl, each of which are substituted with one or two substituents independently selected from C<sub>1-4</sub>alkyl and C<sub>3-6</sub>cycloalkyl;

Het<sup>5</sup> is a heterocyclyl selected from the group of tetrahydrofuranyl and oxetanyl; and the pharmaceutically acceptable salts, and the solvates thereof.

15

The present invention relates in particular to compounds of Formula (I) as defined herein, and tautomers and stereoisomeric forms thereof, wherein

R<sup>1</sup> is selected from the group of C<sub>1-4</sub>alkyl;

R<sup>2</sup> is selected from the group of C<sub>1-4</sub>alkyl; C<sub>3-6</sub>cycloalkyl; and Het<sup>1</sup>;

20 Het<sup>1</sup> is a heteroaryl selected from the group of thiazolyl, oxadiazolyl, and isoxazolyl, each of which may be optionally substituted with one or two C<sub>1-4</sub>alkyl substituents; or R<sup>1</sup> and R<sup>2</sup> together with the carbon atom to which they are attached form a C<sub>3-6</sub>cycloalkyl;

R<sup>3</sup> is selected from the group of hydrogen; halogen; cyano; and C<sub>1-4</sub>alkyl substituted with one or more fluoro substituents;

25 R<sup>4a</sup> is hydrogen;

R<sup>4b</sup> is selected from the group of hydrogen and halogen;

R<sup>5</sup> is hydrogen;

R<sup>6</sup> is hydrogen;

30 R<sup>7</sup> is selected from the group of hydrogen; halogen; C<sub>1-4</sub>alkyl; C<sub>1-4</sub>alkyl substituted with one or more fluoro substituents; and -NR<sup>7a</sup>R<sup>7b</sup>; wherein

R<sup>7a</sup> and R<sup>7b</sup> are each independently selected from hydrogen;

R<sup>8</sup> is selected from the group of hydrogen; Het<sup>4</sup>; C<sub>1-6</sub>alkyl optionally substituted with one or more Het<sup>5</sup> substituents; and C<sub>2-6</sub>alkyl substituted with one or more -OR<sup>8f</sup> substituents;

35 R<sup>8f</sup> is selected from the group of hydrogen and C<sub>1-6</sub>alkyl;

Het<sup>4</sup> is a heterocyclyl, bound through any available carbon atom, selected from the group of piperidinyl and azetidinyl, each of which are substituted with one or two substituents independently selected from C<sub>1-4</sub>alkyl and C<sub>3-6</sub>cycloalkyl;

Het<sup>5</sup> is a heterocyclyl selected from the group of tetrahydrofuranyl and oxetanyl;

5 and the pharmaceutically acceptable salts, and the solvates thereof.

Another embodiment of the present invention relates to those compounds of Formula (I) and the pharmaceutically acceptable addition salts, and the solvates thereof, or any subgroup thereof as mentioned in any of the other embodiments wherein one or more 10 of the following restrictions apply:

(a) R<sup>1</sup> is selected from the group of C<sub>1-4</sub>alkyl;

R<sup>2</sup> is selected from the group of C<sub>1-4</sub>alkyl; C<sub>3-6</sub>cycloalkyl; and Het<sup>1</sup>;

Het<sup>1</sup> is a heteroaryl selected from the group of thiazolyl, oxadiazolyl, and isoxazolyl, each of which may be optionally substituted with one or two C<sub>1-4</sub>alkyl substituents; 15 or R<sup>1</sup> and R<sup>2</sup> together with the carbon atom to which they are attached form a C<sub>3-6</sub>cycloalkyl;

(b) R<sup>3</sup> is selected from the group of hydrogen; halogen; cyano; and C<sub>1-4</sub>alkyl substituted with one or more fluoro substituents;

(c) R<sup>4a</sup> is selected from the group of hydrogen;

20 (d) R<sup>4b</sup> is selected from the group of hydrogen and halogen;

(e) R<sup>5</sup> is selected from the group of hydrogen;

(f) R<sup>6</sup> is selected from the group of hydrogen;

(g) R<sup>7</sup> is selected from the group of hydrogen; halogen; C<sub>1-4</sub>alkyl; C<sub>1-4</sub>alkyl substituted with one or more fluoro substituents; and -NR<sup>7a</sup>R<sup>7b</sup>;

25 (h) R<sup>7a</sup> and R<sup>7b</sup> are each independently selected from hydrogen;

(i) R<sup>8</sup> is selected from the group of hydrogen; Het<sup>4</sup>; C<sub>1-6</sub>alkyl optionally substituted with one or more Het<sup>5</sup> substituents; and C<sub>2-6</sub>alkyl substituted with one or more -OR<sup>8f</sup> substituents;

(j) R<sup>8f</sup> is selected from the group of hydrogen and C<sub>1-6</sub>alkyl;

30 (k) Het<sup>4</sup> is a heterocyclyl, bound through any available carbon atom, selected from the group of piperidinyl and azetidinyl, each of which are substituted with one or two substituents independently selected from C<sub>1-4</sub>alkyl and C<sub>3-6</sub>cycloalkyl;

(l) Het<sup>5</sup> is a heterocyclyl selected from the group of tetrahydrofuran and oxetanyl.

The present invention relates in particular to compounds of Formula (I) as defined herein, and tautomers and stereoisomeric forms thereof, wherein

35 R<sup>1</sup> is selected from the group of C<sub>1-4</sub>alkyl;

R<sup>2</sup> is selected from the group of C<sub>1-4</sub>alkyl; and Het<sup>1</sup>;

Het<sup>1</sup> is thiazolyl;  
R<sup>3</sup> is hydrogen;  
R<sup>4a</sup> is hydrogen;  
R<sup>4b</sup> is selected from the group of hydrogen and halogen;

5 R<sup>5</sup> is hydrogen;  
R<sup>6</sup> is hydrogen;  
R<sup>7</sup> is selected from the group of hydrogen and halogen;  
R<sup>8</sup> is selected from the group of hydrogen; Het<sup>4</sup>; C<sub>1-6</sub>alkyl; and C<sub>2-6</sub>alkyl substituted with one or more -OR<sup>8f</sup> substituents;

10 R<sup>8f</sup> is C<sub>1-6</sub>alkyl;  
Het<sup>4</sup> is a heterocyclyl, bound through any available carbon atom, selected from the group of piperidinyl and azetidinyl, each of which are substituted on the nitrogen atom with one C<sub>1-4</sub>alkyl;  
and the pharmaceutically acceptable salts, and the solvates thereof.

15 Another embodiment of the present invention relates to those compounds of Formula (I) and the pharmaceutically acceptable addition salts, and the solvates thereof, or any subgroup thereof as mentioned in any of the other embodiments wherein one or more of the following restrictions apply:

20 (a) R<sup>1</sup> is selected from the group of C<sub>1-4</sub>alkyl;  
(b) R<sup>2</sup> is selected from the group of C<sub>1-4</sub>alkyl; and Het<sup>1</sup>;  
(c) Het<sup>1</sup> is thiazolyl;  
(d) R<sup>3</sup> is hydrogen;  
(e) R<sup>4a</sup> is hydrogen;

25 (f) R<sup>4b</sup> is selected from the group of hydrogen and halogen;  
(g) R<sup>5</sup> is hydrogen;  
(h) R<sup>6</sup> is hydrogen;  
(i) R<sup>7</sup> is selected from the group of hydrogen and halogen;  
(j) R<sup>8</sup> is selected from the group of hydrogen; Het<sup>4</sup>; C<sub>1-6</sub>alkyl; and C<sub>2-6</sub>alkyl substituted

30 with one or more -OR<sup>8f</sup> substituents;  
(k) R<sup>8f</sup> is C<sub>1-6</sub>alkyl;  
(l) Het<sup>4</sup> is a heterocyclyl, bound through any available carbon atom, selected from the group of piperidinyl and azetidinyl, each of which are substituted on the nitrogen atom with one C<sub>1-4</sub>alkyl.

35 In an embodiment, the present invention relates to those compounds of Formula (I) and the pharmaceutically acceptable addition salts, and the solvates thereof, or any

subgroup thereof as mentioned in any of the other embodiments, wherein R<sup>3</sup> is hydrogen; R<sup>4a</sup> is hydrogen; R<sup>5</sup> is hydrogen; R<sup>6</sup> is hydrogen.

In an embodiment, the present invention relates to those compounds of Formula (I) and the pharmaceutically acceptable addition salts, and the solvates thereof, or any

5 subgroup thereof as mentioned in any of the other embodiments, wherein R<sup>1</sup> is selected from the group of hydrogen; C<sub>1-4</sub>alkyl; and C<sub>1-4</sub>alkyl substituted with one or more fluoro substituents;

R<sup>2</sup> is selected from the group of hydrogen; C<sub>1-4</sub>alkyl; C<sub>1-4</sub>alkyl substituted with one or more fluoro substituents; C<sub>3-6</sub>cycloalkyl; and Het<sup>1</sup>.

10 In an embodiment, the present invention relates to those compounds of Formula (I) and the pharmaceutically acceptable addition salts, and the solvates thereof, or any subgroup thereof as mentioned in any of the other embodiments, wherein R<sup>1</sup> is selected from the group of C<sub>1-4</sub>alkyl; and C<sub>1-4</sub>alkyl substituted with one or more fluoro substituents;

15 R<sup>2</sup> is selected from the group of C<sub>1-4</sub>alkyl; C<sub>1-4</sub>alkyl substituted with one or more fluoro substituents; C<sub>3-6</sub>cycloalkyl; and Het<sup>1</sup>.

In an embodiment, the present invention relates to those compounds of Formula (I) and the pharmaceutically acceptable addition salts, and the solvates thereof, or any subgroup thereof as mentioned in any of the other embodiments, wherein

20 R<sup>1</sup> is selected from the group of C<sub>1-4</sub>alkyl; and C<sub>1-4</sub>alkyl substituted with one or more fluoro substituents;

R<sup>2</sup> is selected from the group of C<sub>1-4</sub>alkyl; C<sub>1-4</sub>alkyl substituted with one or more fluoro substituents; C<sub>3-6</sub>cycloalkyl; and Het<sup>1</sup>;

25 or R<sup>1</sup> and R<sup>2</sup> together with the carbon atom to which they are attached form a C<sub>3-6</sub>cycloalkyl or a Het<sup>2</sup> group.

In an embodiment, the present invention relates to those compounds of Formula (I) and the pharmaceutically acceptable addition salts, and the solvates thereof, or any subgroup thereof as mentioned in any of the other embodiments, wherein

R<sup>1</sup> is C<sub>1-4</sub>alkyl;

30 R<sup>2</sup> is selected from the group of C<sub>1-4</sub>alkyl; C<sub>3-6</sub>cycloalkyl; and Het<sup>1</sup>.

In an embodiment, the present invention relates to those compounds of Formula (I) and the pharmaceutically acceptable addition salts, and the solvates thereof, or any subgroup thereof as mentioned in any of the other embodiments, wherein

R<sup>1</sup> is C<sub>1-4</sub>alkyl.

In an embodiment, the present invention relates to those compounds of Formula (I) and the pharmaceutically acceptable addition salts, and the solvates thereof, or any subgroup thereof as mentioned in any of the other embodiments, wherein

R<sup>1</sup> is C<sub>1-4</sub>alkyl;

5 R<sup>2</sup> is selected from the group of C<sub>1-4</sub>alkyl and C<sub>3-6</sub>cycloalkyl.

In an embodiment, the present invention relates to those compounds of Formula (I) and the pharmaceutically acceptable addition salts, and the solvates thereof, or any subgroup thereof as mentioned in any of the other embodiments, wherein

R<sup>1</sup> is C<sub>1-4</sub>alkyl;

10 R<sup>2</sup> is C<sub>1-4</sub>alkyl.

In an embodiment, the present invention relates to those compounds of Formula (I) and the pharmaceutically acceptable addition salts, and the solvates thereof, or any subgroup thereof as mentioned in any of the other embodiments, wherein

R<sup>1</sup> is C<sub>1-4</sub>alkyl;

15 R<sup>2</sup> is selected from the group of C<sub>1-4</sub>alkyl; C<sub>3-6</sub>cycloalkyl; and thiazolyl.

In an embodiment, the present invention relates to those compounds of Formula (I) and the pharmaceutically acceptable addition salts, and the solvates thereof, or any subgroup thereof as mentioned in any of the other embodiments, wherein

R<sup>1</sup> is C<sub>1-4</sub>alkyl;

20 R<sup>2</sup> is selected from the group of C<sub>1-4</sub>alkyl; C<sub>3-6</sub>cycloalkyl; and Het<sup>1</sup>;

Het<sup>1</sup> is a heteroaryl selected from the group of thiazolyl, oxadiazolyl, and isoxazolyl, each of which may be optionally substituted with one or two C<sub>1-4</sub>alkyl substituents.

In an embodiment, the present invention relates to those compounds of Formula (I) and the pharmaceutically acceptable addition salts, and the solvates thereof, or any

25 subgroup thereof as mentioned in any of the other embodiments, wherein Het<sup>1</sup> is thiazolyl.

In an embodiment, the present invention relates to those compounds of Formula (I) and the pharmaceutically acceptable addition salts, and the solvates thereof, or any subgroup thereof as mentioned in any of the other embodiments, wherein Het<sup>1</sup> is a

30 heteroaryl selected from the group of thiazolyl, oxadiazolyl, and isoxazolyl, each of which may be optionally substituted with one or two C<sub>1-4</sub>alkyl substituents.

In an embodiment, the present invention relates to those compounds of Formula (I) and the pharmaceutically acceptable addition salts, and the solvates thereof, or any subgroup thereof as mentioned in any of the other embodiments, wherein R<sup>1</sup> and R<sup>2</sup>

together with the carbon atom to which they are attached form a C<sub>3-6</sub>cycloalkyl or a Het<sup>2</sup> group.

In an embodiment, the present invention relates to those compounds of Formula (I) and the pharmaceutically acceptable addition salts, and the solvates thereof, or any 5 subgroup thereof as mentioned in any of the other embodiments, wherein R<sup>1</sup> and R<sup>2</sup> together with the carbon atom to which they are attached form a C<sub>3-6</sub>cycloalkyl.

In an embodiment, the present invention relates to those compounds of Formula (I) and the pharmaceutically acceptable addition salts, and the solvates thereof, or any 10 subgroup thereof as mentioned in any of the other embodiments, wherein R<sup>1</sup> and R<sup>2</sup> together with the carbon atom to which they are attached form a Het<sup>2</sup> group.

In an embodiment, the present invention relates to those compounds of Formula (I) and the pharmaceutically acceptable addition salts, and the solvates thereof, or any subgroup thereof as mentioned in any of the other embodiments, wherein R<sup>4a</sup> is 15 hydrogen; R<sup>5</sup> is hydrogen; and R<sup>6</sup> is hydrogen.

In an embodiment, the present invention relates to those compounds of Formula (I) and the pharmaceutically acceptable addition salts, and the solvates thereof, or any subgroup thereof as mentioned in any of the other embodiments, wherein R<sup>3</sup> is hydrogen or halo.

20 In an embodiment, the present invention relates to those compounds of Formula (I) and the pharmaceutically acceptable addition salts, and the solvates thereof, or any subgroup thereof as mentioned in any of the other embodiments, wherein Het<sup>5</sup> is attached to the remainder of the molecule via a carbon atom.

In an embodiment, the present invention relates to those compounds of Formula (I) and 25 the pharmaceutically acceptable addition salts, and the solvates thereof, or any subgroup thereof as mentioned in any of the other embodiments, wherein Het<sup>4</sup> is a heterocyclyl, bound through any available carbon atom, selected from the group of piperidinyl, tetrahydropyranyl, pyrrolidinyl, tetrahydrofuranyl, azetidinyl and oxetanyl, each of which is substituted on a nitrogen atom with a substituent selected from fluoro, 30 C<sub>1-4</sub>alkyl, -OC<sub>1-4</sub>alkyl, C<sub>3-6</sub>cycloalkyl, C<sub>1-4</sub>alkyl substituted with one -OC<sub>1-4</sub>alkyl, and C<sub>1-4</sub>alkyl substituted with one or more fluoro substituents.

In an embodiment, the present invention relates to those compounds of Formula (I) and the pharmaceutically acceptable addition salts, and the solvates thereof, or any subgroup thereof as mentioned in any of the other embodiments, wherein Het<sup>4</sup> is a

heterocyclyl, bound through any available carbon atom, selected from the group of piperidinyl and azetidinyl, each of which are substituted with one or two substituents independently selected from C<sub>1-4</sub>alkyl and C<sub>3-6</sub>cycloalkyl.

In an embodiment, the present invention relates to those compounds of Formula (I) and

5 the pharmaceutically acceptable addition salts, and the solvates thereof, or any subgroup thereof as mentioned in any of the other embodiments, wherein Het<sup>4</sup> is a heterocyclyl, bound through any available carbon atom, selected from the group of piperidinyl and azetidinyl, each of which are substituted on the nitrogen atom with one substituent selected from C<sub>1-4</sub>alkyl and C<sub>3-6</sub>cycloalkyl.

10 In an embodiment, the present invention relates to those compounds of Formula (I) and the pharmaceutically acceptable addition salts, and the solvates thereof, or any subgroup thereof as mentioned in any of the other embodiments, wherein Het<sup>4</sup> is a heterocyclyl, bound through any available carbon atom, selected from the group of piperidinyl and azetidinyl, each of which are substituted on the nitrogen atom with one

15 from C<sub>1-4</sub>alkyl substituent.

In an embodiment, the present invention relates to those compounds of Formula (I) and the pharmaceutically acceptable addition salts, and the solvates thereof, or any subgroup thereof as mentioned in any of the other embodiments, wherein Het<sup>1</sup> is a heteroaryl selected from the group of thienyl, thiazolyl, pyrrolyl, oxazolyl, pyrazolyl,

20 imidazolyl, isoxazolyl, and isothiazolyl, each of which may be optionally substituted with one or two substituents independently selected from halogen and C<sub>1-4</sub>alkyl.

In an embodiment, the present invention relates to those compounds of Formula (I) and the pharmaceutically acceptable addition salts, and the solvates thereof, or any subgroup thereof as mentioned in any of the other embodiments, wherein R<sup>8</sup> is selected

25 from the group of -SO<sub>2</sub>C<sub>1-6</sub>alkyl; Het<sup>4</sup>; R<sup>9</sup>; C<sub>1-6</sub>alkyl optionally substituted with one or more substituents independently selected from the group of (i) Ar<sup>1</sup> and (ii) Het<sup>5</sup>; and C<sub>2-6</sub>alkyl substituted with one or more substituents independently selected from the group of

30 (iii) fluoro,

(iv) -NR<sup>8a</sup>R<sup>8b</sup>,

(v) -NR<sup>8c</sup>C(=O)R<sup>8d</sup>,

(vi) -NR<sup>8c</sup>C(=O)NR<sup>8a</sup>R<sup>8b</sup>,

(vii) -NR<sup>8c</sup>C(=O)OR<sup>8e</sup>,

(viii) -NR<sup>8c</sup>S(=O)<sub>2</sub>NR<sup>8a</sup>R<sup>8b</sup>,

35 (ix) -NR<sup>8c</sup>S(=O)<sub>2</sub>R<sup>8d</sup>,

(x) -OR<sup>8f</sup>,

- (xi)  $-\text{OC}(=\text{O})\text{NR}^{8a}\text{R}^{8b}$ ,
- (xii)  $-\text{C}(=\text{O})\text{NR}^{8a}\text{R}^{8b}$ ,
- (xiii)  $-\text{S}(\text{O})_2\text{R}^{8d}$ , and
- (xiv)  $-\text{S}(\text{O})_2\text{NR}^{8a}\text{R}^{8b}$ .

5 In an embodiment, the present invention relates to those compounds of Formula (I) and the pharmaceutically acceptable addition salts, and the solvates thereof, or any subgroup thereof as mentioned in any of the other embodiments, wherein  $\text{R}^8$  is selected from the group of hydrogen;  $\text{Het}^4$ ;  $\text{R}^9$ ;  $\text{C}_{1-6}\text{alkyl}$  optionally substituted with one  $\text{Het}^5$ ; and  $\text{C}_{2-6}\text{alkyl}$  substituted with one or more substituents independently selected from the group of fluoro,  $-\text{NR}^{8a}\text{R}^{8b}$ , and  $-\text{OR}^{8f}$ ,  
10 wherein  $\text{R}^{8a}$ ,  $\text{R}^{8b}$  and  $\text{R}^{8f}$  are each independently selected from the group of hydrogen and  $\text{C}_{1-6}\text{alkyl}$ .

In an embodiment, the present invention relates to those compounds of Formula (I) and the pharmaceutically acceptable addition salts, and the solvates thereof, or any subgroup thereof as mentioned in any of the other embodiments, wherein  $\text{R}^{8a}$ ,  $\text{R}^{8b}$  and  $15 \text{R}^{8f}$  are each independently selected from the group of hydrogen and  $\text{C}_{1-6}\text{alkyl}$ .

In an embodiment, the present invention relates to those compounds of Formula (I) and the pharmaceutically acceptable addition salts, and the solvates thereof, or any subgroup thereof as mentioned in any of the other embodiments, wherein  $\text{R}^{8a}$ ,  $\text{R}^{8b}$ ,  $\text{R}^{8c}$  and  $20 \text{R}^{8f}$  are each independently selected from the group of hydrogen and  $\text{C}_{1-6}\text{alkyl}$ .

In an embodiment, the present invention relates to those compounds of Formula (I) and the pharmaceutically acceptable addition salts, and the solvates thereof, or any subgroup thereof as mentioned in any of the other embodiments, wherein  $\text{R}^8$  is selected from the group of hydrogen;  $-\text{SO}_2\text{C}_{1-6}\text{alkyl}$ ;  $\text{Het}^4$ ;  $\text{C}_{3-6}\text{cycloalkyl}$  optionally substituted with one  $-\text{OC}_{1-4}\text{alkyl}$ ;  $\text{C}_{1-6}\text{alkyl}$  optionally substituted with one or more substituents independently selected from the group of (i)  $\text{Ar}^1$  and (ii)  $\text{Het}^5$ ; and  $25 \text{C}_{2-6}\text{alkyl}$  substituted with one or more substituents independently selected from the group of

(iii) fluoro,

- 30 (iv)  $-\text{NR}^{8a}\text{R}^{8b}$ ,
- (v)  $-\text{NR}^{8c}\text{C}(=\text{O})\text{R}^{8d}$ ,
- (vi)  $-\text{NR}^{8c}\text{C}(=\text{O})\text{NR}^{8a}\text{R}^{8b}$ ,
- (vii)  $-\text{NR}^{8c}\text{C}(=\text{O})\text{OR}^{8e}$ ,
- (viii)  $-\text{NR}^{8c}\text{S}(=\text{O})_2\text{NR}^{8a}\text{R}^{8b}$ ,
- 35 (ix)  $-\text{NR}^{8c}\text{S}(=\text{O})_2\text{R}^{8d}$ ,
- (x)  $-\text{OR}^{8f}$ ,

- (xi)  $-\text{OC}(=\text{O})\text{NR}^{8a}\text{R}^{8b}$ ,
- (xii)  $-\text{C}(=\text{O})\text{NR}^{8a}\text{R}^{8b}$ ,
- (xiii)  $-\text{S}(\text{O})_2\text{R}^{8d}$ , and
- (xiv)  $-\text{S}(\text{O})_2\text{NR}^{8a}\text{R}^{8b}$ .

5 In an embodiment, the present invention relates to those compounds of Formula (I) and the pharmaceutically acceptable addition salts, and the solvates thereof, or any subgroup thereof as mentioned in any of the other embodiments, wherein  $\text{R}^9$  is  $\text{C}_{3-6}\text{cycloalkyl}$  optionally substituted with one  $-\text{OC}_{1-4}\text{alkyl}$ .

10 In an embodiment, the present invention relates to those compounds of Formula (I) and the pharmaceutically acceptable addition salts, and the solvates thereof, or any subgroup thereof as mentioned in any of the other embodiments, wherein  $\text{R}^8$  is selected from the group of hydrogen;  $-\text{SO}_2\text{C}_{1-6}\text{alkyl}$ ;  $\text{Het}^4$ ;  $\text{R}^9$ ;  $\text{C}_{1-6}\text{alkyl}$  optionally substituted with one or more substituents independently selected from the group of (i)  $\text{Ar}^1$  and (ii)  $\text{Het}^5$ ; and  $\text{C}_{2-6}\text{alkyl}$  substituted with one or more  $-\text{OR}^{8f}$  substituents.

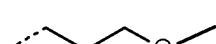
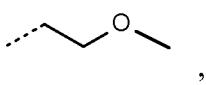
15 In an embodiment, the present invention relates to those compounds of Formula (I) and the pharmaceutically acceptable addition salts, and the solvates thereof, or any subgroup thereof as mentioned in any of the other embodiments, wherein  $\text{R}^8$  is selected from the group of  $\text{Het}^4$ ; and  $\text{C}_{1-6}\text{alkyl}$  optionally substituted with one or more substituents independently selected from the group of (i)  $\text{Ar}^1$  and (ii)  $\text{Het}^5$ .

20 In an embodiment, the present invention relates to those compounds of Formula (I) and the pharmaceutically acceptable addition salts, and the solvates thereof, or any subgroup thereof as mentioned in any of the other embodiments, wherein  $\text{R}^{8f}$  is hydrogen or  $\text{C}_{1-6}\text{alkyl}$ .

25 In an embodiment, the present invention relates to those compounds of Formula (I) and the pharmaceutically acceptable addition salts, and the solvates thereof, or any subgroup thereof as mentioned in any of the other embodiments, wherein  $\text{R}^{8f}$  is  $\text{C}_{1-6}\text{alkyl}$ .

30 In an embodiment, the present invention relates to those compounds of Formula (I) and the pharmaceutically acceptable addition salts, and the solvates thereof, or any subgroup thereof as mentioned in any of the other embodiments, wherein  $\text{R}^8$  is selected

from the group of hydrogen,  $-\text{CH}_3$ ,  $-\text{CH}_2\text{CH}_3$ ,  $-\text{CH}(\text{CH}_3)_2$ ,



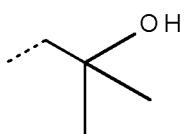
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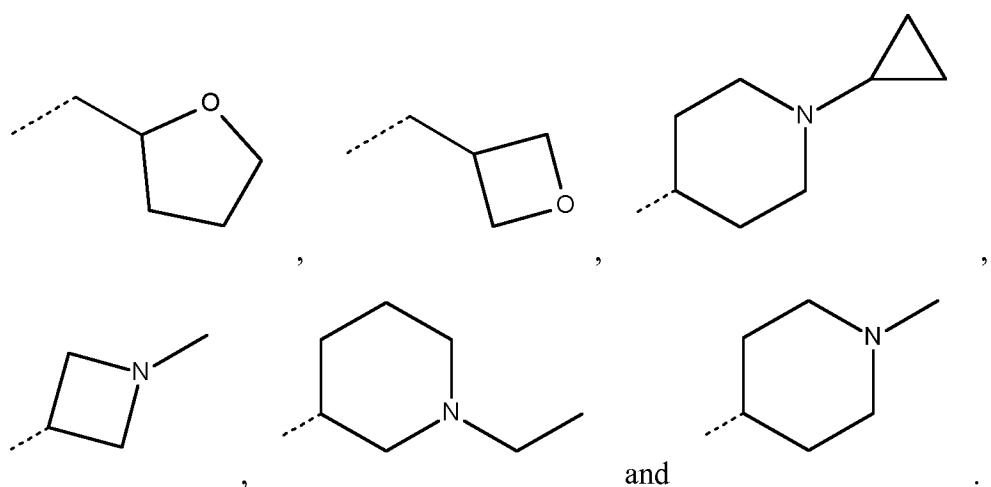
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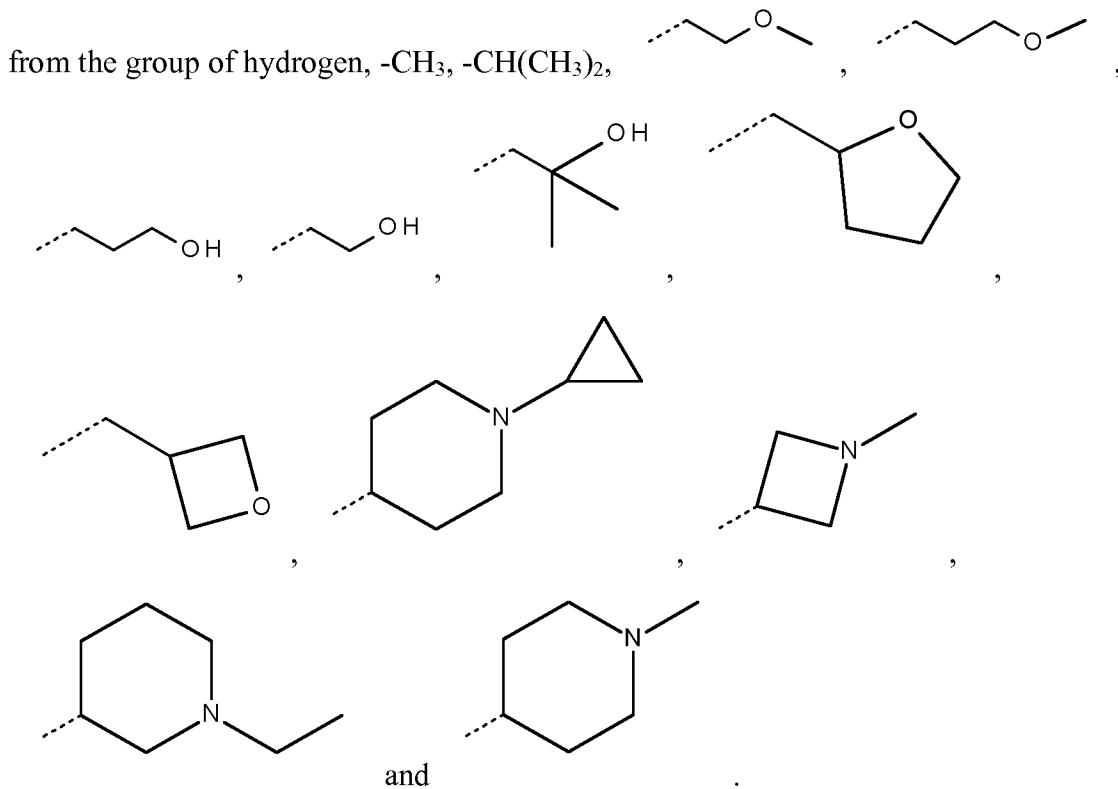
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In an embodiment, the present invention relates to those compounds of Formula (I) and the pharmaceutically acceptable addition salts, and the solvates thereof, or any 5 subgroup thereof as mentioned in any of the other embodiments, wherein R<sup>8</sup> is selected



10 In an embodiment, the present invention relates to those compounds of Formula (I) and the pharmaceutically acceptable addition salts, and the solvates thereof, or any subgroup thereof as mentioned in any of the other embodiments, wherein R<sup>8</sup> is other 15 than hydrogen.

In an embodiment, the present invention relates to those compounds of Formula (I) and 15 the pharmaceutically acceptable addition salts, and the solvates thereof, or any

subgroup thereof as mentioned in any of the other embodiments, wherein R<sup>7</sup> is other than hydrogen.

In an embodiment, the present invention relates to those compounds of Formula (I) and the pharmaceutically acceptable addition salts, and the solvates thereof, or any

5 subgroup thereof as mentioned in any of the other embodiments, wherein R<sup>7</sup> is selected from the group of halogen; cyano; C<sub>1-4</sub>alkyl; C<sub>1-4</sub>alkyl substituted with one or more fluoro substituents; and -NR<sup>7a</sup>R<sup>7b</sup>.

In an embodiment, the present invention relates to those compounds of Formula (I) and the pharmaceutically acceptable addition salts, and the solvates thereof, or any

10 subgroup thereof as mentioned in any of the other embodiments, wherein R<sup>7</sup> is selected from the group of halogen; C<sub>1-4</sub>alkyl; and -NH<sub>2</sub>.

In an embodiment, the present invention relates to those compounds of Formula (I) and the pharmaceutically acceptable addition salts, and the solvates thereof, or any subgroup thereof as mentioned in any of the other embodiments, wherein R<sup>4b</sup> is other

15 than fluoro.

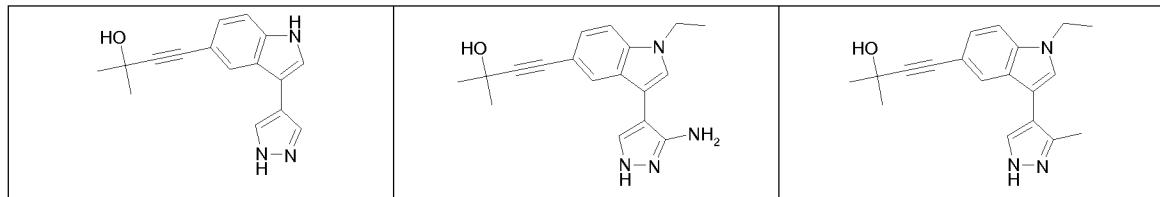
In an embodiment, the present invention relates to those compounds of Formula (I) and the pharmaceutically acceptable addition salts, and the solvates thereof, or any subgroup thereof as mentioned in any of the other embodiments, wherein R<sup>4b</sup> is hydrogen.

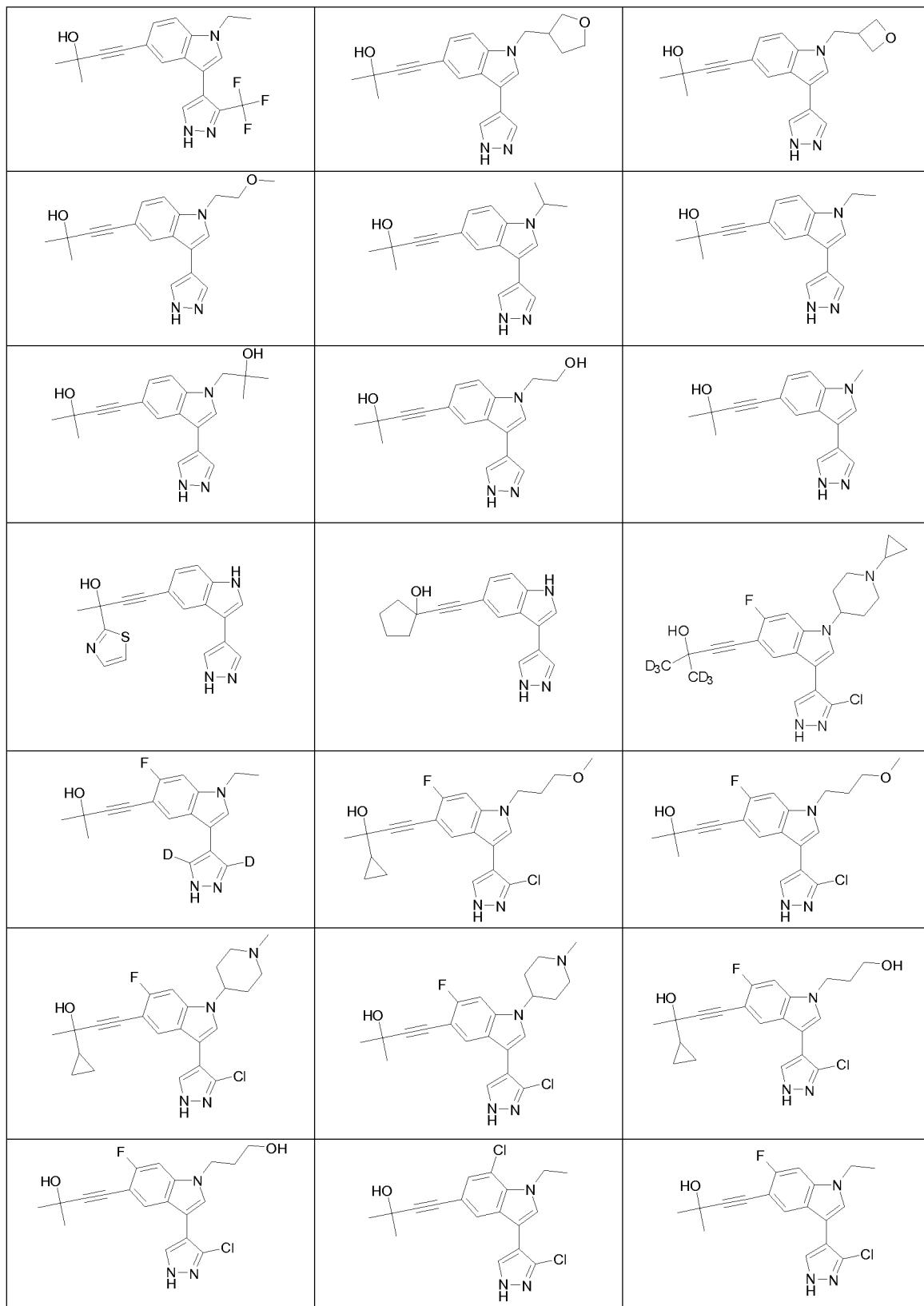
20 In an embodiment, the present invention relates to those compounds of Formula (I) and the pharmaceutically acceptable addition salts, and the solvates thereof, or any subgroup thereof as mentioned in any of the other embodiments, wherein R<sup>4b</sup> is fluoro.

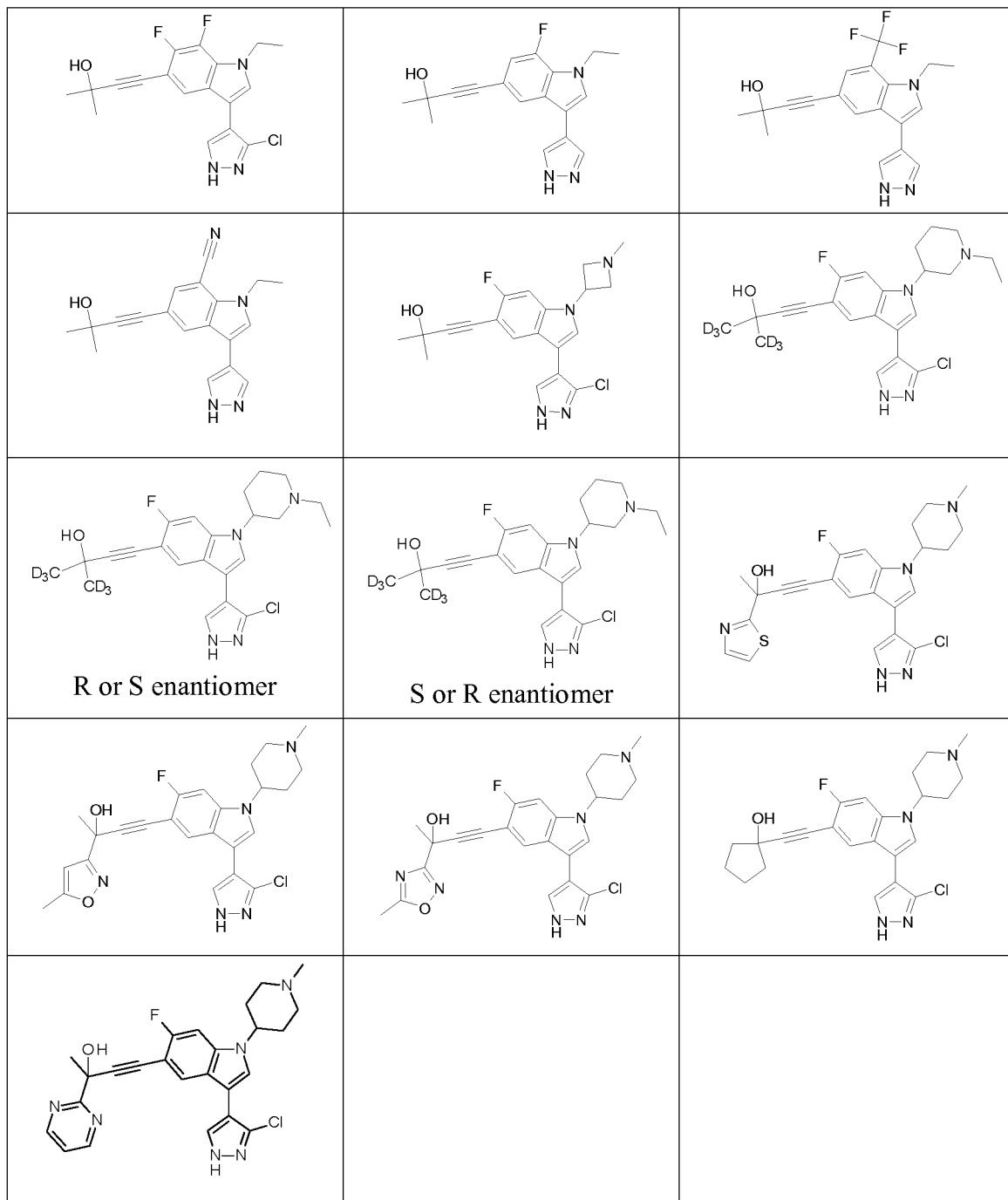
In an embodiment, the present invention relates to those compounds of Formula (I) and the pharmaceutically acceptable addition salts, and the solvates thereof, or any

25 subgroup thereof as mentioned in any of the other embodiments, wherein Het<sup>5</sup> is a heterocyclyl, bound through any available carbon atom.

Specific compounds according to the invention include:

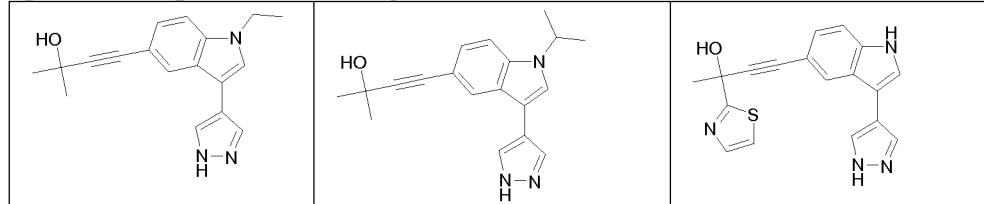


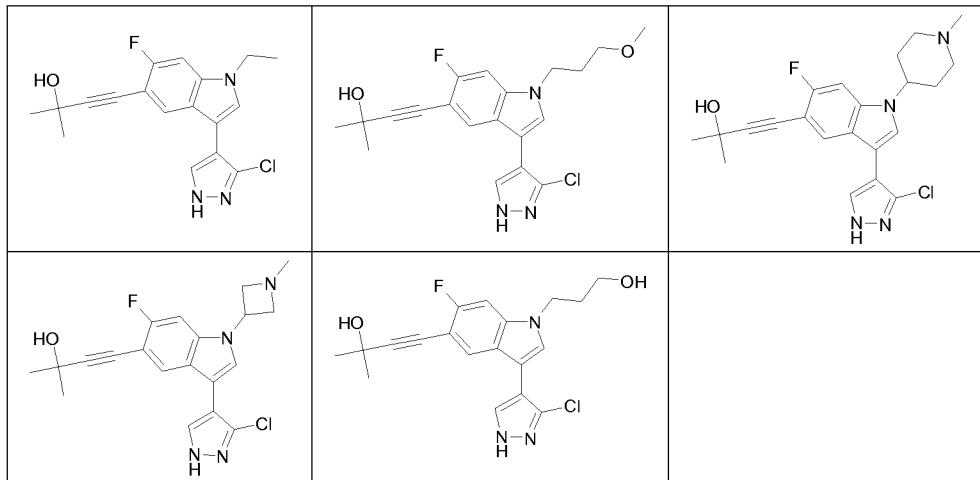




tautomers and stereoisomeric forms thereof,  
and the pharmaceutically acceptable salts, and the solvates thereof.

More specific compounds according to the invention include:





tautomers and stereoisomeric forms thereof,  
and the pharmaceutically acceptable salts, and the solvates thereof.

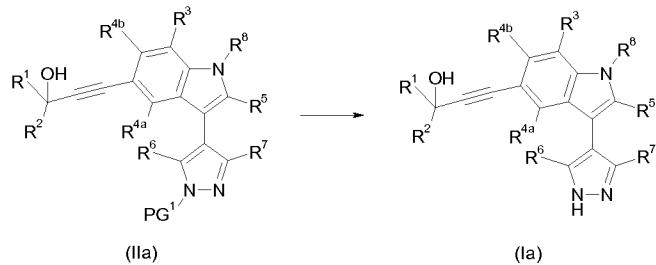
### Methods of Synthesis

5 Compounds of Formula (I) can be prepared by methods known to those who are skilled in the art. The following schemes are only meant to represent examples of the invention and are in no way meant to be a limit of the invention.

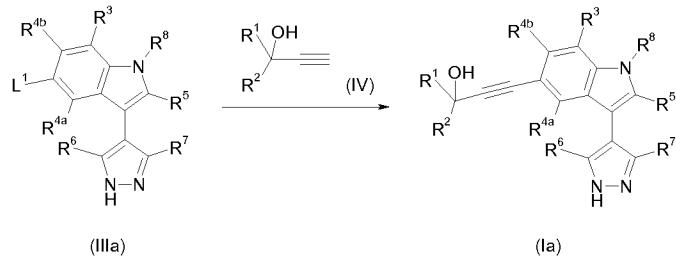
10 For clarity, only one specific regioisomer of the intermediates is shown in the general schemes. However, the skilled person will realize that some intermediates may appear as mixtures of regioisomers as is also clear from the examples in the specific experimental part.

15 Herein, the term 'Me' means methyl, 'DMF' means *N,N*-dimethylformamide, 'Pd(PPh<sub>3</sub>)<sub>4</sub>' means tetrakis(triphenylphosphine)palladium, 'Boc' means t-butoxycarbonyl, '[Ir(OMe)cod]<sub>2</sub>' means (1,5-cyclooctadiene)(methoxy) iridium(I) dimer (also bis(1,5-cyclooctadiene)di- $\mu$ -methoxydiiridium(I)), 'TFA' means trifluoroacetic acid, 'SEM' means 2-(trimethylsilyl)ethoxy]-methyl, 'TBAF' means tetrabutylammonium fluoride, 'THF' means tetrahydrofuran, 'PdCl<sub>2</sub>(dppf)' means 20 [1,1'-bis(diphenylphosphino- $\kappa$ P)ferrocene]dichloropalladium, 'KOAc' means potassium acetate and 'Ts' means tosyl.

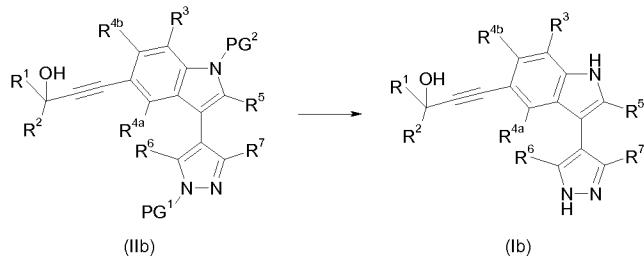
25 Scheme 1 illustrates methods of preparing compounds of Formula (Ia), wherein R<sup>1</sup>-R<sup>8</sup> are as defined in Formula (I). Intermediates of Formula (IIa), wherein PG<sup>1</sup> is a suitable protecting group, such as a Boc or SEM, can be treated with reagents, such as TBAF in THF, with heating, or TFA in DCM, to furnish compounds of Formula (Ia).

**Scheme 1**

5 Scheme 2 illustrates alternative methods of preparing compounds of Formula (Ia),  
 wherein R<sup>1</sup>-R<sup>8</sup> are as defined in Formula (I). Intermediates of Formula (IIIa), wherein  
 L<sup>1</sup> is a suitable leaving group such as chloro or bromo, can be coupled with alkynes of  
 Formula (IV) under palladium-catalyzed Sonogashira coupling conditions, using for  
 example Pd(PPh<sub>3</sub>)<sub>4</sub>, CuI and a base such as triethylamine in acetonitrile, with heating,  
 10 to furnish compounds of Formula (Ia).

**Scheme 2**

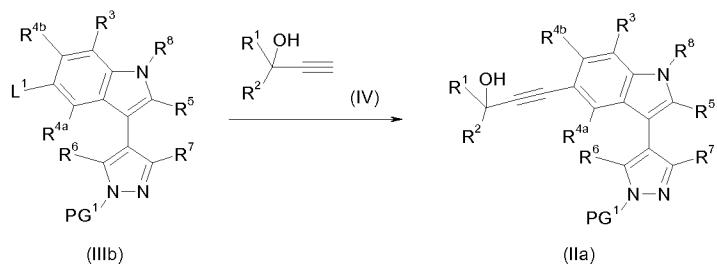
15 Scheme 3 illustrates methods of preparing compounds of Formula (Ib), wherein R<sup>1</sup>-R<sup>7</sup>  
 are as defined in Formula (I) and R<sup>8</sup> is hydrogen. Intermediates of Formula (IIb),  
 wherein PG<sup>1</sup> is a suitable protecting group, such as SEM, and PG<sup>2</sup> is a suitable  
 protecting group, such as Ts, can be treated with a suitable reagent, such as TBAF in  
 20 THF, to furnish compounds of Formula (Ib).

**Scheme 3**

5 Additional compounds of Formula (I) can be prepared from compounds of Formula (Ia) and (Ib) by elaboration of functional groups present. Such elaboration includes, but is not limited to, hydrolysis, reduction, oxidation, alkylation, amidation and dehydration. Such transformations may in some instances require the use of protecting groups.

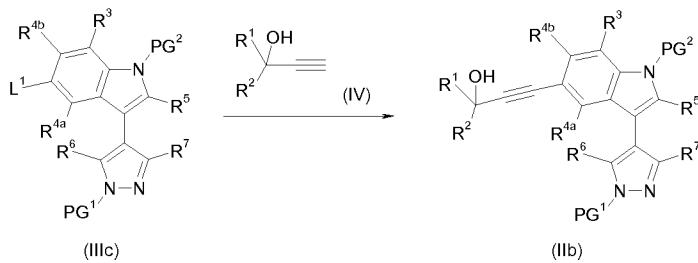
10 Intermediates of Formula (IIa), wherein R<sup>1</sup>-R<sup>8</sup> are as defined in Formula (I) and PG<sup>1</sup> is a suitable protecting group, can be prepared by reaction of intermediates of Formula (IIIb) wherein L<sup>1</sup> is a suitable leaving group such as chloro or bromo, with alkynes of Formula (IV) under palladium-catalyzed Sonogashira coupling conditions, using for example Pd(PPh<sub>3</sub>)<sub>4</sub>, CuI and a base such as triethylamine in acetonitrile, with heating

15 (Scheme 4).

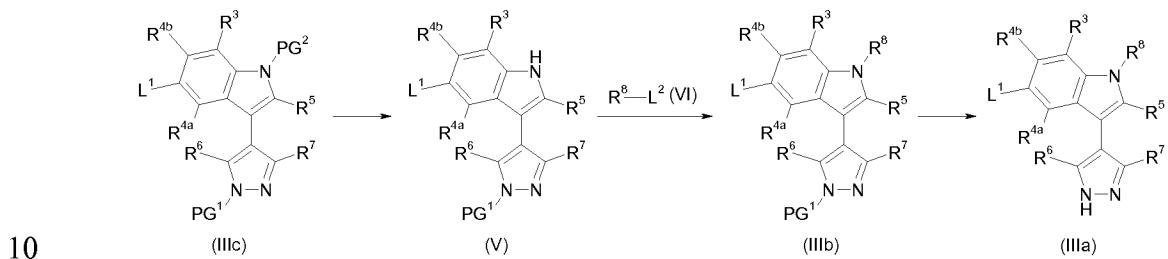
**Scheme 4**

20 Intermediates of Formula (IIb), wherein R<sup>1</sup>-R<sup>7</sup> are as defined in Formula (I), PG<sup>1</sup> and PG<sup>2</sup> are suitable protecting groups, can be prepared by means of a Sonogashira palladium-catalyzed coupling of intermediates of Formula (IIIc), wherein L<sup>1</sup> is a suitable leaving group such as chloro or bromo, with alkynes of Formula (IV), using a suitable palladium catalyst, copper catalyst, base and solvent (for example, Pd(PPh<sub>3</sub>)<sub>4</sub>, CuI, triethylamine and acetonitrile, respectively) (Scheme 5).

25

**Scheme 5**

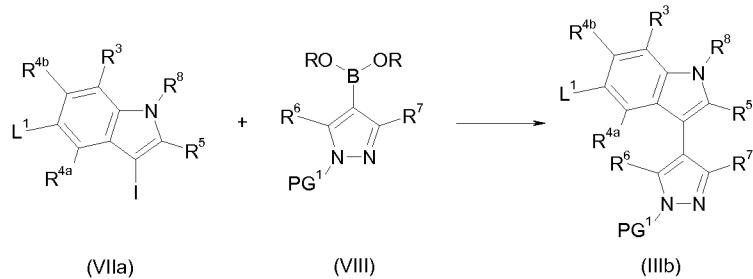
5 Alkynes of Formula (IV) are commercially available or can be prepared by known methods.

**Scheme 6**

10 Scheme 6 illustrates methods of preparing intermediates of Formula (IIIb) and (IIIa) from intermediates of Formula (IIIc). Intermediates of Formula (IIIc), wherein R<sup>3</sup>-R<sup>7</sup> are as defined above, PG<sup>1</sup> is Boc, PG<sup>2</sup> is Ts and L<sup>1</sup> is a suitable leaving group, can be selectively deprotected in the presence of a suitable reagent, such as TBAF in THF, to furnish intermediates of Formula (V). Intermediates of Formula (V) can be reacted in a variety of ways to yield intermediates of Formula (IIIb). For example, N-alkylation of (V) by treatment with an appropriate alkylating agent of Formula (VI) wherein L<sup>2</sup> is a suitable leaving group, for example sulfonate esters (e.g., mesylate, tosylate, or triflate), or alkyl halides (e.g., bromo or iodo), in the presence of a suitable base such as NaH or K<sub>2</sub>CO<sub>3</sub>, in an appropriate solvent such as DMF, yields intermediates of Formula (IIIb). Intermediates of Formula (V) can also be alkylated by reacting with an epoxide, for example 1,2-epoxy-2-methylpropane, employing a suitable base such as NaH, in an appropriate solvent such DMF. Alternatively, intermediates of Formula (V) can be reacted with alcohols, wherein R<sup>8</sup> is C<sub>1-6</sub>alkyl or C<sub>2-6</sub>alkyl optionally substituted as in R<sup>8</sup> in Formula (I), under standard Mitsunobu reaction conditions to yield intermediates of Formula (IIIb). Furthermore, intermediate of Formula (V) can be reacted with sulfonyl chlorides, in an appropriate solvent such as DMF, in the presence of a suitable base such as NaH, to yield intermediates of Formula (IIIb), wherein R<sup>8</sup> is -SO<sub>2</sub>C<sub>1-6</sub>alkyl.

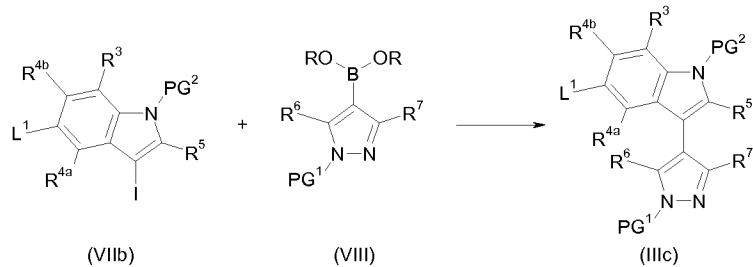
optionally substituted as in R<sup>8</sup> in Formula (I). Intermediates of Formula (IIIa) can be prepared from intermediates of Formula (IIIb), using the methods described above for the preparation of compounds of Formula (Ia) from intermediates of Formula (IIa).

### 5 Scheme 7

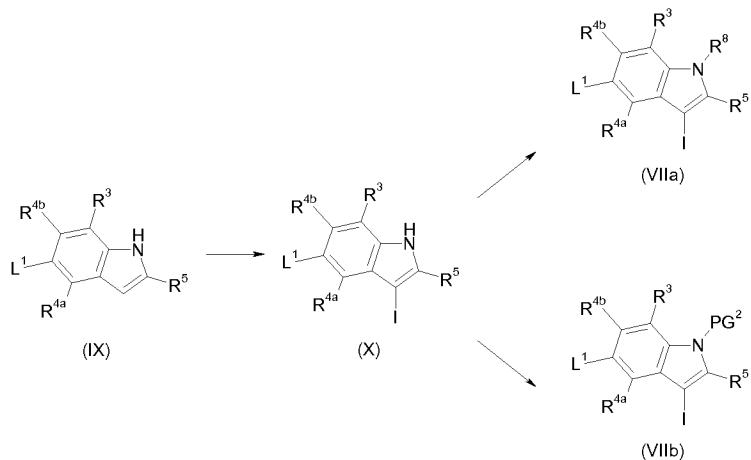


Intermediates of Formula (IIIb), wherein R<sup>3</sup>-R<sup>8</sup> are as defined in Formula (I), PG<sup>1</sup> is a suitable protecting group and L<sup>1</sup> is a suitable leaving group, can also be prepared according to scheme 7. Heating intermediates of Formula (VIIa) with the appropriate pyrazole boronate of Formula (VIII), protected with a suitable protecting group, such as SEM, under palladium-catalyzed Suzuki coupling conditions, using for example PdCl<sub>2</sub>(dppf), K<sub>2</sub>CO<sub>3</sub> in water and DMF as a solvent, yields intermediates of Formula (IIIb).

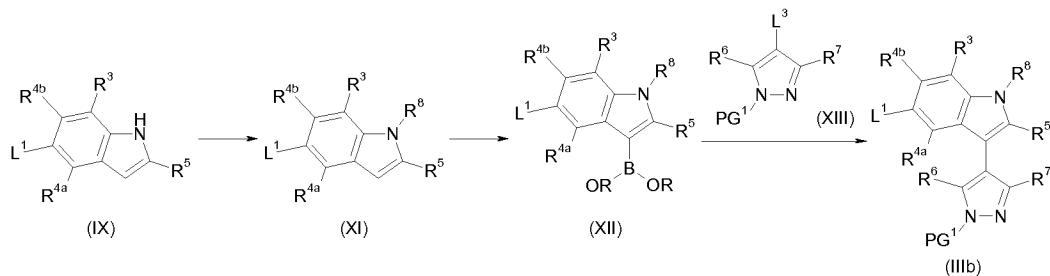
### Scheme 8



Intermediates of Formula (IIIc), wherein R<sup>3</sup>-R<sup>7</sup> are as defined in Formula (I), PG<sup>1</sup> and PG<sup>2</sup> are suitable protecting groups, and L<sup>1</sup> is a suitable leaving group, can be prepared from intermediates of Formula (VIIb) and (VIII), using the methods described above for the preparation of intermediates of Formula (IIIb) from intermediates of Formula (VIIa) and (VIII) (Scheme 8).

**Scheme 9**

5 Scheme 9 illustrates methods of preparing intermediates of Formula (VIIa) and (VIIb), wherein R<sup>3</sup>-R<sup>5</sup> and R<sup>8</sup> are as defined in Formula (I), PG<sup>2</sup> is a suitable protecting group and L<sup>1</sup> is a suitable leaving group. Treatment of intermediates of Formula (IX) with a mixture of iodine and potassium hydroxide in a suitable solvent such as DMF yields intermediates of Formula (X). Intermediates of Formula (VIIa) can be prepared from  
 10 intermediates of Formula (X), using the methods described above for the preparation of intermediates of Formula (IIIb) from intermediates of Formula (V) and (VI).  
 Intermediates of Formula (X) can be converted to intermediates of Formula (VIIb), wherein R<sup>3</sup>-R<sup>5</sup> and L<sup>1</sup> are as defined above, and PG<sup>2</sup> is Ts, by reaction with tosyl  
 15 chloride, in an appropriate solvent such as DMF, in the presence of a suitable base such as NaH.

**Scheme 10**

20

Scheme 10 illustrates a further method for preparing intermediates of Formula (IIIb), wherein R<sup>3</sup>-R<sup>8</sup> are as defined in Formula (I), PG<sup>1</sup> is a suitable protecting group and L<sup>1</sup> is a suitable leaving group. Intermediates of Formula (XI) can be prepared from intermediates of Formula (IX), using the methods described above for the preparation

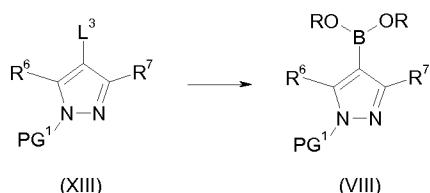
of intermediates of Formula (IIIb) from intermediates of Formula (V) and (VI). Heating intermediates of Formula (XI) with an appropriate borane species, such as 4,4,5,5-tetramethyl-1,3,2-dioxaborolane, under Iridium-catalyzed conditions using for example  $[\text{Ir}(\text{OMe})\text{cod}]_2$  with an appropriate ligand, and cyclohexane as solvent, yields boronates of Formula (XII). In turn, heating boronates of Formula (XII) with pyrazoles of Formula (XIII), wherein  $\text{L}^3$  is a suitable leaving group such as chloro or bromo and  $\text{PG}^1$  is a suitable protecting group such as SEM, under palladium-catalyzed Suzuki coupling conditions using for example  $\text{PdCl}_2(\text{dppf})$ ,  $\text{K}_2\text{CO}_3$  in water and DMF as solvent, furnishes intermediates of Formula (IIIb).

10

Indoles of Formula (IX) are commercially available or can be prepared by known methods.

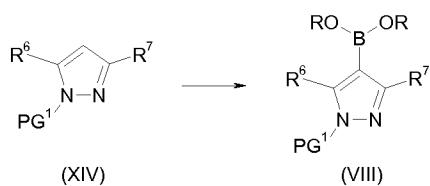
### Scheme 11

15



Scheme 11 illustrates a method of preparing intermediates of Formula (VIII), wherein R<sup>6</sup> and R<sup>7</sup> are as defined in Formula (I) and PG<sup>1</sup> is a suitable protecting group. Heating pyrazoles of Formula (XIII), wherein L<sup>3</sup> is a suitable leaving group such as chloro or bromo, with the appropriate borane species, such as bis(pinacolato)diborane, under palladium-catalyzed conditions using for example PdCl<sub>2</sub>(dppf), KOAc base, in DMF as a solvent, furnishes pyrazole boronates of Formula (VIII).

## 25 Scheme 12



30 Scheme 12 illustrates a further method for preparing pyrazole boronates of Formula (VIII). Heating of intermediates of Formula (XIV), wherein R<sup>6</sup> and R<sup>7</sup> are as defined in Formula (I) and PG<sup>1</sup> is a suitable protecting group, with an appropriate borane species, such as 4,4,5,5-tetramethyl-1,3,2-dioxaborolane, under Iridium-catalyzed conditions

using for example  $[\text{Ir}(\text{OMe})\text{cod}]_2$  with an appropriate ligand, and cyclohexane as solvent yields pyrazole boronates of Formula (VIII).

One skilled in the art will appreciate that alternative methods may be applicable for 5 preparing intermediates of Formula (VIII), for example halogen-metal exchange and subsequent quench with boron electrophiles such as tri-isopropyl borate. Pyrazoles of Formula (XIII) and (XIV) can be sourced from commercial suppliers or synthesized by those skilled in the art employing methods described in the literature [J. Elguero, 'Comprehensive Heterocyclic Chemistry II', Pergamon Press: Oxford, 1996, Vol. 3, 10 Editors: A. R. Katritzky, C. W. Rees and E. F. V. Scriven; Fustero *et al.* *Chem. Rev.*, 2011, 111, 6984-7034].

It will be appreciated that where appropriate functional groups exist, compounds of 15 various formulae or any intermediates used in their preparation may be further derivatised by one or more standard synthetic methods employing condensation, substitution, oxidation, reduction, or cleavage reactions. Particular substitution approaches include conventional alkylation, arylation, heteroarylation, acylation, sulfonylation, halogenation, nitration, formylation and coupling procedures.

20 The compounds of Formula (I) may be synthesized in the form of racemic mixtures of enantiomers which can be separated from one another following art-known resolution procedures. The racemic compounds of Formula (I) containing a basic nitrogen atom may be converted into the corresponding diastereomeric salt forms by reaction with a suitable chiral acid. Said diastereomeric salt forms are subsequently separated, for 25 example, by selective or fractional crystallization and the enantiomers are liberated therefrom by alkali. An alternative manner of separating the enantiomeric forms of the compounds of Formula (I) involves liquid chromatography using a chiral stationary phase. Said pure stereochemically isomeric forms may also be derived from the corresponding pure stereochemically isomeric forms of the appropriate starting 30 materials, provided that the reaction occurs stereospecifically.

In the preparation of compounds of the present invention, protection of remote 35 functionality (e.g., primary or secondary amine) of intermediates may be necessary. The need for such protection will vary depending on the nature of the remote functionality and the conditions of the preparation methods. Suitable amino-protecting groups (NH-Pg) include acetyl, trifluoroacetyl, t-butoxycarbonyl (Boc), benzyloxycarbonyl (CBz) and 9-fluorenylmethyleneoxycarbonyl (Fmoc). The need for such protection is readily determined by one skilled in the art. For a general description

of protecting groups and their use, see T. W. Greene and P. G. M. Wuts, Protective Groups in Organic Synthesis, 4th ed., Wiley, Hoboken, New Jersey, 2007.

Compounds of the invention may be prepared from commercially available starting  
5 materials using the general methods illustrated herein.

### Pharmacology

It has been found that the compounds of the present invention inhibit NF- $\kappa$ B-inducing kinase (NIK - also known as MAP3K14). The compounds according to the invention

10 and the pharmaceutical compositions comprising such compounds may be useful for treating or preventing diseases such as cancer, inflammatory disorders, metabolic disorders including obesity and diabetes, and autoimmune disorders. In particular, the compounds according to the present invention and the pharmaceutical compositions thereof may be useful in the treatment of a haematological malignancy or solid tumour.

15 In a specific embodiment said haematological malignancy is selected from the group consisting of multiple myeloma, Hodgkin lymphoma, T-cell leukaemia, mucosa-associated lymphoid tissue lymphoma, diffuse large B-cell lymphoma and mantle cell lymphoma, in a particular embodiment mantle cell lymphoma. In another specific embodiment of the present invention, the solid tumour is selected from the group  
20 consisting of pancreatic cancer, breast cancer, melanoma and non-small cell lung cancer.

Examples of cancers which may be treated (or inhibited) include, but are not limited to, a carcinoma, for example a carcinoma of the bladder, breast, colon (e.g. colorectal carcinomas such as colon adenocarcinoma and colon adenoma), kidney, urothelial,

25 uterus, epidermis, liver, lung (for example adenocarcinoma, small cell lung cancer and non-small cell lung carcinomas, squamous lung cancer), oesophagus, head and neck, gall bladder, ovary, pancreas (e.g. exocrine pancreatic carcinoma), stomach, gastrointestinal (also known as gastric) cancer (e.g. gastrointestinal stromal tumours), cervix, endometrium, thyroid, prostate, or skin (for example squamous cell carcinoma  
30 or dermatofibrosarcoma protuberans); pituitary cancer, a hematopoietic tumour of lymphoid lineage, for example leukemia, acute lymphocytic leukemia, chronic lymphocytic leukemia, B-cell lymphoma (e.g. diffuse large B-cell lymphoma, mantle cell lymphoma), T-cell leukaemia/lymphoma, Hodgkin's lymphoma, non-Hodgkin's lymphoma, hairy cell lymphoma, or Burkett's lymphoma; a hematopoietic tumour of

35 myeloid lineage, for example leukemias, acute and chronic myelogenous leukemias, chronic myelomonocytic leukemia (CMML), myeloproliferative disorder, myeloproliferative syndrome, myelodysplastic syndrome, or promyelocytic leukemia;

multiple myeloma; thyroid follicular cancer; hepatocellular cancer, a tumour of mesenchymal origin (e.g. Ewing's sarcoma), for example fibrosarcoma or rhabdomyosarcoma; a tumour of the central or peripheral nervous system, for example astrocytoma, neuroblastoma, glioma (such as glioblastoma multiforme) or

5 schwannoma; melanoma; seminoma; teratocarcinoma; osteosarcoma; xeroderma pigmentosum; keratoctanthoma; thyroid follicular cancer; or Kaposi's sarcoma.

Hence, the invention relates to compounds of Formula (I), the tautomers and the stereoisomeric forms thereof, and the pharmaceutically acceptable salts, and the solvates thereof, for use as a medicament.

10 The invention also relates to the use of a compound of Formula (I), or a tautomer or a stereoisomeric form thereof, or a pharmaceutically acceptable salt, or a solvate thereof, or a pharmaceutical composition according to the invention, for the manufacture of a medicament.

15 The present invention also relates to a compound of Formula (I), or a tautomer or a stereoisomeric form thereof, or a pharmaceutically acceptable salt, or a solvate thereof, or a pharmaceutical composition according to the invention, for use in the treatment, prevention, amelioration, control or reduction of the risk of disorders associated with NF- $\kappa$ B-inducing kinase dysfunction in a mammal, including a human, the treatment or prevention of which is affected or facilitated by inhibition of NF- $\kappa$ B-inducing kinase.

20 Also, the present invention relates to the use of a compound of Formula (I), or a tautomer or a stereoisomeric form thereof, or a pharmaceutically acceptable salt, or a solvate thereof, or a pharmaceutical composition according to the invention, for the manufacture of a medicament for treating, preventing, ameliorating, controlling or reducing the risk of disorders associated with NF- $\kappa$ B-inducing kinase dysfunction in a

25 mammal, including a human, the treatment or prevention of which is affected or facilitated by inhibition of NF- $\kappa$ B-inducing kinase.

30 The invention also relates to a compound of Formula (I), or a tautomer or a stereoisomeric form thereof, or a pharmaceutically acceptable salt, or a solvate thereof, for use in the treatment or prevention of any one of the diseases mentioned hereinbefore.

The invention also relates to a compound of Formula (I), or a tautomer or a stereoisomeric form thereof, or a pharmaceutically acceptable salt, or a solvate thereof, for use in treating or preventing any one of the diseases mentioned hereinbefore.

35 The invention also relates to the use of a compound of Formula (I), or a tautomer or a stereoisomeric form thereof, or a pharmaceutically acceptable salt, or a solvate thereof,

for the manufacture of a medicament for the treatment or prevention of any one of the disease conditions mentioned hereinbefore.

The compounds of the present invention can be administered to mammals, preferably humans, for the treatment or prevention of any one of the diseases mentioned  
5 hereinbefore.

In view of the utility of the compounds of Formula (I), or a tautomer or a stereoisomeric form thereof, or a pharmaceutically acceptable salt, or a solvate thereof, there is provided a method of treating warm-blooded animals, including humans, suffering from any one of the diseases mentioned hereinbefore.

10 Said method comprises the administration, i.e. the systemic or topical administration, preferably oral administration, of a therapeutically effective amount of a compound of Formula (I), or a tautomer or a stereoisomeric form thereof, or a pharmaceutically acceptable salt, or a solvate thereof, to warm-blooded animals, including humans.

Therefore, the invention also relates to a method for the treatment of any one of the  
15 diseases mentioned hereinbefore comprising administering a therapeutically effective amount of compound according to the invention to a patient in need thereof.

One skilled in the art will recognize that a therapeutically effective amount of the compounds of the present invention is the amount sufficient to have therapeutic activity and that this amount varies *inter alias*, depending on the type of disease, the  
20 concentration of the compound in the therapeutic formulation, and the condition of the patient. Generally, the amount of a compound of the present invention to be administered as a therapeutic agent for treating the disorders referred to herein will be determined on a case by case by an attending physician.

Those of skill in the treatment of such diseases could determine the effective  
25 therapeutic daily amount from the test results presented hereinafter. An effective therapeutic daily amount would be from about 0.005 mg/kg to 50 mg/kg, in particular 0.01 mg/kg to 50 mg/kg body weight, more in particular from 0.01 mg/kg to 25 mg/kg body weight, preferably from about 0.01 mg/kg to about 15 mg/kg, more preferably from about 0.01 mg/kg to about 10 mg/kg, even more preferably from about  
30 0.01 mg/kg to about 1 mg/kg, most preferably from about 0.05 mg/kg to about 1 mg/kg body weight. The amount of a compound according to the present invention, also referred to here as the active ingredient, which is required to achieve a therapeutically effect may vary on case-by-case basis, for example with the particular compound, the route of administration, the age and condition of the recipient, and the particular  
35 disorder or disease being treated. A method of treatment may also include administering the active ingredient on a regimen of between one and four intakes per

day. In these methods of treatment the compounds according to the invention are preferably formulated prior to administration. As described herein below, suitable pharmaceutical formulations are prepared by known procedures using well known and readily available ingredients.

5 The present invention also provides compositions for preventing or treating the disorders referred to herein. Said compositions comprising a therapeutically effective amount of a compound of Formula (I), or a tautomer or a stereoisomeric form thereof, or a pharmaceutically acceptable salt, or a solvate thereof, and a pharmaceutically acceptable carrier or diluent.

10 While it is possible for the active ingredient to be administered alone, it is preferable to present it as a pharmaceutical composition. Accordingly, the present invention further provides a pharmaceutical composition comprising a compound according to the present invention, together with a pharmaceutically acceptable carrier or diluent. The carrier or diluent must be "acceptable" in the sense of being compatible with the other 15 ingredients of the composition and not deleterious to the recipients thereof.

The pharmaceutical compositions of this invention may be prepared by any methods well known in the art of pharmacy, for example, using methods such as those described in Gennaro et al. Remington's Pharmaceutical Sciences (18<sup>th</sup> ed., Mack Publishing Company, 1990, see especially Part 8 : Pharmaceutical preparations and their

20 Manufacture). A therapeutically effective amount of the particular compound, in base form or addition salt form, as the active ingredient is combined in intimate admixture with a pharmaceutically acceptable carrier, which may take a wide variety of forms depending on the form of preparation desired for administration. These pharmaceutical compositions are desirably in unitary dosage form suitable, preferably, for systemic 25 administration such as oral, percutaneous or parenteral administration; or topical administration such as via inhalation, a nose spray, eye drops or via a cream, gel, shampoo or the like. For example, in preparing the compositions in oral dosage form, any of the usual pharmaceutical media may be employed, such as, for example, water, glycols, oils, alcohols and the like in the case of oral liquid preparations such as 30 suspensions, syrups, elixirs and solutions; or solid carriers such as starches, sugars, kaolin, lubricants, binders, disintegrating agents and the like in the case of powders, pills, capsules and tablets. Because of their ease in administration, tablets and capsules represent the most advantageous oral dosage unit form, in which case solid pharmaceutical carriers are obviously employed. For parenteral compositions, the 35 carrier will usually comprise sterile water, at least in large part, though other ingredients, for example, to aid solubility, may be included. Injectable solutions, for example, may be prepared in which the carrier comprises saline solution, glucose

solution or a mixture of saline and glucose solution. Injectable suspensions may also be prepared in which case appropriate liquid carriers, suspending agents and the like may be employed. In the compositions suitable for percutaneous administration, the carrier optionally comprises a penetration enhancing agent and/or a suitable wettable agent,

5     optionally combined with suitable additives of any nature in minor proportions, which additives do not cause any significant deleterious effects on the skin. Said additives may facilitate the administration to the skin and/or may be helpful for preparing the desired compositions. These compositions may be administered in various ways, e.g., as a transdermal patch, as a spot-on or as an ointment.

10    It is especially advantageous to formulate the aforementioned pharmaceutical compositions in dosage unit form for ease of administration and uniformity of dosage. Dosage unit form as used in the specification and claims herein refers to physically discrete units suitable as unitary dosages, each unit containing a predetermined quantity of active ingredient calculated to produce the desired therapeutic effect in association

15    with the required pharmaceutical carrier. Examples of such dosage unit forms are tablets (including scored or coated tablets), capsules, pills, powder packets, wafers, injectable solutions or suspensions, teaspoonfuls, tablespoonfuls and the like, and segregated multiples thereof.

20    The present compounds can be used for systemic administration such as oral, percutaneous or parenteral administration; or topical administration such as via inhalation, a nose spray, eye drops or via a cream, gel, shampoo or the like. The compounds are preferably orally administered. The exact dosage and frequency of administration depends on the particular compound of Formula (I) used, the particular condition being treated, the severity of the condition being treated, the age, weight, sex,

25    extent of disorder and general physical condition of the particular patient as well as other medication the individual may be taking, as is well known to those skilled in the art. Furthermore, it is evident that said effective daily amount may be lowered or increased depending on the response of the treated subject and/or depending on the evaluation of the physician prescribing the compounds of the instant invention.

30    The compounds of the present invention may be administered alone or in combination with one or more additional therapeutic agents. Combination therapy includes administration of a single pharmaceutical dosage formulation which contains a compound according to the present invention and one or more additional therapeutic agents, as well as administration of the compound according to the present invention

35    and each additional therapeutic agent in its own separate pharmaceutical dosage formulation. For example, a compound according to the present invention and a therapeutic agent may be administered to the patient together in a single oral dosage

composition such as a tablet or capsule, or each agent may be administered in separate oral dosage formulations.

For the treatment of the above conditions, the compounds of the invention may be advantageously employed in combination with one or more other medicinal agents,

5 more particularly, with other anti-cancer agents or adjuvants in cancer therapy.

Examples of anti-cancer agents or adjuvants (supporting agents in the therapy) include but are not limited to:

- platinum coordination compounds for example cisplatin optionally combined with amifostine, carboplatin or oxaliplatin;

10 - taxane compounds for example paclitaxel, paclitaxel protein bound particles (AbraxaneTM) or docetaxel;

- topoisomerase I inhibitors such as camptothecin compounds for example irinotecan, SN-38, topotecan, topotecan hcl;

- topoisomerase II inhibitors such as anti-tumour epipodophyllotoxins or

15 podophyllotoxin derivatives for example etoposide, etoposide phosphate or teniposide;

- anti-tumour vinca alkaloids for example vinblastine, vincristine or vinorelbine;

- anti-tumour nucleoside derivatives for example 5-fluorouracil, leucovorin, gemcitabine, gemcitabine hcl, capecitabine, cladribine, fludarabine, nelarabine;

- alkylating agents such as nitrogen mustard or nitrosourea for example

20 cyclophosphamide, chlorambucil, carmustine, thiotapec, mephalan (melphalan), lomustine, altretamine, busulfan, dacarbazine, estramustine, ifosfamide optionally in combination with mesna, pipobroman, procarbazine, streptozocin, temozolamide, uracil;

- anti-tumour anthracycline derivatives for example daunorubicin, doxorubicin

25 optionally in combination with dexrazoxane, doxil, idarubicin, mitoxantrone, epirubicin, epirubicin hcl, valrubicin;

- molecules that target the IGF-1 receptor for example picropodophilin;

- tetracarcin derivatives for example tetrocarcin A;

- glucocorticoïden for example prednisone;

30 - antibodies for example trastuzumab (HER2 antibody), rituximab (CD20 antibody), gemtuzumab, gemtuzumab ozogamicin, cetuximab, pertuzumab, bevacizumab, alemtuzumab, eculizumab, ibritumomab tiuxetan, nefertumomab, panitumumab, tositumomab, CNTO 328;

- estrogen receptor antagonists or selective estrogen receptor modulators or inhibitors of estrogen synthesis for example tamoxifen, fulvestrant, toremifene, droloxifene, faslodex, raloxifene or letrozole;

- aromatase inhibitors such as exemestane, anastrozole, letrozole, testolactone and vorozole;
- differentiating agents such as retinoids, vitamin D or retinoic acid and retinoic acid metabolism blocking agents (RAMBA) for example accutane;
- 5 - DNA methyl transferase inhibitors for example azacytidine or decitabine;
- antifolates for example premetrexed disodium;
- antibiotics for example antinomycin D, bleomycin, mitomycin C, dactinomycin, carminomycin, daunomycin, levamisole, plicamycin, mithramycin;
- antimetabolites for example clofarabine, aminopterin, cytosine arabinoside or methotrexate, azacitidine, cytarabine, floxuridine, pentostatin, thioguanine;
- apoptosis inducing agents and antiangiogenic agents such as Bcl-2 inhibitors for example YC 137, BH 312, ABT 737, gossypol, HA 14-1, TW 37 or decanoic acid;
- tubuline-binding agents for example combrestatin, colchicines or nocodazole;
- kinase inhibitors (e.g. EGFR (epithelial growth factor receptor) inhibitors, 15 MTKI (multi target kinase inhibitors), mTOR inhibitors) for example flavoperidol, imatinib mesylate, erlotinib, gefitinib, dasatinib, lapatinib, lapatinib ditosylate, sorafenib, sunitinib, sunitinib maleate, temsirolimus;
- farnesyltransferase inhibitors for example tipifarnib;
- histone deacetylase (HDAC) inhibitors for example sodium butyrate,
- 20 suberoylanilide hydroxamic acid (SAHA), depsipeptide (FR 901228), NVP-LAQ824, R306465, quisinostat, trichostatin A, vorinostat;
- Inhibitors of the ubiquitin-proteasome pathway for example PS-341, MLN .41 or bortezomib;
- Yondelis;
- 25 - Telomerase inhibitors for example telomestatin;
- Matrix metalloproteinase inhibitors for example batimastat, marimastat, prinostat or metastat;
- Recombinant interleukins for example aldesleukin, denileukin diftitox, interferon alfa 2a, interferon alfa 2b, peginterferon alfa 2b;
- 30 - MAPK inhibitors;
- Retinoids for example alitretinoin, bexarotene, tretinoin;
- Arsenic trioxide;
- Asparaginase;
- Steroids for example dromostanolone propionate, megestrol acetate, nandrolone
- 35 (decanoate, phenpropionate), dexamethasone;
- Gonadotropin releasing hormone agonists or antagonists for example abarelix, goserelin acetate, histrelin acetate, leuprolide acetate;
- Thalidomide, lenalidomide;

- Mercaptopurine, mitotane, pamidronate, pegademase, pegaspargase, rasburicase;
- BH3 mimetics for example ABT-737;
- MEK inhibitors for example PD98059, AZD6244, CI-1040;
- 5 - colony-stimulating factor analogs for example filgrastim, pegfilgrastim, sargramostim; erythropoietin or analogues thereof (e.g. darbepoetin alfa); interleukin 11; oprelvekin; zoledronate, zoledronic acid; fentanyl; bisphosphonate; palifermin;
- a steroidal cytochrome P450 17alpha-hydroxylase-17,20-lyase inhibitor (CYP17), e.g. abiraterone, abiraterone acetate.

10 Therefore, an embodiment of the present invention relates to a product containing as first active ingredient a compound according to the invention and as further active ingredient one or more anticancer agent, as a combined preparation for simultaneous, separate or sequential use in the treatment of patients suffering from cancer.

The one or more other medicinal agents and the compound according to the present

15 invention may be administered simultaneously (e.g. in separate or unitary compositions) or sequentially in either order. In the latter case, the two or more compounds will be administered within a period and in an amount and manner that is sufficient to ensure that an advantageous or synergistic effect is achieved. It will be appreciated that the preferred method and order of administration and the respective

20 dosage amounts and regimes for each component of the combination will depend on the particular other medicinal agent and compound of the present invention being administered, their route of administration, the particular tumour being treated and the particular host being treated. The optimum method and order of administration and the dosage amounts and regime can be readily determined by those skilled in the art using

25 conventional methods and in view of the information set out herein.

The weight ratio of the compound according to the present invention and the one or more other anticancer agent(s) when given as a combination may be determined by the person skilled in the art. Said ratio and the exact dosage and frequency of

30 administration depends on the particular compound according to the invention and the other anticancer agent(s) used, the particular condition being treated, the severity of the condition being treated, the age, weight, gender, diet, time of administration and general physical condition of the particular patient, the mode of administration as well as other medication the individual may be taking, as is well known to those skilled in the art. Furthermore, it is evident that the effective daily amount may be lowered or

35 increased depending on the response of the treated subject and/or depending on the evaluation of the physician prescribing the compounds of the instant invention. A particular weight ratio for the present compound of Formula (I) and another anticancer

agent may range from 1/10 to 10/1, more in particular from 1/5 to 5/1, even more in particular from 1/3 to 3/1.

The platinum coordination compound is advantageously administered in a dosage of 1 to 500 mg per square meter (mg/m<sup>2</sup>) of body surface area, for example 50 to 400

5 mg/m<sup>2</sup>, particularly for cisplatin in a dosage of about 75 mg/m<sup>2</sup> and for carboplatin in about 300 mg/m<sup>2</sup> per course of treatment.

The taxane compound is advantageously administered in a dosage of 50 to 400 mg per square meter (mg/m<sup>2</sup>) of body surface area, for example 75 to 250 mg/m<sup>2</sup>, particularly for paclitaxel in a dosage of about 175 to 250 mg/m<sup>2</sup> and for docetaxel in about 75 to

10 150 mg/m<sup>2</sup> per course of treatment.

The camptothecin compound is advantageously administered in a dosage of 0.1 to 400 mg per square meter (mg/m<sup>2</sup>) of body surface area, for example 1 to 300 mg/m<sup>2</sup>, particularly for irinotecan in a dosage of about 100 to 350 mg/m<sup>2</sup> and for topotecan in about 1 to 2 mg/m<sup>2</sup> per course of treatment.

15 The anti-tumour podophyllotoxin derivative is advantageously administered in a dosage of 30 to 300 mg per square meter (mg/m<sup>2</sup>) of body surface area, for example 50 to 250 mg/m<sup>2</sup>, particularly for etoposide in a dosage of about 35 to 100 mg/m<sup>2</sup> and for teniposide in about 50 to 250 mg/m<sup>2</sup> per course of treatment.

20 The anti-tumour vinca alkaloid is advantageously administered in a dosage of 2 to 30 mg per square meter (mg/m<sup>2</sup>) of body surface area, particularly for vinblastine in a dosage of about 3 to 12 mg/m<sup>2</sup>, for vincristine in a dosage of about 1 to 2 mg/m<sup>2</sup>, and for vinorelbine in dosage of about 10 to 30 mg/m<sup>2</sup> per course of treatment.

25 The anti-tumour nucleoside derivative is advantageously administered in a dosage of 200 to 2500 mg per square meter (mg/m<sup>2</sup>) of body surface area, for example 700 to 1500 mg/m<sup>2</sup>, particularly for 5-FU in a dosage of 200 to 500mg/m<sup>2</sup>, for gemcitabine in a dosage of about 800 to 1200 mg/m<sup>2</sup> and for capecitabine in about 1000 to 2500 mg/m<sup>2</sup> per course of treatment.

30 The alkylating agents such as nitrogen mustard or nitrosourea is advantageously administered in a dosage of 100 to 500 mg per square meter (mg/m<sup>2</sup>) of body surface area, for example 120 to 200 mg/m<sup>2</sup>, particularly for cyclophosphamide in a dosage of about 100 to 500 mg/m<sup>2</sup> , for chlorambucil in a dosage of about 0.1 to 0.2 mg/kg, for carmustine in a dosage of about 150 to 200 mg/m<sup>2</sup> , and for lomustine in a dosage of about 100 to 150 mg/m<sup>2</sup> per course of treatment.

The anti-tumour anthracycline derivative is advantageously administered in a dosage of 10 to 75 mg per square meter (mg/m<sup>2</sup>) of body surface area, for example 15 to 60 mg/m<sup>2</sup>, particularly for doxorubicin in a dosage of about 40 to 75 mg/m<sup>2</sup>, for daunorubicin in a dosage of about 25 to 45 mg/m<sup>2</sup>, and for idarubicin in a dosage of 5 about 10 to 15 mg/m<sup>2</sup> per course of treatment.

The antiestrogen agent is advantageously administered in a dosage of about 1 to 100 mg daily depending on the particular agent and the condition being treated. Tamoxifen is advantageously administered orally in a dosage of 5 to 50 mg, preferably 10 to 20 mg twice a day, continuing the therapy for sufficient time to achieve and maintain a 10 therapeutic effect. Toremifene is advantageously administered orally in a dosage of about 60 mg once a day, continuing the therapy for sufficient time to achieve and maintain a therapeutic effect. Anastrozole is advantageously administered orally in a dosage of about 1 mg once a day. Droloxifene is advantageously administered orally in a dosage of about 20-100 mg once a day. Raloxifene is advantageously administered 15 orally in a dosage of about 60 mg once a day. Exemestane is advantageously administered orally in a dosage of about 25 mg once a day.

Antibodies are advantageously administered in a dosage of about 1 to 5 mg per square meter (mg/m<sup>2</sup>) of body surface area, or as known in the art, if different. Trastuzumab is advantageously administered in a dosage of 1 to 5 mg per square meter (mg/m<sup>2</sup>) of 20 body surface area, particularly 2 to 4 mg/m<sup>2</sup> per course of treatment.

These dosages may be administered for example once, twice or more per course of treatment, which may be repeated for example every 7, 14, 21 or 28 days.

The following examples further illustrate the present invention.

## 25 Examples

Several methods for preparing the compounds of this invention are illustrated in the following examples. Unless otherwise noted, all starting materials were obtained from commercial suppliers and used without further purification.

Herein, the term 'Boc' means *tert*-butoxycarbonyl, 'DCE' means 1,2-dichloroethane, 30 'Cs<sub>2</sub>CO<sub>3</sub>' means cesium carbonate, 'DCM' means dichloromethane, 'BEH' means bridged ethylsiloxane/silica hybrid, 'DIAD' means diisopropylazodicarboxylate, 'DIPEA' means diisopropylethylamine, 'DMAP' means *N,N*-dimethylpyridin-4-amine, 'DMF' means *N,N*-dimethylformamide, 'DMSO' means dimethylsulfoxide, 'UPLC' means ultra performance liquid chromatography, 'LC' means liquid chromatography, 35 'EtOAc' means ethyl acetate, 'flash-NH<sub>2</sub>' means ISOLUTE<sup>®</sup> silica polypropylamino weak anion exchange column, 'HPLC' means high performance liquid

chromatography, 'LCMS' means liquid chromatography/mass spectrometry, 'MeCN' means acetonitrile, 'MeOH' means methanol, 'R<sub>t</sub>' means retention time, 'ISOLUTE<sup>®</sup> SCX-2 SPE' means ISOLUTE<sup>®</sup> silica propylsulfonic acid strong cation exchange column, 'SEM' means 2-(trimethylsilyl)ethoxy]-methyl, 'TBAF' means

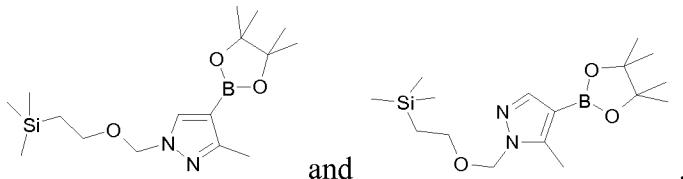
5 tetrabutylammonium fluoride, 'TFA' means trifluoroacetic acid, 'Na<sub>2</sub>SO<sub>4</sub>' means sodium sulfate, 'HATU' means 1-[bis(dimethylamino)methylene]-1H-[1,2,3]triazolo[4,5-b]pyridin-1-ium 3-oxide hexafluorophosphate, 'SFC' means supercritical fluid chromatography, and 'THF' means tetrahydrofuran.

In the structures of the intermediates and the compounds of the present invention,

10 deuterium (<sup>2</sup>H) is represented by the chemical symbol D.

Some intermediates are indicated in the experimental part to appear as mixtures of regioisomers (position isomers). This means that there are two or more positions in the intermediate to which the substituent may be attached, and that the intermediate referred to actually is a mixture of different potential products formed during the

15 synthesis. For example, intermediate 6 , which is indicated as a mixture of regioisomers, is a mixture of



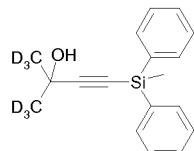
Intermediates were obtained as mixtures of regioisomers or as single regioisomers. The skilled person will realize that mixtures of regioisomers can be easily separated into

20 single regioisomers if desired by methods well-known by the skilled person and as illustrated for some intermediates in the sections below.

## Preparation of intermediates

### Example A1

#### a) Preparation of intermediate 1

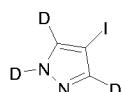


5 A stirred solution of (methyldiphenylsilyl)acetylene (2.0 ml, 9.08 mmol) in anhydrous THF (40 ml) under an argon atmosphere at -78 °C was treated with a 1.6 M solution of *n*-butyllithium in hexanes (6.25 ml, 10.0 mmol) maintaining the temperature below -70 °C. After 1 hour, the mixture was treated with acetone-*d*<sub>6</sub> (0.79 ml, 10.91 mmol) and the resulting mixture stirred at 0 °C for 1.5 hours. The mixture was quenched by the 10 addition of water and partitioned between water and EtOAc. The organic phase was washed with brine, dried over Na<sub>2</sub>SO<sub>4</sub> and concentrated *in vacuo*. The residue was purified by column chromatography on silica gel, eluting with a mixture of EtOAc and cyclohexane (0:1 to 3:7 by volume), to afford the desired product as a colourless oil (2.51 g, 96%).

15

### Example A2

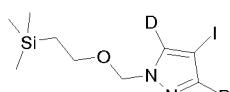
#### a) Preparation of intermediate 2



20 A stirred mixture of iodine (0.21 g, 1.66 mmol), pyrazole-*d*<sub>4</sub> (0.20 g, 2.77 mmol) and MeCN (3.0 ml) at ambient temperature was treated with ammonium ceric nitrate (0.91 g, 1.66 mmol), and the resulting mixture stirred for 3 hours. The mixture was concentrated *in vacuo* and the residue partitioned between 5% aqueous sodium bisulphite solution and EtOAc. The organic phase was washed with brine, dried over Na<sub>2</sub>SO<sub>4</sub> and concentrated *in vacuo*. The residue was purified by column chromatography on silica gel, eluting with a mixture of EtOAc and pentane (0:1 to 7:3 by volume), to afford the desired product as an off-white solid (0.26 g, 47%).

25 LCMS (Method B): R<sub>t</sub> = 2.12 min, m/z [M+H]<sup>+</sup> = 197.

#### b) Preparation of intermediate 3



30

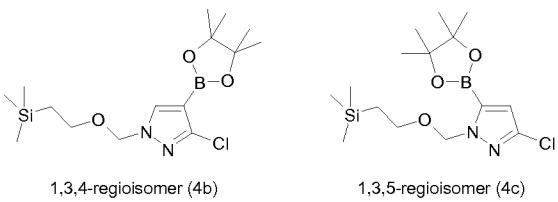
A stirred solution of intermediate 2 (0.26 g, 1.32 mmol) in DMF (3.0 ml) under a nitrogen atmosphere at 0 °C was treated with sodium hydride (0.06 g, 1.58 mmol, 60% in mineral oil). After 15 minutes, the mixture was treated with 2-(trimethylsilyl)ethoxymethyl chloride (0.26 ml, 1.45 mmol) and the resulting mixture 5 was stirred at ambient temperature for 18 hours. The mixture was partitioned between EtOAc and brine. The organic phase was dried over Na<sub>2</sub>SO<sub>4</sub> and concentrated *in vacuo*. The residue was purified by column chromatography on silica gel, eluting with a mixture of pentane and EtOAc (1:0 to 4:1 by volume), to afford the desired product as a yellow oil (0.29 g, 91%).

10 LCMS (Method B): R<sub>t</sub> = 4.09 min, m/z [M+H]<sup>+</sup> = 327.

### Example A3

#### a) Preparation of intermediates 4a, 4b and 4c

15

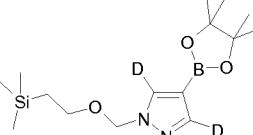


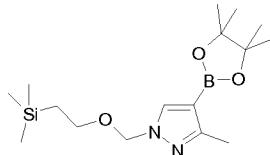
A degassed solution of intermediate 10 (50.0 g, 161 mmol) in anhydrous THF (400 ml) under an argon atmosphere at ambient temperature was treated dropwise with a 2.0 M solution of isopropylmagnesium chloride in THF (121 ml, 242 mmol). After stirring for 1 hour, 2-methoxy-4,4,5,5-tetramethyl-[1,3,2]dioxaborolane (50.9 g, 322 mmol) was 20 added dropwise and the resulting mixture stirred for 1 hour. The mixture was diluted with saturated aqueous ammonium chloride solution and partitioned between water and EtOAc. The organic phase was dried over Na<sub>2</sub>SO<sub>4</sub> and concentrated *in vacuo*. The residue was purified by column chromatography on silica gel, eluting with a mixture of EtOAc and pentane (0:1 to 1:1 by volume), to afford 4a as a colourless oil (57.6 g, 25 100%, mixture of two regioisomers). The regioisomers 4b and 4c (regiochemistry of the SEM groups assumed for intermediates 4b and 4c) were isolated from the isomeric mixture 4a by purification by column chromatography on silica gel, eluting with a mixture of EtOAc and petroleum ether (b.p. 40-60 °C) (1:100 to 1:10 by volume).

30

Intermediate 5 was prepared by using an analogous reaction protocol as described in Example A3 using the appropriate starting material (Table 1).

Table 1:

Intermediate	Structure	Starting Material	LCMS Data
5		Intermediate 3	$R_t = 4.14$ min, m/z $[M+H]^+ = 327$ (Method B)

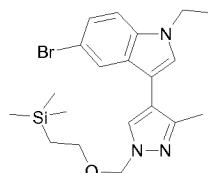
5 Example A4a) Preparation of intermediate 6

A mixture of 3-methylpyrazole-4-boronic acid pinacol ester (0.50 g, 2.40 mmol), 2-(trimethylsilyl)ethoxymethyl chloride (0.53 ml, 3.00 mmol) and DIPEA (1.3 ml, 7.21

10 mmol) in DCM (10 ml) was stirred at ambient temperature for 1.5 hours. The mixture was partitioned between DCM and water. The organic phase was washed with brine, dried over  $\text{Na}_2\text{SO}_4$  and concentrated *in vacuo* to afford the desired product as a pale brown oil (0.81 g, 100%, mixture of two regioisomers).

LCMS (Method D):  $R_t = 4.21$  and 4.32 min, m/z  $[M+H]^+ = 339$ .

15

b) Preparation of intermediate 7

A degassed suspension of intermediate 51 (0.50 g, 1.43 mmol), intermediate 6 (0.65 g, 1.93 mmol), [1,1'-bis(diphenylphosphino)ferrocene]dichloropalladium(II) (0.12 g, 0.14

20 mmol) and potassium carbonate (0.39 g, 2.86 mmol) in DMF (5.5 ml) and water (1.4 ml) was heated at 50 °C for 3.5 hours. The mixture was cooled to ambient temperature and partitioned between water and EtOAc. The organic phase was washed with brine, dried over  $\text{Na}_2\text{SO}_4$  and concentrated *in vacuo*. The residue was purified by column chromatography on silica gel, eluting with a mixture of cyclohexane and EtOAc (19:1 to 7:3 by volume), to afford the desired product as a pale brown oil (0.18 g, 28%, mixture of two regioisomers).

LCMS (Method D):  $R_t = 4.53$  and  $4.61$  min,  $m/z [M+H]^+ = 434/436$ .

Intermediates 8 to 10 were prepared by using an analogous reaction protocol as described for intermediate 6 using the appropriate starting material (Table 2).

5 Table 2:

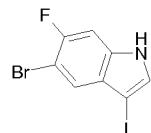
Intermediate	Structure	Starting Material	LCMS Data
8		4-(4,4,5,5-tetramethyl-1,3,2-dioxaborolan-2-yl)-1H-pyrazole	$R_t = 4.16$ min, $m/z [M+H]^+ = 325$ (Method C)
9		4-(4,4,5,5-tetramethyl-1,3,2-dioxaborolan-2-yl)-5-trifluoromethyl-1H-pyrazole	
10		4-Bromo-3-chloro-1H-pyrazole	$R_t = 4.44$ min, $m/z [M+H]^+ = 311/313/315$ (Method C)

Intermediates 11 to 15 were prepared by using an analogous reaction protocol as described for intermediate 7 using the appropriate starting materials (Table 3).

Table 3:

Intermediate	Structure	Starting Materials	LCMS Data
11		a) Intermediate 65 b) Intermediate 8	$R_t = 4.93$ min, $m/z [M+H]^+ = 438/440$ (Method C)
12		a) Intermediate 62 b) Intermediate 4a	
13		a) Intermediate 63 b) Intermediate 8	

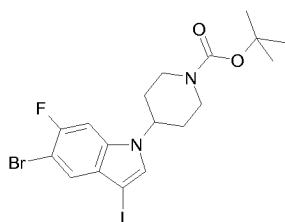
Intermediate	Structure	Starting Materials	LCMS Data
14		a) Intermediate 64 b) Intermediate 8	$R_t = 4.75$ min, $m/z [M+H]^+ = 445/447$ (Method C)
15		a) Intermediate 51 b) Intermediate 9	$R_t = 4.76$ min and $4.89$ min, $m/z [M-SiMe_3+OH+H]^+ = 430/432$ (Method D)

Example A5a) Preparation of intermediate 16

5 A stirred solution of 5-bromo-6-fluoro-1H-indole (2.5 g, 11.7 mmol) in DMF (30 ml) at ambient temperature was treated with potassium hydroxide (2.5 g, 44.6 mmol). After 10 minutes, iodine (4.45 g, 17.5 mmol) was added and the resulting mixture was stirred for 18 hours. The mixture was diluted with water and extracted with EtOAc. The combined extracts were washed with 5% aqueous sodium metabisulphite solution and 10 brine, dried over  $\text{Na}_2\text{SO}_4$  and concentrated *in vacuo*. The residue was purified by column chromatography on silica gel, eluting with a mixture of EtOAc and cyclohexane (0:1 to 2:3 by volume), to afford the desired product as an off-white solid (1.88 g, 47%).

LCMS (Method B):  $R_t = 3.94$  min,  $m/z [M-H]^- = 338/340$ .

15

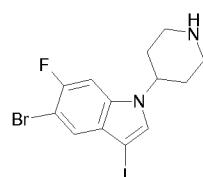
b) Preparation of intermediate 17

A stirred mixture of intermediate 16 (2.1 g, 6.18 mmol),  $\text{Cs}_2\text{CO}_3$  (8.05 g, 24.7 mmol), 4-methanesulfonyloxy-piperidine-1-carboxylic acid *tert*-butyl ester (4.31 g, 15.43

20 mmol) and DMF (50 ml) was heated at 90 °C for 16 hours. A second aliquot of 4-

methanesulfonyloxy-piperidine-1-carboxylic acid *tert*-butyl ester (1.39 g, 5.0 mmol) and Cs<sub>2</sub>CO<sub>3</sub> (2.93 g, 9.0 mmol) was added and the resulting mixture was heated at 90 °C for 6 hours. The mixture was cooled to ambient temperature and partitioned between EtOAc and water. The organic phase was washed with brine, dried over Na<sub>2</sub>SO<sub>4</sub> and 5 concentrated *in vacuo*. The residue was purified by column chromatography on silica gel eluting with a mixture of cyclohexane and EtOAc (1:0 to 1:1 by volume). Further purification by column chromatography on silica gel, eluting with DCM, afforded the desired product as a white solid (0.89 g, 27%).

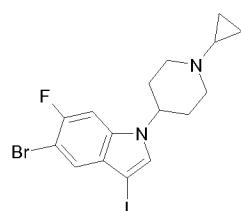
10 c) Preparation of intermediate 18



A stirred solution of intermediate 17 (0.89 g, 1.69 mmol) in DCM (20 ml) at ambient temperature was treated with TFA (1.5 ml, 19.6 mmol) and the resulting mixture was stirred for 2 hours. The mixture was concentrated *in vacuo* and the residue purified by 15 ISOLUTE® SCX-2 SPE column, eluting with a mixture of MeOH and 2.0 M ammonia solution in MeOH (1:0 to 0:1 by volume), to afford the desired product as a pale brown solid (0.67 g, 94%).

LCMS (Method B): R<sub>t</sub> = 2.42 min, m/z [M+H]<sup>+</sup> = 423/425.

20 d) Preparation of intermediate 19

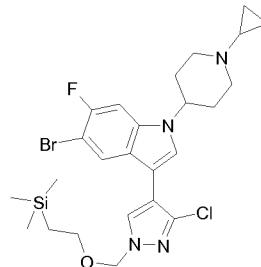


A stirred solution of intermediate 18 (0.67 g, 1.59 mmol) in a mixture of MeOH (7.0 ml) and acetic acid (7.0 ml) under a nitrogen atmosphere at ambient temperature was treated with (1-ethoxycyclopropoxy)trimethylsilane (0.59 g, 3.38 mmol). After 10 25 minutes, the mixture was treated with sodium cyanoborohydride (0.50 g, 7.96 mmol) and the resulting mixture was stirred at 55 °C for 18 hours. The mixture was cooled to ambient temperature and concentrated *in vacuo*. The residue was partitioned between 1.0 M aqueous sodium hydroxide solution and EtOAc. The organic phase was washed with brine, dried over Na<sub>2</sub>SO<sub>4</sub> and concentrated *in vacuo*. The residue was purified by 30 column chromatography on silica gel, eluting with a mixture of 2.0 M ammonia

solution in MeOH and DCM (0:1 to 1:4 by volume), to afford the desired product as a yellow oil (0.61 g, 58%).

LCMS (Method B):  $R_t$  = 2.60 min, m/z  $[M+H]^+$  = 463/465.

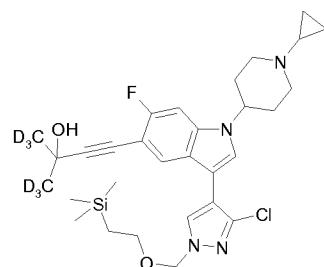
5    e) Preparation of intermediate 20



A degassed suspension of intermediate 19 (0.61 g, 0.93 mmol), intermediate 4b or 4c (0.40 g, 1.12 mmol), [1,1'-bis(diphenylphosphino)ferrocene]dichloropalladium(II) (0.08 g, 0.10 mmol) and  $Cs_2CO_3$  (0.90 g, 2.76 mmol) in 1,4-dioxane (8.0 ml) and water (2.0 ml) was heated at 85 °C for 3 hours. The mixture was cooled to ambient temperature and partitioned between water and EtOAc. The organic phase was washed with brine, dried over  $Na_2SO_4$  and concentrated *in vacuo*. The residue was purified by column chromatography on silica gel eluting with a mixture of DCM and MeOH (1:0 to 9:1 by volume). Further purification by reverse phase preparative HPLC, eluting with a mixture of MeCN and water containing 0.1% formic acid (1:19 to 49:1 by volume) afforded the desired product as a pale yellow solid (0.09 g, 16%; regiochemistry of the SEM group assumed).

LCMS (Method B):  $R_t$  = 3.11 min, m/z  $[M+H]^+$  = 567/569/571.

20    f) Preparation of intermediate 21



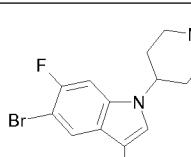
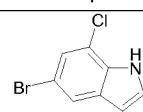
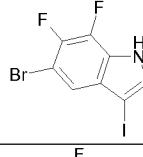
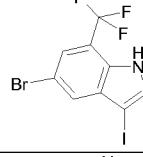
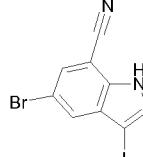
A degassed mixture of intermediate 20 (0.13 g, 0.23 mmol), intermediate 1 (0.49 g, 1.72 mmol), tetrakis(triphenylphosphine) palladium (0.26 g, 0.23 mmol), copper(I) iodide (0.02 g, 0.11 mmol), triethylamine (1.11 ml, 7.96 mmol) and MeCN (8.0 ml) at ambient temperature was treated with 1.0 M solution of tetrabutylammonium fluoride in THF (1.6 ml, 1.6 mmol), and the resulting mixture was heated by microwave irradiation at 100 °C for 1.5 hour. The mixture cooled to ambient temperature and

concentrated *in vacuo*. The residue was purified by column chromatography on silica gel, eluting with a mixture of EtOAc and cyclohexane (0:1 to 1:0 by volume), to afford the desired product as a brown oil (0.03 g, 20%; regiochemistry of the SEM group assumed).

5 LCMS (Method B):  $R_t = 2.88$  min, m/z  $[M+H]^+ = 577/579$ .

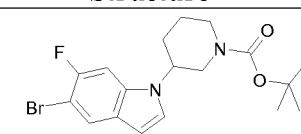
Intermediates 22 to 26 were prepared by using an analogous reaction protocol as described for intermediate 16 using the appropriate starting materials (Table 4).

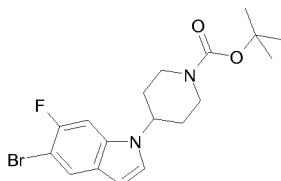
Table 4:

Intermediate	Structure	Starting Material	LCMS Data
22		Intermediate 30	$R_t = 2.66$ min, m/z $[M+H]^+ = 437/439$ (Method A)
23		5-Bromo-7-chloro-1H-indole	
24		5-Bromo-6,7-difluoro-1H-indole	$R_t = 4.17$ min, m/z $[M-H]^- = 356/358$ (Method C)
25		5-Bromo-7-trifluoromethyl-1H-indole	
26		5-Bromo-1H-indole-7-carbonitrile	

Intermediate 27 was prepared by using an analogous reaction protocol as described for intermediate 17 using the appropriate starting materials (Table 5).

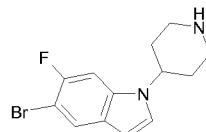
Table 5:

Intermediate	Structure	Starting Materials	LCMS Data
27	 Regiochemistry of the SEM group assumed	a) Intermediate 34 b) 3-Methanesulfonyloxy-piperidine-1-carboxylic acid <i>tert</i> -butyl ester	$R_t = 5.42$ min, $m/z [M+H]^+ = 627/629/631$ (Method C)

5 Example A6a) Preparation of intermediate 28

A stirred mixture of 5-bromo-6-fluoro-1H-indole (1.0 g, 4.67 mmol), powdered KOH (0.52 g, 9.34 mmol) and toluene (40 ml) under a nitrogen atmosphere at ambient

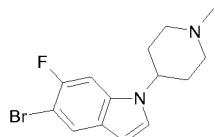
10 temperature was treated with 4-methanesulfonyloxy-piperidine-1-carboxylic acid *tert*-butyl ester (1.31 g, 4.67 mmol), and the resulting mixture was heated at 100 °C 18 hours. The mixture was cooled to ambient temperature and concentrated *in vacuo*. The residue was partitioned between water and EtOAc. The organic phase was dried over Na<sub>2</sub>SO<sub>4</sub> and concentrated *in vacuo*. The residue was purified by column chromatography on silica gel eluting with a mixture of DCM and cyclohexane (3:7 to 1:0 by volume). Further purification by column chromatography on silica gel, eluting with a mixture of DCM and cyclohexane (1:1 to 4:1 by volume), afforded the desired product as a white solid (0.65 g, 31%).

20 b) Preparation of intermediate 29

A stirred solution of intermediate 28 (0.57 g, 1.45 mmol) in DCM (10 ml) at ambient temperature was treated with TFA (5.0 ml, 65 mmol) and the resulting mixture was stirred for 10 minutes. The mixture was concentrated *in vacuo* and the residue purified

by ISOLUTE® SCX-2 SPE column, eluting with a mixture of MeOH and 2.0 M ammonia solution in MeOH (1:0 to 0:1 by volume), to afford the desired product as a pale brown solid (0.53 g, 99%).

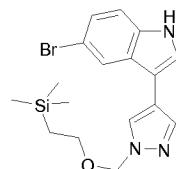
5    c) Preparation of intermediate 30



A stirred mixture of intermediate 29 (0.89 g, 3.0 mmol), 37% aqueous formaldehyde (2.23 ml, 30 mmol), acetic acid (0.01ml, 0.3 mmol) and DCM (30 ml) at ambient temperature was treated with sodium triacetoxyborohydride (1.27 g, 6.0 mmol), and the 10 resulting mixture was stirred for 1 hour. The mixture was concentrated *in vacuo* and the residue partitioned between saturated aqueous sodium hydrogen carbonate solution and EtOAc. The organic phase was washed with brine, dried over Na<sub>2</sub>SO<sub>4</sub> and concentrated *in vacuo*. The residue was purified by column chromatography on silica gel, eluting with a mixture of 2.0 M ammonia solution in MeOH and DCM (0:1 to 1:12 by 15 volume), to afford the desired product as a white solid (0.42 g, 45%).

Example A7

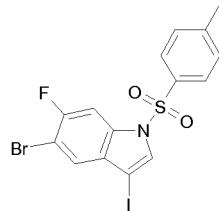
a) Preparation of intermediate 31



20    A stirred solution of intermediate 66 (3.92 g, 7.17 mmol) in THF (150 ml) at ambient temperature was treated with 1.0 M TBAF solution in THF (35.9 ml, 35.9 mmol), and the resulting mixture was heated at 50 °C for 3 hours. A second aliquot of 1.0 M TBAF solution in THF (18.0 ml, 18.0 mmol) was added and the resulting mixture was heated at 60 °C for 78 hours. The mixture was cooled to ambient temperature and partitioned 25 between EtOAc and water. The organic phase was washed with brine, dried over Na<sub>2</sub>SO<sub>4</sub> and concentrated *in vacuo*. The residue was purified by column chromatography on silica gel, eluting with a mixture of petroleum ether (b.p. 40-60°C) and EtOAc (1:0 to 3:2 by volume), to afford the desired product (2.03 g, 72%). LCMS (Method C): R<sub>t</sub> = 4.18 min, m/z [M+H]<sup>+</sup> = 392/394.

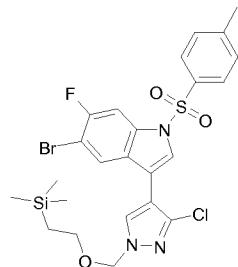
Example A8

## a) Preparation of intermediate 32

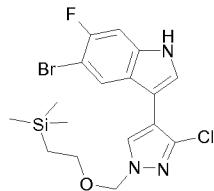


A mixture of intermediate 16 (29.4 g, 86.7 mmol), 4-methylbenzenesulfonyl chloride (16.5 g, 86.7 mmol), NaOH (6.8 g, 152 mmol), benzyltriethylammonium chloride (1.64 g, 8.67 mmol) and anhydrous DCM (52 ml) was stirred at 0 °C for 1 hour and then at ambient temperature for 2 hours. The mixture was partitioned between water and EtOAc. The organic phase was washed with brine, dried over Na<sub>2</sub>SO<sub>4</sub> and concentrated *in vacuo*. The residue was purified by crystallisation from a mixture of EtOAc and petroleum ether (1:1 by volume) to afford the desired product as a white solid (20 g, 47%).

## b) Preparation of intermediate 33

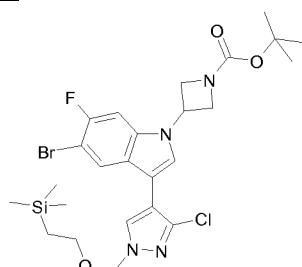


A degassed suspension of intermediate 32 (2.50 g, 5.06 mmol), intermediate 4b or 4c (1.99 g, 5.57 mmol), [1,1'-bis(diphenylphosphino)ferrocene]dichloropalladium(II) (0.42 g, 0.51 mmol) and cesium carbonate (4.95 g, 15.2 mmol) in 1,4-dioxane (35 ml) and water (7.0 ml) was heated at 80 °C for 24 hours. The mixture was cooled to ambient temperature and partitioned between water and EtOAc. The organic phase was washed with brine, dried over Na<sub>2</sub>SO<sub>4</sub> and concentrated *in vacuo*. The residue was purified by column chromatography on silica gel, eluting with a mixture of cyclohexane and EtOAc (1:0 to 4:1 by volume) to afford the desired product as a yellow oil (2.14 g, 71%; regiochemistry of the SEM group assumed).

c) Preparation of intermediate 34

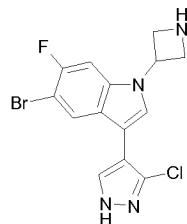
A stirred solution of intermediate 33 (2.1 g, 3.51 mmol) in THF (15 ml) at ambient temperature was treated with sodium methoxide (25% wt. in MeOH, 8.0 ml, 35.0

5 mmol) and the resulting mixture was stirred for 30 minutes. The mixture was concentrated *in vacuo* and the residue partitioned between EtOAc and a saturated aqueous sodium hydrogen carbonate solution. The organic phase was washed with brine, dried over Na<sub>2</sub>SO<sub>4</sub> and concentrated *in vacuo*. The residue was purified by column chromatography on silica gel, eluting with a mixture of cyclohexane and 10 EtOAc (1:0 to 3:2 by volume), to afford the desired product as a purple solid (0.78 g, 50%; regiochemistry of the SEM group assumed).

d) Preparation of intermediate 35

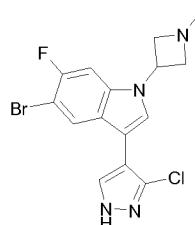
15 A stirred mixture of intermediate 34 (0.78 g, 1.75 mmol), 3-iodo-azetidine-1-carboxylic acid *tert*-butyl ester (0.42 ml, 2.45 mmol) and Cs<sub>2</sub>CO<sub>3</sub> (1.14 g, 3.50 mmol) in DMF (5.0 ml) was heated at 110 °C for 18 hours. The mixture was cooled to ambient temperature and partitioned between EtOAc and water. The organic phase was washed with brine, dried over Na<sub>2</sub>SO<sub>4</sub> and concentrated *in vacuo*. The residue was purified by column chromatography on silica gel, eluting with a mixture of cyclohexane and 20 EtOAc (1:0 to 3:2 by volume), to afford the desired product as a beige foam (0.74 g, 71%; regiochemistry of the SEM group assumed).

LCMS (Method B): R<sub>t</sub> = 4.94 min, m/z [M+H]<sup>+</sup> = 599/601/603.

e) Preparation of intermediate 36

A stirred solution of intermediate 35 (0.74 g, 1.24 mmol) in DCM (14 ml) at ambient temperature was treated with TFA (1.42 ml, 18.6 mmol). After 30 minutes, a second 5 aliquot of TFA (1.42 ml, 18.6 mmol) was added and the resulting mixture was stirred for 2 hours. The mixture was diluted with DCM and purified by ISOLUTE<sup>®</sup> SCX-2 SPE column, eluting with a mixture of MeOH and 2.0 M ammonia solution in MeOH (1:0 to 0:1 by volume), to afford the desired product as a brown oil (0.46 g, 100%). LCMS (Method B):  $R_t$  = 2.12 min, m/z  $[M+H]^+$  = 369/371/373.

10

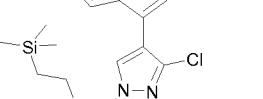
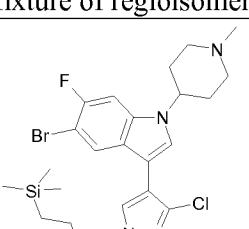
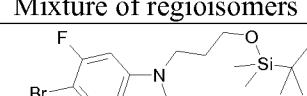
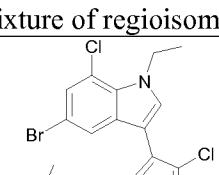
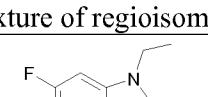
f) Preparation of intermediate 37

A stirred mixture of intermediate 36 (0.22 g, 0.58 mmol), 37% aqueous formaldehyde (0.08 ml, 1.16 mmol), sodium acetate (0.09 g, 0.16 mmol), MeOH (5.0 ml) and DCE (3.0 ml) at 0 °C was treated with sodium triacetoxyborohydride (0.25 g, 1.16 mmol), and the resulting mixture was stirred at ambient temperature for 18 hours. The mixture was concentrated *in vacuo* and the residue purified by ISOLUTE<sup>®</sup> SCX-2 SPE column, eluting with a mixture of MeOH and 2.0 M ammonia solution in MeOH (1:0 to 0:1 by volume), to afford the desired product as a pink solid (0.20 g, 90%). 15 20 LCMS (Method B):  $R_t$  = 2.02 min, m/z  $[M+H]^+$  = 383/385/387.

Intermediates 38 to 43 were prepared by using an analogous reaction protocol as described for intermediate 33 using the appropriate starting materials (Table 6).

Table 6:

Intermediate	Structure	Starting Materials	LCMS Data
38		a) Intermediate 59 b) Intermediate 5	$R_t$ = 4.62 min, m/z $[M+H]^+$ = 440/442 (Method D)

Intermediate	Structure	Starting Materials	LCMS Data
39	 Mixture of regioisomers	a) Intermediate 58 b) Intermediate 4a	$R_t = 4.98$ min and $5.06$ min, $m/z [M+H]^+ = 516/518/520$ (Method C)
40	 Mixture of regioisomers	a) Intermediate 22 b) Intermediate 4a	$R_t = 3.05$ min, $m/z [M+H]^+ = 541/543/545$ (Method C)
41	 Mixture of regioisomers	a) Intermediate 60 b) Intermediate 4a	
42	 Mixture of regioisomers	a) Intermediate 61 b) Intermediate 4a	
43	 Mixture of regioisomers	a) Intermediate 59 b) Intermediate 4a	

Intermediate 44 was prepared by using an analogous reaction protocol as described for intermediate 36 using the appropriate starting material (Table 7).

Table 7:

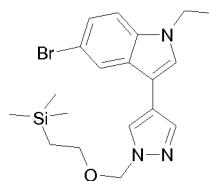
Intermediate	Structure	Starting Material	LCMS Data
44		Intermediate 27	$R_t = 2.20 \text{ min, m/z } [M+H]^+ = 397/399/401$ (Method A)

Intermediate 45 was prepared by using an analogous reaction protocol as described for intermediate 37 using the appropriate starting materials (Table 8).

Table 8:

Intermediate	Structure	Starting Materials	LCMS Data
45		a) Intermediate 44 b) Acetaldehyde	$R_t = 2.39$ min, m/z $[M+H]^+ = 425/427/429$ (Method A)

5

Example A9a) Preparation of intermediate 46

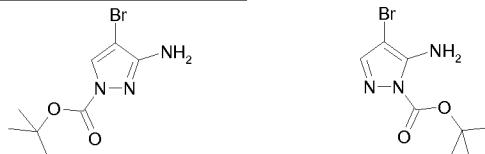
A stirred mixture of intermediate 31 (0.30 g, 0.77 mmol),  $K_2CO_3$  (0.21 g, 1.53 mmol), 10 iodoethane (0.07 ml, 0.84 mmol) and DMF (4.0 ml) was heated at 100 °C for 19 hours. A second aliquot of iodoethane (0.07 ml, 0.84 mmol) was added and the resulting mixture was heated at 100 °C for 6.5 hours. The mixture was cooled to ambient temperature and partitioned between EtOAc and water. The organic phase was washed with brine, dried over  $Na_2SO_4$  and concentrated *in vacuo*. The residue was purified by 15 column chromatography on silica gel, eluting with a mixture of cyclohexane and EtOAc (1:0 to 7:3 by volume), to afford the desired product (0.25 g, 76%). LCMS (Method C):  $R_t = 4.69$  min, m/z  $[M+H]^+ = 420/422$ .

Intermediates 47 to 49 were prepared by using an analogous reaction protocol as 20 described in Example A9 using the appropriate starting materials (Table 9).

Table 9:

Intermediate	Structure	Starting Materials	LCMS Data
47		a) Intermediate 31 b) 2,2-Dimethyl-oxirane	$R_t = 4.31$ min, m/z $[M+H]^+ = 464/466$ (Method C)

Intermediate	Structure	Starting Materials	LCMS Data
48		a) Intermediate 31 b) 2-Bromoethanol	$R_t = 3.89$ min, $m/z [M+H]^+ = 436/438$ (Method D)
49		a) Intermediate 31 b) Iodomethane	$R_t = 4.56$ min, $m/z [M+H]^+ = 406/408$ (Method C)

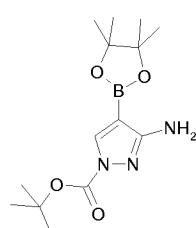
Example A10a) Preparation of intermediates 93a and 93b

5 A stirred solution of 3-amino-4-bromo-1H-pyrazole (1.00 g, 6.17 mmol) and DMAP (0.15 g, 1.23 mmol) in THF (17 ml) at ambient temperature was treated with di-*tert*-butyl dicarbonate (1.48 g, 6.79 mmol), and the resulting mixture was stirred for 2 hours. The mixture was partitioned between DCM and water. The organic phase was washed with brine, dried over  $\text{Na}_2\text{SO}_4$  and concentrated *in vacuo*. The residue was

10 purified by flash chromatography on silica gel, eluting with a mixture of cyclohexane and EtOAc (4:1 to 2:3 by volume) to afford the desired product as a mixture of regioisomers (93a, 1.0 g, 63% and 93b, 0.55 g, 33%; regiochemistry of the Boc group assumed).

LCMS (Method D):  $R_t = 2.74$  min,  $m/z [M+\text{H-}tert\text{-butyl}]^+ = 206/208$ .

15 LCMS (Method D):  $R_t = 2.76$  min,  $m/z [M+\text{H-Boc}]^+ = 162/164$ .

b) Preparation of intermediate 50

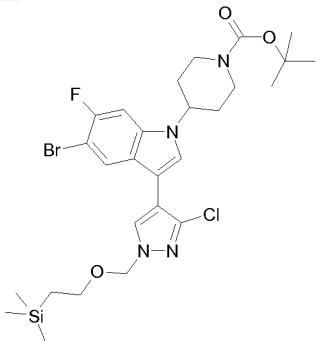
20 A degassed suspension of intermediate 93a (0.25 g, 0.95 mmol), *bis*(pinacolato)diboron (0.30 g, 1.19 mmol), potassium acetate (0.28 g, 2.86 mmol) and [1,1'-

5 bis(diphenylphosphino)ferrocene]dichloropalladium(II) (0.70 g, 0.01 mmol) in DMF (9.5 ml) was heated at 70 °C for 3.5 hours. The mixture was cooled to ambient temperature and partitioned between DCM and water. The organic phase was washed with brine, dried over  $\text{Na}_2\text{SO}_4$  and concentrated *in vacuo* to afford the desired product as a brown oil (2.02 g, 100%; regiochemistry of the boc group assumed).

10 LCMS (Method A):  $R_t = 2.94$  min, m/z  $[\text{M}+\text{H}]^+ = 309$ .

Example A11

a) Preparation of intermediate 94

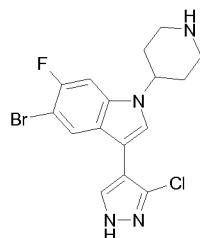


10

A stirred mixture of intermediate 34 (2.0 g, 4.50 mmol),  $\text{Cs}_2\text{CO}_3$  (5.86 g, 17.9 mmol), 4-methanesulfonyloxy-piperidine-1-carboxylic acid *tert*-butyl ester (2.51 g, 8.98 mmol) and DMF (20 ml) was heated at 90 °C for 18 hours. A second portion of 4-methanesulfonyloxy-piperidine-1-carboxylic acid *tert*-butyl ester (2.51 g, 8.98 mmol) and  $\text{Cs}_2\text{CO}_3$  (2.93 g, 8.98 mmol) was added and the resulting mixture was heated at 90 °C for 24 hours. The mixture was cooled to ambient temperature and partitioned between EtOAc and water. The organic phase was washed with brine, dried over  $\text{Na}_2\text{SO}_4$  and concentrated *in vacuo*. The residue was purified by column chromatography on silica gel, eluting with a mixture of cyclohexane and EtOAc (1:0 to 0:1 by volume), to afford the desired product as a pale yellow oil (2.80 g, 99%).

15 LCMS (Method C):  $R_t = 5.26$  min, m/z  $[\text{M}+\text{H}]^+ = 627/629/631$ .

b) Preparation of intermediate 95

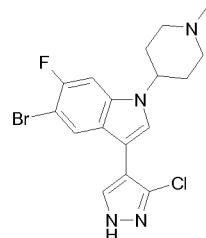


25 A stirred solution of intermediate 94 (2.80 g, 4.46 mmol) in DCM (5.0 ml) at ambient temperature was treated with TFA (2.5 ml, 32.7 mmol) and the resulting mixture was

stirred for 20 hours. The mixture was concentrated *in vacuo* and the residue purified by ISOLUTE<sup>®</sup> SCX-2 SPE column, eluting with a mixture of MeOH and 2.0 M ammonia solution in MeOH (1:0 to 0:1 by volume), to afford the desired product as a white solid (1.74 g, 98%).

5 LCMS (Method C):  $R_t$  = 2.27 min, m/z [M+H]<sup>+</sup> = 397/399/401.

c) Preparation of intermediate 96

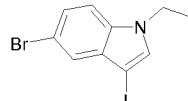


A stirred mixture of intermediate 95 (1.74 g, 4.39 mmol), 37% aqueous formaldehyde (0.20 g, 6.57 mmol), sodium acetate (0.72 g, 8.78 mmol), DCM (20 ml) and MeOH (10 ml) at ambient temperature was treated with sodium triacetoxyborohydride (1.40 g, 6.60 mmol), and the resulting mixture was stirred for 20 hours. The mixture was concentrated *in vacuo* and the residue purified by ISOLUTE<sup>®</sup> SCX-2 SPE column, eluting with a mixture of MeOH and 2.0 M ammonia solution in MeOH (1:0 to 0:1 by volume), to afford the desired product as a pale yellow solid (1.69 g, 94%).

10 LCMS (Method C):  $R_t$  = 2.26 min, m/z [M+H]<sup>+</sup> = 411/413/415.

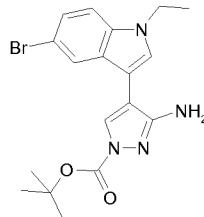
Example A12

a) Preparation of intermediate 51



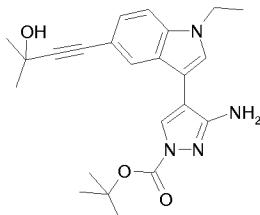
20 A stirred solution of 5-bromo-3-iodo-1H-indole (7.88 g, 24.48 mmol) in DMF (100 ml) at 0 °C was treated with sodium hydride (1.96 g, 49.0 mmol, 60% in mineral oil). After 30 minutes, the mixture was treated with a second aliquot of iodoethane (3.94 ml, 49.0 mmol) and the resulting mixture was stirred at ambient temperature for 1.5 hour. The mixture was partitioned between EtOAc and brine. The organic phase was dried over Na<sub>2</sub>SO<sub>4</sub> and concentrated *in vacuo*. The residue was purified by column chromatography on silica gel, eluting with a mixture of cyclohexane and EtOAc (1:0 to 4:1 by volume), to afford the desired product (7.38 g, 86%).

25 LCMS (Method D):  $R_t$  = 4.34 min, m/z [M+H]<sup>+</sup> = 349/351.

b) Preparation of intermediate 52

A degassed suspension of intermediate 51 (0.36 g, 1.03 mmol), intermediate 50 (0.43 g, 5 1.39 mmol), [1,1'-bis(diphenylphosphino)ferrocene]dichloropalladium(II) (0.08 g, 0.10 mmol) and potassium carbonate (0.28 g, 2.06 mmol) in DMF (4.0 ml) and water (1.0 ml) was heated at 50 °C for 5.5 hours. The mixture was cooled to ambient temperature and partitioned between water and EtOAc. The organic phase was washed with brine, dried over Na<sub>2</sub>SO<sub>4</sub> and concentrated *in vacuo*. The residue was purified by column 10 chromatography on silica gel, eluting with a mixture of cyclohexane and EtOAc (1:0 to 4:1 by volume), to afford the desired product as a pale brown oil (0.06 g, 14%; regiochemistry of the Boc group assumed).

LCMS (Method D): R<sub>t</sub> = 3.82 min, m/z [M-(*tert*-butyl)+H]<sup>+</sup> = 405/407.

15 c) Preparation of intermediate 53

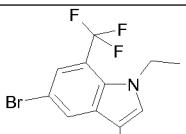
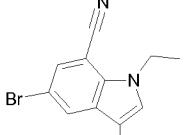
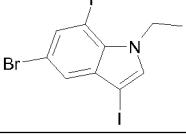
A degassed suspension of intermediate 52 (0.06 g, 0.15 mmol), 2-methyl-3-butyn-2-ol (0.10 ml, 1.02 mmol), tetrakis(triphenylphosphine)palladium(0) (0.025 g, 0.022 mmol), copper(I) iodide (0.003 g, 0.015 mmol) and triethylamine (0.14 ml, 1.02 mmol) in 20 MeCN (2.0 ml) was heated at 75 °C by microwave irradiation for 1.5 hours. The mixture was cooled to ambient temperature and concentrated *in vacuo*. The residue was purified by column chromatography on silica gel, eluting with a mixture of cyclohexane and EtOAc (1:1 to 0:1 by volume), to afford the desired product (0.04 g, 64%; regiochemistry of the Boc group assumed).

25 LCMS (Method D): R<sub>t</sub> = 3.30 min, m/z [M+H]<sup>+</sup> = 409.

Intermediates 54 to 65 were prepared by using an analogous reaction protocol as described for intermediate 51 using the appropriate starting materials (Table 10).

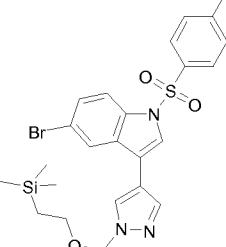
Table 10:

Intermediate	Structure	Starting Materials	LCMS Data
54		a) Intermediate 31 b) 3-Bromomethyl-tetrahydrofuran	$R_t = 4.50$ min, m/z [M+H] <sup>+</sup> = 476/478 (Method C)
55		a) Intermediate 31 b) Toluene-4-sulfonic acid oxetan-3-yl methyl ester	$R_t = 4.23$ min, m/z [M+H] <sup>+</sup> = 462/464 (Method B)
56		a) Intermediate 31 b) 1-Bromo-2-methoxy-ethane	$R_t = 4.41$ min, m/z [M+H] <sup>+</sup> = 450/452 (Method B)
57		a) Intermediate 31 b) 2-Iodopropane	$R_t = 4.80$ min, m/z [M+H] <sup>+</sup> = 434/436 (Method C)
58		a) Intermediate 16 b) 1-Bromo-3-methoxypropane	
59		a) Intermediate 16 b) Iodoethane	$R_t = 4.55$ min, m/z [M+H] <sup>+</sup> = 367/369 (Method C)
60		a) Intermediate 16 b) (3-Bromo-2-propoxy)-tert-butyl-dimethyl-silane	
61		a) Intermediate 23 b) Iodoethane	
62		a) Intermediate 24 b) Iodoethane	

Intermediate	Structure	Starting Materials	LCMS Data
63		a) Intermediate 25 b) Iodoethane	
64		a) Intermediate 26 b) Iodoethane	
65		a) 5-Bromo-7-fluoro-3-iodo-1H-indole b) Iodoethane	

Intermediate 66 was prepared by using an analogous reaction protocol as described for intermediate 52 using the appropriate starting materials (Table 11).

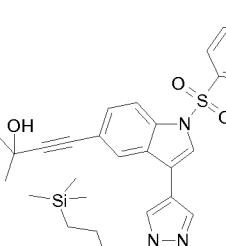
Table 11:

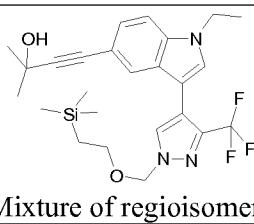
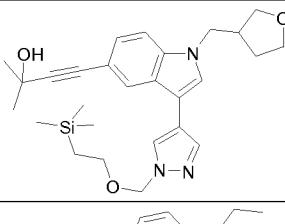
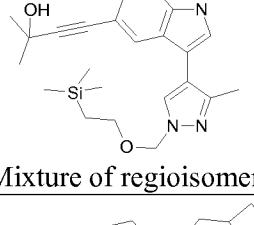
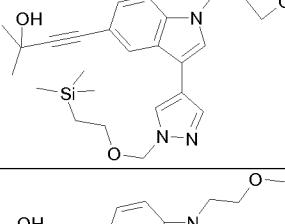
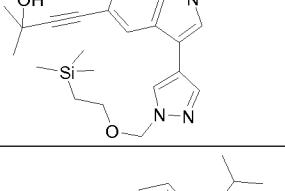
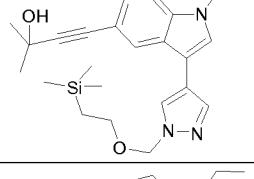
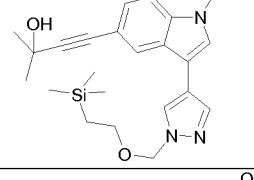
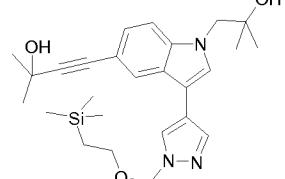
Intermediate	Structure	Starting Materials	LCMS Data
66		a) 5-Bromo-3-iodo-1-(toluene-4-sulfonyl)-1H-indole b) Intermediate 8	R <sub>t</sub> = 4.90 min, m/z [M+H] <sup>+</sup> = 546/548 (Method B)

5

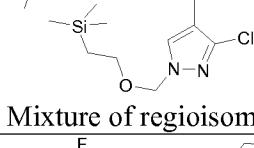
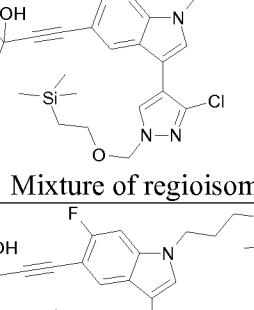
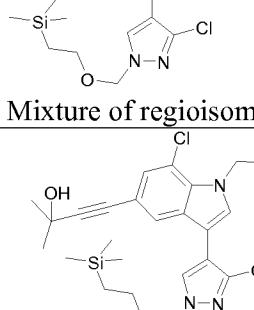
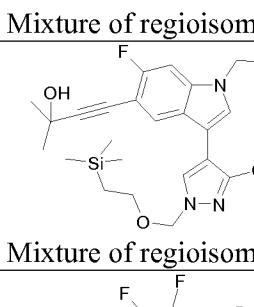
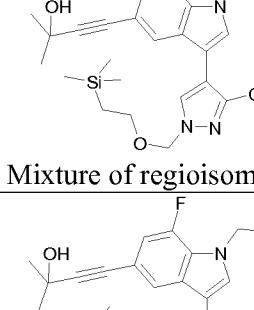
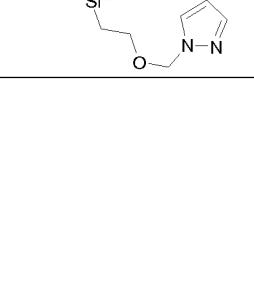
Intermediates 67 to 92 were prepared by using an analogous reaction protocol as described for intermediate 53 using the appropriate starting materials (Table 12).

Table 12:

Intermediate	Structure	Starting Materials	LCMS Data
67		a) Intermediate 66 b) 2-Methyl-but-3-yn-2-ol	R <sub>t</sub> = 4.49 min, m/z [M+H] <sup>+</sup> = 550 (Method C)

Intermediate	Structure	Starting Materials	LCMS Data
68	 Mixture of regioisomers	a) Intermediate 15 b) 2-Methyl-but-3-yn-2-ol	$R_t = 4.38/4.45$ min, $m/z [M-OH]^+ = 474$ (Method D)
69		a) Intermediate 54 b) 2-Methyl-but-3-yn-2-ol	$R_t = 3.97$ min, $m/z [M+H]^+ = 480$ (Method C)
70	 Mixture of regioisomers	a) Intermediate 7 b) 2-Methyl-but-3-yn-2-ol	$R_t = 4.01/4.10$ min, $m/z [M+H]^+ = 438$ (Method D)
71		a) Intermediate 55 b) 2-Methyl-but-3-yn-2-ol	$R_t = 3.81$ min, $m/z [M+H]^+ = 466$ (Method C)
72		a) Intermediate 56 b) 2-Methyl-but-3-yn-2-ol	$R_t = 4.01$ min, $m/z [M+H]^+ = 454$ (Method C)
73		a) Intermediate 57 b) 2-Methyl-but-3-yn-2-ol	$R_t = 4.24$ min, $m/z [M+H]^+ = 438$ (Method B)
74		a) Intermediate 46 b) 2-Methyl-but-3-yn-2-ol	$R_t = 4.12$ min, $m/z [M+H]^+ = 424$ (Method B)
75		a) Intermediate 47 b) 2-Methyl-but-3-yn-2-ol	$R_t = 3.81$ min, $m/z [M+H]^+ = 468$ (Method C)

Intermediate	Structure	Starting Materials	LCMS Data
76		a) Intermediate 48 b) 2-Methyl-but-3-yn-2-ol	$R_t = 3.56$ min, $m/z [M+H]^+ = 440$ (Method B)
77		a) Intermediate 49 b) 2-Methyl-but-3-yn-2-ol	$R_t = 4.04$ min, $m/z [M+H]^+ = 410$ (Method C)
78		a) Intermediate 31 b) 2-Thiazol-2-yl-but-3-yn-2-ol	$R_t = 3.75$ min, $m/z [M+H]^+ = 465$ (Method C)
79		a) Intermediate 31 b) 1-Ethynyl-cyclopentanol	$R_t = 3.83$ min, $m/z [M+H]^+ = 422$ (Method D)
80		a) Intermediate 38 b) 2-Methyl-but-3-yn-2-ol	$R_t = 4.24$ min, $m/z [M+H]^+ = 444$ (Method B)
81		a) Intermediate 39 b) 2-Cyclopropyl-but-3-yn-2-ol	
82		a) Intermediate 39 b) 2-Methyl-but-3-yn-2-ol	
83		a) Intermediate 40 b) 2-Cyclopropyl-but-3-yn-2-ol	$R_t = 2.95$ min, $m/z [M+H]^+ = 571/573$ (Method C)

Intermediate	Structure	Starting Materials	LCMS Data
84	 Mixture of regioisomers	a) Intermediate 40 b) 2-Methyl-but-3-yn-2-ol	$R_t = 2.83$ min, $m/z [M+H]^+ = 545/547$ (Method A)
85	 Mixture of regioisomers	a) Intermediate 41 b) 2-Cyclopropyl-but-3-yn-2-ol	
86	 Mixture of regioisomers	a) Intermediate 41 b) 2-Methyl-but-3-yn-2-ol	
87	 Mixture of regioisomers	a) Intermediate 42 b) 2-Methyl-but-3-yn-2-ol	
88	 Mixture of regioisomers	a) Intermediate 43 b) 2-Methyl-but-3-yn-2-ol	
89	 Mixture of regioisomers	a) Intermediate 12 b) 2-Methyl-but-3-yn-2-ol	
90	 Mixture of regioisomers	a) Intermediate 11 b) 2-Methyl-but-3-yn-2-ol	$R_t = 4.30$ min, $m/z [M+H]^+ = 442$ (Method C)

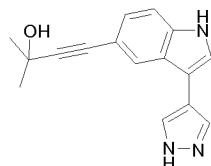
Intermediate	Structure	Starting Materials	LCMS Data
91		a) Intermediate 13 b) 2-Methyl-but-3-yn-2-ol	
92		a) Intermediate 14 b) 2-Methyl-but-3-yn-2-ol	$R_t = 4.26$ min, $m/z [M+H]^+ = 449$ (Method C)

### Preparation of compounds

The values of acid content (e.g. formic acid or acetic acid) in the compounds as provided herein, are those obtained experimentally and may vary when using different analytical methods. The content of formic acid or acetic acid reported herein was determined by  $^1\text{H}$  NMR integration and is reported together with the  $^1\text{H}$  NMR results. Compounds with an acid content of below 0.5 equivalents may be considered as free bases.

10 Example B1

a) Preparation of compound 1



A mixture of intermediate 67 (0.13 g, 0.24 mmol), 1.0 M TBAF solution in THF (1.18 ml, 1.18 mmol) and 1,2-ethylenediamine (0.08 ml, 1.17 mmol) in THF (10 ml) was heated at reflux for 24 hours. The mixture was cooled to ambient temperature, concentrated *in vacuo* and the residue partitioned between EtOAc and brine. The organic phase was dried over  $\text{Na}_2\text{SO}_4$  and concentrated *in vacuo*. The residue was purified by column chromatography on silica gel, eluting with a mixture of cyclohexane and EtOAc (1:1 to 0:1 by volume), followed by a mixture MeOH and EtOAc (0:1 to 1:9 by volume). Further purification by HPLC on C18 column, eluting with a mixture of MeCN and water containing 0.1% ammonia (1:9 to 19:1 by volume), afforded the desired product as an off-white solid (0.017 g, 27%).

<sup>1</sup>H NMR (400 MHz, DMSO-*d*<sub>6</sub>) δ ppm: 12.84 (s, 1H), 11.29 (s, 1H), 7.95 (br. s, 2H), 7.76 (d, *J* = 0.8 Hz, 1H), 7.57 (s, 1H), 7.36 (d, *J* = 8.4 Hz, 1H), 7.11 (dd, *J* = 1.5, 8.4 Hz, 1H), 5.35 (s, 1H), 1.48 (s, 6H).

LCMS (Method E): R<sub>t</sub> = 3.15 min, m/z [M+H]<sup>+</sup> = 266.

5

Compounds 3 to 28 were prepared by using an analogous reaction protocol as described in Example B1 using the appropriate starting material (Table 13).

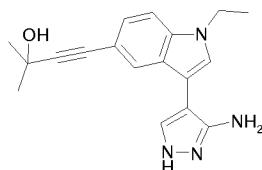
Table 13:

Compound	Structure	Starting Material
3		Intermediate 70
4		Intermediate 68
5		Intermediate 69
6		Intermediate 71
7		Intermediate 72
8		Intermediate 73
9		Intermediate 74

Compound	Structure	Starting Material
10		Intermediate 75
11		Intermediate 76
12		Intermediate 77
13		Intermediate 78
14		Intermediate 79
15		Intermediate 21
16		Intermediate 80
17		Intermediate 81

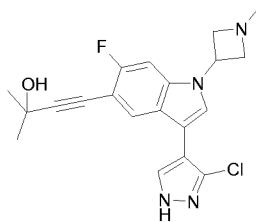
Compound	Structure	Starting Material
18		Intermediate 82
19		Intermediate 83
20		Intermediate 84
21		Intermediate 85
22		Intermediate 86
23		Intermediate 87
24		Intermediate 88
25		Intermediate 89

Compound	Structure	Starting Material
26		Intermediate 90
27		Intermediate 91
28		Intermediate 92

Example B2a) Preparation of compound 2

5 A suspension of intermediate 53 (0.037 g, 0.091 mmol) in MeCN (2.5 ml) was heated by microwave irradiation at 150 °C for 1 hour. The mixture was cooled to ambient temperature and purified by column chromatography on silica gel, eluting with a mixture of DCM and MeOH (1:0 to 9:1 by volume), to afford the desired product as a pale yellow solid (0.013 g, 46%).

10  $^1\text{H}$  NMR (400 MHz,  $\text{CDCl}_3$ )  $\delta$  ppm: 7.75 (s, 1H), 7.54 (s, 1H), 7.32-7.29 (m, 1H), 7.29-7.25 (m, 2H), 7.20 (s, 1H), 5.67 (d,  $J$  = 2.2 Hz, 2H), 4.15 (q,  $J$  = 7.3 Hz, 2H), 1.64 (s, 6H), 1.46 (t,  $J$  = 7.3 Hz, 3H).  
 LCMS (Method E):  $R_t$  = 3.20 min,  $m/z$   $[\text{M}+\text{H}]^+$  = 309.

Example B3a) Preparation of compound 29

A mixture of intermediate 37 (0.20 g, 0.52 mmol), 2-methylbut-3-yn-2-ol (0.11 ml, 5 1.04 mmol), tetrakis(triphenylphosphine) palladium (0.12 g, 0.10 mmol), copper(I) iodide (0.01g, 0.05 mmol), triethylamine (0.51 ml, 3.64 mmol) and MeCN (4.5 ml) was heated by microwave irradiation at 100 °C for 1 hour. The mixture was cooled to ambient temperature and concentrated *in vacuo*. The residue was purified by 10 ISOLUTE® SCX-2 SPE column eluting with a mixture of MeOH and 2.0 M ammonia solution in MeOH (1:0 to 0:1 by volume). Further purification by column chromatography on silica gel, eluting with a mixture of 2.0 M ammonia solution in MeOH and DCM (0:1 to 1:9 by volume), followed by HPLC on C18 column, eluting with a mixture of MeCN and water containing 0.1% of formic acid (1:9 to 7:3), afforded the desired product as a white solid (0.03 g, 13%, 0.9 equivalents of formic acid present).

<sup>1</sup>H NMR (400 MHz, DMSO-*d*<sub>6</sub>) δ ppm: 13.19 (s, 1H), 8.22 (s, 1H), 8.17 (s, 0.9H), 7.87 (s, 1H), 7.64 (d, *J* = 6.9 Hz, 1H), 7.60 (d, *J* = 10.9 Hz, 1H), 5.43 (s, 1H), 5.16-5.08 (m, 1H), 3.78-3.72 (m, 2H), 3.41-3.33 (m, 2H), 2.35 (s, 3H), 1.47 (s, 6H).

LCMS (Method E): R<sub>t</sub> = 2.62 min, m/z [M+H]<sup>+</sup> = 387/389.

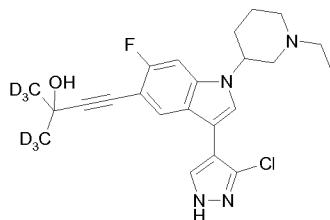
20

Compounds 33 to 37 were prepared by using an analogous reaction protocol as described in Example B3 using the appropriate starting materials (Table 14).

Table 14:

Compound	Structure	Starting Materials
33		a) Intermediate 96 b) 2-Thiazol-2-yl-but-3-yn-2-ol

Compound	Structure	Starting Materials
34		a) Intermediate 96 b) 2-(5-Methyl-isoxazol-3-yl)-but-3-yn-2-ol
35		a) Intermediate 96 b) 2-(5-Methyl-[1,2,4]oxadiazol-3-yl)-but-3-yn-2-ol
36		a) Intermediate 96 b) 1-Ethynylcyclopentanol
37		a) Intermediate 96 b) 2-(pyrimidin-2-yl)but-3-yn-2-ol

Example B4a) Preparation of compound 30

5 A degassed mixture of intermediate 45 (0.24 g, 0.56 mmol), intermediate 1 (0.32 g, 1.11 mmol), tetrakis(triphenylphosphine) palladium (0.13 g, 0.11 mmol), copper iodide (0.01 g, 0.06 mmol), triethylamine (0.54 ml, 3.89 mmol) and MeCN (3.0 ml) under an argon atmosphere at ambient temperature was treated with 1.0 M solution of TBAF in THF (0.28 ml, 0.28 mmol). The resulting mixture was heated by microwave irradiation 10 at 100 °C for 1 hour. The mixture was cooled to ambient temperature and partitioned between water and EtOAc. The organic phase was washed with brine, dried over

Na<sub>2</sub>SO<sub>4</sub> and concentrated *in vacuo*. The residue was purified by column chromatography on silica gel eluting with a mixture of MeOH and DCM (0:1 to 1:9 by volume). Further purification by reverse phase preparative HPLC, eluting with a mixture of acetonitrile and water containing 0.1% formic acid (1:9 to 3:1 by volume),

5 afforded the desired product (0.05 g, 17%, 0.8 equivalents of formic acid present).

<sup>1</sup>H NMR (400 MHz, DMSO-*d*<sub>6</sub>) δ ppm: 13.17 (s, 1H), 8.21 (s, 1H), 8.19 (s, 0.8H), 7.90 (s, 1H), 7.65 (d, *J* = 6.9 Hz, 1H), 7.56 (d, *J* = 10.9 Hz, 1H), 5.41 (s, 1H), 4.58-4.49 (m, 1H), 2.91 (dd, *J* = 2.4, 10.4 Hz, 1H), 2.73 (d, *J* = 11.3 Hz, 1H), 2.46-2.32 (m, 3H), 2.24-2.13 (m, 1H), 1.99-1.90 (m, 1H), 1.84-1.63 (m, 3H), 1.02 (t, *J* = 7.1 Hz, 3H).

10 LCMS (Method E): R<sub>t</sub> = 2.74 min, m/z [M+H]<sup>+</sup> = 435/437.

### Example C1

#### a) Preparation of compounds 31 and 32

Compound 30 (0.04 g, 0.09 mmol) was purified by chiral preparative SFC with the

15 following conditions: column, Phenomenex Lux<sup>®</sup> 5u Cellulose-4, 250 x 21.2 mm, 5 μm; mobile phase, CO<sub>2</sub> (70%), MeOH containing 0.1% diethanolamine (30%), 100 mL/min, 120 bar, 40 °C; detector, UV 240 nm. This afforded Compound 31 (first eluting enantiomer) as an off-white solid (0.01 g, 35%) and Compound 32 (second eluting enantiomer) as an off-white solid (0.01 g, 34%).

20

#### Compound 31

<sup>1</sup>H NMR (400 MHz, DMSO-*d*<sub>6</sub>) δ ppm: 13.16 (s, 1H), 8.20 (s, 1H), 7.89 (s, 1H), 7.64 (d, *J* = 6.9 Hz, 1H), 7.55 (d, *J* = 11.0 Hz, 1H), 5.40 (s, 1H), 4.57-4.48 (m, 1H), 2.90(dd, *J* = 3.1, 10.7 Hz, 1H), 2.70(d, *J* = 11.1 Hz, 1H), 2.47-2.36 (m, 3H), 2.23-2.13 (m, 1H), 1.98-1.90 (m, 1H), 1.83-1.61 (m, 3H), 1.01 (t, *J* = 7.1 Hz, 3H).

LCMS (Method E): R<sub>t</sub> = 2.73 min, m/z [M+H]<sup>+</sup> = 435/437.

#### Compound 32

<sup>1</sup>H NMR (400 MHz, DMSO-*d*<sub>6</sub>) δ ppm: 13.17 (s, 1H), 8.20 (s, 1H), 7.89 (s, 1H), 7.64 (d, *J* = 6.9 Hz, 1H), 7.55 (d, *J* = 11.0 Hz, 1H), 5.40 (s, 1H), 4.57-4.48 (m, 1H), 2.90(dd, *J* = 2.7, 10.5 Hz, 1H), 2.71(d, *J* = 11.0 Hz, 1H), 2.45-2.36 (m, 3H), 2.20-2.15 (m, 1H), 1.96-1.89 (m, 1H), 1.82-1.62 (m, 3H), 1.01 (t, *J* = 7.1 Hz, 3H).

LCMS (Method E): R<sub>t</sub> = 2.73 min, m/z [M+H]<sup>+</sup> = 435/437.

**Analytical Part****LCMS**

Mass Spectrometry (LCMS) experiments to determine retention times and associated mass ions were performed using the following methods:

5

Method A: Experiments were performed on a Waters ZMD quadrupole mass spectrometer linked to a Waters 1525 LC system with a diode array detector. The spectrometer had an electrospray source operating in positive and negative ion mode. Additional detection was achieved using a Sedex 85 evaporative light scattering detector. LC was carried out using a Luna 3micron 30 x 4.6mm C18 column and a 2 mL/minute flow rate. The initial solvent system was 95% water containing 0.1% formic acid (solvent A) and 5% MeCN containing 0.1% formic acid (solvent B) for the first 0.5 minute followed by a gradient up to 5% solvent A and 95% solvent B over the next 4 min. The final solvent system was held constant for a further 1 minute.

10

15

20

Method D: Experiments were performed on a Waters ZQ quadrupole mass spectrometer linked to a Hewlett Packard HP1100 LC system with quaternary pump and PDA detector. The spectrometer had an electrospray source operating in positive and negative ion mode. Additional detection was achieved using a Sedex 65

5 evaporative light scattering detector. LC was carried out using a Phenomenex Luna 3micron 30 x 4.6mm C18 column and a 2 mL/minute flow rate. The initial solvent system was 95% water containing 0.1% formic acid (solvent A) and 5% MeCN containing 0.1% formic acid (solvent B) for the first 0.3 minute followed by a gradient up to 5% solvent A and 95% solvent B over the next 4 min. The final solvent system

10 was held constant for a further 1 minute.

Method E: Experiments were performed on a Waters Micromass ZQ2000 quadrupole mass spectrometer linked to a Waters Acquity UPLC system with a PDA UV detector. The spectrometer had an electrospray source operating in positive and negative ion mode. LC was carried out using an Acquity BEH 1.7micron C18 column, an Acquity BEH Shield 1.7micron RP18 column or an Acquity HST 1.8micron column. Each column has dimensions of 100 x 2.1mm and was maintained at 40°C with a flow rate of 0.4 mL/minute. The initial solvent system was 95% water containing 0.1% formic acid (solvent A) and 5% MeCN containing 0.1% formic acid (solvent B) for the first 0.4

15 minute followed by a gradient up to 5% solvent A and 95% solvent B over the next 5.2 min. The final solvent system was held constant for a further 0.8 min.

#### NMR Data

The NMR experiments herein were carried out using a Varian Unity Inova spectrometer with standard pulse sequences, operating at 400 MHz at ambient temperature. Chemical shifts ( $\delta$ ) are reported in parts per million (ppm) downfield from tetramethylsilane (TMS), which was used as internal standard.  $\text{CDCl}_3$  (deuterated chloroform),  $\text{CD}_3\text{OD}$  (methanol-d) or  $\text{DMSO-}d_6$  (deuterated DMSO, dimethyl-d6 sulfoxide) was used as solvent.

25

30 The values of acid content (e.g. formic acid or acetic acid) in the compounds as provided herein, are those obtained experimentally and may vary when using different analytical methods. The content of formic acid or acetic acid reported herein was determined by  $^1\text{H}$  NMR integration. Compounds with an acid content of below 0.5 equivalents may be considered as free bases.

## Compound 3

<sup>1</sup>H NMR (400 MHz, CDCl<sub>3</sub>) δ ppm: 7.75 (s, 2H), 7.34-7.28 (m, 2H), 7.10 (s, 1H), 6.08 (br. s, 1H), 4.18 (q, J = 7.3 Hz, 2H), 2.38 (s, 3H), 1.64 (s, 6H), 1.48 (t, J = 7.3 Hz, 3H).  
LCMS (Method E): R<sub>t</sub> = 3.89 min, m/z [M+H]<sup>+</sup> = 308.

5

## Compound 4

<sup>1</sup>H NMR (400 MHz, CDCl<sub>3</sub>) δ ppm: 12.25 (s, 1H), 7.91 (s, 1H), 7.73 (s, 1H), 7.31 (s, 2H), 7.29 (s, 1H), 4.20 (q, J = 7.3 Hz, 2H), 1.64 (s, 6H), 1.49 (t, J = 7.3 Hz, 3H).  
LCMS (Method E): R<sub>t</sub> = 4.52 min, m/z [M+H]<sup>+</sup> = 362.

10

## Compound 5

<sup>1</sup>H NMR (400 MHz, DMSO-d<sub>6</sub>) δ ppm: 12.86 (s, 1H), 8.05 (s, 1H), 7.82 (s, 1H), 7.78 (d, J = 1.1 Hz, 1H), 7.68 (s, 1H), 7.53 (d, J = 8.6 Hz, 1H), 7.18 (dd, J = 1.4, 8.6 Hz, 1H), 5.36 (s, 1H), 4.15 (d, J = 7.1 Hz, 2H), 3.87-3.80 (m, 1H), 3.68-3.61 (m, 2H), 3.50-3.45 (m, 1H), 2.81-2.67 (m, 1H), 1.96-1.86 (m, 1H), 1.68-1.58 (m, 1H), 1.49 (s, 6H).  
LCMS (Method E): R<sub>t</sub> = 3.57 min, m/z [M+H]<sup>+</sup> = 350.

## Compound 6

<sup>1</sup>H NMR (400 MHz, DMSO-d<sub>6</sub>) δ ppm: 12.84 (s, 1H), 8.07 (s, 1H), 7.77 (s, 1H), 7.75 (d, J = 1.0 Hz, 1H), 7.64 (s, 1H), 7.53 (d, J = 8.6 Hz, 1H), 7.17 (dd, J = 1.4, 8.6 Hz, 1H), 5.35 (s, 1H), 4.62 (dd, J = 6.2, 7.7 Hz, 2H), 4.47 (d, J = 7.2 Hz, 2H), 4.38 (t, J = 6.2 Hz, 2H), 3.50-3.39 (m, 1H), 1.47 (s, 6H).  
LCMS (Method E): R<sub>t</sub> = 3.31 min, m/z [M+H]<sup>+</sup> = 336.

25

## Compound 7

<sup>1</sup>H NMR (400 MHz, DMSO-d<sub>6</sub>) δ ppm: 12.84 (s, 1H), 8.07 (s, 1H), 7.80 (s, 1H), 7.75 (d, J = 0.9 Hz, 1H), 7.58 (s, 1H), 7.48 (d, J = 8.6 Hz, 1H), 7.15 (dd, J = 1.4, 8.6 Hz, 1H), 5.35 (s, 1H), 4.32 (t, J = 5.2 Hz, 2H), 3.66 (t, J = 5.3 Hz, 2H), 3.21 (s, 3H), 1.47 (s, 6H).

30

LCMS (Method E): R<sub>t</sub> = 3.60 min, m/z [M+H]<sup>+</sup> = 324.

## Compound 8

<sup>1</sup>H NMR (400 MHz, DMSO-d<sub>6</sub>) δ ppm: 12.82 (s, 1H), 8.08 (s, 1H), 7.81 (s, 1H), 7.75 (d, J = 2.4 Hz, 2H), 7.50 (d, J = 8.6 Hz, 1H), 7.15 (dd, J = 1.4, 8.6 Hz, 1H), 5.35 (s, 1H), 4.81-4.70 (m, 1H), 1.45(s, 6H), 1.43 (d, J = 6.7 Hz, 6H).  
LCMS (Method E): R<sub>t</sub> = 4.08 min, m/z [M+H]<sup>+</sup> = 308.

## Compound 9

<sup>1</sup>H NMR (400 MHz, DMSO-*d*<sub>6</sub>) δ ppm: 12.83 (s, 1H), 8.03 (s, 1H), 7.78 (s, 1H), 7.75 (d, J = 0.9 Hz, 1H), 7.63 (s, 1H), 7.47 (d, J = 8.5 Hz, 1H), 7.16 (dd, J = 1.4, 8.5 Hz, 1H), 5.35 (s, 1H), 4.19 (q, J = 7.2 Hz, 2H), 1.47 (s, 6H), 1.37 (t, J = 7.2 Hz, 3H).

5 LCMS (Method E): R<sub>t</sub> = 3.93 min, m/z [M+H]<sup>+</sup> = 294.

## Compound 10

<sup>1</sup>H NMR (400 MHz, DMSO-*d*<sub>6</sub>) δ ppm: 12.83 (s, 1H), 8.05 (s, 1H), 7.78 (s, 1H), 7.73 (d, J = 1.0 Hz, 1H), 7.52 (d, J = 8.9 Hz, 2H), 7.13 (dd, J = 1.4, 8.6 Hz, 1H), 5.34 (s, 1H), 4.66 (s, 1H), 4.05 (s, 2H), 1.47 (s, 6H), 1.10 (s, 6H).

10 LCMS (Method E): R<sub>t</sub> = 3.45 min, m/z [M+H]<sup>+</sup> = 338.

## Compound 11

<sup>1</sup>H NMR (400 MHz, DMSO-*d*<sub>6</sub>) δ ppm: 12.83 (s, 1H), 8.06 (br. s, 1H), 7.80 (br. s, 1H), 7.75 (d, J = 1.0 Hz, 1H), 7.59 (s, 1H), 7.46 (d, J = 8.5 Hz, 1H), 7.15 (dd, J = 1.4, 8.5 Hz, 1H), 5.35 (s, 1H), 4.90 (t, J = 5.3 Hz, 1H), 4.20 (t, J = 5.4 Hz, 2H), 3.72 (q, J = 5.5 Hz, 2H), 1.47 (s, 6H).

LCMS (Method E): R<sub>t</sub> = 3.07 min, m/z [M+H]<sup>+</sup> = 310.

## Compound 12

<sup>1</sup>H NMR (400 MHz, DMSO-*d*<sub>6</sub>) δ ppm: 12.83 (s, 1H), 8.07 (br. s, 1H), 7.78 (br. s, 1H), 7.75 (d, J = 0.9 Hz, 1H), 7.55 (s, 1H), 7.42 (d, J = 8.6 Hz, 1H), 7.17 (dd, J = 1.4, 8.5 Hz, 1H), 5.34 (s, 1H), 3.78 (s, 3H), 1.47 (s, 6H).

LCMS (Method E): R<sub>t</sub> = 3.65 min, m/z [M+H]<sup>+</sup> = 280.

25

## Compound 13

<sup>1</sup>H NMR (400 MHz, DMSO-*d*<sub>6</sub>) δ ppm: 12.80 (s, 1H), 11.32 (d, J = 1.6 Hz, 1H), 8.06 (s, 1H), 7.78 (s, 1H), 7.77 (s, 1H), 7.76 (d, J = 3.5 Hz, 1H), 7.65 (d, J = 3.3 Hz, 1H), 7.58 (d, J = 2.3 Hz, 1H), 7.38 (d, J = 8.4 Hz, 1H), 7.13 (dd, J = 1.5, 8.5 Hz, 1H), 6.89 (s, 1H), 1.88 (s, 3H).

30 LCMS (Method E): R<sub>t</sub> = 3.22 min, m/z [M+H]<sup>+</sup> = 335.

## Compound 14

<sup>1</sup>H NMR (400 MHz, DMSO-*d*<sub>6</sub>) δ ppm: 12.80 (br. s, 1H), 11.26 (d, J = 1.5 Hz, 1H), 8.07 (br. s, 1H), 7.81 (br. s, 1H), 7.76 (s, 1H), 7.57 (d, J = 2.4 Hz, 1H), 7.36 (d, J = 8.4 Hz, 1H), 7.11 (dd, J = 1.5, 8.4 Hz, 1H), 5.20 (s, 1H), 1.96-1.84 (m, 4H), 1.79-1.62 (m, 4H).

LCMS (Method E): R<sub>t</sub> = 3.62 min, m/z [M+H]<sup>+</sup> = 292.

## Compound 15

<sup>1</sup>H NMR (400 MHz, DMSO-*d*<sub>6</sub>) δ ppm: 8.14 (s, 1H), 7.66-7.58 (m, 3H), 5.40 (s, 1H), 4.44-4.35 (m, 1H), 3.06 (d, *J* = 11.6 Hz, 2H), 2.47-2.39 (m, 3H), 1.89-1.87 (m, 2H), 1.60-1.51 (m, 1H), 1.35-1.26 (m, 1H), 0.48-0.42 (m, 2H), 0.35-0.29 (m, 2H).

5 LCMS (Method E): R<sub>t</sub> = 2.80 min, m/z [M+H]<sup>+</sup> = 447/449.

## Compound 16

<sup>1</sup>H NMR (400 MHz, DMSO-*d*<sub>6</sub>) δ ppm: 13.18 (s, 1H), 7.54 (d, *J* = 7.1 Hz, 1H), 7.46 (d, *J* = 10.9 Hz, 1H), 6.51 (s, 1H), 5.43 (s, 1H), 4.23 (q, *J* = 7.1 Hz, 2H), 1.47 (s, 6H), 1.19 (t, *J* = 7.1 Hz, 3H).

10 LCMS (Method E): R<sub>t</sub> = 3.87 min, m/z [M+H]<sup>+</sup> = 314.

## Compound 17

<sup>1</sup>H NMR (400 MHz, DMSO-*d*<sub>6</sub>) δ ppm: 13.16 (s, 1H), 8.22 (s, 1H), 7.64 (d, *J* = 7.0 Hz, 1H), 7.61 (s, 1H), 7.45 (d, *J* = 10.7 Hz, 1H), 5.30 (s, 1H), 4.22 (t, *J* = 6.8 Hz, 2H), 3.24 (t, *J* = 5.9 Hz, 2H), 3.21 (s, 3H), 2.00-1.91 (m, 2H), 1.50 (s, 3H), 1.16-1.08 (m, 1H), 0.59-0.53 (m, 1H), 0.46-0.36 (m, 3H).

LCMS (Method E): R<sub>t</sub> = 4.54 min, m/z [M+H]<sup>+</sup> = 416/418.

## 20 Compound 18

<sup>1</sup>H NMR (400 MHz, DMSO-*d*<sub>6</sub>) δ ppm: 13.17 (s, 1H), 8.23 (s, 1H), 7.66 (d, *J* = 7.0 Hz, 1H), 7.62 (s, 1H), 7.45 (d, *J* = 10.8 Hz, 1H), 5.41 (s, 1H), 4.22 (t, *J* = 6.8 Hz, 2H), 3.24 (t, *J* = 6.0 Hz, 2H), 3.21 (s, 3H), 2.00-1.91 (m, 2H), 1.47 (s, 6H).

LCMS (Method E): R<sub>t</sub> = 4.23 min, m/z [M+H]<sup>+</sup> = 390/392.

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## Compound 19

<sup>1</sup>H NMR (400 MHz, DMSO-*d*<sub>6</sub>) δ ppm: 13.15 (s, 1H), 8.16 (s, 1H), 7.67 (s, 1H), 7.62-7.57 (m, 2H), 5.29 (s, 1H), 4.39-4.30 (m, 1H), 2.88 (d, *J* = 11.5 Hz, 2H), 2.22 (s, 3H), 2.18-2.09 (m, 2H), 2.02-1.89 (m, 4H), 1.50 (s, 3H), 1.16-1.08 (m, 1H), 0.59-0.52 (m, 1H), 0.47-0.35 (m, 3H).

LCMS (Method E): R<sub>t</sub> = 2.89 min, m/z [M+H]<sup>+</sup> = 441/443.

## Compound 20

<sup>1</sup>H NMR (400 MHz, DMSO-*d*<sub>6</sub>) δ ppm: 13.16 (s, 1H), 8.18 (s, 1H), 7.68 (s, 1H), 7.64-7.58 (m, 2H), 5.42 (s, 1H), 4.40-4.29 (m, 1H), 2.88 (d, *J* = 11.5 Hz, 2H), 2.22 (s, 3H), 2.18-2.05 (m, 2H), 2.02-1.87 (m, 4H), 1.47 (s, 6H).

LCMS (Method E): R<sub>t</sub> = 2.64 min, m/z [M+H]<sup>+</sup> = 415/417.

## Compound 21

<sup>1</sup>H NMR (400 MHz, DMSO-*d*<sub>6</sub>) δ ppm: 13.16 (s, 1H), 8.21 (s, 1H), 7.65-7.62 (m, 2H), 7.47 (d, J = 10.7 Hz, 1H), 5.30 (s, 1H), 4.61 (t, J = 4.9 Hz, 1H), 4.23 (t, J = 6.8 Hz, 2H), 3.37 (q, J = 5.7 Hz, 2H), 1.92-1.83 (m, 2H), 1.50 (s, 3H), 1.16-1.08 (m, 1H), 0.59-0.53 (m, 1H), 0.47-0.35 (m, 3H).

LCMS (Method E): R<sub>t</sub> = 3.78 min, m/z [M+H]<sup>+</sup> = 402/404.

## Compound 22

<sup>1</sup>H NMR (400 MHz, DMSO-*d*<sub>6</sub>) δ ppm: 13.16 (s, 1H), 8.23 (s, 1H), 7.66 (d, J = 7.0 Hz, 1H), 7.64 (s, 1H), 7.48 (d, J = 10.7 Hz, 1H), 5.42 (s, 1H), 4.62 (t, J = 4.6 Hz, 1H), 4.23 (t, J = 6.9 Hz, 2H), 3.42-3.35 (m, 2H), 1.93-1.84 (m, 2H), 1.48 (s, 6H).

LCMS (Method E): R<sub>t</sub> = 3.48 min, m/z [M+H]<sup>+</sup> = 376/378.

## Compound 23

<sup>1</sup>H NMR (400 MHz, CD<sub>3</sub>OD) δ ppm: 7.94 (s, 1H), 7.60 (d, J = 1.4 Hz, 1H), 7.54 (s, 1H), 7.21 (d, J = 1.3 Hz, 1H), 4.62 (q, J = 7.3 Hz, 2H), 1.57 (s, 6H), 1.47 (t, J = 7.1 Hz, 3H).

LCMS (Method E): R<sub>t</sub> = 4.88 min, m/z [M+H]<sup>+</sup> = 362/364.

## Compound 24

<sup>1</sup>H NMR (400 MHz, CD<sub>3</sub>OD) δ ppm: 7.95 (s, 1H), 7.66 (d, J = 6.7 Hz, 1H), 7.53 (s, 1H), 7.22 (d, J = 10.3 Hz, 1H), 4.20 (q, J = 7.3 Hz, 2H), 1.57 (s, 6H), 1.44 (t, J = 7.3 Hz, 3H).

LCMS (Method E): R<sub>t</sub> = 4.31 min, m/z [M+H]<sup>+</sup> = 346/348.

## Compound 25

<sup>1</sup>H NMR (400 MHz, CD<sub>3</sub>OD) δ ppm: 7.94 (s, 1H), 7.53 (s, 1H), 7.43 (dd, J = 1.4, 5.7 Hz, 1H), 4.36 (q, J = 7.2 Hz, 2H), 1.57 (s, 6H), 1.46 (t, J = 7.1 Hz, 3H).

LCMS (Method E): R<sub>t</sub> = 4.64 min, m/z [M+H]<sup>+</sup> = 364/366.

## Compound 26

<sup>1</sup>H NMR (400 MHz, CD<sub>3</sub>OD) δ ppm: 7.90 (s, 2H), 7.57 (d, J = 1.2 Hz, 1H), 7.44 (s, 1H), 6.90 (dd, J = 1.1, 13.3 Hz, 1H), 4.34 (q, J = 7.2 Hz, 2H), 1.56 (s, 6H), 1.44 (t, J = 7.1 Hz, 3H).

LCMS (Method E): R<sub>t</sub> = 4.13 min, m/z [M+H]<sup>+</sup> = 312.

## Compound 27

<sup>1</sup>H NMR (400 MHz, CD<sub>3</sub>OD) δ ppm: 8.00 (s, 1H), 7.90 (br. s, 2H), 7.58 (s, 1H), 7.56 (s, 1H), 4.36 (q, J = 7.1 Hz, 2H), 1.58 (s, 6H), 1.42 (t, J = 7.1 Hz, 3H).

LCMS (Method E): R<sub>t</sub> = 4.61 min, m/z [M+H]<sup>+</sup> = 362.

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## Compound 28

<sup>1</sup>H NMR (400 MHz, CD<sub>3</sub>OD) δ ppm: 8.05 (d, J = 1.5 Hz, 1H), 7.98-7.85 (m, 2H), 7.60 (s, 2H), 4.57 (q, J = 7.2 Hz, 2H), 1.58 (s, 6H), 1.52 (t, J = 7.2 Hz, 3H).

LCMS (Method E): R<sub>t</sub> = 3.85 min, m/z [M+H]<sup>+</sup> = 319.

10

## Compound 33 (Formic acid 1.0 equivalents)

<sup>1</sup>H NMR (400 MHz, DMSO-*d*<sub>6</sub>) δ ppm: d 13.22 (s, 1H), 9.51 (s, 1H), 8.26 (s, 1H), 7.77 (d, J = 3.2 Hz, 1H), 7.72 (d, J = 6.9 Hz, 1H), 7.68 (d, J = 3.3 Hz, 1H), 7.64 (d, J = 6.2 Hz, 1H), 7.00 (s, 1H), 4.77-4.67 (m, 1H), 3.62 (d, J = 12.1 Hz, 2H), 3.22-3.12 (m, 2H), 2.88 (s, 3H), 2.29-2.17 (m, 4H), 1.90 (s, 3H).

LCMS (Method E): R<sub>t</sub> = 2.68 min, m/z [M+H]<sup>+</sup> = 484/486.

## Compound 34 (Formic acid 1.0 equivalents)

<sup>1</sup>H NMR (400 MHz, DMSO-*d*<sub>6</sub>) δ ppm: 13.23 (s, 1H), 9.51 (br. s, 1H), 8.26 (s, 1H), 7.73 (d, J = 6.6 Hz, 1H), 7.69-7.62 (m, 2H), 6.48 (s, 1H), 6.35 (d, J = 0.9 Hz, 1H), 4.76-4.67 (m, 1H), 3.63-3.57 (m, 1H), 2.86 (s, 3H), 2.41 (d, J = 0.8 Hz, 3H), 2.28-2.23 (m, 4H), 1.81 (s, 3H).

LCMS (Method E): R<sub>t</sub> = 2.77 min, m/z [M+H]<sup>+</sup> = 482/484.

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## Compound 35 (Formic acid 1.0 equivalents)

<sup>1</sup>H NMR (400 MHz, DMSO-*d*<sub>6</sub>) δ ppm: 13.23 (s, 1H), 9.54 (s, 1H), 8.26 (s, 1H), 7.73 (d, J = 6.8 Hz, 1H), 7.71-7.64 (m, 2H), 6.68 (s, 1H), 4.77-4.68 (m, 1H), 3.62 (d, J = 11.5 Hz, 2H), 3.19 (br. s, 2H), 2.88 (s, 3H), 2.62 (s, 3H), 2.28-2.20 (m, 4H), 1.85 (s, 3H).

30

LCMS (Method E): R<sub>t</sub> = 2.58 min, m/z [M+H]<sup>+</sup> = 483/485.

## Compound 36 (Formic acid 0.5 equivalents)

<sup>1</sup>H NMR (400 MHz, DMSO-*d*<sub>6</sub>) δ ppm: 13.18 (br. s, 1H), 8.20 (s, 1.5H), 7.69 (s, 1H), 7.66-7.64 (m, 1H), 7.63-7.59 (m, 1H), 5.29 (br. s, 1H), 4.42-4.32 (m, 1H), 2.95-2.87

35

(m, 2H), 2.25 (s, 3H), 2.21-2.12 (m, 2H), 2.03-1.88 (m, 8H), 1.77-1.66 (m, 4H).

LCMS (Method E): R<sub>t</sub> = 2.93 min, m/z [M+H]<sup>+</sup> = 441/443.

## Compound 37

LCMS (Method E):  $R_t = 2.50$  min, m/z  $[M+H]^+ = 479/481$ **Pharmacological Part**5 Biological assay A**Inhibition of recombinant human NF-kappaB-inducing kinase (NIK/MAP3K14) activity**

Assay buffer was 50 mM Tris pH 7.5 containing 1 mM EGTA (ethylene glycol tetraacetic acid), 1 mM DTT (dithiothreitol), 0.1 mM  $Na_3VO_4$ , 5 mM  $MgCl_2$ , 0.01% Tween<sup>®</sup> 20. Assays were carried out in 384 well Mesoscale high binding plates which had been coated with myelin basic protein (MBP) and blocked with bovine serum

10 albumin to prevent non-specific protein binding. All compounds tested were dissolved in dimethyl sulfoxide (DMSO) and further dilutions were made in assay buffer. Final DMSO concentration was 1% (v/v) in assays. Incubations consisted of compound (1% DMSO in control and blank wells), 25  $\mu$ M Adenosine-5'-triphosphate (ATP), and 10 nM NIK/MAP3K14 substituting enzyme with buffer in the blank wells. Incubations were carried out for 1h at 25°C and were followed by washing and sequential 15 incubation with rabbit anti-phospho-MBP and anti-rabbit Ig Sulfotag antibody before reading bound Sulfotag on a Mesoscale Discovery. Signal obtained in the wells containing blank samples was subtracted from all other wells and  $IC_{50}$ 's were determined by fitting a sigmoidal curve to % inhibition of control versus  $Log_{10}$  compound concentration.

Biological assay A225 **Inhibition of auto-phosphorylation of recombinant human NF-kappaB-inducing kinase (NIK/MAP3K14) activity (AlphaScreen<sup>®</sup>)**

NIK/MAP3K14 auto-phosphorylation activity was measured using the AlphaScreen<sup>®</sup> (αscreen) format (Perkin Elmer). All compounds tested were dissolved in dimethyl sulfoxide (DMSO) and further dilutions were made in assay buffer. Final DMSO

30 concentration was 1% (v/v) in assays. Assay buffer was 50 mM Tris pH 7.5 containing 1 mM EGTA (ethylene glycol tetraacetic acid), 1 mM DTT (dithiothreitol), 0.1 mM  $Na_3VO_4$ , 5 mM  $MgCl_2$ , 0.01% Tween<sup>®</sup> 20. Assays were carried out in 384 well Alphaplates (Perkin Elmer). Incubations consisted of compound, 25 microM Adenosine-5'-triphosphate (ATP), and 0.2 nM NIK/MAP3K14. Incubations were 35 initiated by addition of GST-tagged NIK/MAP3K14 enzyme, carried out for 1h at 25 °C and terminated by addition of stop buffer containing anti-phospho-IKK Ser176/180 antibody. Protein A Acceptor and Glutathione-Donor beads were added before reading

using an EnVision<sup>®</sup> Multilabel Plate Reader (Perkin Elmer). Signal obtained in the wells containing blank samples was subtracted from all other wells and IC<sub>50</sub>'s were determined by fitting a sigmoidal curve to % inhibition of control versus Log<sub>10</sub> compound concentration.

5

#### Biological assay B

##### **Effect of compounds on P-IKK $\alpha$ levels in L363 cells**

All compounds tested were dissolved in DMSO and further dilutions were made in culture medium. Final DMSO concentration was 1% (v/v) in cell assays. The human

10 L363 cells (ATCC) were cultured in RPMI 1640 medium supplemented with GlutaMax and 10% fetal calf serum (PAA). Cells were routinely maintained at densities of 0.2x10<sup>6</sup> cells per ml – 1x10<sup>6</sup> cells per ml at 37°C in a humidified 5% CO<sub>2</sub> atmosphere. Cells were passaged twice a week splitting back to obtain the low density. Cells were seeded in 96 well plates (Nunc 167008) at 2x10<sup>6</sup> per ml media in a volume of 75  $\mu$ l per 15 well plus 25  $\mu$ l 1  $\mu$ g/ml recombinant human B-cell activating factor (BAFF/BLyS/TNFSF13B). Seeded cells were incubated at 37°C in a humidified 5% CO<sub>2</sub> atmosphere for 24 hr. Drugs and/or solvents were added (20  $\mu$ l) to a final volume of 120  $\mu$ l. Following 2 hr treatment plates were removed from the incubator and cell lysis was achieved by the addition of 30  $\mu$ l 5x lysis buffer followed by shaking on a 20 plate shaker at 4°C for 10 min. At the end of this incubation lysed cells were centrifuged at 800 x g for 20 min at 4°C and the lysate was assessed for P-IKK $\alpha$  levels by sandwich immuno-assay carried out in anti-rabbit antibody coated Mesoscale plates. Within an experiment, the results for each treatment were the mean of 2 replicate wells. For initial screening purposes, compounds were tested using an 8 point dilution curve 25 (serial 1:3 dilutions). For each experiment, controls (containing MG132 and BAFF but no test drug) and a blank incubation (containing MG132 and BAFF and 10 $\mu$ M ADS125117, a test concentration known to give full inhibition) were run in parallel. The blank incubation value was subtracted from all control and sample values. To determine the IC<sub>50</sub> a sigmoidal curve was fitted to the plot of % inhibition of control P- 30 IKK $\alpha$  levels versus Log<sub>10</sub> compound concentration.

#### Biological assay C

##### **Determination of antiproliferative activity on LP-1, L-363 and JJN-3 cells**

All compounds tested were dissolved in DMSO and further dilutions were made in

35 culture medium. Final DMSO concentration was 0.3% (v/v) in cell proliferation assays. Viability was assessed using CellTiter-Glo cell viability assay kit (Promega). The human LP-1, L-363 and JJN-3 cells (DSMZ) were cultured in RPMI 1640 medium

supplemented with 2 mM L-glutamine, and 10% fetal calf serum (PAA). Cells were routinely kept as suspension cells at 37°C in a humidified 5% CO<sub>2</sub> atmosphere. Cells were passaged at a seeding density of 0.2x10<sup>6</sup> /ml twice a week. Cells were seeded in black tissue culture treated 96-well plates (Perkin Elmer). Densities used for plating 5 ranged from 2,000 to 6,000 cells per well in a total volume of 75 µl medium. After twenty four hours, drugs and/or solvents were added (25 µl) to a final volume of 100 µl. Following 72 hr of treatment plates were removed from the incubator and allowed to equilibrate to room temperature for approx 10 min. 100 µl CellTiter-Glo reagent was added to each well that was then covered (Perkin Elmer Topseal) and shaken on plate 10 shaker for 10 min. Luminescence was measured on a HTS Topcount (Perkin Elmer). Within an experiment, the results for each treatment were the mean of 2 replicate wells. For initial screening purposes, compounds were tested using a 9 point dilution curve (serial 1:3 dilutions). For each experiment, controls (containing no drug) and a blank incubation (containing cells read at the time of compound addition) were run in 15 parallel. The blank value was subtracted from all control and sample values. For each sample, the mean value for cell growth (in relative light units) was expressed as a percentage of the mean value for cell growth of the control.

20 Data for the compounds of the invention in the above assays are provided in Table 14 (the values in Table 15 are averaged values over all measurements on all batches of a compound).

Table 15:

Compound	Biochemical (MSD MBP) IC <sub>50</sub> (nM)	Alpha-Screen IC <sub>50</sub> (nM)	IKK $\alpha$ Cellular IC <sub>50</sub> (nM)	JJN-3 EC <sub>50</sub> (nM)	L-363 EC <sub>50</sub> (nM)	LP-1 EC <sub>50</sub> (nM)
<b>1</b>	28	22	122	432	245	320
<b>2</b>	44	43	87	733	990	1420
<b>3</b>	71	35	139	1858	3124	3163
<b>4</b>	581	350	n.c.	n.c.	n.c.	n.c.
<b>5</b>	38	25	145	1408	1828	1886
<b>6</b>	6	66	73	1082	704	1951
<b>7</b>	11	73	175	1408	1175	2179
<b>8</b>	13	14	18	218	221	219
<b>9</b>	8	43	54	418	332	298

Compound	Biochemical (MSD MBP) IC <sub>50</sub> (nM)	Alpha- Screen IC <sub>50</sub> (nM)	IKK $\alpha$ Cellular IC <sub>50</sub> (nM)	JJN-3 EC <sub>50</sub> (nM)	L-363 EC <sub>50</sub> (nM)	LP-1 EC <sub>50</sub> (nM)
<b>10</b>	38	110	111	723	759	947
<b>11</b>	16	65	83	394	340	483
<b>12</b>	41	65	38	754	700	769
<b>13</b>	9	7	16	704	5518	9907
<b>14</b>	30	28	300	2199	4051	5438
<b>15</b>	n.c.	71	n.c.	608	265	581
<b>16</b>	n.c.	8508	n.c.	n.c.	n.c.	14175
<b>17</b>	n.c.	183	n.c.	1517	3242	1397
<b>18</b>	n.c.	33	n.c.	706	1185	1514
<b>19</b>	n.c.	190	n.c.	811	632	749
<b>20</b>	n.c.	21	n.c.	61	43	111
<b>21</b>	n.c.	67	n.c.	1093	1932	3509
<b>22</b>	n.c.	11	32	255	430	1351
<b>23</b>	n.c.	204	n.c.	2738	5402	3612
<b>24</b>	n.c.	11	127	734	683	1578
<b>25</b>	n.c.	86	n.c.	2232	4346	3231
<b>26</b>	n.c.	51	n.c.	1571	1130	2212
<b>27</b>	n.c.	552	n.c.	n.c.	n.c.	n.c.
<b>28</b>	n.c.	554	n.c.	n.c.	n.c.	n.c.
<b>29</b>	n.c.	50	n.c.	375	176	758
<b>30</b>	n.c.	126	n.c.	379	201	397
<b>31</b>	n.c.	146	n.c.	606	436	731
<b>32</b>	n.c.	76	n.c.	437	310	407
<b>33</b>	n.c.	18	n.c.	624	875	1611
<b>34</b>	n.c.	42	n.c.	1385	1224	2451
<b>35</b>	n.c.	84	n.c.	1361	1093	4585
<b>36</b>	n.c.	n.c.	n.c.	1222	845	1213

Compound	Biochemical (MSD MBP) IC <sub>50</sub> (nM)	Alpha- Screen IC <sub>50</sub> (nM)	IKK $\alpha$ Cellular IC <sub>50</sub> (nM)	JJN-3 EC <sub>50</sub> (nM)	L-363 EC <sub>50</sub> (nM)	LP-1 EC <sub>50</sub> (nM)
37	n.c.	162	n.c.	4467	2884	2512

n.c.: not calculated

#### Prophetic composition examples

“Active ingredient” (a.i.) as used throughout these examples relates to a compound of  
 5 Formula (I), including any tautomer or stereoisomeric form thereof, or a pharmaceutically acceptable addition salt, or a solvate thereof; in particular to any one of the exemplified compounds.

Typical examples of recipes for the formulation of the invention are as follows:

##### *1. Tablets*

10	Active ingredient	5 to 50 mg
	Di-calcium phosphate	20 mg
	Lactose	30 mg
	Talcum	10 mg
	Magnesium stearate	5 mg
15	Potato starch	ad 200 mg

##### *2. Suspension*

An aqueous suspension is prepared for oral administration so that each milliliter contains 1 to 5 mg of active ingredient, 50 mg of sodium carboxymethyl cellulose, 1 mg of sodium benzoate, 500 mg of sorbitol and water ad 1 ml.

##### *20 3. Injectable*

A parenteral composition is prepared by stirring 1.5 % (weight/volume) of active ingredient in 0.9 % NaCl solution or in 10 % by volume propylene glycol in water.

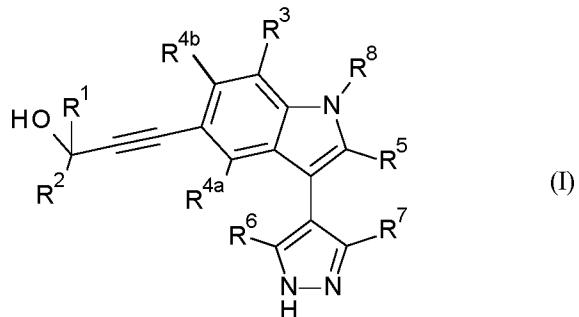
##### *4. Ointment*

25	Active ingredient	5 to 1000 mg
	Stearyl alcohol	3 g
	Lanoline	5 g
	White petroleum	15 g
	Water	ad 100 g

In this Example, active ingredient can be replaced with the same amount of any of the  
 30 compounds according to the present invention, in particular by the same amount of any of the exemplified compounds.

## CLAIMS

1. A compound of Formula (I):



5 or a tautomer or a stereoisomeric form thereof, wherein

R<sup>1</sup> is selected from the group of hydrogen; C<sub>1-4</sub>alkyl; and C<sub>1-4</sub>alkyl substituted with one or more fluoro substituents;

R<sup>2</sup> is selected from the group of hydrogen; C<sub>1-4</sub>alkyl; C<sub>1-4</sub>alkyl substituted with one or more fluoro substituents; C<sub>3-6</sub>cycloalkyl; and Het<sup>1</sup>;

10 Het<sup>1</sup> is a heteroaryl selected from the group of thienyl, thiazolyl, pyrrolyl, oxazolyl, pyrazolyl, imidazolyl, oxadiazolyl, isoxazolyl, isothiazolyl, pyridinyl and pyrimidinyl each of which may be optionally substituted with one or two substituents independently selected from halogen and C<sub>1-4</sub>alkyl;

or R<sup>1</sup> and R<sup>2</sup> together with the carbon atom to which they are attached form a

15 C<sub>3-6</sub>cycloalkyl or a Het<sup>2</sup> group; wherein

Het<sup>2</sup> is a heterocyclyl selected from the group of piperidinyl, tetrahydropyranlyl, pyrrolidinyl, tetrahydrofuranlyl, azetidinyl and oxetanyl, each of which may be optionally substituted with one C<sub>1-4</sub>alkyl; or Het<sup>2</sup> is 2-oxo-3-pyrrolidinyl optionally substituted with one C<sub>1-4</sub>alkyl;

20 R<sup>3</sup> is selected from the group of hydrogen; halogen; cyano; C<sub>1-4</sub>alkyl; and C<sub>1-4</sub>alkyl substituted with one or more fluoro substituents;

R<sup>4a</sup> is selected from the group of hydrogen and halogen;

R<sup>4b</sup> is selected from the group of hydrogen and halogen;

$R^5$  is selected from the group of hydrogen; cyano;  $C_{1-4}$ alkyl;  $C_{1-4}$ alkyl substituted with one or more fluoro substituents;  $C_{1-4}$ alkyl substituted with one substituent selected from the group of  $-NR^{5a}R^{5b}$ ,  $-OC_{1-4}$ alkyl and  $Het^3$ ; wherein

$R^{5a}$  and  $R^{5b}$  are each independently selected from the group of hydrogen and  $C_{1-4}$ alkyl;

5  $Het^3$  is a heterocyclyl selected from the group of piperidinyl, morpholinyl, piperazinyl, tetrahydropyran, pyrrolidinyl, tetrahydrofuran, azetidinyl and oxetanyl, each of which may be optionally substituted with one or two substituents selected from fluoro,  $C_{1-4}$ alkyl,  $-OC_{1-4}$ alkyl,  $C_{3-6}$ cycloalkyl and  $C_{1-4}$ alkyl substituted with one or more fluoro substituents;

10  $R^6$  is selected from the group of hydrogen and halogen;

$R^7$  is selected from the group of hydrogen; halogen; cyano;  $C_{1-4}$ alkyl;  $C_{1-4}$ alkyl substituted with one or more fluoro substituents; and  $-NR^{7a}R^{7b}$ ; wherein

$R^{7a}$  and  $R^{7b}$  are each independently selected from hydrogen and  $C_{1-4}$ alkyl;

$R^8$  is selected from the group of hydrogen;  $-SO_2C_{1-6}$ alkyl;  $Het^4$ ;  $R^9$ ;

15  $C_{1-6}$ alkyl optionally substituted with one or more substituents independently selected from the group of (i)  $Ar^1$  and (ii)  $Het^5$ ; and

$C_{2-6}$ alkyl substituted with one or more substituents independently selected from the group of

(iii) fluoro,

20 (iv)  $-NR^{8a}R^{8b}$ ,

(v)  $-NR^{8c}C(=O)R^{8d}$ ,

(vi)  $-NR^{8c}C(=O)NR^{8a}R^{8b}$ ,

(vii)  $-NR^{8c}C(=O)OR^{8e}$ ,

(viii)  $-NR^{8c}S(=O)_2NR^{8a}R^{8b}$ ,

25 (ix)  $-NR^{8c}S(=O)_2R^{8d}$ ,

(x)  $-OR^{8f}$ ,

(xi)  $-OC(=O)NR^{8a}R^{8b}$ ,

(xii)  $-C(=O)NR^{8a}R^{8b}$ ,

(xiii)  $-S(O)_2R^{8d}$ , and

30 (xiv)  $-S(O)_2NR^{8a}R^{8b}$ ;

$R^{8a}$ ,  $R^{8b}$ ,  $R^{8c}$  and  $R^{8f}$  are each independently selected from the group of hydrogen;

$C_{1-6}$ alkyl;  $C_{3-6}$ cycloalkyl; and  $C_{2-6}$ alkyl substituted with one substituent selected from  $-NR^{8x}R^{8y}$ ,  $-OH$ , and  $-OC_{1-4}$ alkyl;

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$R^{8d}$  is selected from the group of  $C_{1-6}$ alkyl, which may be optionally substituted with one substituent selected from  $-NR^{8x}R^{8y}$ ,  $-OH$ , and  $-OC_{1-4}$ alkyl; and  $C_{3-6}$ cycloalkyl;

$R^{8e}$  is selected from the group of  $C_{1-6}$ alkyl;  $C_{3-6}$ cycloalkyl; and  $C_{2-6}$ alkyl substituted with one substituent selected from  $-NR^{8x}R^{8y}$ ,  $-OH$ , and  $-OC_{1-4}$ alkyl;

5 wherein  $R^{8x}$  and  $R^{8y}$  are each independently selected from hydrogen and  $C_{1-4}$ alkyl;

$R^9$  is  $C_{3-6}$ cycloalkyl optionally substituted with one or two substituents independently selected from fluoro,  $C_{1-4}$ alkyl,  $-OC_{1-4}$ alkyl,

$C_{1-4}$ alkyl substituted with one  $-OC_{1-4}$ alkyl,

and  $C_{1-4}$ alkyl substituted with one or more fluoro substituents;

10  $Ar^1$  is selected from the group of phenyl, thienyl, thiazolyl, pyrrolyl, oxazolyl, pyrazolyl, imidazolyl, isoxazolyl, isothiazolyl, pyridinyl, pyrimidinyl, pyridazinyl and pyrazinyl, each of which may be optionally substituted with one or two substituents independently selected from halogen, cyano,  $C_{1-4}$ alkyl,  $C_{1-4}$ alkyl substituted with one or more fluoro substituents,  $-OC_{1-4}$ alkyl, and  $-OC_{1-4}$ alkyl substituted with one or more fluoro substituents;

15  $Het^4$  is a heterocyclyl, bound through any available carbon atom, selected from the group of piperidinyl, tetrahydropyranyl, pyrrolidinyl, tetrahydrofuranyl, azetidinyl and oxetanyl, each of which may be optionally substituted with one or two substituents independently selected from fluoro,  $C_{1-4}$ alkyl,  $-OC_{1-4}$ alkyl,  $C_{3-6}$ cycloalkyl,  $C_{1-4}$ alkyl

20 substituted with one  $-OC_{1-4}$ alkyl,  $C_{1-4}$ alkyl substituted with one or more fluoro substituents, and  $C_{1-4}$ alkyl substituted with one  $C_{3-6}$ cycloalkyl;

$Het^5$  is a heterocyclyl selected from the group of morpholinyl, piperidinyl, piperazinyl, tetrahydropyranyl, pyrrolidinyl, tetrahydrofuranyl, azetidinyl and oxetanyl, each of which may be optionally substituted with one or two substituents independently

25 selected from fluoro,  $C_{1-4}$ alkyl,  $-OC_{1-4}$ alkyl,  $C_{3-6}$ cycloalkyl,  $C_{1-4}$ alkyl substituted with one  $-OC_{1-4}$ alkyl,  $C_{1-4}$ alkyl substituted with one or more fluoro substituents, and  $C_{1-4}$ alkyl substituted with one  $C_{3-6}$ cycloalkyl;

or a pharmaceutically acceptable addition salt, or a solvate thereof.

30 2. The compound according to claim 1, wherein

$R^1$  is selected from the group of hydrogen;  $C_{1-4}$ alkyl; and  $C_{1-4}$ alkyl substituted with one or more fluoro substituents;

$R^2$  is selected from the group of hydrogen;  $C_{1-4}$ alkyl;  $C_{1-4}$ alkyl substituted with one or more fluoro substituents;  $C_{3-6}$ cycloalkyl; and  $Het^1$ ;

Het<sup>1</sup> is a heteroaryl selected from the group of thienyl, thiazolyl, pyrrolyl, oxazolyl, pyrazolyl, imidazolyl, oxadiazolyl, isoxazolyl, and isothiazolyl, each of which may be optionally substituted with one or two substituents independently selected from halogen and C<sub>1-4</sub>alkyl;

5 or R<sup>1</sup> and R<sup>2</sup> together with the carbon atom to which they are attached form a C<sub>3-6</sub>cycloalkyl; wherein

R<sup>3</sup> is selected from the group of hydrogen; halogen; cyano; C<sub>1-4</sub>alkyl; and C<sub>1-4</sub>alkyl substituted with one or more fluoro substituents;

R<sup>4a</sup> is selected from the group of hydrogen and halogen;

10 R<sup>4b</sup> is selected from the group of hydrogen and halogen;

R<sup>5</sup> is selected from the group of hydrogen;

R<sup>6</sup> is selected from the group of hydrogen;

R<sup>7</sup> is selected from the group of hydrogen; halogen; cyano; C<sub>1-4</sub>alkyl; C<sub>1-4</sub>alkyl substituted with one or more fluoro substituents; and -NR<sup>7a</sup>R<sup>7b</sup>; wherein

15 R<sup>7a</sup> and R<sup>7b</sup> are each independently selected from hydrogen and C<sub>1-4</sub>alkyl;

R<sup>8</sup> is selected from the group of hydrogen; -SO<sub>2</sub>C<sub>1-6</sub>alkyl; Het<sup>4</sup>; R<sup>9</sup>; C<sub>1-6</sub>alkyl optionally substituted with one or more substituents independently selected from the group of (i)

Ar<sup>1</sup> and (ii) Het<sup>5</sup>; and C<sub>2-6</sub>alkyl substituted with one or more -OR<sup>8f</sup> substituents;

R<sup>8f</sup> is selected from the group of hydrogen and C<sub>1-6</sub>alkyl;

20 R<sup>9</sup> is C<sub>3-6</sub>cycloalkyl optionally substituted with one or two substituents independently selected from fluoro, C<sub>1-4</sub>alkyl, -OC<sub>1-4</sub>alkyl,

C<sub>1-4</sub>alkyl substituted with one -OC<sub>1-4</sub>alkyl,

and C<sub>1-4</sub>alkyl substituted with one or more fluoro substituents;

Ar<sup>1</sup> is selected from the group of phenyl, thienyl, thiazolyl, pyrrolyl, oxazolyl,

25 pyrazolyl, imidazolyl, isoxazolyl, isothiazolyl, pyridinyl, pyrimidinyl, pyridazinyl and pyrazinyl, each of which may be optionally substituted with one or two substituents independently selected from halogen, cyano, C<sub>1-4</sub>alkyl, C<sub>1-4</sub>alkyl substituted with one or more fluoro substituents, -OC<sub>1-4</sub>alkyl, and -OC<sub>1-4</sub>alkyl substituted with one or more fluoro substituents;

30 Het<sup>4</sup> is a heterocyclyl, bound through any available carbon atom, selected from the group of piperidinyl, tetrahydropyranyl, pyrrolidinyl, tetrahydrofuranyl, azetidinyl and oxetanyl, each of which may be optionally substituted with one or two substituents independently selected from fluoro, C<sub>1-4</sub>alkyl, -OC<sub>1-4</sub>alkyl, C<sub>3-6</sub>cycloalkyl, C<sub>1-4</sub>alkyl substituted with one -OC<sub>1-4</sub>alkyl, and C<sub>1-4</sub>alkyl substituted with one or more fluoro substituents;

35 Het<sup>5</sup> is a heterocyclyl selected from the group of morpholinyl, piperidinyl, piperazinyl, tetrahydropyranyl, pyrrolidinyl, tetrahydrofuranyl, azetidinyl and oxetanyl, each of

which may be optionally substituted with one or two substituents independently selected from fluoro, C<sub>1-4</sub>alkyl, -OC<sub>1-4</sub>alkyl, C<sub>1-4</sub>alkyl substituted with one -OC<sub>1-4</sub>alkyl, and C<sub>1-4</sub>alkyl substituted with one or more fluoro substituents.

5 3. The compound according to claim 1, wherein  
R<sup>1</sup> is selected from the group of C<sub>1-4</sub>alkyl;  
R<sup>2</sup> is selected from the group of C<sub>1-4</sub>alkyl; C<sub>3-6</sub>cycloalkyl; and Het<sup>1</sup>;  
Het<sup>1</sup> is a heteroaryl selected from the group of thiazolyl, oxadiazolyl, and isoxazolyl, each of which may be optionally substituted with one or two C<sub>1-4</sub>alkyl substituents;  
10 or R<sup>1</sup> and R<sup>2</sup> together with the carbon atom to which they are attached form a C<sub>3-6</sub>cycloalkyl;  
R<sup>3</sup> is selected from the group of hydrogen; halogen; cyano; and C<sub>1-4</sub>alkyl substituted with one or more fluoro substituents;  
R<sup>4a</sup> is hydrogen;  
15 R<sup>4b</sup> is selected from the group of hydrogen and halogen;  
R<sup>5</sup> is hydrogen;  
R<sup>6</sup> is hydrogen;  
R<sup>7</sup> is selected from the group of hydrogen; halogen; C<sub>1-4</sub>alkyl; C<sub>1-4</sub>alkyl substituted with one or more fluoro substituents; and -NR<sup>7a</sup>R<sup>7b</sup>; wherein  
20 R<sup>7a</sup> and R<sup>7b</sup> are each independently selected from hydrogen;  
R<sup>8</sup> is selected from the group of hydrogen; Het<sup>4</sup>; C<sub>1-6</sub>alkyl optionally substituted with one or more Het<sup>5</sup> substituents; and C<sub>2-6</sub>alkyl substituted with one or more -OR<sup>8f</sup> substituents;  
R<sup>8f</sup> is selected from the group of hydrogen and C<sub>1-6</sub>alkyl;  
25 Het<sup>4</sup> is a heterocyclyl, bound through any available carbon atom, selected from the group of piperidinyl and azetidinyl, each of which are substituted with one or two substituents independently selected from C<sub>1-4</sub>alkyl and C<sub>3-6</sub>cycloalkyl;  
Het<sup>5</sup> is a heterocyclyl selected from the group of tetrahydrofuranyl and oxetanyl.  
  
30 4. The compound according to claim 1, wherein  
R<sup>1</sup> is selected from the group of C<sub>1-4</sub>alkyl;  
R<sup>2</sup> is selected from the group of C<sub>1-4</sub>alkyl; and Het<sup>1</sup>;  
Het<sup>1</sup> is thiazolyl;  
R<sup>3</sup> is hydrogen;  
35 R<sup>4a</sup> is hydrogen;  
R<sup>4b</sup> is selected from the group of hydrogen and halogen;  
R<sup>5</sup> is hydrogen;

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$R^6$  is hydrogen;

$R^7$  is selected from the group of hydrogen and halogen;

$R^8$  is selected from the group of hydrogen;  $Het^4$ ;  $C_{1-6}$ alkyl; and  $C_{2-6}$ alkyl substituted with one or more  $-OR^{8f}$  substituents;

5  $R^{8f}$  is  $C_{1-6}$ alkyl;

$Het^4$  is a heterocyclyl, bound through any available carbon atom, selected from the group of piperidinyl and azetidinyl, each of which are substituted on the nitrogen atom with one  $C_{1-4}$ alkyl.

10 5. The compound according to claim 1, wherein

$R^1$  is selected from the group of hydrogen;  $C_{1-4}$ alkyl; and  $C_{1-4}$ alkyl substituted with one or more fluoro substituents;

$R^2$  is selected from the group of hydrogen;  $C_{1-4}$ alkyl;  $C_{1-4}$ alkyl substituted with one or more fluoro substituents;  $C_{3-6}$ cycloalkyl; and  $Het^1$ .

15

6. The compound according to claim 1, wherein  $R^1$  and  $R^2$  together with the carbon atom to which they are attached form a  $C_{3-6}$ cycloalkyl or a  $Het^2$  group.

7. The compound according to claim 1, wherein  $R^8$  is selected from the group of

20 hydrogen;  $Het^4$ ;  $R^9$ ;  $C_{1-6}$ alkyl optionally substituted with one  $Het^5$ ; and  $C_{2-6}$ alkyl substituted with one or more substituents independently selected from the group of fluoro,  $-NR^{8a}R^{8b}$ , and  $-OR^{8f}$ ,

wherein  $R^{8a}$ ,  $R^{8b}$  and  $R^{8f}$  are each independently selected from the group of hydrogen and  $C_{1-6}$ alkyl.

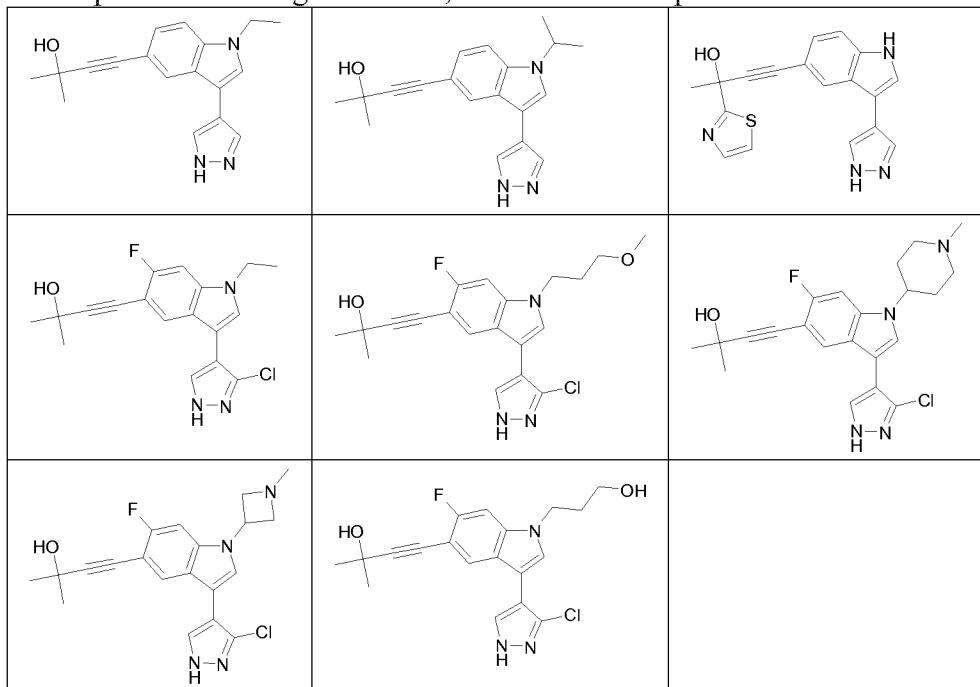
25

8. The compound according to any one of claims 1 to 7 wherein  $R^3$  is hydrogen;  $R^{4a}$  is hydrogen;  $R^5$  is hydrogen;  $R^6$  is hydrogen.

9. The compound according to any one of claims 1 to 8 wherein  $R^7$  is selected from the

30 group of halogen;  $C_{1-4}$ alkyl; and  $-NH_2$ .

10. The compound according to claim 1, wherein the compound is selected from



tautomers and stereoisomeric forms thereof,

and the pharmaceutically acceptable addition salts, and the solvates thereof.

5 11. A pharmaceutical composition comprising a compound as claimed in any one of claims 1 to 10 and a pharmaceutically acceptable carrier or diluent.

12. A compound as claimed in any one of claims 1 to 10 for use as a medicament.

10 13. A compound as claimed in any one of claims 1 to 10 for use in the prevention or treatment of cancer.

14. A pharmaceutical composition as claimed in claim 11 for use in the prevention or treatment of cancer.

15 15. A method of treating or preventing a cell proliferative disease in a warm-blooded animal which comprises administering to the said animal an effective amount of a compound as claimed in any one of claims 1 to 10.

# INTERNATIONAL SEARCH REPORT

International application No  
PCT/EP2015/074433

A. CLASSIFICATION OF SUBJECT MATTER	INV. C07D401/14	C07D413/14	C07D403/04	C07D403/14	C07D407/14
	C07D417/14	A61K31/4155	A61P35/00		

ADD.

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

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

C07D

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

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EPO-Internal, CHEM ABS Data, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	WO 2009/158011 A1 (AMGEN INC [US]; CHEN GUOQING [US]; CUSHING TIMOTHY D [US]; FISHER BENJ) 30 December 2009 (2009-12-30) cited in the application claim 1 page 15 ----- A US 2012/214762 A1 (STABEN STEVEN [US] ET AL) 23 August 2012 (2012-08-23) claims 1, 5 page 1, paragraph [0002] -----	1-15 1-15



Further documents are listed in the continuation of Box C.



See patent family annex.

\* Special categories of cited documents :

- "A" document defining the general state of the art which is not considered to be of particular relevance
- "E" earlier application or patent but published on or after the international filing date
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- "O" document referring to an oral disclosure, use, exhibition or other means
- "P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

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"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
16 November 2015	25/11/2015

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# INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/EP2015/074433

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