

PYRIDIZINONE DERIVATIVES

CROSS-REFERENCE TO RELATED APPLICATIONS

This application claims the benefit of U.S. Provisional Application Serial No. 60/833,164 filed July 25, 2006, the disclosure of which is incorporated herein by reference in its entirety.

FIELD OF THE INVENTION

The present invention is related to pyridizinone derivatives, their use as H₃ inhibitors, processes for their preparation, and pharmaceutical compositions thereof.

BACKGROUND OF THE INVENTION

Histamine is a well established modulator of neuronal activity. At least four subtypes of histamine receptors have been reported in the literature – H₁, H₂, H₃, H₄. The histamine H₃ receptors play a key role in neurotransmission in the central nervous system. The H₃ receptor was discovered in 1983 originally on histamine-containing neurons where it was shown to function presynaptically, regulating the release and synthesis of the biogenic amine histamine (Arrang et al, 1983) now a well established neurotransmitter. H₃ receptors are predominately expressed in the brain, localizing to the cerebral cortex, amygdala, hippocampus, striatum, thalamus and hypothalamus. H₃ receptors are also localized presynaptically on histaminergic nerve terminals and act as inhibitory autoreceptors (Alguacil and Perez-Garcia, 2003; Passani et al, 2004; Leurs et al, 2005; Celanire et al, 2005; Witkin and Nelson, 2004). When these receptors are activated by histamine, histamine release is inhibited. H₃ receptors can also be found in the periphery (skin, lung, cardiovascular system, intestine, GI tract, etc). H₃ receptors are also involved in presynaptic regulation of the release of acetylcholine, dopamine, GABA, glutamate and serotonin (see Repka-Ramirez, 2003; Chazot and Hann, 2001; Leurs et al, 1998). The H₃ receptor demonstrates a high degree of constitutive or spontaneous activity (e.g., receptor is active in the absence of agonist stimulation) *in vitro* and *in vivo*, thus, ligands to the receptor can display, agonist, neutral antagonist or inverse agonist effects.

The location and function of histaminergic neurons in the CNS suggests that compounds interacting with the H₃ receptor may have utility in a number of therapeutic

applications including narcolepsy or sleep/wake disorders, feeding behavior, eating disorders, obesity, cognition, arousal, memory, mood disorders, mood attention alteration, attention deficit hyperactivity disorder (ADHD), Alzheimer's disease/dementia, schizophrenia, pain, stress, migraine, motion sickness, depression, psychiatric disorders and epilepsy (Leurs et al, 2005; Witkin and Nelson, 2004, Hancock and Fox 2004; Esbenshade et al. 2006). An H₃ antagonist/inverse agonist could be important for gastrointestinal disorders, respiratory disorders such as asthma, inflammation, and myocardial infarction.

Ohtake et al. (US 2006/0178375 A1) disclosed compounds that reportedly exhibit histamine receptor H₃ antagonist or inverse agonist activity and may be useful for the treatment or prevention of obesity, diabetes, hormonal secretion abnormality, or sleep disorders.

Celanire et al. (WO 2006/103057 A1 and WO 2006/103045) have disclosed compounds comprising an oxazoline or thiazoline moiety, processes for preparing them, their pharmaceutical compositions and their uses as H₃ ligands.

Bertrand et al. (WO 2006/117609 A2) disclosed novel histamine H₃ receptor ligands, processes for their preparation, and their therapeutic applications.

Schwartz et al. (WO 2006/103546 A2) disclosed certain methods of treatment for Parkinson's disease, obstructive sleep apnea, narcolepsy, dementia with Lewy bodies, and/or vascular dementia using non-imidazole alkylamine derivatives that are antagonists of the H₃ receptors of histamine.

Apodaca et al. (EP 1 311 482 B1) disclosed certain non-imidazole aryloxypiperidines as H₃ receptor ligands, their synthesis, and their use for the treatment of disorders and conditions mediated by the histamine receptor.

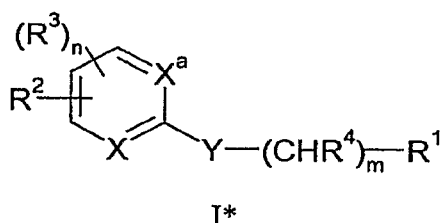
Xu et al. disclosed certain 6-substituted phenyl-4,5-dihydro-3(2*H*)-pyridazinones, their synthesis, and rabbit platelet aggregation inhibitory activity induced by ADP *in vitro*.

Thus, there is a need for novel classes of compounds that possess the beneficial properties. It has been discovered that currently disclosed class of compounds, referred to herein as substituted pyridizinone derivatives, are useful as agents for treating or preventing various diseases or disorders disclosed herein.

SUMMARY OF THE INVENTION

Accordingly, the present invention is directed, in part, to novel pyridizinone compounds which may be useful as H₃ inhibitors, and thus may be useful, *inter alia*, in methods for treating diseases, disorders, and/or conditions that may be mediated or

modulated by inhibition of H₃, or otherwise associated with the H₃ receptor system, including, for example, narcolepsy or sleep/wake disorders, feeding behavior, eating disorders, obesity, cognition, arousal, memory, mood disorders, mood attention alteration, attention deficit hyperactivity disorder (ADHD), Alzheimer's disease/dementia, schizophrenia, pain, stress, migraine, motion sickness, depression, psychiatric disorders, epilepsy, gastrointestinal disorders, respiratory disorders (such as asthma), inflammation, and myocardial infarction. In preferred form, the novel compounds of the invention have the following formula I*:



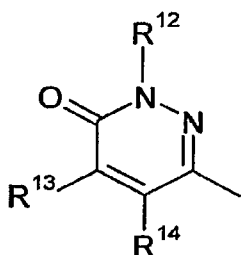
or a stereoisomeric form, mixture of stereoisomeric forms, or a pharmaceutically acceptable salt forms thereof, wherein:

X and X^a are each independently CH or N;

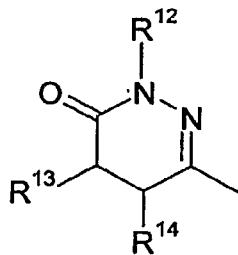
Y is S(O)_q, O, or NR¹⁵;

R¹ is NR¹⁰R¹¹ or a 4- to 9-membered heterocycloalkyl ring containing 1 or 2 nitrogen atoms and optionally substituted with 1 to 3 R²⁰ groups;

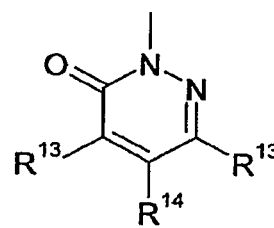
R² is



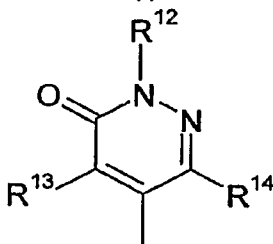
(i)



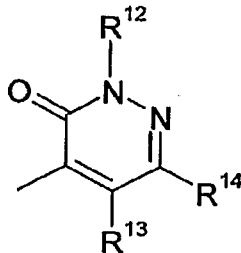
(ii)



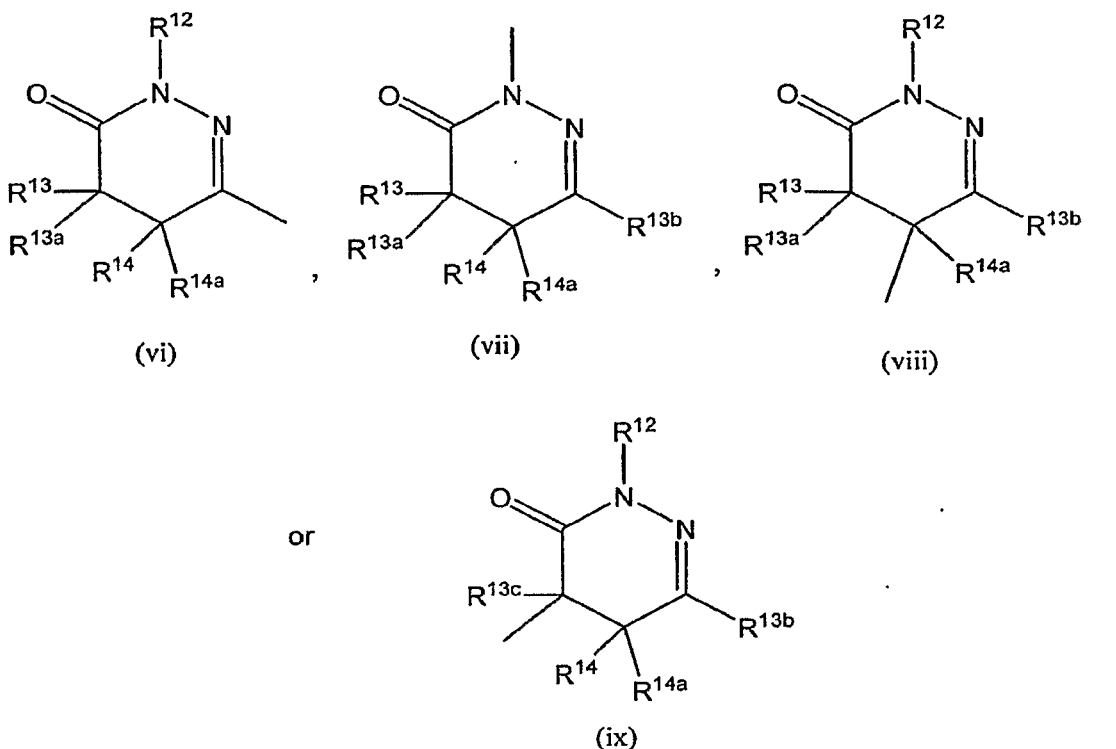
(iii)



(iv)



(v)



wherein:

when X and X^a are both CH, then R² is meta or para to the Y-(CHR⁴)_m-R¹ group;

and

when either X or X^a are N, then R² is para to the Y-(CHR⁴)_m-R¹ group;

each R³ is:

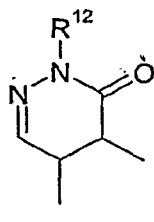
independently H, F, Cl, Br, I, OR²¹, NR²³R²⁴, NO₂, CN, CF₃, C₁-C₆alkyl, C(=O)R²¹, CO₂R²¹, or C(=O)NR²³R²⁴; or

when R³ is ortho to R², and R² is (i), (ii), (iv), (vi), or (ix), then R³ and R¹⁴ taken together may form -(CH₂)_s-, -CH₂Z-, -ZCH₂-, -ZCH₂CH₂- or CH₂CH₂Z-; wherein Z is O, S(O)_y, or NR²⁷; or

when R³ is ortho to R², and R² is (iv), (v), or (viii), then R³ and R¹³ taken together may form -(CH₂)_s-, -CH₂Z-, -ZCH₂-, -ZCH₂CH₂- or CH₂CH₂Z-; or

when R³ is ortho to R², and R² is (viii), then R³ and R^{13b} taken together may form -(CH₂)_s-, -CH₂Z-, -ZCH₂-, -ZCH₂CH₂- or CH₂CH₂Z-; or

when R³ is ortho to X^a and R² is ortho to R³ and meta to X^a, then R² and R³ taken together may form:



each R^4 is independently H, C_1 - C_6 alkyl, or OR^{21} , wherein the alkyl group is optionally substituted with 1 to 3 R^{20} groups;

R^{10} and R^{11} are each independently H, C_1 - C_6 alkyl, or C_3 - C_6 cycloalkyl, wherein the alkyl or cycloalkyl group is optionally substituted with 1 to 3 R^{20} groups;

R^{12} is H, C_1 - C_6 alkyl, cycloalkyl, aryl, arylalkyl, heteroaryl, heterocycloalkyl, $C(=O)R^{27}$, or CO_2R^{27} , wherein the alkyl, cycloalkyl, aryl, arylalkyl, heteroaryl, or heterocycloalkyl group is optionally substituted with 1 to 3 R^{20} groups;

R^{13} and R^{14} are each independently H, C_1 - C_6 alkyl, aryl, arylalkyl, C_1 - C_6 alkoxyl, $S(=O)_y$ - C_1 - C_6 alkyl, cycloalkyl, heterocycloalkyl, or heteroaryl;

R^{13a} , R^{13b} , R^{13c} , and R^{14a} are each independently H, C_1 - C_6 alkyl; or R^{13} and R^{14} , taken together with the carbon atoms through which they are connected form a fused phenyl, thienyl, pyrrolyl, oxazolyl, pyridinyl, or C_3 - C_6 cycloalkyl ring; or R^{13b} and R^{14} , or R^{13} and R^{14a} , or R^{13b} and R^{14a} , or R^{13c} and R^{14a} , taken together with the carbon atoms through which they are connected form a fused C_3 - C_6 cycloalkyl ring; or R^{13} and R^{13a} , or R^{14} and R^{14a} , taken together with the carbon atom to which they are attached form a C_3 - C_8 cycloalkyl ring; provided that no more than one pair of R^{13} and R^{14} , R^{13b} and R^{14} , R^{13} and R^{14a} , R^{13b} and R^{14a} , R^{13c} and R^{14a} , R^{13} and R^{13a} , and R^{14} and R^{14a} are taken together with the carbon atoms through which they are connected or to which they are attached to form a ring; and wherein the fused phenyl, thienyl, pyrrolyl, oxazolyl, pyridinyl, or cycloalkyl ring is optionally substituted with 1 to 3 R^{20} groups;

R^{15} is H, C_1 - C_6 alkyl, $C(=O)R^{25}$, CO_2R^{25} ;

R^{20} at each occurrence is independently, H, F, Cl, Br, I, OR^{21} , OR^{22} , $NR^{23}R^{24}$, $NHOH$, NO_2 , CN, CF_3 , C_1 - C_6 alkyl optionally substituted with OR^{26} , C_2 - C_6 alkenyl, C_2 - C_6 alkynyl, C_3 - C_7 cycloalkyl, C_0 - C_4 alkyl, 3- to 7-membered heterocycloalkyl, C_0 - C_4 alkyl, phenyl, 5- or 6-membered heteroaryl, C_0 - C_4 alkyl, arylalkyl, $(=O)$, $C(=O)R^{21}$, CO_2R^{21} , $OC(=O)R^{21}$, $C(=O)NR^{23}R^{24}$, $NR^{27}C(=O)R^{21}$, $NR^{27}C(=O)OR^{21}$, $OC(=O)NR^{23}R^{24}$, $NR^{27}C(=S)R^{21}$, or $S(O)_qR^{21}$;

each R^{21} is independently H, C_1 - C_6 alkyl, aryl, or arylalkyl;

each R²² is independently the residue of an amino acid after the hydroxyl group of the carboxyl group is removed;

each R²³ and R²⁴ is independently selected from H, C₁-C₆alkyl, and aryl, or R²³ and R²⁴, together with the nitrogen atom to which they are attached, form a 3 to 7 membered heterocyclic ring optionally substituted with =O;

R²⁵ is C₁-C₆alkyl, aryl, or alkylaryl;

R²⁶ is H, C₁-C₆alkyl, aryl, or alkylaryl;

R²⁷ is H or C₁-C₆alkyl;

m is 1, 2, 3, 4, or 5 when R¹ is attached via a nitrogen atom, and m is 0, 1, 2, 3, 4, or 5 when

R¹ is attached via a carbon atom;

n is 1, 2, or 3;

q is 0, 1, or 2;

s is 1, 2, or 3; and

y is 0, 1, or 2.

In another aspect, the present invention is directed to pharmaceutical compositions which comprise a pharmaceutically acceptable carrier and a compound of the present invention, preferably in a therapeutically effective amount.

In other aspects, the present invention is directed to methods for treating a disorder selected from the group consisting of narcolepsy or sleep/wake disorders, feeding behavior, eating disorders, obesity, cognition, arousal, memory, mood disorders, mood attention alteration, attention deficit hyperactivity disorder (ADHD), Alzheimer's disease/dementia, schizophrenia, pain, stress, migraine, motion sickness, depression, psychiatric disorders, epilepsy, gastrointestinal disorders, respiratory disorders, inflammation, and myocardial infarction in a patient in need thereof comprising administering to the patient a therapeutically effective amount of a compound of the present invention.

These and other aspects of the invention will become more apparent from the following detailed description.

DETAILED DESCRIPTION OF ILLUSTRATIVE EMBODIMENTS

The invention is generally directed to pyridizinone derivatives, processes for their preparation, and pharmaceuticals compositions their and methods of their pharmaceutical use.

As employed above and throughout the disclosure, the following terms, unless otherwise indicated, shall be understood to have the following meanings.

As used herein, the term "about" refers to a range of values from $\pm 10\%$ of a specified value. For example, the phrase "about 50" includes $\pm 10\%$ of 50, or from 45 to 55. The phrase "from about 10 to 100" includes $\pm 10\%$ of 10 and $\pm 10\%$ of 100, or from 9 to 110.

As used herein, a range of values in the form "x-y" or "x to y", or "x through y", include integers x, y, and the integers therebetween. For example, the phrases "1-6", or "1 to 6" or "1 through 6" are intended to include the integers 1, 2, 3, 4, 5, and 6. Preferred embodiments include each individual integer in the range, as well as any subcombination of integers. For example, preferred integers for "1-6" can include 1, 2, 3, 4, 5, 6, 1 to 2, 1 to 3, 1 to 4, 1 to 5, 2 to 3, 2 to 4, 2 to 5, 2 to 6, etc.

As used herein "stable compound" or "stable structure" refers to a compound that is sufficiently robust to survive isolation to a useful degree of purity from a reaction mixture, and preferably capable of formulation into an efficacious therapeutic agent. The present invention is directed only to stable compounds.

As used herein, "substituted" refers to any one or more hydrogen atoms on the indicated atom is replaced with a selected group referred to herein as a "substituent", provided that the substituted atom's valency is not exceeded, and that the substitution results in a stable compound. A substituted group has 1 to 5, preferably 1 to 3, and more preferably 1 independently selected substituents. Preferred substituents include, but are not limited to F, Cl, Br, I, OH, OR, NH₂, NHR, NR₂, NHOH, NO₂, CN, CF₃, CF₂CF₃, C₁-C₆ alkyl, C₂-C₆ alkenyl, C₂-C₆ alkynyl, C₁-C₆ alkoxy, C₃-C₇ cycloalkyl, heterocyclyl, C₆-C₁₀ aryl, heteroaryl, arylalkyl, =O, C(=O)R, COOH, CO₂R, O-C(=O)R, C(=O)NRR', NRC(=O)R', NRCO₂R', OC(=O)NRR', -NRC(=O)NRR', -NRC(=S)NRR', and -SO₂NRR', wherein R and R' are each independently hydrogen, C₁-C₆ alkyl, or C₆-C₁₀ aryl.

As used herein, the term "alkyl" refers to a straight-chain, or branched alkyl group having 1 to 8 carbon atoms, preferably from 1 to 6, with 1 to 3 more preferred. Exemplary alkyl groups include methyl, ethyl, propyl, isopropyl, butyl, isobutyl, sec-butyl, tert-butyl, pentyl, isoamyl, neopentyl, 1-ethylpropyl, 3-methylpentyl, 2,2-dimethylbutyl, 2,3-dimethylbutyl, hexyl, octyl, etc. The alkyl moiety of alkyl-containing groups, such as alkoxy, alkoxycarbonyl, and alkylaminocarbonyl groups, has the same meaning as alkyl defined above. Lower alkyl groups, which are preferred, are alkyl groups as defined above which contain 1 to 4 carbons. A designation such as "C₁-C₄ alkyl" refers to an alkyl radical containing from 1 to 4 carbon atoms. Alkyl groups may be optionally substituted.

As used herein, the term "alkenyl" refers to a straight chain, or branched hydrocarbon chains of 2 to 8 carbon atoms having at least one carbon-carbon double bond. A designation "C₂-C₈ alkenyl" refers to an alkenyl radical containing from 2 to 8 carbon atoms. Examples of alkenyl groups include ethenyl, propenyl, isopropenyl, 2,4-pentadienyl, etc. Alkenyl groups may be optionally substituted.

As used herein, the term "alkynyl" refers to a straight chain, or branched hydrocarbon chains of 2 to 8 carbon atoms having at least one carbon-carbon triple bond. A designation "C₂-C₈ alkynyl" refers to an alkynyl radical containing from 2 to 8 carbon atoms. Examples include ethynyl, propynyl, isopropynyl, 3,5-hexadiynyl, etc. Alkynyl groups may be optionally substituted.

As used herein, the term "cycloalkyl" refers to a saturated or partially saturated mono- or bicyclic alkyl ring system containing 3 to 10 carbon atoms. Certain embodiments contain 3 to 6 carbon atoms, preferably 3 or 4 carbon atoms, and other embodiments contain 5 or 6 carbon atoms. A designation such as "C₅-C₇ cycloalkyl" refers to a cycloalkyl radical containing from 5 to 7 ring carbon atoms. Examples of cycloalkyl groups include such groups as cyclopropyl, cyclobutyl, cyclopentyl, cyclohexyl, cycloheptyl, cyclooctyl, pinenyl, pinanyl, and adamantanyl. Cycloalkyl groups may be optionally substituted.

As used herein, the term "aryl" refers to a substituted or unsubstituted, mono- or bicyclic hydrocarbon aromatic ring system having 6 to 12 ring carbon atoms. Examples include phenyl and naphthyl. Preferred aryl groups include unsubstituted or substituted phenyl and naphthyl groups. Included within the definition of "aryl" are fused ring systems, including, for example, ring systems in which an aromatic ring is fused to a cycloalkyl ring. Examples of such fused ring systems include, for example, indane, indene, and tetrahydronaphthalene. Aryl groups may be optionally substituted.

As used herein, the terms "heterocycle", "heterocyclic" or "heterocyclyl" refer to a substituted or unsubstituted carbocyclic group in which one or more ring carbon atoms are replaced by at least one hetero atom such as -O-, -N-, or -S-. Certain embodiments include 4 to 9 membered rings preferably 3 to 7 membered rings, and other embodiments include 5 or 6 membered rings. The nitrogen and sulfur heteroatoms may be optionally oxidized, and the nitrogen may be optionally substituted in non-aromatic rings. Heterocycles are intended to include heteroaryl and heterocycloalkyl groups. Heterocyclic groups may be optionally substituted.

As used herein, the term "heteroaryl" refers to an aromatic group containing 5 to 10 ring carbon atoms in which one or more ring carbon atoms are replaced by at least one

hetero atom such as -O-, -N-, or -S-. Certain embodiments include 5 or 6 membered rings. Examples of heteroaryl groups include pyrrolyl, furanyl, thienyl, pyrazolyl, imidazolyl, thiazolyl, isothiazolyl, isoxazolyl, oxazolyl, oxathiolyl, oxadiazolyl, triazolyl, oxatriazolyl, furazanyl, tetrazolyl, pyridyl, pyrazinyl, pyrimidinyl, pyridazinyl, triazinyl, picolinyl, indolyl, isoindolyl, indazolyl, benzofuranyl, isobenzofuranyl, purinyl, quinazolinyl, quinolyl, isoquinolyl, benzoimidazolyl, benzothiazolyl, benzothiophenyl, thianaphthenyl, benzoxazolyl, benzisoxazolyl, cinnolinyl, phthalazinyl, naphthyridinyl, and quinoxalinyl. Included within the definition of "heteroaryl" are fused ring systems, including, for example, ring systems in which an aromatic ring is fused to a heterocycloalkyl ring.

Examples of such fused ring systems include, for example, phthalamide, phthalic anhydride, indoline, isoindoline, tetrahydroisoquinoline, chroman, isochroman, chromene, and isochromene. Heteroaryl groups may be optionally substituted. In certain preferred embodiments, heteroaryl is pyridinyl, more preferably pyridine-2-yl, or thienyl

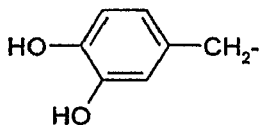
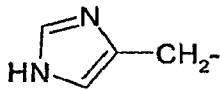
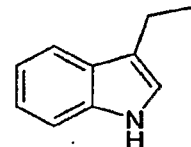
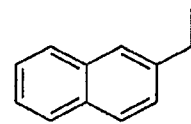
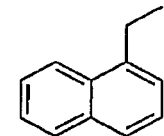
As used herein, the term "heterocycloalkyl" refers to a cycloalkyl group in which one or more ring carbon atoms are replaced by at least one hetero atom such as -O-, -N-, or -S-. Certain embodiments include 4 to 9 membered rings, preferably 3 to 7, more preferably 3 to 6 membered rings, and other embodiments include 5 or 6 membered rings. Examples of heterocycloalkyl groups include pyrrolidinyl, pyrrolinyl, imidazolidinyl, imidazoliny, pirazolidinyl, pirazolinyl, pyrazalinyl, piperidinyl, piperazinyl, hexahydropyrimidinyl, morpholinyl, thiomorpholinyl, tetrahydrofuranyl, dithiolyl, oxathiolyl, dioxazolyl, oxathiazolyl, pyranyl, oxazinyl, oxathiazinyl, and oxadiazinyl, preferably pyrrolidinyl, morpholinyl, piperidinyl, or azapanyl, more preferably pyrrolidinyl or piperidinyl. Heterocycloalkyl groups may be optionally substituted.

As used herein, the term "arylalkyl" refers to an alkyl group that is substituted with an aryl group. Examples of arylalkyl groups include, but are not limited to, benzyl, bromobenzyl, phenethyl, benzhydryl, diphenylmethyl, triphenylmethyl, diphenylethyl, naphthylmethyl, etc. preferably benzyl. Arylalkyl groups may be optionally substituted.

As used herein, the term "amino acid" refers to a group containing both an amino group and a carboxyl group. Embodiments of amino acids include α -amino, β -amino, γ -amino acids. The α -amino acids have a general formula $\text{HOOC-CH}(\text{side chain})\text{-NH}_2$. The amino acids can be in their D, L or racemic configurations. Amino acids include naturally-occurring and non-naturally occurring moieties. The naturally-occurring amino acids include the standard 20 α -amino acids found in proteins, such as glycine, serine, tyrosine,

proline, histidine, glutamine, etc. Naturally-occurring amino acids can also include non- α -amino acids (such as β -alanine, γ -aminobutyric acid, homocysteine, etc.), rare amino acids (such as 4-hydroxyproline, 5-hydroxylysine, 3-methylhistidine, etc.) and non-protein amino acids (such as citrulline, ornithine, canavanine, etc.). Non-naturally occurring amino acids are well-known in the art, and include analogs of natural amino acids. See Lehninger, A. L. *Biochemistry*, 2nd ed.; Worth Publishers: New York, 1975; 71-77, the disclosure of which is incorporated herein by reference. Non-naturally occurring amino acids also include α -amino acids wherein the side chains are replaced with synthetic derivatives. In certain embodiments, substituent groups for the compounds of the present invention include the residue of an amino acid after removal of the hydroxyl moiety of the carboxyl group thereof; i.e., groups of formula $-C(=O)CH(\text{side chain})-NH_2$. Representative side chains of naturally occurring and non-naturally occurring α -amino acids include are shown below in Table A.

Table.A

H	HS-CH ₂ -
CH ₃ -	HO ₂ C-CH(NH ₂)-CH ₂ -S-S-CH ₂ -
HO-CH ₂ -	CH ₃ -CH ₂ -
C ₆ H ₅ -CH ₂ -	CH ₃ -S-CH ₂ -CH ₂ -
HO-C ₆ H ₄ -CH ₂ -	CH ₃ -CH ₂ -S-CH ₂ -CH ₂ -
	HO-CH ₂ -CH ₂ -
	C ₅ H ₉ -
	C ₆ H ₁₁ -
	C ₆ H ₁₁ -CH ₂ -
	CH ₃ -CH(OH)-
	HO ₂ C-CH ₂ -NHC(=O)-CH ₂ -
	HO ₂ C-CH ₂ -
	HO ₂ C-CH ₂ -CH ₂ -
	NH ₂ C(=O)-CH ₂ -
	NH ₂ C(=O)-CH ₂ -CH ₂ -
	(CH ₃) ₂ -CH-
	(CH ₃) ₂ -CH-CH ₂ -
	CH ₃ -CH ₂ -CH ₂ -
	H ₂ N-CH ₂ -CH ₂ -CH ₂ -
	H ₂ N-C(=NH)-NH-CH ₂ -CH ₂ -CH ₂ -
	H ₂ N-C(=O)-NH-CH ₂ -CH ₂ -CH ₂ -
	CH ₃ -CH ₂ -CH(CH ₃)-
	CH ₃ -CH ₂ -CH ₂ -CH ₂ -
	H ₂ N-CH ₂ -CH ₂ -CH ₂ -CH ₂ -

As used herein, the term “subject” or “patient” refers to a warm blooded animal such as a mammal, preferably a human, or a human child, which is afflicted with, or has the potential to be afflicted with one or more diseases and conditions described herein.

5 As used herein, a “therapeutically effective amount” refers to an amount of a compound of the present invention effective to prevent or treat the symptoms of particular disorder. Such disorders include, but are not limited to, those pathological and neurological disorders associated with the aberrant activity of the receptors described herein, wherein the

treatment or prevention comprises inhibiting, inducing, or enhancing the activity thereof by contacting the receptor with a compound of the present invention.

As used herein, the term "pharmaceutically acceptable" refers to those compounds, materials, compositions, and/or dosage forms which are, within the scope of sound medical judgment, suitable for contact with the tissues of human beings and animals without excessive toxicity, irritation, allergic response, or other problem complications commensurate with a reasonable benefit/risk ratio.

As used herein, the term "unit dose" refers to a single dose which is capable of being administered to a patient, and which can be readily handled and packaged, remaining as a physically and chemically stable unit dose comprising either the active compound itself, or as a pharmaceutically acceptable composition, as described hereinafter.

As used herein, "pharmaceutically acceptable salts" refer to derivatives of the disclosed compounds wherein the parent compound is modified by making acid or base salts thereof. Examples of pharmaceutically acceptable salts include, but are not limited to, mineral or organic acid salts of basic residues such as amines; alkali or organic salts of acidic residues such as carboxylic acids; and the like. The pharmaceutically acceptable salts include the conventional non-toxic salts or the quaternary ammonium salts of the parent compound formed, for example, from non-toxic inorganic or organic acids. For example, such conventional non-toxic salts include those derived from inorganic acids such as hydrochloric, hydrobromic, sulfuric, sulfamic, phosphoric, nitric and the like; and the salts prepared from organic acids such as acetic, propionic, succinic, glycolic, stearic, lactic, malic, tartaric, citric, ascorbic, pamoic, maleic, hydroxymaleic, phenylacetic, glutamic, benzoic, salicylic, sulfanilic, 2-acetoxybenzoic, fumaric, toluenesulfonic, methanesulfonic, ethane disulfonic, oxalic, isethionic, and the like. These physiologically acceptable salts are prepared by methods known in the art, e.g., by dissolving the free amine bases with an excess of the acid in aqueous alcohol, or neutralizing a free carboxylic acid with an alkali metal base such as a hydroxide, or with an amine.

Compounds described herein throughout, can be used or prepared in alternate forms. For example, many amino-containing compounds can be used or prepared as an acid addition salt. Often such salts improve isolation and handling properties of the compound. For example, depending on the reagents, reaction conditions and the like, compounds as described herein can be used or prepared, for example, as their hydrochloride or tosylate salts. Isomorphic crystalline forms, all chiral and racemic forms, N-oxide, hydrates,

solvates, and acid salt hydrates, are also contemplated to be within the scope of the present invention.

Certain acidic or basic compounds of the present invention may exist as zwitterions. All forms of the compounds, including free acid, free base and zwitterions, are
5 contemplated to be within the scope of the present invention. It is well known in the art that compounds containing both amino and carboxy groups often exist in equilibrium with their zwitterionic forms. Thus, any of the compounds described herein throughout that contain, for example, both amino and carboxy groups, also include reference to their corresponding zwitterions.

10 As used herein, "prodrug" refers to compounds specifically designed to maximize the amount of active species that reaches the desired site of reaction, which are of themselves typically inactive or minimally active for the activity desired, but through biotransformation are converted into biologically active metabolites.

Accordingly, prodrugs include, for example, compounds described herein in which a
15 hydroxy, amino, or carboxy group is bonded to any group that, when the prodrug is administered to a mammalian subject, cleaves to form a free hydroxyl, free amino, or carboxylic acid, respectively. Examples include, but are not limited to, acetate, formate and benzoate derivatives of alcohol and amine functional groups; and alkyl, cycloalkyl, aryl, and alkylaryl esters such as methyl, ethyl, propyl, isopropyl, butyl, isobutyl, sec-butyl, tert-
20 butyl, cyclopropyl, phenyl, benzyl, and phenethyl esters, and the like.

Compounds described herein may contain one or more asymmetrically substituted carbon atoms, and may be isolated in optically active or racemic forms. Thus, all isomeric forms of a structure, including all stereogenic (such as enantiomeric, diastereomeric, and/or meso forms, whether chiral or racemic), all achiral, all geometric, and/or all conformational
25 isomeric forms are intended, unless the specific stereochemical or other isomeric form is specifically indicated and/or achiral. It is well known in the art how to prepare and isolate such isomeric forms of a structure including those having stereogenic centers including those stereogenic forms wherein the structure is present in optically active form. For example, mixtures of stereoisomers may be separated by standard techniques including, but
30 not limited to, resolution of racemic forms, normal, reverse-phase, and chiral chromatography, preferential salt formation, recrystallization, and the like, or by chiral synthesis either from chiral starting materials or by deliberate synthesis of target chiral centers.

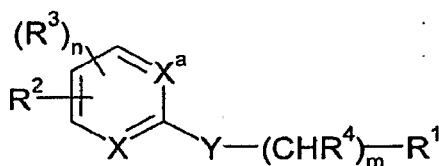
As used herein, the term "stereoisomers" refers to compounds that have identical chemical constitution, but differ as regards the arrangement of the atoms or groups in space.

The terms "treatment" and "treating" as used herein include preventative (e.g., prophylactic), curative and/or palliative treatment.

When any variable occurs more than one time in any constituent or in any formula, its definition in each occurrence is independent of its definition at every other occurrence. Combinations of substituents and/or variables are permissible only if such combinations result in stable compounds.

It is believed the chemical formulas and names used herein correctly and accurately reflect the underlying chemical compounds. However, the nature and value of the present invention does not depend upon the theoretical correctness of these formulae, in whole or in part. Thus it is understood that the formulas used herein, as well as the chemical names attributed to the correspondingly indicated compounds, are not intended to limit the invention in any way, including restricting it to any specific tautomeric form or to any specific optical or geometric isomer, except where such stereochemistry is clearly defined.

Accordingly, the present invention is directed, in part, to novel pyridizinone compounds which have the following formula I*:



I*

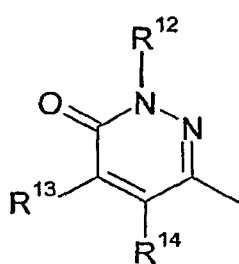
or a stereoisomeric form, mixture of stereoisomeric forms, or a pharmaceutically acceptable salt forms thereof, wherein:

X and X^a are each independently CH or N;

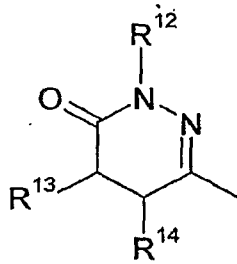
Y is S(O)_q, O, or NR¹⁵;

R¹ is NR¹⁰R¹¹ or a 4- to 9-membered heterocycloalkyl ring containing 1 or 2 nitrogen atoms and optionally substituted with 1 to 3 R²⁰ groups;

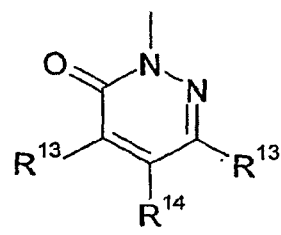
R² is



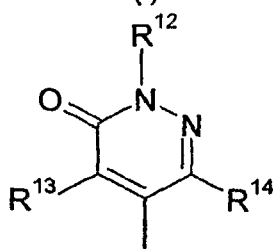
(i)



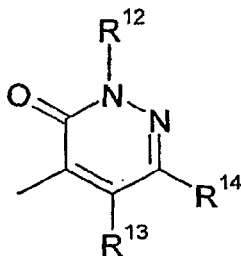
(ii)



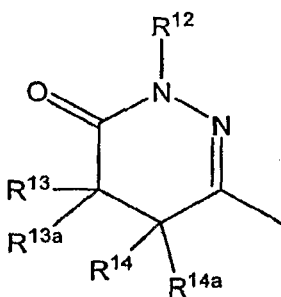
(iii)



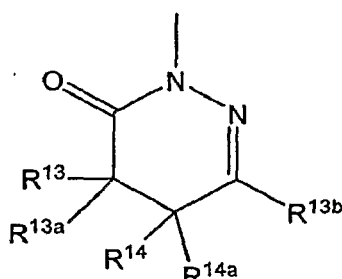
(iv)



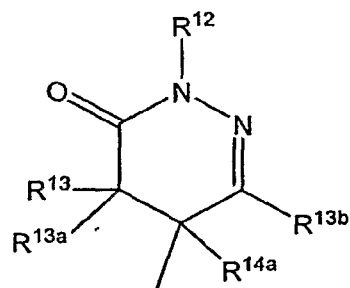
(v)



(vi)

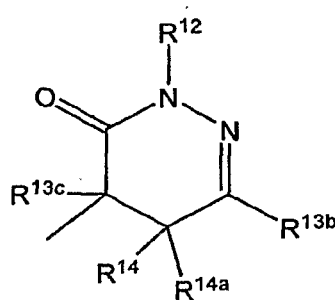


(vii)



(viii)

or



(ix)

wherein:

5 when X and X^a are both CH, then R² is meta or para to the Y-(CHR⁴)_m-R¹ group;

and

when either X or X^a are N, then R² is para to the Y-(CHR⁴)_m-R¹ group;

each R³ is:

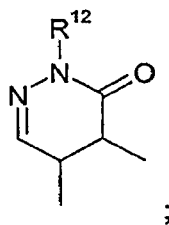
independently H, F, Cl, Br, I, OR^{21} , $\text{NR}^{23}\text{R}^{24}$, NO_2 , CN, CF_3 , $\text{C}_1\text{-C}_6\text{alkyl}$, C(=O)R^{21} , CO_2R^{21} , or $\text{C(=O)NR}^{23}\text{R}^{24}$; or

when R^3 is ortho to R^2 , and R^2 is (i), (ii), (iv), (vi), or (ix), then R^3 and R^{14} taken together may form $-(\text{CH}_2)_5-$, $-\text{CH}_2\text{Z}-$, $-\text{ZCH}_2-$, $-\text{ZCH}_2\text{CH}_2-$ or $\text{CH}_2\text{CH}_2\text{Z}-$; wherein Z is O, S(O)_y , or NR^{27} ; or

when R^3 is ortho to R^2 , and R^2 is (iv), (v), or (viii), then R^3 and R^{13} taken together may form $-(\text{CH}_2)_5-$, $-\text{CH}_2\text{Z}-$, $-\text{ZCH}_2-$, $-\text{ZCH}_2\text{CH}_2-$ or $\text{CH}_2\text{CH}_2\text{Z}-$; or

when R^3 is ortho to R^2 , and R^2 is (viii), then R^3 and R^{13b} taken together may form $-(\text{CH}_2)_5-$, $-\text{CH}_2\text{Z}-$, $-\text{ZCH}_2-$, $-\text{ZCH}_2\text{CH}_2-$ or $\text{CH}_2\text{CH}_2\text{Z}-$; or

when R^3 is ortho to X^a and R^2 is ortho to R^3 and meta to X^a , then R^2 and R^3 taken together may form:



each R^4 is independently H, $\text{C}_1\text{-C}_6\text{alkyl}$, or OR^{21} , wherein the alkyl group is optionally substituted with 1 to 3 R^{20} groups;

R^{10} and R^{11} are each independently H, $\text{C}_1\text{-C}_6\text{alkyl}$, or $\text{C}_3\text{-C}_6\text{cycloalkyl}$, wherein the alkyl or cycloalkyl group is optionally substituted with 1 to 3 R^{20} groups;

R^{12} is H, $\text{C}_1\text{-C}_6\text{alkyl}$, cycloalkyl, aryl, arylalkyl, heteroaryl, heterocycloalkyl, C(=O)R^{27} , or CO_2R^{27} , wherein the alkyl, cycloalkyl, aryl, arylalkyl, heteroaryl, or heterocycloalkyl group is optionally substituted with 1 to 3 R^{20} groups;

R^{13} and R^{14} are each independently H, $\text{C}_1\text{-C}_6\text{alkyl}$, aryl, arylalkyl $\text{C}_1\text{-C}_6\text{alkoxyl}$, $\text{S(=O)}_y\text{-C}_1\text{-C}_6\text{alkyl}$, cycloalkyl, heterocycloalkyl, or heteroaryl;

R^{13a} , R^{13b} , R^{13c} , and R^{14a} are each independently H, $\text{C}_1\text{-C}_6\text{alkyl}$; or R^{13} and R^{14} , taken together with the carbon atoms through which they are connected form a fused phenyl, thienyl, pyrrolyl, oxazolyl, pyridinyl, or $\text{C}_3\text{-C}_6\text{cycloalkyl}$ ring; or R^{13b} and R^{14} , or R^{13} and R^{14a} , or R^{13b} and R^{14a} , or R^{13c} and R^{14a} , taken together with the carbon atoms through which they are connected form a fused $\text{C}_3\text{-C}_6\text{cycloalkyl}$ ring; or R^{13} and R^{13a} , or R^{14} and R^{14a} , taken together with the carbon atom to which they are attached form a $\text{C}_3\text{-C}_8\text{cycloalkyl}$ ring; provided that no more than one pair of R^{13} and R^{14} , R^{13b} and R^{14} , R^{13} and R^{14a} , R^{13b} and R^{14a} , R^{13c} and R^{14a} , R^{13} and R^{13a} , and R^{14} and R^{14a} are taken together with the carbon atoms through which they are

connected or to which they are attached to form a ring; and wherein the fused phenyl, thienyl, pyrrolyl, oxazolyl, pyridinyl, or cycloalkyl ring is optionally substituted with 1 to 3 R^{20} groups;

R^{15} is H, C_1 - C_6 alkyl, $C(=O)R^{25}$, CO_2R^{25} ;

5 R^{20} at each occurrence is independently, H, F, Cl, Br, I, OR^{21} , OR^{22} , $NR^{23}R^{24}$, $NHOH$, NO_2 , CN, CF_3 , C_1 - C_6 alkyl optionally substituted with OR^{26} , C_2 - C_6 alkenyl, C_2 - C_6 alkynyl, C_3 - C_7 cycloalkyl C_0 - C_4 alkyl, 3- to 7-membered heterocycloalkyl C_0 - C_4 alkyl, phenyl, 5- or 6-membered heteroaryl C_0 - C_4 alkyl, arylalkyl, $(=O)$, $C(=O)R^{21}$, CO_2R^{21} , $OC(=O)R^{21}$, $C(=O)NR^{23}R^{24}$, $NR^{27}C(=O)R^{21}$, $NR^{27}C(=O)OR^{21}$, $OC(=O)NR^{23}R^{24}$,
10 $NR^{27}C(=S)R^{21}$, or $S(O)_qR^{21}$;

each R^{21} is independently H, C_1 - C_6 alkyl, aryl, or arylalkyl;

each R^{22} is independently the residue of an amino acid after the hydroxyl group of the carboxyl group is removed;

each R^{23} and R^{24} is independently selected from H, C_1 - C_6 alkyl, and aryl, or R^{23} and R^{24} ,

15 together with the nitrogen atom to which they are attached, form a 3 to 7 membered heterocyclic ring optionally substituted with $=O$;

R^{25} is C_1 - C_6 alkyl, aryl, or alkylaryl;

R^{26} is H, C_1 - C_6 alkyl, aryl, or alkylaryl;

R^{27} is H or C_1 - C_6 alkyl;

20 m is 1, 2, 3, 4, or 5 when R^1 is attached via a nitrogen atom, and m is 0, 1, 2, 3, 4, or 5 when R^1 is attached via a carbon atom;

n is 1, 2, or 3;

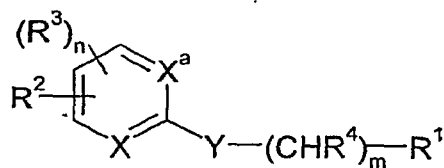
q is 0, 1, or 2;

s is 1, 2, or 3; and

25 y is 0, 1, or 2.

In certain preferred embodiments, the compounds of formula I or I* are other than 6-[4-(3-Diethylamino-propoxy)-phenyl]-4,5-dihydro-2H-pyridazin-3-one. In other preferred embodiments of the compounds of formula I or I*; when X^a and X are each CH, Y is O, n is 0, each R^4 is H, m is 2, 3, or 4, R^1 is methylamino, hydroxyethylamino, pyrrolidin-1-yl, piperidin-1-yl, morpholin-4-yl, and R^2 is para to the $Y-(CHR^4)_m-R^1$ group, then R^2 is other than 4,5-dihydro-2H-pyridazin-3-one-6-yl.

In some preferred embodiments, the present invention provides a novel of formula I:

**I**

and stereoisomeric forms, mixtures of stereoisomeric forms or pharmaceutically acceptable salt forms thereof,

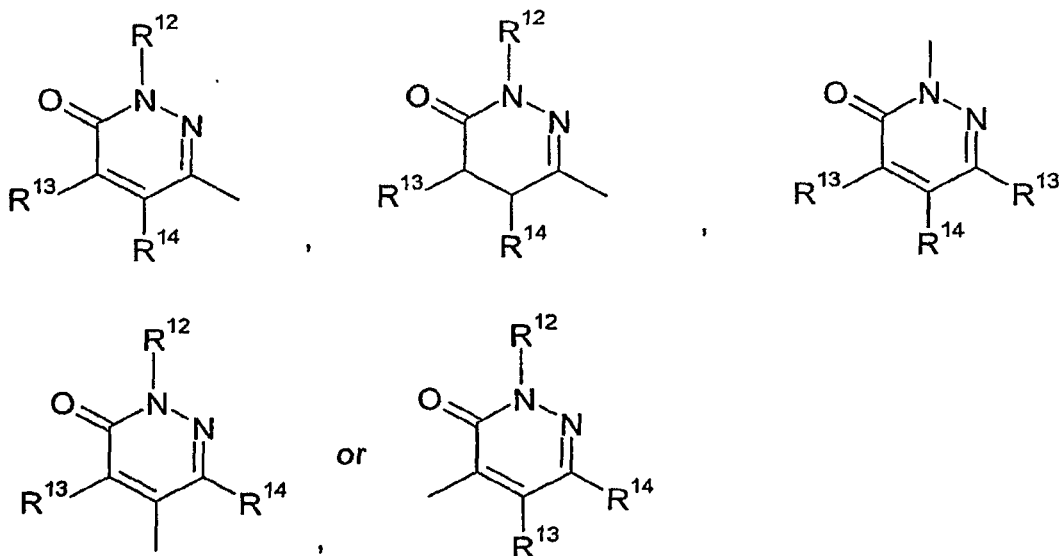
5 wherein:

X and X^a are each independently CH or N;

Y is selected from S(O)_q, O, and NR¹⁵;

R¹ is NR¹⁰R¹¹ or a 4 to 9 membered heterocycloalkyl ring containing 1 or 2 nitrogen atoms and optionally substituted with 1 to 3 R²⁰ groups;

10 R² is



wherein:

15 when X and X^a are both CH, then R² is meta or para to the Y-(CHR⁴)_m-R¹ group; and

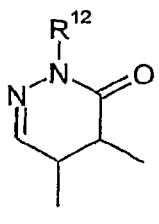
when either X or X^a are N, then R² is para to the Y-(CHR⁴)_m-R¹ group;

R³ is:

20 at each occurrence is independently, H, F, Cl, Br, I, OR²¹, NR²³R²⁴, NO₂, CN, CF₃, C₁-C₆ alkyl, C(=O)R²¹, CO₂R²¹, or C(=O)NR²³R²⁴; or

when R^3 is ortho to R^2 , then R^3 and R^{14} can combine to form $-(CH_2)_s-$, $-CH_2Z-$, CH_2CH_2Z- ; wherein Z is O, $S(O)_y$, NR^{27} ; or

when R^3 is ortho to X^a and R^2 is ortho to R^3 and meta to X^a , then R^2 and R^3 combine to form:



R^4 is H, C_1 - C_6 alkyl, or OR^{21} , wherein the alkyl group is optionally substituted with 1 to 3 R^{20} groups;

R^{10} and R^{11} are each, independently H or C_1 - C_6 alkyl, wherein the alkyl group is optionally substituted with 1 to 3 R^{20} groups;

10 R^{12} is H, C_1 - C_6 alkyl, cycloalkyl, aryl, arylalkyl, heteroaryl, heterocycloalkyl, $C(=O)R^{27}$, or CO_2R^{27} , wherein the alkyl, cycloalkyl, aryl, arylalkyl, heteroaryl, and heterocycloalkyl groups are optionally substituted with 1 to 3 R^{20} groups;

15 R^{13} and R^{14} are independently H, C_1 - C_6 alkyl, aryl, or arylalkyl or R^{13} and R^{14} can combine to form a fused phenyl, thienyl, pyrrolyl, cyclopentyl or cyclohexyl ring; wherein the phenyl, thienyl, pyrrolyl, cyclopentyl or cyclohexyl rings are optionally substituted with 1 to 3 R^{20} groups;

R^{15} is H, C_1 - C_6 alkyl, $C(=O)R^{25}$, CO_2R^{25} ;

20 R^{20} at each occurrence is independently, H, F, Cl, Br, I, OR^{21} , OR^{22} , $NR^{23}R^{24}$, $NHOH$, NO_2 , CN, CF_3 , C_1 - C_6 alkyl optionally substituted with OR^{26} , C_2 - C_6 alkenyl, C_2 - C_6 alkynyl, C_3 - C_7 cycloalkyl, 3-7 membered heterocycloalkyl, phenyl, 5 or 6 membered heteroaryl, arylalkyl, $(=O)$, $C(=O)R^{21}$, CO_2R^{21} , $OC(=O)R^{21}$, $C(=O)NR^{23}R^{24}$, $NR^{27}C(=O)R^{21}$, $NR^{27}C(=O)OR^{21}$, $OC(=O)NR^{23}R^{24}$, $NR^{27}C(=S)R^{21}$, or $S(O)_qR^{21}$;

R^{21} at each occurrence is independently H, C_1 - C_6 alkyl, aryl, or arylalkyl;

25 R^{22} at each occurrence is independently the residue of an amino acid after the hydroxyl group of the carboxyl group is removed;

R^{23} and R^{24} at each occurrence are each independently selected from H, C_1 - C_6 alkyl, and aryl, or R^{23} and R^{24} , together with the nitrogen atom to which they are attached, form a 3 to 7 membered heterocyclic ring optionally substituted with $=O$;

R^{25} is C_1 - C_6 alkyl, aryl, or alkylaryl;

30 R^{26} is H, C_1 - C_6 alkyl, aryl, or alkylaryl;

R^{27} is H or C_1 - C_6 alkyl;

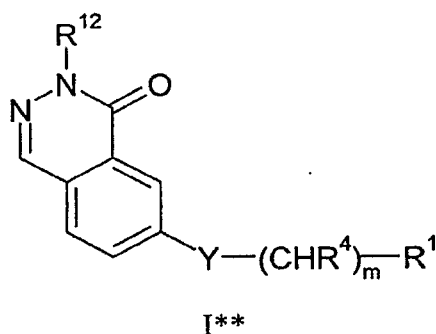
m is 1, 2, 3, 4, or 5 when R^1 is attached via a nitrogen atom, and m is 0, 1, 2, 3, 4, or 5 when R^1 is attached via a carbon atom;

n is 0, 1, 2, or 3;

5 q is 0, 1, or 2;

s is 1, 2, or 3.

Embodiments of the present invention include those compounds of formula I having the structure I**:



wherein:

Y is O;

15 R^1 is $NR^{10}R^{11}$ or a 5 to 6 membered heterocycloalkyl ring containing 1 or 2 nitrogen atoms and optionally substituted with 1 to 3 R^{20} groups; or R^1 is $NR^{10}R^{11}$, pyrrolidinyl or piperidyl, wherein the pyrrolidinyl and piperidyl groups are optionally substituted with 1 to 3 R^{20} groups; or R^1 is pyrrolidinyl or piperidyl, wherein the pyrrolidinyl and piperidyl groups are optionally substituted with 1 to 3 R^{20} groups;

20 R^4 is H or C_1 - C_6 alkyl, wherein the alkyl group is optionally substituted with 1 to 3 R^{20} groups;

R^{10} and R^{11} are each, independently H or C_1 - C_6 alkyl, wherein the alkyl group is optionally substituted with 1 to 3 R^{20} groups;

R^{12} is H, C_1 - C_6 alkyl, phenyl, or benzyl, wherein the alkyl, phenyl and benzyl groups are optionally substituted with 1 to 3 R^{20} groups;

25 R^{20} at each occurrence is independently, H, F, Cl, Br, I, OR^{21} , OR^{22} , $NR^{23}R^{24}$, $NHOH$, NO_2 , CN, CF_3 , C_1 - C_6 alkyl optionally substituted with OR^{26} , C_2 - C_6 alkenyl, C_2 - C_6 alkynyl, C_3 - C_7 cycloalkyl, 3-7 membered heterocycloalkyl, phenyl, 5 or 6 membered heteroaryl, arylalkyl, $(=O)$, $C(=O)R^{21}$, CO_2R^{21} , $OC(=O)R^{21}$, $C(=O)NR^{23}R^{24}$, $NR^{27}C(=O)R^{21}$, $NR^{27}C(=O)OR^{21}$, $OC(=O)NR^{23}R^{24}$, $NR^{27}C(=S)R^{21}$, or $S(O)_qR^{21}$;

R^{21} at each occurrence is independently H, C_1 - C_6 alkyl, aryl, or arylalkyl;

R^{22} at each occurrence is independently the residue of an amino acid after the hydroxyl group of the carboxyl group is removed;

R^{23} and R^{24} at each occurrence are each independently selected from H, C_1 - C_6 alkyl, and aryl, or R^{23} and R^{24} , together with the nitrogen atom to which they are attached, form a 3 to 7 membered heterocyclic ring optionally substituted with =O;

R^{26} is H, C_1 - C_6 alkyl, aryl, or alkylaryl;

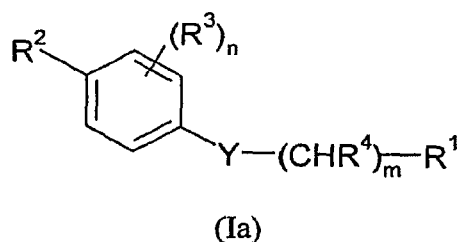
R^{27} is H or C_1 - C_6 alkyl;

m is 3 when R^1 is attached via a nitrogen atom, and m is 0 or 1 when R^1 is attached via a carbon atom;

n is 0 or 1;

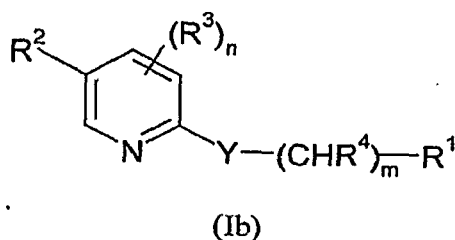
q is 0, 1, or 2.

In another embodiment, the present invention includes compounds of formula (Ia):



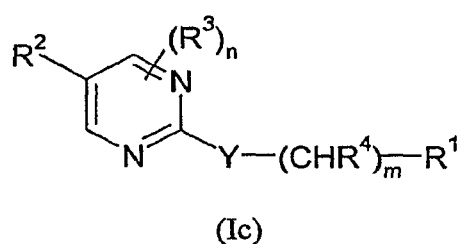
wherein each variable is defined in formula I. Additional aspects of the present invention include compounds of formula (Ia) which incorporate the embodiments described above for compounds of formula I, as is appropriate. For example, additional embodiments include compound of formula (Ia) with the preferred moieties of groups R^1 and R^2 ; or R^1 and Y; or R^1 , R^2 and Y; etc.

In another embodiment, the present invention includes compounds of formula (Ib):



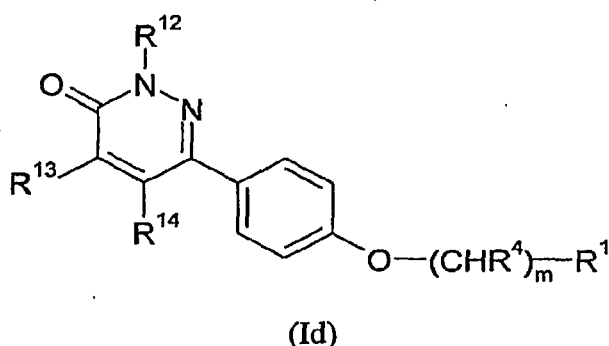
wherein each variable is defined in formula I. Additional aspects of the present invention include compounds of formula (Ib) which incorporate the embodiments described above for compounds of formula I, as is appropriate. For example, additional embodiments include compound of formula (Ib) with the preferred moieties of groups R^1 and R^2 ; or R^1 and Y; or R^1 , R^2 and Y; etc.

In another embodiment, the present invention includes compounds of formula (Ic):



wherein each variable is defined in formula I. Additional aspects of the present invention include compounds of formula (Ic) which incorporate the embodiments described above for compounds of formula I, as is appropriate. For example, additional embodiments include compound of formula (Ic) with the preferred moieties of groups R^1 and R^2 ; or R^1 and Y; or R^1 , R^2 and Y; etc.

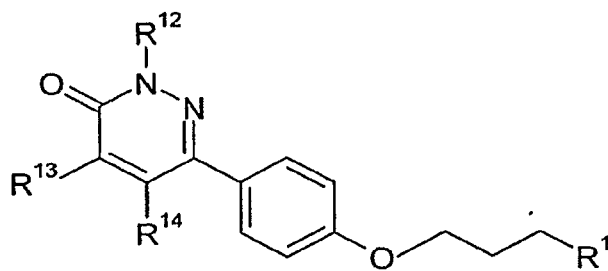
In another embodiment, the present invention includes compounds of formula (Id):



wherein each variable is defined in formula I. Additional aspects of the present invention include compounds of formula (Id) which incorporate the embodiments described above for compounds of formula I, as is appropriate. For example, additional embodiments include

compound of formula (Id) with the preferred moieties of groups R^1 ; or R^1 and m ; or R^1 , R^{13} and R^{14} ; etc.

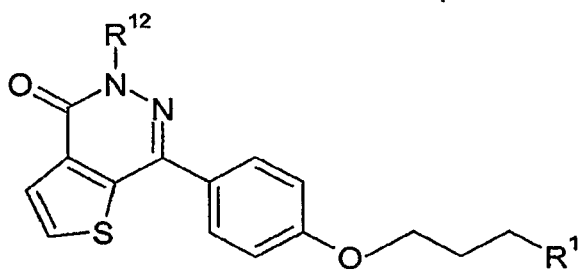
In another embodiment, the present invention includes compounds of formula (Ie):



(Ie)

wherein each variable is defined in formula I. Additional aspects of the present invention include compounds of formula (Ie) which incorporate the embodiments described above for compounds of formula I, as is appropriate. For example, additional embodiments include compound of formula (Ie) with the preferred moieties of groups R^1 ; or R^1 , R^{13} and R^{14} ; etc.

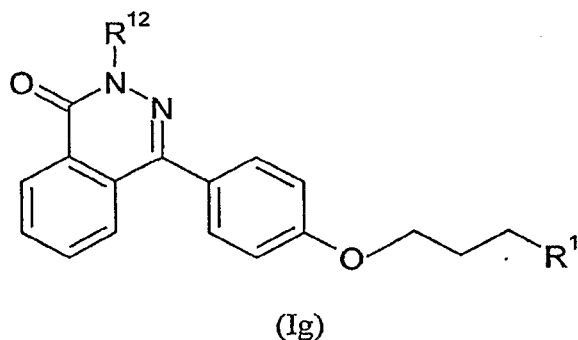
In another embodiment, the present invention includes compounds of formula (If):



(If)

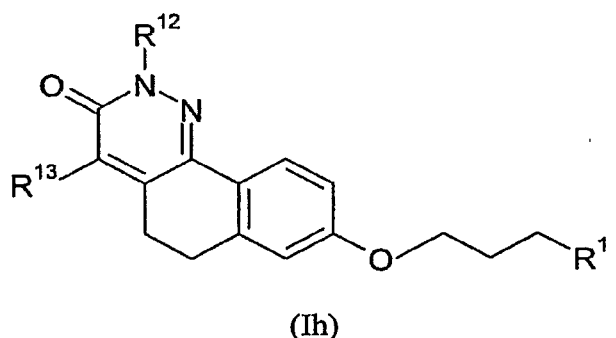
wherein each variable is defined in formula I. Additional aspects of the present invention include compounds of formula (If) which incorporate the embodiments described above for compounds of formula I, as is appropriate. For example, additional embodiments include compound of formula (If) with the preferred moieties of groups R^1 ; or R^{12} ; or R^1 and R^{12} .

In another embodiment, the present invention includes compounds of formula (Ig):



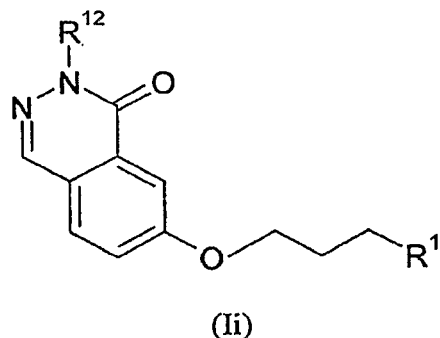
wherein each variable is defined in formula I. Additional aspects of the present invention
 5 include compounds of formula (Ig) which incorporate the embodiments described above for
 compounds of formula I, as is appropriate. For example, additional embodiments include
 compound of formula (Ig) with the preferred moieties of groups R^1 ; or R^{12} ; or R^1 and R^{12} .

In another embodiment, the present invention includes compounds of formula (Ih):



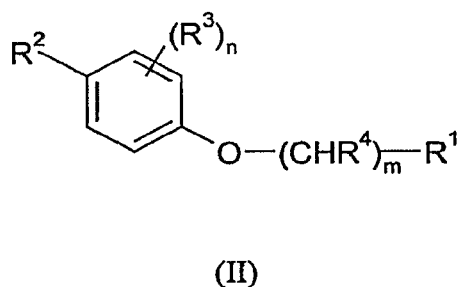
wherein each variable is defined in formula I. Additional aspects of the present invention
 15 include compounds of formula (Ih) which incorporate the embodiments described above for
 compounds of formula I, as is appropriate. For example, additional embodiments include
 compound of formula (Ih) with the preferred moieties of groups R^1 ; or R^1 and R^{13} ; or R^1 ,
 R^{23} and R^{24} .

In another embodiment, the present invention includes compounds of formula (Ii):



wherein each variable is defined in formula I. Additional aspects of the present invention include compounds of formula (Ii) which incorporate the embodiments described above for compounds of formula I, as is appropriate. For example, additional embodiments include compound of formula (Ii) with the preferred moieties of the R^1 and R^{12} groups.

In a further embodiment of the present invention, there are included compounds having a structure of Formula II:

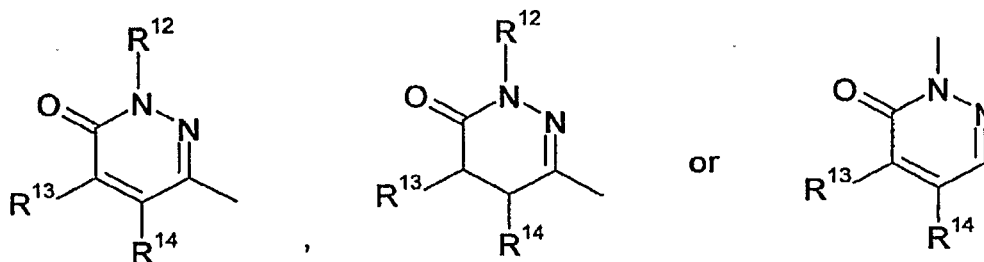


and stereoisomeric forms, mixtures of stereoisomeric forms or pharmaceutically acceptable salt forms thereof,

wherein:

R^1 is $NR^{10}R^{11}$ or a 5 to 6 membered heterocycloalkyl ring containing 1 or 2 nitrogen atoms and optionally substituted with 1 to 3 R^{20} groups;

R^2 is

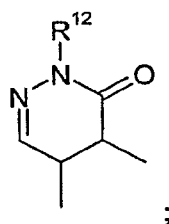


R^3 is:

at each occurrence is independently, H, F, Cl, Br, I, OR^{21} , $NR^{23}R^{24}$, NO_2 , CN, CF_3 , C_1 - C_6 alkyl, $C(=O)R^{21}$, CO_2R^{21} , or $C(=O)NR^{23}R^{24}$; or

5 when R^3 is ortho to R^2 , then R^3 and R^{14} can combine to form $-CH_2CH_2-$; or

when R^3 is ortho to X^a and R^2 is ortho to R^3 and meta to X^a , then R^2 and R^3 combine to form:



10 R^4 is H or C_1 - C_6 alkyl, wherein the alkyl group is optionally substituted with 1 to 3 R^{20} groups;

R^{10} and R^{11} are each, independently H or C_1 - C_6 alkyl, wherein the alkyl group is optionally substituted with 1 to 3 R^{20} groups;

R^{12} is H, C_1 - C_6 alkyl, phenyl, or benzyl, wherein the alkyl, phenyl and benzyl groups are optionally substituted with 1 to 3 R^{20} groups;

15 R^{13} and R^{14} are independently H, C_1 - C_6 alkyl, phenyl, or benzyl, or R^{13} and R^{14} can combine to form a fused phenyl, thienyl, cyclopentyl or cyclohexyl ring; wherein the phenyl, thienyl, pyrrolyl, cyclopentyl or cyclohexyl rings are optionally substituted with 1 to 3 R^{20} groups;

20 R^{20} at each occurrence is independently, H, F, Cl, Br, I, OR^{21} , OR^{22} , $NR^{23}R^{24}$, $NHOH$, NO_2 , CN, CF_3 , C_1 - C_6 alkyl optionally substituted with OR^{26} , C_2 - C_6 alkenyl, C_2 - C_6 alkynyl, C_3 - C_7 cycloalkyl, 3-7 membered heterocycloalkyl, phenyl, 5 or 6 membered heteroaryl, arylalkyl, $(=O)$, $C(=O)R^{21}$, CO_2R^{21} , $OC(=O)R^{21}$, $C(=O)NR^{23}R^{24}$, $NR^{27}C(=O)R^{21}$, $NR^{27}C(=O)OR^{21}$, $OC(=O)NR^{23}R^{24}$, $NR^{27}C(=S)R^{21}$, or $S(O)_qR^{21}$;

R^{21} at each occurrence is independently H, C_1 - C_6 alkyl, aryl, or arylalkyl;

25 R^{22} at each occurrence is independently the residue of an amino acid after the hydroxyl group of the carboxyl group is removed;

R^{23} and R^{24} at each occurrence are each independently selected from H, C_1 - C_6 alkyl, and aryl, or R^{23} and R^{24} , together with the nitrogen atom to which they are attached, form a 3 to 7 membered heterocyclic ring optionally substituted with $=O$;

30 R^{26} is H, C_1 - C_6 alkyl, aryl, or alkylaryl;

R^{27} is H or C_1-C_6 alkyl;

m is 3 when R^1 is attached via a nitrogen atom, and m is 0 or 1 when R^1 is attached via a carbon atom;

n is 0 or 1;

5 q is 0, 1, or 2.

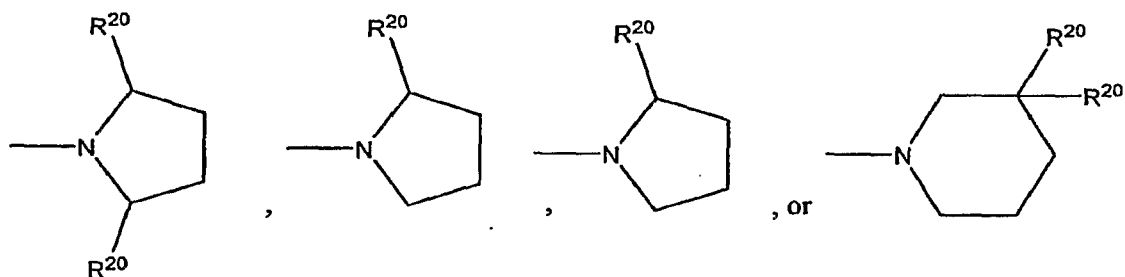
As used herein, "embodiments of the present invention" is intended to include the full scope of compounds of any of formulas I, I*, I**, I(a-i), and II, or any combination or subcombination thereof, unless specifically otherwise provided.

10 Embodiments of the present invention include those compounds where Y is O. In other embodiments Y is $S(O)_q$, or Y is NR^{15} .

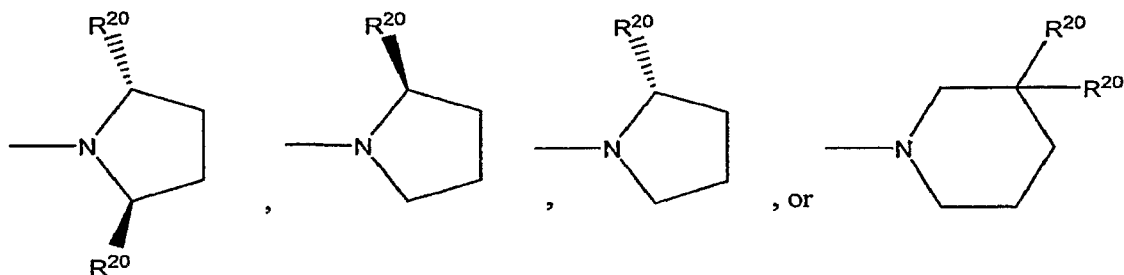
Embodiments of the present invention include those compounds where R^1 is $NR^{10}R^{11}$, and those compounds where R^{10} and R^{11} are each, independently H or C_1-C_6 alkyl, preferably both are C_1-C_6 alkyl.

15 Embodiments of the present invention include those compounds where R^1 is a 4- to 9-membered heterocycloalkyl ring, preferably a 5- to 6-membered heterocycloalkyl ring containing 1 or 2 nitrogen atoms, more preferably 1 nitrogen atom, and optionally substituted with 1 to 3 R^{20} groups. In certain embodiments R^1 is an optionally substituted 5-membered heterocycloalkyl ring containing 1 or 2 nitrogen atoms, such as pyrrolidinyl, imidazolidinyl, or pyrazolidinyl. In other embodiments, R^1 is an optionally substituted 6-membered heterocycloalkyl ring containing 1 or 2 nitrogen atoms, such as piperidinyl, piperazinyl, or hexahydropyrimidinyl. In certain preferred embodiments, R^1 is attached to Y through a ring nitrogen atom. In other preferred embodiments, R^1 is attached to Y through a ring carbon atom.

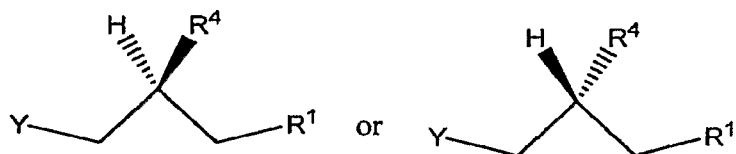
In other preferred embodiments, R^1 is:



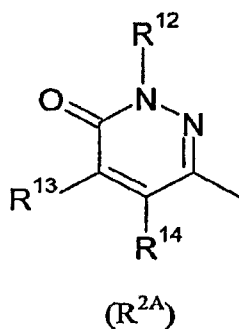
; more preferably:



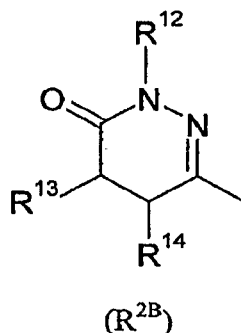
In certain preferred embodiments of the moiety $Y-(CHR^4)_m-R^1$, one or more of the carbon centers [(i.e., the subgroup “ $-(CHR^4)_m-$ ”), said subgroup which is present in the $Y-(CHR^4)_m-R^1$ moiety “m” times] may have the potential to be chiral in nature. That is to say, there may be 4 different groups attached to a carbon center in the subgroup. Each $-(CHR^4)-$ independently may be chiral and all possible stereoisomeric combinations are within the scope of the present invention. In certain more preferable embodiments, m is 3, more preferably the moiety $Y-(CHR^4)_m-R^1$ is



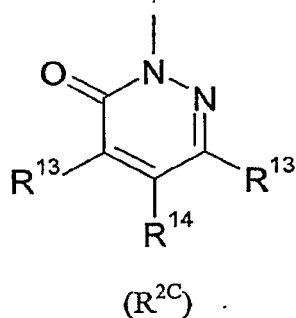
Embodiments of the present invention include those compounds where R^2 is



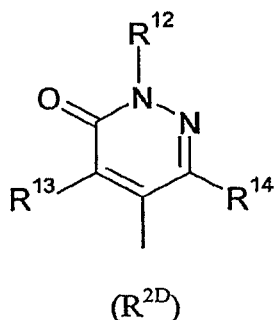
In certain embodiments R^2 is



In other embodiments, R^2 is

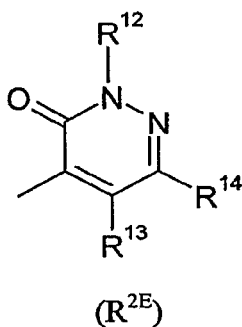


5 In other embodiments, R^2 is



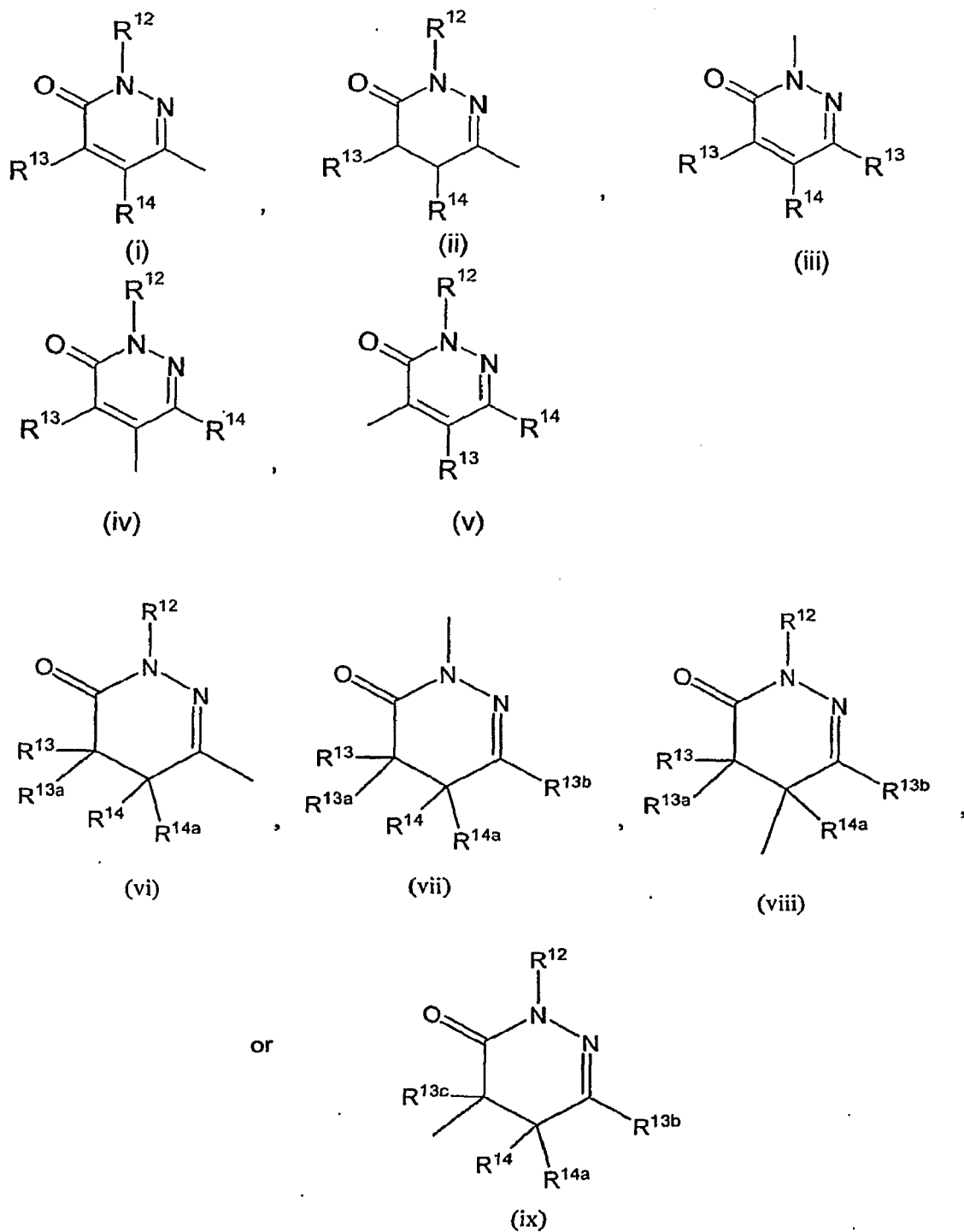
In other embodiments, R^2 is

10



15 In other embodiments; the R^2 can be a combination of R^{2A} through R^{2E} . For example, such combinations include: R^{2A} , R^{2C} , R^{2D} , and R^{2E} ; R^{2A} , R^{2B} , R^{2D} , and R^{2E} ; R^{2A} , R^{2B} , and R^{2C} ; R^{2A} , R^{2D} , and R^{2E} ; R^{2A} , R^{2D} , and R^{2E} ; R^{2A} and R^{2B} ; R^{2B} and R^{2C} ; R^{2D} and R^{2E} ; etc.

In other embodiments, R^2 is:



wherein:

5 when X and X^a are both CH, then R² is meta or para to the Y-(CHR⁴)_m-R¹ group;
and

when either X or X^a are N, then R² is para to the Y-(CHR⁴)_m-R¹ group;

each R³ is:

independently H, F, Cl, Br, I, OR²¹, NR²³R²⁴, NO₂, CN, CF₃, C₁-C₆alkyl, C(=O)R²¹, CO₂R²¹, or C(=O)NR²³R²⁴; or

when R³ is ortho to R², and R² is (i), (ii), (iv), (vi), or (ix), then R³ and R¹⁴ taken together may form -(CH₂)_s-, -CH₂Z-, -ZCH₂-, -ZCH₂CH₂- or CH₂CH₂Z-; wherein Z is O, S(O)_y, or NR²⁷; or

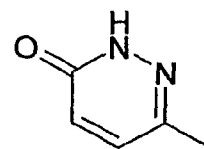
when R³ is ortho to R², and R² is (iv), (v), or (viii), then R³ and R¹³ taken together may form -(CH₂)_s-, -CH₂Z-, -ZCH₂-, -ZCH₂CH₂- or CH₂CH₂Z-; or

when R³ is ortho to R², and R² is (viii), then R³ and R^{13b} taken together may form -(CH₂)_s-, -CH₂Z-, -ZCH₂-, -ZCH₂CH₂- or CH₂CH₂Z-; or

when R³ is ortho to X^a and R² is ortho to R³ and meta to X^a, then R² and R³ taken together may form:

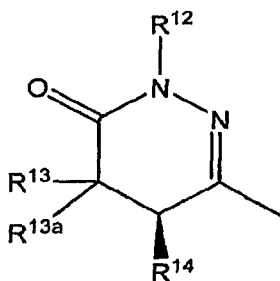


; preferably wherein R² is (i), (ii), (iv), (vi), (viii), or (ix). In certain

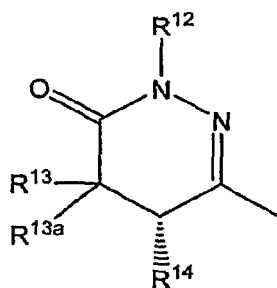


more preferred embodiments, R² is (iv); or it is (i); more preferably (iii) and one of R¹³ is cyclopropyl. In other alternatively preferred embodiments, R² is (vi), (viii), or (ix).

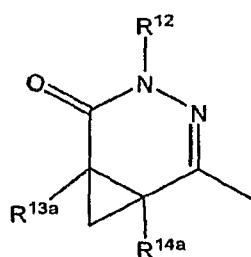
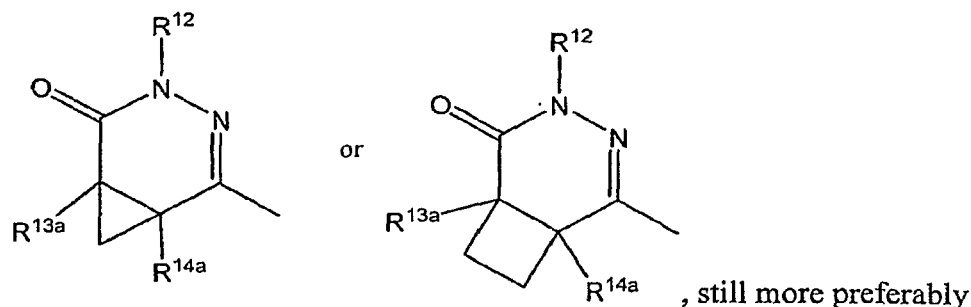
In some preferred embodiments, R² is:



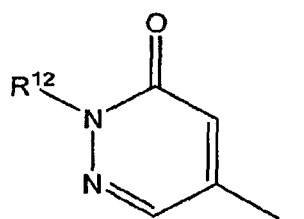
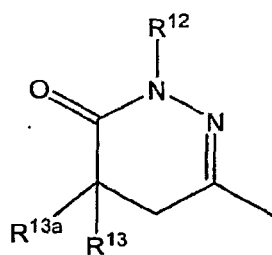
or



, more preferably



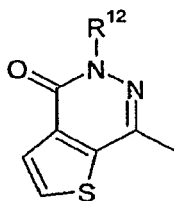
Alternatively preferred in some embodiments, R^2 is:



5 In still other embodiments, R^2 is:

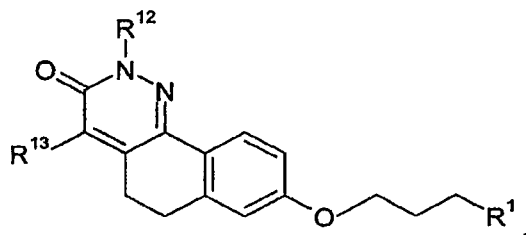
In further embodiments of the present invention, R^2 is para to the $Y-(CHR^4)-R^1$ group. In certain embodiments when X and X^a are both CH , then R^2 is meta to the $Y-(CHR^4)-R^1$ group, or R^2 is para to the $Y-(CHR^4)-R^1$ group. In other embodiments when X and X^a are both CH , then R^2 is meta or para to the $Y-(CHR^4)-R^1$ group. In other
 10 embodiments in combination with any of the three R^2 groups, R^{13} and R^{14} are independently H , or they are each independently C_1-C_6 alkyl, or they are each independently aryl, or they are each independently arylalkyl. In further embodiments of R^2 , R^{13} and R^{14} can combine to

form a fused phenyl ring, or they can form a fused thienyl ring, or they can form a fused pyrrolyl ring, or they can form a fused cyclopentyl ring or they can form a fused cyclohexyl ring. An example of R^{13} and R^{14} combining to form a fused thienyl ring has the following structure:



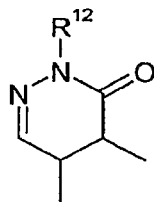
Embodiments of the present invention include those compounds where n is 0. Certain embodiments include those compounds where n is 1. Still other embodiments include those compounds where n is 2.

Embodiments of the present invention include those compounds where R^3 at each occurrence is independently, H, F, Cl, Br, I, OR^{21} , $NR^{23}R^{24}$, NO_2 , CN, CF_3 , C_1 - C_6 alkyl, $C(=O)R^{21}$, CO_2R^{21} , or $C(=O)NR^{23}R^{24}$, preferably F, Cl, Br, or C_1 - C_6 alkyl, more preferably F. In other preferred embodiments when R^3 is ortho to R^2 , then R^3 and R^{14} can combine to form $-CH_2CH_2-$. In certain embodiments R^3 at each occurrence is independently, H, F, Cl, Br, I, OR^{21} , $NR^{23}R^{24}$, NO_2 , CN, CF_3 , C_1 - C_6 alkyl, $C(=O)R^{21}$, CO_2R^{21} , or $C(=O)NR^{23}R^{24}$. In other embodiments, R^3 is ortho to R^2 , then R^3 and R^{14} can combine to form $-(CH_2)_s-$. An example includes a compound where s is 2, which has the following structure:

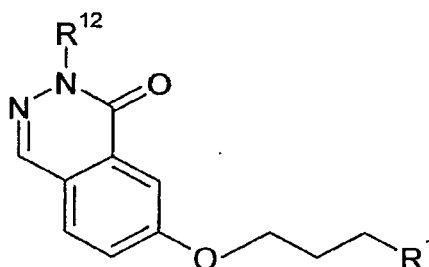


In certain embodiments of the present invention, s is 2, or s is 3. In other embodiments, R^3 and R^{14} can combine to form $-CH_2Z-$ or CH_2CH_2Z- ; wherein Z is O, $S(O)_y$, NR^{27} . In particular, R^3 and R^{14} can combine to form $-CH_2Z-$ or they can combine to form CH_2CH_2Z- . In particular embodiments, Z is O and in others, Z is $-S-$.

In further embodiments of the present invention, R^3 is ortho to X^a and R^2 is ortho to R^3 and meta to X^a , then R^2 and R^3 combine to form:



5 An example includes a compound of the following structure:



10 Embodiments of the present invention include those compounds where R^4 is H, optionally substituted C_1 - C_6 alkyl, or optionally substituted C_1 - C_6 alkoxyl, preferably H or optionally substituted C_1 - C_6 alkyl. In certain embodiments, R^4 is optionally substituted C_1 - C_6 alkyl. In embodiments where R^4 is alkyl, it is preferably C_1 - C_3 alkyl, more preferably, C_1 - C_6 alkyl, with methyl being even more preferred.

15 Embodiments of the present invention include those compounds where m is 1, 2, 3, 4, or 5 when R^1 is attached via a nitrogen atom. In particular, m is 1, or m is 2, or m is 3, or m is 4, or m is 5, or m can be any combination of the above including, 1 and 2; 1 and 3; 2 and 3; 1, 2, and 3; etc. Other embodiments include those compounds where m is 0, 1, 2, 3, 4, or 5 when R^1 is attached via a carbon atom. In particular, m is 0, or m is 1, or m is 2, or m is 3, or m is 4, or m is 5, or m can be any combination of the above including, 0 and 1; 0 and 2; 0, 1, and 2; 1, 2, and 3; etc.

In certain preferred embodiments of the present invention, s is 2.

25 In other preferred embodiments of the present invention, R^{12} is H, C_1 - C_6 alkyl, cycloalkyl, aryl, arylalkyl, or heteroaryl, more preferably H or heteroaryl, with heteroaryl being even more preferred. Alternatively, C_1 - C_6 alkyl, aryl, arylalkyl, or heteroaryl is preferred in some embodiments.

In certain preferred embodiments of the present invention, R^{13} , R^{14} , R^{13a} , R^{13b} , R^{13c} , and R^{14a} are each independently H or C_1 - C_6 alkyl, more preferably wherein at least one of is R^{13} , R^{14} , R^{13a} , R^{13b} , R^{13c} , and R^{14a} is C_1 - C_6 alkyl. In other alternatively preferred embodiments, R^{13a} and R^{13} are each independently C_1 - C_3 alkyl; or R^{14a} and R^{14} are each independently C_1 - C_3 alkyl.

In still other preferred embodiments of the present invention, R^{13} and R^{14} , taken together with the carbon atoms through which they are connected form a fused phenyl, thienyl, oxazolyl, pyridinyl, or C_3 - C_6 cycloalkyl ring; or R^{13b} and R^{14} , or R^{13} and R^{14a} , or R^{13b} and R^{14a} , or R^{13c} and R^{14a} , taken together with the carbon atoms through which they are connected form a fused C_3 - C_6 cycloalkyl ring; or R^{13} and R^{13a} , or R^{14} and R^{14a} , taken together with the carbon atom to which they are attached form a C_3 - C_8 cycloalkyl ring; provided that no more than one pair of R^{13} and R^{14} , R^{13b} and R^{14} , R^{13} and R^{14a} , R^{13b} and R^{14a} , R^{13c} and R^{14a} , R^{13} and R^{13a} , and R^{14} and R^{14a} are taken together with the carbon atoms through which they are connected or to which they are attached to form a ring; and wherein the fused phenyl, thienyl, pyrrolyl, oxazolyl, pyridinyl, or cycloalkyl ring is optionally substituted with 1 to 3 R^{20} groups. More preferably, R^{13} and R^{14} , R^{13b} and R^{14} , or R^{13} and R^{14a} , or R^{13b} and R^{14a} , or R^{13c} and R^{14a} , taken together with the carbon atoms through which they are connected form a fused C_3 - C_6 cycloalkyl ring; or R^{13} and R^{13a} , or R^{14} and R^{14a} , taken together with the carbon atom to which they are attached form a C_3 - C_8 cycloalkyl ring; then the cycloalkyl ring is a C_3 - C_4 cycloalkyl ring.

In some preferred embodiments of the present invention, R^{14} is heteroaryl.

In some preferred embodiments of the present invention, R^{20} is alkyl; in others it is cycloalkyl, more preferably cyclobutyl. In still others, R^{20} is F, Cl, CF_3 , $NR^{23}R^{24}$, or C_1 - C_6 alkyl optionally substituted with OR^{26} , cycloalkyl C_0 - C_4 alkyl, or heterocycloalkyl C_0 - C_4 alkyl, more preferably C_1 - C_6 alkyl optionally substituted with OR^{26} .

In certain other preferred embodiments of the present invention, R^{21} is H or C_1 - C_6 alkyl.

In some preferred embodiments of the present invention, R^{23} and R^{24} are each independently C_1 - C_6 alkyl.

In yet other preferred embodiments of the present invention, R^{26} is H or C_1 - C_6 alkyl.

In some preferred embodiments of the present invention, at least one of X and X_a is CH, more preferably X and X_a are each CH.

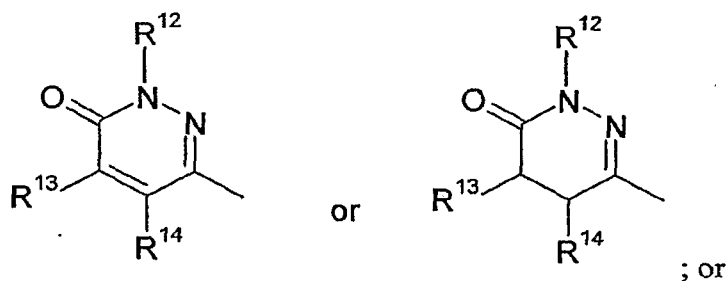
Embodiments of the present invention include those compounds of formula I wherein:

X and X^a are CH;

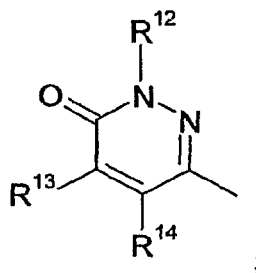
Y is O;

R¹ is NR¹⁰R¹¹ or a 5 to 6 membered heterocycloalkyl ring containing 1 or 2 nitrogen atoms and optionally substituted with 1 to 3 R²⁰ groups; or R¹ is NR¹⁰R¹¹, pyrrolidinyl or piperidyl, wherein the pyrrolidinyl and piperidyl groups are optionally substituted with 1 to 3 R²⁰ groups; or R¹ is pyrrolidinyl or piperidyl, wherein the pyrrolidinyl and piperidyl groups are optionally substituted with 1 to 3 R²⁰ groups;

R² is



R² is



R³ at each occurrence is independently, H, F, Cl, Br, I, OR²¹, NR²³R²⁴, NO₂, CN, CF₃, C₁-C₆ alkyl, C(=O)R²¹, CO₂R²¹, or C(=O)NR²³R²⁴; or

when R³ is ortho to R², then R³ and R¹⁴ can combine to form -CH₂CH₂-; or

R³ at each occurrence is independently, H; F; Cl; Br; I; OR²¹; NR²³R²⁴; NO₂; CN; CF₃; C₁-C₆ alkyl; C(=O)R²¹; CO₂R²¹; or C(=O)NR²³R²⁴;

R⁴ is H or C₁-C₆ alkyl, wherein the alkyl group is optionally substituted with 1 to 3 R²⁰ groups;

R¹⁰ and R¹¹ are each, independently H or C₁-C₆ alkyl, wherein the alkyl group is optionally substituted with 1 to 3 R²⁰ groups;

- R^{12} is H, C_1 - C_6 alkyl, phenyl, or benzyl, wherein the alkyl, phenyl and benzyl groups are optionally substituted with 1 to 3 R^{20} groups;
- R^{13} and R^{14} are independently H, C_1 - C_6 alkyl, phenyl, or benzyl, or R^{13} and R^{14} can combine to form a fused phenyl, thienyl, cyclopentyl or cyclohexyl ring; wherein the phenyl, thienyl, pyrrolyl, cyclopentyl or cyclohexyl rings are optionally substituted with 1 to 3 R^{20} groups; or
- R^{13} and R^{14} are independently H, C_1 - C_6 alkyl, phenyl, or benzyl; or
- R^{13} and R^{14} can combine to form a fused phenyl, thienyl, cyclopentyl or cyclohexyl ring;
- R^{20} at each occurrence is independently, H, F, Cl, Br, I, OR^{21} , OR^{22} , $NR^{23}R^{24}$, $NHOH$, NO_2 , CN , CF_3 , C_1 - C_6 alkyl optionally substituted with OR^{26} , C_2 - C_6 alkenyl, C_2 - C_6 alkynyl, C_3 - C_7 cycloalkyl, 3-7 membered heterocycloalkyl, phenyl, 5 or 6 membered heteroaryl, arylalkyl, $(=O)$, $C(=O)R^{21}$, CO_2R^{21} , $OC(=O)R^{21}$, $C(=O)NR^{23}R^{24}$, $NR^{27}C(=O)R^{21}$, $NR^{27}C(=O)OR^{21}$, $OC(=O)NR^{23}R^{24}$, $NR^{27}C(=S)R^{21}$, or $S(O)_qR^{21}$;
- R^{21} at each occurrence is independently H, C_1 - C_6 alkyl, aryl, or arylalkyl;
- R^{22} at each occurrence is independently the residue of an amino acid after the hydroxyl group of the carboxyl group is removed;
- R^{23} and R^{24} at each occurrence are each independently selected from H, C_1 - C_6 alkyl, and aryl, or R^{23} and R^{24} , together with the nitrogen atom to which they are attached, form a 3 to 7 membered heterocyclic ring optionally substituted with $=O$;
- R^{26} is H, C_1 - C_6 alkyl, aryl, or alkylaryl;
- R^{27} is H or C_1 - C_6 alkyl;
- m is 3 when R^1 is attached via a nitrogen atom, and m is 0 or 1 when R^1 is attached via a carbon atom;
- n is 0 or 1;
- q is 0, 1, or 2.

Embodiments of the present invention include those compounds of formula I

wherein:

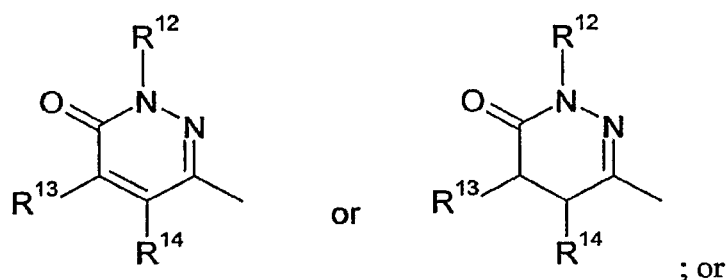
- X is N and X^a is N or CH; or X and X^a are each N; or X is N and X^a is CH;

Y is O;

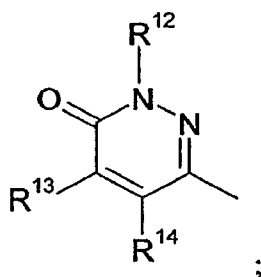
R^1 is $NR^{10}R^{11}$ or a 5 to 6 membered heterocycloalkyl ring containing 1 or 2 nitrogen atoms and optionally substituted with 1 to 3 R^{20} groups; or R^1 is $NR^{10}R^{11}$, pyrrolidinyl or piperidyl, wherein the pyrrolidinyl and piperidinyl groups are optionally substituted

with 1 to 3 R^{20} groups; or R^1 is pyrrolidinyl or piperidinyl, wherein the pyrrolidinyl and piperidyl groups are optionally substituted with 1 to 3 R^{20} groups;

R^2 is



R^2 is



R^3 at each occurrence is independently, H, F, Cl, Br, I, OR^{21} , $NR^{23}R^{24}$, NO_2 , CN, CF_3 , C_1 - C_6 alkyl, $C(=O)R^{21}$, CO_2R^{21} , or $C(=O)NR^{23}R^{24}$; or

when R^3 is ortho to R^2 , then R^3 and R^{14} can combine to form $-CH_2CH_2-$; or

R^3 at each occurrence is independently, H; F; Cl; Br; I; OR^{21} ; $NR^{23}R^{24}$; NO_2 ; CN; CF_3 ; C_1 - C_6 alkyl; $C(=O)R^{21}$; CO_2R^{21} ; or $C(=O)NR^{23}R^{24}$;

R^4 is H or C_1 - C_6 alkyl, wherein the alkyl group is optionally substituted with 1 to 3 R^{20} groups;

R^{10} and R^{11} are each, independently H or C_1 - C_6 alkyl, wherein the alkyl group is optionally substituted with 1 to 3 R^{20} groups;

R^{12} is H, C_1 - C_6 alkyl, phenyl, or benzyl, wherein the alkyl, phenyl and benzyl groups are optionally substituted with 1 to 3 R^{20} groups;

R^{13} and R^{14} are independently H, C_1 - C_6 alkyl, phenyl, or benzyl, or R^{13} and R^{14} can combine to form a fused phenyl, thienyl, cyclopentyl or cyclohexyl ring; wherein the

phenyl, thienyl, pyrrolyl, cyclopentyl or cyclohexyl rings are optionally substituted with 1 to 3 R^{20} groups; or

R^{13} and R^{14} are independently H, C_1 - C_6 alkyl, phenyl, or benzyl; or

R^{13} and R^{14} can combine to form a fused phenyl, thienyl, cyclopentyl or cyclohexyl

5 ring;

R^{20} at each occurrence is independently, H, F, Cl, Br, I, OR^{21} , OR^{22} , $NR^{23}R^{24}$, $NHOH$, NO_2 ,

CN, CF_3 , C_1 - C_6 alkyl optionally substituted with OR^{26} , C_2 - C_6 alkenyl, C_2 - C_6

alkynyl, C_3 - C_7 cycloalkyl, 3-7 membered heterocycloalkyl, phenyl, 5 or 6 membered

heteroaryl, arylalkyl, $(=O)$, $C(=O)R^{21}$, CO_2R^{21} , $OC(=O)R^{21}$, $C(=O)NR^{23}R^{24}$,

10 $NR^{27}C(=O)R^{21}$, $NR^{27}C(=O)OR^{21}$, $OC(=O)NR^{23}R^{24}$, $NR^{27}C(=S)R^{21}$, or $S(O)_qR^{21}$;

R^{21} at each occurrence is independently H, C_1 - C_6 alkyl, aryl, or arylalkyl;

R^{22} at each occurrence is independently the residue of an amino acid after the hydroxyl group of the carboxyl group is removed;

R^{23} and R^{24} at each occurrence are each independently selected from H, C_1 - C_6 alkyl, and

15 aryl, or R^{23} and R^{24} , together with the nitrogen atom to which they are attached,

form a 3 to 7 membered heterocyclic ring optionally substituted with $=O$;

R^{26} is H, C_1 - C_6 alkyl, aryl, or alkylaryl;

R^{27} is H or C_1 - C_6 alkyl;

m is 3 when R^1 is attached via a nitrogen atom, and m is 0 or 1 when R^1 is attached via a

20 carbon atom;

n is 0 or 1;

q is 0, 1, or 2.

Embodiments of the present invention include those compounds of formula I wherein:

25 X and X^a are CH;

Y is O;

R^1 is $NR^{10}R^{11}$, pyrrolidinyl or piperidyl, wherein the pyrrolidinyl and piperidyl groups are optionally substituted with 1 to 3 R^{20} groups;

R^2 is para to the $Y-(CHR^4)_m-R^1$ group;

30 R^3 at each occurrence is independently, H, F, Cl, Br, I, OR^{21} , $NR^{23}R^{24}$, NO_2 , CN,

CF_3 , C_1 - C_6 alkyl, $C(=O)R^{21}$, CO_2R^{21} , or $C(=O)NR^{23}R^{24}$; or

when R^3 is ortho to R^2 , then R^3 and R^{14} can combine to form $-CH_2CH_2-$;

m is 3 when R^1 is attached via a nitrogen atom, and m is 0 or 1 when R^1 is attached via a carbon atom;

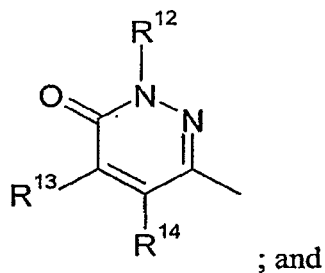
n is 0 or 1.

In particular, a first embodiment includes those compounds wherein:

R^1 is attached by the nitrogen atom;

R^2 is:

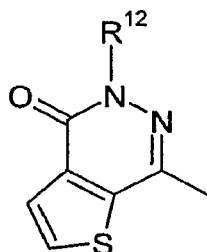
5



R^{13} and R^{14} combine to form a fused phenyl or thienyl ring; and

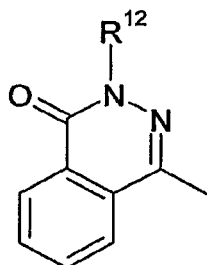
m is 3.

10 In other embodiments, R^2 is:



In further embodiments, R^2 is:

15

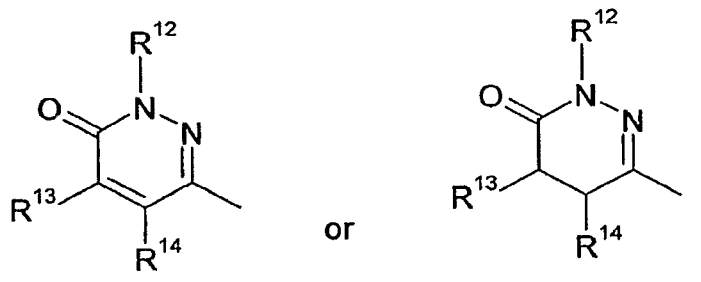


In a second particular embodiment:

R^1 is attached by the nitrogen atom;

R^2 is:

20

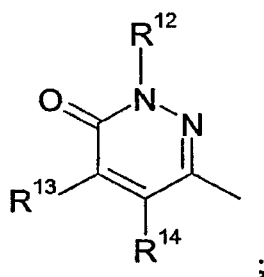


R^{13} and R^{14} combine to form a fused cyclopentyl or cyclohexyl ring; and
 5 m is 3.

In a third particular embodiment:

R^1 is attached by the nitrogen atom;

R^2 is:

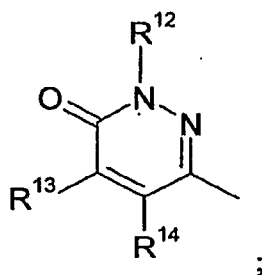


R^{13} and R^{14} are independently H, C_1 - C_6 alkyl, phenyl, or benzyl; and
 10 m is 3.

In a fourth particular embodiment:

15 R^1 is pyrrolidinyl or piperidyl, wherein the pyrrolidinyl and piperidyl groups are attached by a ring carbon atom and each are optionally substituted with 1 to 3 R^{20} groups;

R^2 is:



R^4 is H;

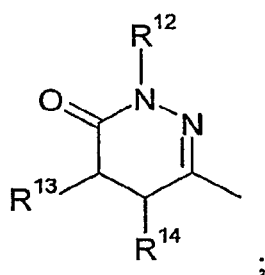
R^{13} and R^{14} are independently H, C_1 - C_6 alkyl, phenyl, or benzyl;

m is 0 or 1.

5 In a fifth particular embodiment:

R^1 is attached by the nitrogen atom;

R^2 is:



10

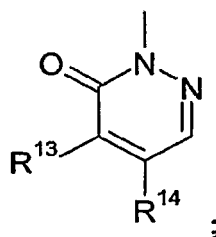
R^{13} and R^{14} are independently H, C_1 - C_6 alkyl, phenyl, or benzyl;

m is 3.

In a sixth particular embodiment:

R^1 is attached by the nitrogen atom;

15 R^2 is:



20

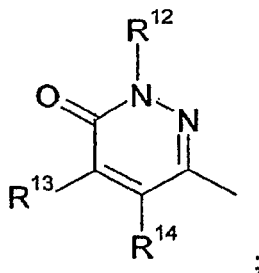
R^{13} and R^{14} are independently H, C_1 - C_6 alkyl, phenyl, or benzyl;

m is 3.

In a seventh particular embodiment:

R^1 is attached by the nitrogen atom;

R^2 is ortho to R^3 , and R^2 is:



R^3 and R^{14} combine to form $-\text{CH}_2\text{CH}_2-$;

m is 3.

Embodiments of the present invention include those compounds of formula I

5 wherein:

X and X^a are CH ;

Y is O ;

R^1 is $\text{NR}^{10}\text{R}^{11}$, pyrrolidinyl or piperidyl, wherein the pyrrolidinyl and piperidyl groups are optionally substituted with 1 to 3 R^{20} groups;

10 R^2 is para to the $Y-(\text{CHR}^4)_m-R^1$ group;

R^3 at each occurrence is independently, H , F , Cl , Br , I , OR^{21} , $\text{NR}^{23}\text{R}^{24}$, NO_2 , CN , CF_3 , C_1 - C_6 alkyl, $\text{C}(=\text{O})\text{R}^{21}$, CO_2R^{21} , or $\text{C}(=\text{O})\text{NR}^{23}\text{R}^{24}$; or

when R^3 is ortho to R^2 , then R^3 and R^{14} can combine to form $-\text{CH}_2\text{CH}_2-$;

m is 3 when R^1 is attached via a nitrogen atom, and m is 0 or 1 when R^1 is attached via a

15 carbon atom;

n is 0 or 1.

Additional aspects of the present invention include compounds of formula II which incorporate the embodiments described above for compounds of formula I, as is

20 appropriate. For example, additional embodiments include compound of formula II with the preferred moieties of groups R^1 ; or R^1 and R^{13} ; or R^1 , R^{23} and R^{24} , etc.

For example, in certain embodiments of compounds of formula II:

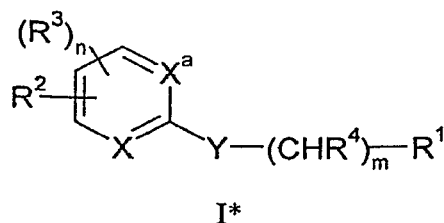
R^1 is $\text{NR}^{10}\text{R}^{11}$, pyrrolidinyl or piperidyl, wherein the pyrrolidinyl and piperidyl groups are optionally substituted with 1 to 3 R^{20} groups.

25 For example, in other embodiments of compounds of formula II:

R^3 at each occurrence is independently, H , F , Cl , Br , I , OR^{21} , $\text{NR}^{23}\text{R}^{24}$, NO_2 , CN , CF_3 , C_1 - C_6 alkyl, $\text{C}(=\text{O})\text{R}^{21}$, CO_2R^{21} , or $\text{C}(=\text{O})\text{NR}^{23}\text{R}^{24}$; or

when R^3 is ortho to R^2 , then R^3 and R^{14} can combine to form $-\text{CH}_2\text{CH}_2-$.

In certain embodiments, the compounds of the formula I*:



are selected from the group consisting of:

- 2-methyl-6-{4-[(R)-2-methyl-3-((R)-2-methyl-pyrrolidin-1-yl)-propoxy]-phenyl}-
 5 2H-pyridazin-3-one;
 6-[4-(1-cyclopentyl-piperidin-4-yloxy)-phenyl]-2-methyl-2H-pyridazin-3-one;
 6-{3,5-difluoro-4-[3-((R)-2-methyl-pyrrolidin-1-yl)-propoxy]-phenyl}-2-methyl-
 2H-pyridazin-3-one;
 6-{3-chloro-4-[3-((R)-2-methyl-pyrrolidin-1-yl)-propoxy]-phenyl}-2-methyl-2H-
 10 pyridazin-3-one;
 2,6-dimethyl-5-{4-[3-((R)-2-methyl-pyrrolidin-1-yl)-propoxy]-phenyl}-2H-
 pyridazin-3-one;
 2,6-dimethyl-5-[4-(3-piperidin-1-yl-propoxy)-phenyl]-2H-pyridazin-3-one;
 6-methyl-5-{4-[3-((R)-2-methyl-pyrrolidin-1-yl)-propoxy]-phenyl}-2H-pyridazin-3-
 15 one;
 6-methyl-5-[4-(3-piperidin-1-yl-propoxy)-phenyl]-2H-pyridazin-3-one;
 5-[4-(3-azepan-1-yl-propoxy)-phenyl]-6-methyl-2H-pyridazin-3-one;
 2-methyl-5-{4-[3-((R)-2-methyl-pyrrolidin-1-yl)-propoxy]-phenyl}-2H-pyridazin-3-
 one;
 20 2-methyl-5-[4-(3-piperidin-1-yl-propoxy)-phenyl]-2H-pyridazin-3-one;
 5-[4-(3-azepan-1-yl-propoxy)-phenyl]-2-methyl-2H-pyridazin-3-one;
 5-{4-[3-((R)-2-methyl-pyrrolidin-1-yl)-propoxy]-phenyl}-2-pyridin-2-yl-2H-
 pyridazin-3-one;
 5-[4-(3-piperidin-1-yl-propoxy)-phenyl]-2-pyridin-2-yl-2H-pyridazin-3-one;
 25 5-[4-(3-azepan-1-yl-propoxy)-phenyl]-2-pyridin-2-yl-2H-pyridazin-3-one;
 2-methyl-5-[4-(3-piperidin-1-yl-propoxy)-phenyl]-2H-pyridazin-3-one;
 2-(6-methyl-pyridin-2-yl)-5-{4-[3-((R)-2-methyl-pyrrolidin-1-yl)-propoxy]-phenyl}-
 2H-
 pyridazin-3-one;
 2-(3-methyl-pyridin-2-yl)-5-{4-[3-((R)-2-methylpyrrolidin-1-yl)-propoxy]-phenyl}-
 30 2H-

pyridazin-3-one;

6-methyl-5-{4-[3-((R)-2-methyl-pyrrolidin-1-yl)-propoxy]-phenyl}-2-pyridin-2-yl-2H-pyridazin-3-one;

6-methyl-2-(3-methyl-pyridin-2-yl)-5-{4-[3-((R)-2-methyl-pyrrolidin-1-yl)-propoxy]-phenyl}-2H-pyridazin-3-one;

6-methyl-5-[4-(piperidin-4-yloxy)-phenyl]-2H-pyridazin-3-one; hydrochloride;

5-[4-(1-cyclobutyl-piperidin-4-yloxy)-phenyl]-6-methyl-2H-pyridazin-3-one;

5-[4-(1-cyclobutyl-piperidin-4-yloxy)-phenyl]-6-methyl-2-pyridin-2-yl-2H-pyridazin-3-one;

5-[4-(piperidin-4-yloxy)-phenyl]-2H-pyridazin-3-one;

5-[4-(1-cyclobutyl-piperidin-4-yloxy)-phenyl]-2H-pyridazin-3-one;

5-[4-(1-cyclobutyl-piperidin-4-yloxy)-phenyl]-6-methyl-2-thiophen-3-yl-2H-pyridazin-3-one;

6-methyl-5-{4-[3-((R)-2-methyl-pyrrolidin-1-yl)-propoxy]-phenyl}-2-thiophen-3-yl-2H-pyridazin-3-one;

5-{4-[3-((S)-2-methyl-pyrrolidin-1-yl)-propoxy]-phenyl}-2-pyridin-2-yl-2H-pyridazin-3-one;

5-[4-(1-cyclobutyl-piperidin-4-yloxy)-phenyl]-6-methyl-4,5-dihydro-2H-pyridazin-3-one;

6-{4-[3-((R)-2-methyl-pyrrolidin-1-yl)-propoxy]-phenyl}-5-pyridin-2-yl-4,5-dihydro-2H-pyridazin-3-one;

6-{4-[3-((R)-2-methyl-pyrrolidin-1-yl)-propoxy]-phenyl}-5-pyridin-2-yl-2H-pyridazin-3-one;

6-[4-(piperidin-4-yloxy)-phenyl]-5-pyridin-2-yl-4,5-dihydro-2H-pyridazin-3-one;

6-[4-(1-cyclobutyl-piperidin-4-yloxy)-phenyl]-5-pyridin-2-yl-4,5-dihydro-2H-pyridazin-3-one;

6-[4-(1-cyclobutyl-piperidin-4-yloxy)-phenyl]-5-pyridin-2-yl-2H-pyridazin-3-one;

6-[4-(1-cyclobutyl-piperidin-4-yloxy)-phenyl]-4-methyl-4,5-dihydro-2H-pyridazin-3-one;

5-[6-(1-cyclobutyl-piperidin-4-yloxy)-pyridin-3-yl]-2H-pyridazin-3-one;

2-(2-fluoro-ethyl)-6-{4-[3-((R)-2-methyl-pyrrolidin-1-yl)-propoxy]-phenyl}-2H-pyridazin-3-one;

6-{3-fluoro-4-[3-((R)-2-methyl-pyrrolidin-1-yl)-propoxy]-phenyl}-2H-pyridazin-3-one;

- 6-[3-fluoro-4-(3-piperidin-1-yl-propoxy)-phenyl]-2H-pyridazin-3-one;
 4-methyl-6-{4-[3-((R)-2-methyl-pyrrolidin-1-yl)-propoxy]-phenyl}-4,5-dihydro-2H-pyridazin-3-one;
 4-methyl-6-{4-[3-((R)-2-methyl-pyrrolidin-1-yl)-propoxy]-phenyl}-2H-pyridazin-3-one;
 4-methyl-6-[4-(3-piperidin-1-yl-propoxy)-phenyl]-2H-pyridazin-3-one;
 4-{4-[3-((S)-2-hydroxymethyl-pyrrolidin-1-yl)-propoxy]-phenyl}-2-methyl-5,6,7,8-tetrahydro-2H-phthalazin-1-one;
 2-methyl-4-{3-[3-((R)-2-methyl-pyrrolidin-1-yl)-propoxy]-phenyl}-2,5,6,7-tetrahydro-cyclopenta[d]pyridazin-1-one;
 2-methyl-4-[3-(3-piperidin-1-yl-propoxy)-phenyl]-2,5,6,7-tetrahydro-cyclopenta[d]pyridazin-1-one;
 4-{3-[3-((S)-2-hydroxymethyl-pyrrolidin-1-yl)-propoxy]-phenyl}-2-methyl-2,5,6,7-tetrahydro-cyclopenta[d]pyridazin-1-one;
 2-isopropyl-5-{4-[3-((R)-2-methyl-pyrrolidin-1-yl)-propoxy]-phenyl}-2H-pyridazin-3-one;
 2-[3-((R)-2-methyl-pyrrolidin-1-yl)-propoxy]-5-(6-oxo-1,6-dihydro-pyridazin-3-yl)-benzonitrile;
 2-[3-(piperidin-1-yl)-propoxy]-5-(6-oxo-1,6-dihydro-pyridazin-3-yl)-benzonitrile;
 2-(2-hydroxyethyl)-6-{4-[3-((R)-2-methyl-pyrrolidin-1-yl)-propoxy]-phenyl}-2H-pyridazin-3-one;
 6-{4-[(S)-2-methyl-3-((R)-2-methyl-pyrrolidin-1-yl)-propoxy]-phenyl}-2H-pyridazin-3-one;
 4-[4-(3-piperidin-1-yl-propoxy)-phenyl]-2,5,6,7-tetrahydro-cyclopenta[d]pyridazin-1-one;
 6-[4-(3-piperidin-1-yl-propoxy)-phenyl]-2H-pyridazin-3-one;
 6-[3-methoxy-4-(3-piperidin-1-yl-propoxy)-phenyl]-2H-pyridazin-3-one;
 6-{3-methoxy-4-[3-((R)-2-methyl-pyrrolidin-1-yl)-propoxy]-phenyl}-2H-pyridazin-3-one;
 6-[2-methyl-4-(3-piperidin-1-yl-propoxy)-phenyl]-2H-pyridazin-3-one;
 6-{4-[3-((R)-2-methyl-pyrrolidin-1-yl)-propoxy]-phenyl}-2-pyrimidin-2-yl-2H-pyridazin-3-one;
 6-[6-(1-cyclopentyl-piperidin-4-yloxy)-pyridin-3-yl]-2H-pyridazin-3-one;
 6-[6-(1-isopropyl-piperidin-4-ylmethoxy)-pyridin-3-yl]-2H-pyridazin-3-one;

6-[6-(1-cyclobutyl-piperidin-4-yloxy)-pyridin-3-yl]-2H-pyridazin-3-one;
6-[6-(1-isopropyl-piperidin-4-yloxy)-pyridin-3-yl]-2H-pyridazin-3-one;
6-[6-(1-cyclopentyl-piperidin-4-yloxy)-pyridin-3-yl]-2-methyl-2H-pyridazin-3-one;
6-[6-(1-cyclobutyl-piperidin-4-yloxy)-pyridin-3-yl]-2-methyl-2H-pyridazin-3-one;
5 6-[6-(1-cyclobutyl-piperidin-4-yloxy)-pyridin-3-yl]-2-isopropyl-2H-pyridazin-3-

one;

6-{6-[3-((R)-2-methyl-pyrrolidin-1-yl)-propoxy]-pyridin-3-yl}-2H-pyridazin-3-one;
6-[6-(3-piperidin-1-yl-propoxy)-pyridin-3-yl]-2H-pyridazin-3-one;
6-[6-(1-cyclobutyl-piperidin-4-yloxy)-pyridin-3-yl]-4,4-dimethyl-4,5-dihydro-2H-

10 pyridazin-3-one;

6-[6-(1-cyclobutyl-piperidin-4-yloxy)-pyridin-3-yl]-2-pyridin-2-yl-2H-pyridazin-3-one;

6-[4-(1-cyclobutyl-piperidin-4-yloxy)-phenyl]-4,5-dihydro-2H-pyridazin-3-one;

6-[4-(1-cyclobutyl-piperidin-4-yloxy)-3-fluoro-phenyl]-4,5-dihydro-2H-pyridazin-3-

15 one;

6-[4-(1-cyclobutyl-piperidin-4-yloxy)-phenyl]-4,4-dimethyl-4,5-dihydro-2H-pyridazin-3-one;

6-[4-(1-cyclobutyl-piperidin-4-yloxy)-3-fluoro-phenyl]-4,4-dimethyl-4,5-dihydro-2H-pyridazin-3-one;

20 6-[4-(1-cyclopentyl-piperidin-4-yloxy)-phenyl]-2H-pyridazin-3-one;

6-[4-(1-cyclobutyl-piperidin-4-yloxy)-phenyl]-2H-pyridazin-3-one;

6-[4-(1-cyclobutyl-piperidin-4-yloxy)-3-fluoro-phenyl]-2H-pyridazin-3-one;

6-[4-(1-cyclobutyl-piperidin-4-yloxy)-phenyl]-2-pyridin-2-yl-2H-pyridazin-3-one;

6-[4-(piperidin-4-yloxy)-phenyl]-2-pyridin-2-yl-4,5-dihydro-2H-pyridazin-3-one;

25 6-[4-((R)-1-cyclohexyl-pyrrolidin-3-yloxy)-phenyl]-4,5-dihydro-2H-pyridazin-3-one;

6-[4-((R)-1-cyclohexyl-pyrrolidin-3-yloxy)-phenyl]-2H-pyridazin-3-one;

6-[4-((R)-1-cyclobutyl-pyrrolidin-3-yloxy)-phenyl]-2H-pyridazin-3-one;

6-[4-((R)-1-cyclopentyl-pyrrolidin-3-yloxy)-phenyl]-4,5-dihydro-2H-pyridazin-3-

30 one;

2-cyclobutyl-6-[4-(1-cyclobutyl-piperidin-4-yloxy)-phenyl]-4,5-dihydro-2H-pyridazin-3-one;

2-cyclobutyl-6-[4-(1-cyclopentyl-piperidin-4-yloxy)-phenyl]-4,5-dihydro-2H-pyridazin-3-one;

2-cyclobutyl-6-[4-(piperidin-4-yloxy)-phenyl]-4,5-dihydro-2H-pyridazin-3-one;
 6-[4-(1-cyclobutyl-piperidin-4-yloxy)-phenyl]-2-(2,2,2-trifluoro-ethyl)-4,5-dihydro-
 2H-pyridazin-3-one;
 6-[4-(1-cyclopentyl-piperidin-4-yloxy)-phenyl]-2-(2,2,2-trifluoro-ethyl)-4,5-
 5 dihydro-2H-pyridazin-3-one;
 6-{4-[3-((R)-2-methyl-pyrrolidin-1-yl)-propoxy]-phenyl}-2-(2,2,2-trifluoro-ethyl)-
 4,5-dihydro-2H-pyridazin-3-one;
 6-{4-[3-piperidin-1-yl-propoxy]-phenyl}-2-(2,2,2-trifluoro-ethyl)-4,5-dihydro-2H-
 yridazin-3-one;
 10 6-{4-[3-((R)-2-methyl-pyrrolidin-1-yl)-propoxy]-phenyl}-2-(2,2,2-trifluoro-ethyl)-
 2H-pyridazin-3-one;
 6-[4-(3-piperidin-1-yl-propoxy)-phenyl]-2-(2,2,2-trifluoro-ethyl)-2H-pyridazin-3-
 one;
 5-[4-(1-cyclobutyl-piperidin-4-yloxy)-phenyl]-3,4-diaza-bicyclo[4.2.0]oct-4-en-2-
 15 one;
 5-{4-[3-((R)-2-methyl-pyrrolidin-1-yl)-propoxy]-phenyl}-3,4-diaza-
 bicyclo[4.2.0]oct-4-en-2-one;
 4-[4-(1-cyclobutyl-piperidin-4-yloxy)-phenyl]-2,4a,5,6,7,7a-hexahydro-
 cyclopenta[d]pyridazin-1-one;
 20 4-{4-[3-((R)-2-methyl-pyrrolidin-1-yl)-propoxy]-phenyl}-2,4a,5,6,7,7a-hexahydro-
 cyclopenta[d]pyridazin-1-one;
 4-[4-(1-cyclobutyl-piperidin-4-yloxy)-phenyl]-2,5,6,7-tetrahydro-
 cyclopenta[d]pyridazin-1-one;
 2-cyclobutyl-6-[6-(1-cyclobutyl-piperidin-4-yloxy)-pyridin-3-yl]-4,5-dihydro-2H-
 25 pyridazin-3-one;
 6-{4-[3-((R)-2-methyl-pyrrolidin-1-yl)-propoxy]-phenyl}-4,5-dihydro-2H-
 pyridazin-3-one;
 4,4-dimethyl-6-{4-[3-((R)-2-methyl-pyrrolidin-1-yl)-propoxy]-phenyl}-4,5-dihydro-
 2H-pyridazin-3-one;
 30 6-{3-fluoro-4-[3-((R)-2-methyl-pyrrolidin-1-yl)-propoxy]-phenyl}-4,5-dihydro-2H-
 pyridazin-3-one;
 6-[3-fluoro-4-(3-piperidin-1-yl-propoxy)-phenyl]-4,5-dihydro-2H-pyridazin-3-one;
 5,5-dimethyl-6-{4-[3-((R)-2-methyl-pyrrolidin-1-yl)-propoxy]-phenyl}-4,5-dihydro-
 2H-pyridazin-3-one;

6-{4-[3-((R)-2-methyl-pyrrolidin-1-yl)-propoxy]-phenyl}-2-pyridin-2-yl-4,5-dihydro-2H-pyridazin-3-one;

6-{3,5-difluoro-4-[3-((R)-2-methyl-pyrrolidin-1-yl)-propoxy]-phenyl}-2H-pyridazin-3-one;

5 6-{3,5-dibromo-4-[3-((R)-2-methyl-pyrrolidin-1-yl)-propoxy]-phenyl}-2H-pyridazin-3-one;

6-{3,5-difluoro-4-[3-((R)-2-methyl-pyrrolidin-1-yl)-propoxy]-phenyl}-4,5-dihydro-2H-pyridazin-3-one;

10 6-[4-(1-cyclobutyl-piperidin-4-yloxy)-3,5-difluoro-phenyl]-4,5-dihydro-2H-pyridazin-3-one;

6-[4-(1-cyclobutyl-piperidin-4-yloxy)-3,5-difluoro-phenyl]-2H-pyridazin-3-one;

6-[4-(1-cyclobutyl-piperidin-4-yloxy)-phenyl]-5-methyl-4,5-dihydro-2H-pyridazin-3-one;

15 (R)-6-[4-(1-cyclobutyl-piperidin-4-yloxy)-phenyl]-5-methyl-4,5-dihydro-2H-pyridazin-3-one;

(S)-6-[4-(1-cyclobutyl-piperidin-4-yloxy)-phenyl]-5-methyl-4,5-dihydro-2H-pyridazin-3-one;

6-[4-(1-cyclobutyl-piperidin-4-yloxy)-phenyl]-5-ethyl-4,5-dihydro-2H-pyridazin-3-one;

20 6-[4-(1-cyclobutyl-piperidin-4-yloxy)-phenyl]-5-methyl-2-pyridin-2-yl-4,5-dihydro-2H-pyridazin-3-one;

5-methyl-6-{4-[3-((R)-2-methyl-pyrrolidin-1-yl)-propoxy]-phenyl}-4,5-dihydro-2H-pyridazin-3-one racemate;

25 5-methyl-6-{4-[3-((R)-2-methyl-pyrrolidin-1-yl)-propoxy]-phenyl}-4,5-dihydro-2H-pyridazin-3-one diastereomer;

5-methyl-6-{4-[3-((R)-2-methyl-pyrrolidin-1-yl)-propoxy]-phenyl}-4,5-dihydro-2H-pyridazin-3-one diastereomer;

5-methyl-6-[4-(3-piperidin-1-yl-propoxy)-phenyl]-4,5-dihydro-2H-pyridazin-3-one;

5-methyl-6-[4-(3-pyrrolidin-1-yl-propoxy)-phenyl]-4,5-dihydro-2H-pyridazin-3-one;

30 6-{(R)-2-methyl-4-[3-(2-methyl-pyrrolidin-1-yl)-propoxy]-phenyl}-4,5-dihydro-2H-pyriazin-3-one;

2-{4-[3-((R)-2-methyl-pyrrolidin-1-yl)-propoxy]-phenyl}-6-phenyl-2H-pyridazin-3-one;

6-methyl-2-{4-[3-((R)-2-methyl-pyrrolidin-1-yl)-propoxy]-phenyl}-2H-pyridazin-3-one;
2-{4-[3-((R)-2-methyl-pyrrolidin-1-yl)-propoxy]-phenyl}-2H-phthalazin-1-one;
2-[6-(1-cyclobutyl-piperidin-4-yloxy)-pyridin-3-yl]-6-phenyl-2H-pyridazin-3-one;
5 2-{4-[3-((R)-2-methyl-pyrrolidin-1-yl)-propoxy]-phenyl}-6-pyridin-3-yl-2H-pyridazin-3-one;
4-[4-(1-cyclobutyl-piperidin-4-yloxy)-phenyl]-3-methyl-6H-isoxazolo[3,4-d]pyridazin-7-one;
3-methyl-4-[4-(piperidin-4-yloxy)-phenyl]-6H-isoxazolo[3,4-d]pyridazin-7-one;
10 3-methyl-4-[4-(3-piperidin-1-yl-propoxy)-phenyl]-6H-isoxazolo[3,4-d]pyridazin-7-one;
3-methyl-4-{4-[3-((R)-2-methyl-pyrrolidin-1-yl)-propoxy]-phenyl}-6H-isoxazolo[3,4-d]pyridazin-7-one;
8-[3-((R)-2-methyl-pyrrolidin-1-yl)-propoxy]-5,6-dihydro-2H-benzo[h]cinnolin-3-one;
15 one;
5-methyl-6-{4-[3-((R)-2-methyl-pyrrolidin-1-yl)-propoxy]-phenyl}-2H-pyridazin-3-one;
5-ethyl-6-{4-[3-((R)-2-methyl-pyrrolidin-1-yl)-propoxy]-phenyl}-2H-pyridazin-3-one;
20 8-[3-(2-methyl-pyrrolidin-1-yl)-propoxy]-4,4a,5,6-tetrahydro-2H-benzo[h]cinnolin-3-one;
6-{2-methoxy-4-[3-((R)-2-methyl-pyrrolidin-1-yl)-propoxy]-phenyl}-2H-pyridazin-3-one;
6-{2-fluoro-4-[3-((R)-2-methyl-pyrrolidin-1-yl)-propoxy]-phenyl}-2H-pyridazin-3-one;
25 one;
6-{4-[3-((R)-2-methyl-pyrrolidin-1-yl)-propoxy]-phenyl}-2-pyridin-2-yl-2H-pyridazin-3-one;;
6-{4-[3-((R)-2-methyl-pyrrolidin-1-yl)-propoxy]-phenyl}-4-pyridin-2-yl-4,5-dihydro-2H-pyridazin-3-one;
30 6-{4-[3-((R)-2-methyl-pyrrolidin-1-yl)-propoxy]-phenyl}-4-pyridin-2-yl-2H-pyridazin-3-one;
8-[3-((R)-2-methyl-pyrrolidin-1-yl)-propoxy]-5,6-dihydro-3H-benzo[f]cinnolin-2-one;

6-[4-(1-cyclobutyl-piperidin-4-yloxy)-2-fluoro-phenyl]-4,5-dihydro-2H-pyridazin-3-one;

8-(1-cyclobutyl-piperidin-4-yloxy)-4,4a,5,6-tetrahydro-2H-benzo[h]cinnolin-3-one;

6-[4-(1-cyclobutyl-piperidin-4-yloxy)-2-fluoro-phenyl]-2H-pyridazin-3-one;

5 6-[4-(1-cyclobutyl-piperidin-4-yloxy)-phenyl]-5-methyl-2H-pyridazin-3-one;

5-{4-[3-((R)-2-methyl-pyrrolidin-1-yl)-propoxy]-phenyl}-2H-pyridazin-3-one;

2-methoxymethyl-5-{4-[3-((R)-2-methyl-pyrrolidin-1-yl)-propoxy]-phenyl}-2H-pyridazin-3-one;

5-{4-[(S)-2-methyl-3-((R)-2-methyl-pyrrolidin-1-yl)-propoxy]-phenyl}-2H-pyridazin-3-one;

10 5-{4-[(R)-2-methyl-3-((R)-2-methyl-pyrrolidin-1-yl)-propoxy]-phenyl}-2H-pyridazin-3-one;

5-[4-((S)-2-methyl-3-piperidin-1-yl-propoxy)-phenyl]-2H-pyridazin-3-one;

5-[4-((R)-2-methyl-3-piperidin-1-yl-propoxy)-phenyl]-2H-pyridazin-3-one;

15 5-{3,5-dibromo-4-[3-((R)-2-methyl-pyrrolidin-1-yl)-propoxy]-phenyl}-2H-pyridazin-3-one;

2-methoxymethyl-5-{2-methyl-4-[3-((R)-2-methyl-pyrrolidin-1-yl)-propoxy]-phenyl}-2H-pyridazin-3-one;

5-{2-methyl-4-[3-((R)-2-methyl-pyrrolidin-1-yl)-propoxy]-phenyl}-2H-pyridazin-3-one;

20 2-methoxymethyl-5-[2-methyl-4-(3-piperidin-1-yl-propoxy)-phenyl]-2H-pyridazin-3-one;

5-[2-methyl-4-(3-piperidin-1-yl-propoxy)-phenyl]-2H-pyridazin-3-one;

5-[4-(1-cyclobutyl-piperidin-4-yloxy)-2-methyl-phenyl]-2-methoxymethyl-2H-pyridazin-3-one;

25 4-methoxy-2-methoxymethyl-5-{4-[3-((R)-2-methyl-pyrrolidin-1-yl)-propoxy]-phenyl}-2H-pyridazin-3-one;

5-methoxy-2-methoxymethyl-4-{4-[3-((R)-2-methyl-pyrrolidin-1-yl)-propoxy]-phenyl}-2H-pyridazin-3-one;

30 5-methoxy-4-{4-[3-((R)-2-methyl-pyrrolidin-1-yl)-propoxy]-phenyl}-2H-pyridazin-3-one;

6-[4-(3-morpholin-4-yl-propoxy)-phenyl]-2H-pyridazin-3-one;

6-{4-[3-((S)-2-methyl-pyrrolidin-1-yl)-propoxy]-phenyl}-2H-pyridazin-3-one;

6-[4-(3-pyrrolidin-1-yl-propoxy)-phenyl]-2H-pyridazin-3-one;

6-{4-[3-(cyclobutyl-methyl-amino)-propoxy]-phenyl}-2H-pyridazin-3-one;

6-{4-[3-(cyclopentyl-methyl-amino)-propoxy]-phenyl}-2H-pyridazin-3-one;

5-{4-[3-((R)-2-methyl-pyrrolidin-1-yl)-propoxy]-phenyl}-3,4-diaza-

5 bicyclo[4.1.0]hept-4-en-2-one;

5-[4-(1-cyclobutyl-piperidin-4-yloxy)-phenyl]-3,4-diaza-bicyclo[4.1.0]hept-4-en-2-one;

5-{4-[(S)-2-methyl-3-((R)-2-methyl-pyrrolidin-1-yl)-propoxy]-phenyl}-3,4-diaza-bicyclo[4.1.0]hept-4-en-2-one;

10 5-{4-[3-((R)-2-methyl-pyrrolidin-1-yl)-propoxy]-phenyl}-3,4-diaza-bicyclo[4.1.0]hept-4-en-2-one single isomer;

5-{4-[3-((R)-2-methyl-pyrrolidin-1-yl)-propoxy]-phenyl}-3,4-diaza-bicyclo[4.1.0]hept-4-en-2-one single isomer;

15 5-[4-(1-cyclobutyl-piperidin-4-yloxy)-phenyl]-3,4-diaza-bicyclo[4.1.0]hept-4-en-2-one single isomer;

5-[4-(1-cyclobutyl-piperidin-4-yloxy)-phenyl]-3,4-diaza-bicyclo[4.1.0]hept-4-en-2-one single isomer;

5-[4-(1-cyclobutyl-piperidin-4-yloxy)-phenyl]-3-ethyl-3,4-diaza-bicyclo[4.1.0]hept-4-en-2-one;

20 5-[4-(1-cyclobutyl-piperidin-4-yloxy)-phenyl]-3-isopropyl-3,4-diaza-bicyclo[4.1.0]hept-4-en-2-one;

5-[4-(1-cyclobutyl-piperidin-4-yloxy)-phenyl]-3-methyl-3,4-diaza-bicyclo[4.1.0]hept-4-en-2-one;

25 5-[4-(1-cyclobutyl-piperidin-4-yloxy)-phenyl]-3-(4-fluoro-phenyl)-3,4-diaza-bicyclo[4.1.0]hept-4-en-2-one;

5-[4-(1-cyclobutyl-piperidin-4-yloxy)-phenyl]-3-(2,2,2-trifluoro-ethyl)-3,4-diaza-bicyclo[4.1.0]hept-4-en-2-one;

6-[4-(2-hydroxy-3-piperidin-1-yl-propoxy)-phenyl]-2H-pyridazin-3-one;

30 6-{4-[2-hydroxy-3-((R)-2-methyl-pyrrolidin-1-yl)-propoxy]-phenyl}-2H-pyridazin-3-one;

6-{4-[(S)-2-hydroxy-3-((R)-2-methyl-pyrrolidin-1-yl)-propoxy]-phenyl}-2H-pyridazin-3-one;

6-{4-[(R)-2-hydroxy-3-((R)-2-methyl-pyrrolidin-1-yl)-propoxy]-phenyl}-2H-pyridazin-3-one;

6-[4-((R)-2-hydroxy-3-piperidin-1-yl-propoxy)-phenyl]-2H-pyridazin-3-one;
 5-[4-(1-cyclopentyl-piperidin-4-yloxy)-phenyl]-3-methyl-3,4-diaza-
 bicyclo[4.1.0]hept-4-en-2-one;
 5-[4-(1-cyclopentyl-piperidin-4-yloxy)-phenyl]-3,4-diaza-bicyclo[4.1.0]hept-4-en-2-
 one; and

6-cyclopropyl-2-{4-[3-((R)-2-methyl-pyrrolidin-1-yl)-propoxy]-phenyl}-2H-
 pyridazin-3-one;

or a stereoisomeric form, mixture of stereoisomeric forms, or a pharmaceutically
 acceptable salt thereof.

10 More preferably, they are selected from the group consisting of:

5-[4-(1-cyclobutyl-piperidin-4-yloxy)-phenyl]-6-methyl-2H-pyridazin-3-one;

6-[4-(3-piperidin-1-yl-propoxy)-phenyl]-2H-pyridazin-3-one;

6-{4-[3-((R)-2-methyl-pyrrolidin-1-yl)-propoxy]-phenyl}-4,5-dihydro-2H-
 pyridazin-3-one;

15 6-[4-(1-cyclobutyl-piperidin-4-yloxy)-phenyl]-4,4-dimethyl-4,5-dihydro-2H-
 pyridazin-3-one;

6-[4-(1-cyclobutyl-piperidin-4-yloxy)-3-fluoro-phenyl]-4,4-dimethyl-4,5-dihydro-
 2H-pyridazin-3-one;

20 6-[6-(1-cyclobutyl-piperidin-4-yloxy)-pyridin-3-yl]-4,4-dimethyl-4,5-dihydro-2H-
 pyridazin-3-one;

5-{4-[3-((R)-2-methyl-pyrrolidin-1-yl)-propoxy]-phenyl}-2-pyridin-2-yl-2H-
 pyridazin-3-one;

5-[4-(3-piperidin-1-yl-propoxy)-phenyl]-2-pyridin-2-yl-2H-pyridazin-3-one;

25 6-{4-[(S)-2-Methyl-3-((R)-2-methyl-pyrrolidin-1-yl)-propoxy]-phenyl}-2H-
 pyridazin-3-one;

4,4-dimethyl-6-{4-[3-((R)-2-methyl-pyrrolidin-1-yl)-propoxy]-phenyl}-4,5-dihydro-
 2H-pyridazin-3-one;

5-{4-[3-((R)-2-methyl-pyrrolidin-1-yl)-propoxy]-phenyl}-3,4-diaza-
 bicyclo[4.1.0]hept-4-en-2-one;

30 5-[4-(1-cyclobutyl-piperidin-4-yloxy)-phenyl]-3,4-diaza-bicyclo[4.1.0]hept-4-en-2-
 one;

5-{4-[(S)-2-methyl-3-((R)-2-methyl-pyrrolidin-1-yl)-propoxy]-phenyl}-3,4-diaza-
 bicyclo[4.1.0]hept-4-en-2-one;

5-{4-[3-((R)-2-methyl-pyrrolidin-1-yl)-propoxy]-phenyl}-3,4-diaza-bicyclo[4.1.0]hept-4-en-2-one;

5-{4-[3-((R)-2-methyl-pyrrolidin-1-yl)-propoxy]-phenyl}-3,4-diaza-bicyclo[4.1.0]hept-4-en-2-one;

5-[4-(1-cyclobutyl-piperidin-4-yloxy)-phenyl]-3,4-diaza-bicyclo[4.1.0]hept-4-en-2-one;

5-[4-(1-cyclobutyl-piperidin-4-yloxy)-phenyl]-3,4-diaza-bicyclo[4.1.0]hept-4-en-2-one;

5-[4-(1-cyclobutyl-piperidin-4-yloxy)-phenyl]-3,4-diaza-bicyclo[4.2.0]oct-4-en-2-one;

5-methyl-6-{4-[3-((R)-2-methyl-pyrrolidin-1-yl)-propoxy]-phenyl}-4,5-dihydro-2H-pyridazin-3-one one diastereomer;

5-methyl-6-{4-[3-((R)-2-methyl-pyrrolidin-1-yl)-propoxy]-phenyl}-4,5-dihydro-2H-pyridazin-3-one one diastereomer;

5-methyl-6-{4-[3-((R)-2-methyl-pyrrolidin-1-yl)-propoxy]-phenyl}-4,5-dihydro-2H-pyridazin-3-one; and

6-{4-[3-((R)-2-methyl-pyrrolidin-1-yl)-propoxy]-phenyl}-2H-pyridazin-3-one; or a stereoisomeric form, mixture of stereoisomeric forms, or a pharmaceutically acceptable salt thereof.

Still more preferably, they are selected from the group consisting of:

5-{4-[3-((R)-2-methyl-pyrrolidin-1-yl)-propoxy]-phenyl}-2-pyridin-2-yl-2H-pyridazin-3-one;

5-[4-(3-piperidin-1-yl-propoxy)-phenyl]-2-pyridin-2-yl-2H-pyridazin-3-one;

6-{4-[(S)-2-methyl-3-((R)-2-methyl-pyrrolidin-1-yl)-propoxy]-phenyl}-2H-pyridazin-3-one;

4,4-dimethyl-6-{4-[3-((R)-2-methyl-pyrrolidin-1-yl)-propoxy]-phenyl}-4,5-dihydro-2H-pyridazin-3-one;

5-{4-[3-((R)-2-methyl-pyrrolidin-1-yl)-propoxy]-phenyl}-3,4-diaza-bicyclo[4.1.0]hept-4-en-2-one;

5-[4-(1-cyclobutyl-piperidin-4-yloxy)-phenyl]-3,4-diaza-bicyclo[4.1.0]hept-4-en-2-one;

5-{4-[(S)-2-methyl-3-((R)-2-methyl-pyrrolidin-1-yl)-propoxy]-phenyl}-3,4-diaza-bicyclo[4.1.0]hept-4-en-2-one;

5-{4-[3-((R)-2-methyl-pyrrolidin-1-yl)-propoxy]-phenyl}-3,4-diaza-bicyclo[4.1.0]hept-4-en-2-one;

5-{4-[3-((R)-2-methyl-pyrrolidin-1-yl)-propoxy]-phenyl}-3,4-diaza-bicyclo[4.1.0]hept-4-en-2-one;

5-{4-(1-cyclobutyl-piperidin-4-yloxy)-phenyl}-3,4-diaza-bicyclo[4.1.0]hept-4-en-2-one;

5-{4-(1-cyclobutyl-piperidin-4-yloxy)-phenyl}-3,4-diaza-bicyclo[4.1.0]hept-4-en-2-one;

5-{4-(1-cyclobutyl-piperidin-4-yloxy)-phenyl}-3,4-diaza-bicyclo[4.2.0]oct-4-en-2-one;

5-methyl-6-{4-[3-((R)-2-methyl-pyrrolidin-1-yl)-propoxy]-phenyl}-4,5-dihydro-2H-pyridazin-3-one one diastereomer;

5-methyl-6-{4-[3-((R)-2-methyl-pyrrolidin-1-yl)-propoxy]-phenyl}-4,5-dihydro-2H-pyridazin-3-one one diastereomer;

5-methyl-6-{4-[3-((R)-2-methyl-pyrrolidin-1-yl)-propoxy]-phenyl}-4,5-dihydro-2H-pyridazin-3-one; and

6-{4-[3-((R)-2-methyl-pyrrolidin-1-yl)-propoxy]-phenyl}-2H-pyridazin-3-one;

or a stereoisomeric form, mixture of stereoisomeric forms, or a pharmaceutically acceptable salt thereof.

Even more preferably, they are selected from the group consisting of:

4,4-dimethyl-6-{4-[3-((R)-2-methyl-pyrrolidin-1-yl)-propoxy]-phenyl}-4,5-dihydro-2H-pyridazin-3-one;

5-{4-[3-((R)-2-methyl-pyrrolidin-1-yl)-propoxy]-phenyl}-3,4-diaza-bicyclo[4.1.0]hept-4-en-2-one;

5-{4-(1-cyclobutyl-piperidin-4-yloxy)-phenyl}-3,4-diaza-bicyclo[4.1.0]hept-4-en-2-one;

5-{4-[(S)-2-methyl-3-((R)-2-methyl-pyrrolidin-1-yl)-propoxy]-phenyl}-3,4-diaza-bicyclo[4.1.0]hept-4-en-2-one;

5-{4-[3-((R)-2-methyl-pyrrolidin-1-yl)-propoxy]-phenyl}-3,4-diaza-bicyclo[4.1.0]hept-4-en-2-one;

5-{4-[3-((R)-2-methyl-pyrrolidin-1-yl)-propoxy]-phenyl}-3,4-diaza-bicyclo[4.1.0]hept-4-en-2-one;

5-{4-(1-cyclobutyl-piperidin-4-yloxy)-phenyl}-3,4-diaza-bicyclo[4.1.0]hept-4-en-2-one;

5-[4-(1-cyclobutyl-piperidin-4-yloxy)-phenyl]-3,4-diaza-bicyclo[4.1.0]hept-4-en-2-one;

5-[4-(1-cyclobutyl-piperidin-4-yloxy)-phenyl]-3,4-diaza-bicyclo[4.2.0]oct-4-en-2-one;

5-methyl-6-{4-[3-((R)-2-methyl-pyrrolidin-1-yl)-propoxy]-phenyl}-4,5-dihydro-2H-pyridazin-3-one one diastereomer;

5-methyl-6-{4-[3-((R)-2-methyl-pyrrolidin-1-yl)-propoxy]-phenyl}-4,5-dihydro-2H-pyridazin-3-one one diastereomer;

5-methyl-6-{4-[3-((R)-2-methyl-pyrrolidin-1-yl)-propoxy]-phenyl}-4,5-dihydro-2H-pyridazin-3-one; and

6-{4-[3-((R)-2-methyl-pyrrolidin-1-yl)-propoxy]-phenyl}-2H-pyridazin-3-one;

or a stereoisomeric form, mixture of stereoisomeric forms, or a pharmaceutically acceptable salt thereof.; with the compound 6-{4-[3-((R)-2-methyl-pyrrolidin-1-yl)-propoxy]-phenyl}-2H-pyridazin-3-one, or a stereoisomeric form, mixture of stereoisomeric forms, or a pharmaceutically acceptable salt thereof being most preferred.

In certain alternatively preferred embodiments, the compounds of formula I are selected from the group consisting of:

2-methyl-6-{4-[3-((R)-2-methyl-pyrrolidin-1-yl)-propoxy]-phenyl}-2H-pyridazin-3-one;

2-methyl-6-[4-(3-piperidin-1-yl-propoxy)-phenyl]-2H-pyridazin-3-one;

2-isopropyl-6-[4-(3-piperidin-1-yl-propoxy)-phenyl]-2H-pyridazin-3-one;

2-isopropyl-6-[4-(3-piperidin-1-yl-propoxy)-phenyl]-4,5-dihydro-2H-pyridazin-3-one;

2-isopropyl-6-{4-[3-((R)-2-methyl-pyrrolidin-1-yl)-propoxy]-phenyl}-2H-pyridazin-3-one;

2-ethyl-6-{4-[3-((R)-2-methyl-pyrrolidin-1-yl)-propoxy]-phenyl}-2H-pyridazin-3-one;

6-{3-fluoro-4-[3-((R)-2-methyl-pyrrolidin-1-yl)-propoxy]-phenyl}-2-methyl-2H-pyridazin-3-one;

2-(2,4-dichloro-benzyl)-6-{4-[3-((R)-2-methyl-pyrrolidin-1-yl)-propoxy]-phenyl}-4,5-dihydro-2H-pyridazin-3-one;

2-(3,5-dichloro-phenyl)-6-{4-[3-((R)-2-methyl-pyrrolidin-1-yl)-propoxy]-phenyl}-2H-pyridazin-3-one;

6-[3-fluoro-4-(3-piperidin-1-yl-propoxy)-phenyl]-2-phenyl-2H-pyridazin-3-one;
 6-{4-[3-((R)-2-methyl-pyrrolidin-1-yl)-propoxy]-phenyl}-2H-pyridazin-3-one;
 4-{4-[3-((R)-2-methyl-pyrrolidin-1-yl)-propoxy]-phenyl}-2,5,6,7-tetrahydro-
 cyclopenta[d]pyridazin-1-one;
 5 2-methyl-6-{4-[3-((S)-2-methyl-3-((R)-2-methyl-pyrrolidin-1-yl)-propoxy]-phenyl}-
 2H-pyridazin-3-one;
 6-{4-[3-((S)-2-hydroxymethyl-pyrrolidin-1-yl)-propoxy]-phenyl}-2-methyl-2H-
 pyridazin-3-one;
 6-{4-[3-((R)-2-hydroxymethyl-pyrrolidin-1-yl)-propoxy]-phenyl}-2-methyl-2H-
 10 pyridazin-3-one;
 2-methyl-6-{4-[3-((R)-2-methyl-pyrrolidin-1-yl)-propoxy]-phenyl}-4,5-dihydro-2H-
 pyridazin-3-one;
 2-benzyl-6-{4-[3-((R)-2-methyl-pyrrolidin-1-yl)-propoxy]-phenyl}-4,5-dihydro-2H-
 pyridazin-3-one;
 15 2-benzyl-6-{4-[3-((R)-2-methyl-pyrrolidin-1-yl)-propoxy]-phenyl}-2H-pyridazin-3-
 one;
 6-{4-[3-((R)-2-methyl-pyrrolidin-1-yl)-propoxy]-phenyl}-2-phenyl-2H-pyridazin-3-
 one;
 6-{4-[3-((R)-2-methyl-pyrrolidin-1-yl)-propoxy]-phenyl}-2-phenyl-2H-pyridazin-3-
 20 one;
 2-{4-[3-((R)-2-methyl-pyrrolidin-1-yl)-propoxy]-phenyl}-2H-pyridazin-3-one;
 5-Isopropyl-7-{4-[3-((R)-2-methyl-pyrrolidin-1-yl)-propoxy]-phenyl}-5H-
 thieno[2,3-d]pyridazin-4-one;
 7-{4-[3-(2,5-dimethyl-pyrrolidin-1-yl)-propoxy]-phenyl}-5-isopropyl-5H-
 25 thieno[2,3-d]pyridazin-4-one;
 5-isopropyl-7-[4-(3-piperidin-1-yl-propoxy)-phenyl]-5H-thieno[2,3-d]pyridazin-4-
 one;
 7-{4-[3-(3,3-dimethyl-piperidin-1-yl)-propoxy]-phenyl}-5-isopropyl-5H-thieno[2,3-
 d]pyridazin-4-one;
 30 5-isopropyl-7-{4-[3-((S)-2-methoxymethyl-pyrrolidin-1-yl)-propoxy]-phenyl}-5H-
 thieno[2,3-d]pyridazin-4-one;
 5-isopropyl-7-{4-[3-((R)-2-methoxymethyl-pyrrolidin-1-yl)-propoxy]-phenyl}-5H-
 thieno[2,3-d]pyridazin-4-one;

7-[4-(3-diethylamino-propoxy)-phenyl]-5-isopropyl-5H-thieno[2,3-d]pyridazin-4-one;

5-isopropyl-7-[4-(3-pyrrolidin-1-yl-propoxy)-phenyl]-5H-thieno[2,3-d]-pyridazin-4-one;

5 5-isopropyl-7-{4-[3-(4-pyrrolidin-1-yl-piperidin-1-yl)-propoxy]-phenyl}-5H-thieno[2,3-d]pyridazin-4-one;

7-{4-[3-((2R,5R)-2,5-dimethyl-pyrrolidin-1-yl)-propoxy]-phenyl}-5-isopropyl-5H-thieno[2,3-d]pyridazin-4-one;

10 7-{4-[3-((R)-2-methyl-pyrrolidin-1-yl)-propoxy]-phenyl}-5-propyl-5H-thieno[2,3-d]pyridazin-4-one;

7-{4-[3-((2R,5R)-2,5-dimethyl-pyrrolidin-1-yl)-propoxy]-phenyl}-5-propyl-5H-thieno[2,3-d]pyridazin-4-one;

7-{4-[3-(4-methyl-piperidin-1-yl)-propoxy]-phenyl}-5-propyl-5H-thieno[2,3-d]pyridazin-4-one;

15 7-{4-[3-(4-dimethylamino-piperidin-1-yl)-propoxy]-phenyl}-5-propyl-5H-thieno[2,3-d]pyridazin-4-one;

5-propyl-7-{4-[3-((S)-2-pyrrolidin-1-ylmethyl-pyrrolidin-1-yl)-propoxy]-phenyl}-5H-thieno[2,3-d]pyridazin-4-one;

20 5-(4-chloro-benzyl)-7-[4-(3-piperidin-1-yl-propoxy)-phenyl]-5H-thieno[2,3-d]pyridazin-4-one;

5-(4-chloro-benzyl)-7-{4-[3-((R)-2-methyl-pyrrolidin-1-yl)-propoxy]-phenyl}-5H-thieno[2,3-d]pyridazin-4-one;

2,4-dimethyl-6-[4-(3-piperidin-1-yl-propoxy)-phenyl]-2H-pyridazin-3-one;

25 2,4-dimethyl-6-{4-[3-((R)-2-methyl-pyrrolidin-1-yl)-propoxy]-phenyl}-2H-pyridazin-3-one;

2-isopropyl-4-methyl-6-{4-[3-((R)-2-methyl-pyrrolidin-1-yl)-propoxy]-phenyl}-2H-pyridazin-3-one;

2-isopropyl-4-methyl-6-[4-(3-piperidin-1-yl-propoxy)-phenyl]-2H-pyridazin-3-one;

30 2-benzyl-4-methyl-6-{4-[3-((R)-2-methyl-pyrrolidin-1-yl)-propoxy]-phenyl}-2H-pyridazin-3-one;

2-benzyl-4-methyl-6-[4-(3-piperidin-1-yl-propoxy)-phenyl]-2H-pyridazin-3-one;

4-benzyl-2-methyl-6-{4-[3-((R)-2-methyl-pyrrolidin-1-yl)-propoxy]-phenyl}-2H-pyridazin-3-one;

4-benzyl-2-methyl-6-[4-(3-piperidin-1-yl-propoxy)-phenyl]-2H-pyridazin-3-one;

2-methyl-6-{4-[3-((R)-2-methyl-pyrrolidin-1-yl)-propoxy]-phenyl}-5-phenyl-2H-pyridazin-3-one;

2-methyl-5-phenyl-6-[4-(3-piperidin-1-yl-propoxy)-phenyl]-2H-pyridazin-3-one;

2-methyl-4-{4-[3-((R)-2-methyl-pyrrolidin-1-yl)-propoxy]-phenyl}-2H-phthalazin-1-one;

2-methyl-4-[4-(3-piperidin-1-yl-propoxy)-phenyl]-2H-phthalazin-1-one;

2-methyl-4-[4-(2-piperidin-1-yl-ethoxy)-phenyl]-2H-phthalazin-1-one;

2-methyl-4-[4-(3-pyrrolidin-1-yl-propoxy)-phenyl]-2H-phthalazin-1-one;

4-[4-(3-azepan-1-yl-propoxy)-phenyl]-2-methyl-2H-phthalazin-1-one;

2-(4-chloro-benzyl)-4-{4-[3-((R)-2-methyl-pyrrolidin-1-yl)-propoxy]-phenyl}-2H-phthalazin-1-one;

2-(4-chloro-benzyl)-4-[4-(3-piperidin-1-yl-propoxy)-phenyl]-2H-phthalazin-1-one;

2-methyl-4-{4-[3-((R)-2-methyl-pyrrolidin-1-yl)-propoxy]-phenyl}-2,5,6,7-tetrahydro-cyclopenta[d]pyridazin-1-one;

2-methyl-4-[4-(3-piperidin-1-yl-propoxy)-phenyl]-2,5,6,7-tetrahydro-cyclopenta[d]pyridazin-1-one;

2-methyl-4-{4-[3-((R)-2-methyl-pyrrolidin-1-yl)-propoxy]-phenyl}-2,4a,5,6,7,7a-hexahydro-cyclopenta[d]pyridazin-1-one;

2-methyl-4-[4-(3-piperidin-1-yl-propoxy)-phenyl]-2,4a,5,6,7,7a-hexahydro-cyclopenta[d]pyridazin-1-one;

2-methyl-4-{4-[3-((R)-2-methyl-pyrrolidin-1-yl)-propoxy]-phenyl}-5,6,7,8-tetrahydro-2H-phthalazin-1-one;

4-{4-[3-(butyl-ethyl-amino)-propoxy]-phenyl}-2-methyl-5,6,7,8-tetrahydro-2H-phthalazin-1-one;

4-[4-(3-methyl-4-oxo-3,4-dihydro-phthalazin-1-yl)-phenoxy-methyl]-piperidine-1-carboxylic acid tert-butyl ester;

2-methyl-4-[4-(piperidin-4-ylmethoxy)-phenyl]-2H-phthalazin-1-one;

4-[4-(1-cyclobutyl-piperidin-4-ylmethoxy)-phenyl]-2-methyl-2H-phthalazin-1-one;

4-[4-(1-methyl-6-oxo-1,6-dihydro-pyridazin-3-yl)-phenoxy-methyl]-piperidine-1-carboxylic acid tert-butyl ester;

2-methyl-6-[4-(piperidin-4-ylmethoxy)-phenyl]-2H-pyridazin-3-one;

6-[4-(1-cyclobutyl-piperidin-4-ylmethoxy)-phenyl]-2-methyl-2H-pyridazin-3-one;

6-[4-(1-isopropyl-piperidin-4-ylmethoxy)-phenyl]-2-methyl-2H-pyridazin-3-one;

6-[4-(1-cyclopropylmethyl-piperidin-4-ylmethoxy)-phenyl]-2-methyl-2H-pyridazin-3-one;

6-[4-(1-cyclopentyl-piperidin-4-ylmethoxy)-phenyl]-2-methyl-2H-pyridazin-3-one;

2-methyl-6-[4-(1-methyl-piperidin-4-ylmethoxy)-phenyl]-2H-pyridazin-3-one;

6-[4-(1-isopropyl-piperidin-4-yloxy)-phenyl]-2-methyl-2H-pyridazin-3-one;

2-methyl-6-[4-(piperidin-4-yloxy)-phenyl]-2H-pyridazin-3-one;

2-methyl-6-[4-(piperidin-4-yloxy)-phenyl]-2H-pyridazin-3-one;

2-methyl-8-[3-((R)-2-methyl-pyrrolidin-1-yl)-propoxy]-5,6-dihydro-2H-benzo[h]cinnolin-3-one;

8-[3-((R)-2-methyl-pyrrolidin-1-yl)-propoxy]-2-phenyl-5,6-dihydro-2H-benzo[h]cinnolin-3-one;

2-benzyl-8-(3-piperidin-1-yl-propoxy)-5,6-dihydro-2H-benzo[h]cinnolin-3-one;

2-isopropyl-8-(3-piperidin-1-yl-propoxy)-5,6-dihydro-2H-benzo[h]cinnolin-3-one;

2-methyl-7-[3-((R)-2-methyl-pyrrolidin-1-yl)-propoxy]-2H-phthalazin-1-one;

2-methyl-7-(3-piperidin-1-yl-propoxy)-2H-phthalazin-1-one; and

6-{3-fluoro-4-[3-((R)-2-methyl-pyrrolidin-1-yl)-propoxy]-phenyl}-2-phenyl-2H-pyridazin-3-one;

and stereoisomeric forms, mixtures of stereoisomeric forms or pharmaceutically acceptable salt forms thereof; with the compound 6-{4-[3-((R)-2-methyl-pyrrolidin-1-yl)-propoxy]-phenyl}-2H-pyridazin-3-one, or a stereoisomeric form, mixture of stereoisomeric forms, or a pharmaceutically acceptable salt thereof being more preferred.

In a second embodiment, the compounds of formula I are selected from Examples 22 to 38, 49 to 50 and 52 to 55. In a third embodiment, the compounds are selected from Examples 12, and 56 to 61. In a fourth embodiment, the compounds are selected from Examples 1 to 3, 5 to 7, 9 to 11, 13 to 15, 18, 20, 39 to 48, and 81. In a fifth embodiment, the compounds are selected from Examples 51, and 62 to 74. In a sixth embodiment, the compounds are selected from Examples 4, 8, 16 to 17, and 19. In a seventh embodiment, the compounds are selected from Examples 75 to 78. In an eighth embodiment, the compounds are Examples 79 and 80.

In another aspect, the present invention is directed to pharmaceutically acceptable salts of the compounds described above. As used herein, "pharmaceutically acceptable salts" includes salts of compounds of the present invention derived from the combination of such compounds with non-toxic acid or base addition salts.

Acid addition salts include inorganic acids such as hydrochloric, hydrobromic, hydroiodic, sulfuric, nitric and phosphoric acid, as well as organic acids such as acetic, citric, propionic, tartaric, glutamic, salicylic, oxalic, methanesulfonic, para-toluenesulfonic, succinic, and benzoic acid, and related inorganic and organic acids.

5 Base addition salts include those derived from inorganic bases such as ammonium and alkali and alkaline earth metal hydroxides, carbonates, bicarbonates, and the like, as well as salts derived from basic organic amines such as aliphatic and aromatic amines, aliphatic diamines, hydroxy alkamines, and the like. Such bases useful in preparing the salts of this invention thus include ammonium hydroxide, potassium carbonate, sodium
10 bicarbonate, calcium hydroxide, methylamine, diethylamine, ethylenediamine, cyclohexylamine, ethanolamine and the like.

In addition to pharmaceutically-acceptable salts, other salts are included in the invention. They may serve as intermediates in the purification of the compounds, in the preparation of other salts, or in the identification and characterization of the compounds or
15 intermediates.

The pharmaceutically acceptable salts of compounds of the present invention can also exist as various solvates, such as with water, methanol, ethanol, dimethylformamide, ethyl acetate and the like. Mixtures of such solvates can also be prepared. The source of such solvate can be from the solvent of crystallization, inherent in the solvent of preparation
20 or crystallization, or adventitious to such solvent. Such solvates are within the scope of the present invention.

The present invention also encompasses the pharmaceutically acceptable prodrugs of the compounds disclosed herein. As used herein, "prodrug" is intended to include any compounds which are converted by metabolic processes within the body of a subject to an
25 active agent that has a formula within the scope of the present invention. Since prodrugs are known to enhance numerous desirable qualities of pharmaceuticals (e.g., solubility, bioavailability, manufacturing, etc.) the compounds of the present invention may be delivered in prodrug form. Conventional procedures for the selection and preparation of suitable prodrug derivatives are described, for example, in *Prodrugs*, Sloane, K. B., Ed.;
30 Marcel Dekker: New York, 1992, incorporated by reference herein in its entirety

It is recognized that compounds of the present invention may exist in various stereoisomeric forms. As such, the compounds of the present invention include both diastereomers and enantiomers. The compounds are normally prepared as racemates and can conveniently be used as such, but individual enantiomers can be isolated or synthesized

by conventional techniques if so desired. Such racemates and individual enantiomers and mixtures thereof form part of the present invention.

It is well known in the art how to prepare and isolate such optically active forms. Specific stereoisomers can be prepared by stereospecific synthesis using enantiomerically pure or enantiomerically enriched starting materials. The specific stereoisomers of either starting materials or products can be resolved and recovered by techniques known in the art, such as resolution of racemic forms, normal, reverse-phase, and chiral chromatography, recrystallization, enzymatic resolution, or fractional recrystallization of addition salts formed by reagents used for that purpose. Useful methods of resolving and recovering specific stereoisomers described in Eliel, E. L.; Wilen, S.H. *Stereochemistry of Organic Compounds*; Wiley: New York, 1994, and Jacques, J, et al. *Enantiomers, Racemates, and Resolutions*; Wiley: New York, 1981, each incorporated by reference herein in their entireties.

It is further recognized that functional groups present on the compounds of Formula I may contain protecting groups. For example, the amino acid side chain substituents of the compounds of Formula I can be substituted with protecting groups such as benzyloxycarbonyl or t-butoxycarbonyl groups. Protecting groups are known per se as chemical functional groups that can be selectively appended to and removed from functionalities, such as hydroxyl groups and carboxyl groups. These groups are present in a chemical compound to render such functionality inert to chemical reaction conditions to which the compound is exposed. Any of a variety of protecting groups may be employed with the present invention. Preferred groups for protecting lactams include silyl groups such as t-butyldimethylsilyl ("TBDMS"), dimethoxybenzhydryl ("DMB"), acyl, benzyl ("Bn"), and methoxybenzyl groups. Preferred groups for protecting hydroxy groups include TBS, acyl, benzyl, benzyloxycarbonyl ("CBZ"), t-butyloxycarbonyl ("Boc"), and methoxymethyl. Many other standard protecting groups employed by one skilled in the art can be found in Greene, T.W. and Wuts, P.G.M., "Protective Groups in Organic Synthesis" 2d. Ed., Wiley & Sons, 1991.

For therapeutic purposes, the compounds of the present invention can be administered by any means that results in the contact of the active agent with the agent's site of action in the body of the subject. The compounds may be administered by any conventional means available for use in conjunction with pharmaceuticals, either as individual therapeutic agents or in combination with other therapeutic agents, such as, for example, analgesics. The compounds employed in the methods of the present invention

including, for example, the compounds of Formula I, I*, I**, I(a-i), and/or II, may be administered by any means that results in the contact of the active agents with the agents' site or site(s) of action in the body of a patient. The compounds of the present invention are preferably administered in therapeutically effective amounts for the treatment of the diseases and disorders described herein to a subject in need thereof.

A therapeutically effective amount can be readily determined by the attending diagnostician, as one skilled in the art, by the use of conventional techniques. The effective dose will vary depending upon a number of factors, including the type and extent of progression of the disease or disorder, the overall health status of the particular patient, the relative biological efficacy of the compound selected, the formulation of the active agent with appropriate excipients, and the route of administration. Typically, the compounds are administered at lower dosage levels, with a gradual increase until the desired effect is achieved.

Typical dose ranges are from about 0.01 mg/kg to about 100 mg/kg of body weight per day, with a preferred dose from about 0.01 mg/kg to 10 mg/kg of body weight per day. A preferred daily dose for adult humans includes about 25, 50, 100 and 200 mg, and an equivalent dose in a human child. The compounds may be administered in one or more unit dose forms. The unit dose ranges from about 1 to about 500 mg administered one to four times a day, preferably from about 10 mg to about 300 mg, two times a day. In an alternate method of describing an effective dose, an oral unit dose is one that is necessary to achieve a blood serum level of about 0.05 to 20 µg/ml in a subject, and preferably about 1 to 20 µg/ml.

Although the compounds of the present invention may be administered as the pure chemicals, it is preferable to present the active ingredient as a pharmaceutical composition.

Generally speaking, therapeutic compounds of this invention may be administered to a patient alone or in combination with a pharmaceutically acceptable carrier. Accordingly, the compounds of the invention, for example, compounds of Formula I, I*, I**, I(a-i), and/or II, are preferably combined with a pharmaceutical carrier selected on the basis of the chosen route of administration and standard pharmaceutical practice as described, for example, in *Remington's Pharmaceutical Sciences* (Mack Publishing Co., Easton, PA, 1980), the disclosures of which are hereby incorporated herein by reference, in their entireties. The carrier(s) must be acceptable in the sense of being compatible with the other ingredients of the composition and not deleterious to the recipient thereof. The relative proportions of active ingredient and carrier may be determined, for example, by the

solubility and chemical nature of the compounds, chosen route of administration and standard pharmaceutical practice.

The compounds of the present invention may be formulated into pharmaceutical compositions by admixture with one or more pharmaceutically acceptable excipients. The
5 excipients are selected on the basis of the chosen route of administration and standard pharmaceutical practice, as described, for example, in *Remington: The Science and Practice of Pharmacy*, 20th ed.; Gennaro, A. R., Ed.; Lippincott Williams & Wilkins: Philadelphia, PA, 2000. The compositions may be formulated to control and/or delay the release of the active agent(s), as in fast-dissolve, modified-release, or sustained-release formulations.
10 Such controlled-release, or extended-release compositions may utilize, for example biocompatible, biodegradable lactide polymers, lactide/glycolide copolymers, polyoxyethylene-polyoxypropylene copolymers, or other solid or semisolid polymeric matrices known in the art.

The compositions can be prepared for administration by oral means; parenteral
15 means, including intravenous, intramuscular, and subcutaneous routes; topical or transdermal means; transmucosal means, including rectal, vaginal, sublingual and buccal routes; ophthalmic means; or inhalation means. Preferably the compositions are prepared for oral administration, particularly in the form of tablets, capsules or syrups; for parenteral administration, particularly in the form of liquid solutions, suspensions or emulsions; for
20 intranasal administration, particularly in the form of powders, nasal drops, or aerosols; or for topical administration, such as creams, ointments, solutions, suspensions aerosols, powders and the like.

For oral administration, the tablets, pills, powders, capsules, troches and the like can contain one or more of the following: diluents or fillers such as starch, or cellulose; binders
25 such as microcrystalline cellulose, gelatins, or polyvinylpyrrolidones; disintegrants such as starch or cellulose derivatives; lubricants such as talc or magnesium stearate; glidants such as colloidal silicon dioxide; sweetening agents such as sucrose or saccharin; or flavoring agents such as peppermint or cherry flavoring. Capsules may contain any of the afore listed excipients, and may additionally contain a semi-solid or liquid carrier, such as a
30 polyethylene glycol. The solid oral dosage forms may have coatings of sugar, shellac, or enteric agents. Liquid preparations may be in the form of aqueous or oily suspensions, solutions, emulsions, syrups, elixirs, etc., or may be presented as a dry product for reconstitution with water or other suitable vehicle before use. Such liquid preparations may

contain conventional additives such as surfactants, suspending agents, emulsifying agents, diluents, sweetening and flavoring agents, dyes and preservatives.

The compositions may also be administered parenterally. The pharmaceutical forms acceptable for injectable use include, for example, sterile aqueous solutions, or suspensions.

5 Aqueous carriers include mixtures of alcohols and water, buffered media, and the like. Nonaqueous solvents include alcohols and glycols, such as ethanol, and polyethylene glycols; oils, such as vegetable oils; fatty acids and fatty acid esters, and the like. Other components can be added including surfactants; such as hydroxypropylcellulose; isotonic agents, such as sodium chloride; fluid and nutrient replenishers; electrolyte replenishers; 10 agents which control the release of the active compounds, such as aluminum monostearate, and various co-polymers; antibacterial agents, such as chlorobutanol, or phenol; buffers, and the like. The parenteral preparations can be enclosed in ampules, disposable syringes or multiple dose vials. Other potentially useful parenteral delivery systems for the active compounds include ethylene-vinyl acetate copolymer particles, osmotic pumps, implantable 15 infusion systems, and liposomes.

Other possible modes of administration include formulations for inhalation, which include such means as dry powder, aerosol, or drops. They may be aqueous solutions containing, for example, polyoxyethylene-9-lauryl ether, glycocholate and deoxycholate, or oily solutions for administration in the form of nasal drops, or as a gel to be applied 20 intranasally. Formulations for topical use are in the form of an ointment, cream, or gel. Typically these forms include a carrier, such as petrolatum, lanolin, stearyl alcohol, polyethylene glycols, or their combinations, and either an emulsifying agent, such as sodium lauryl sulfate, or a gelling agent, such as tragacanth. Formulations suitable for transdermal administration can be presented as discrete patches, as in a reservoir or 25 microreservoir system, adhesive diffusion-controlled system or a matrix dispersion-type system. Formulations for buccal administration include, for example lozenges or pastilles and may also include a flavored base, such as sucrose or acacia, and other excipients such as glycocholate. Formulations suitable for rectal administration are preferably presented as unit-dose suppositories, with a solid based carrier, such as cocoa butter, and may include a 30 salicylate.

Pharmaceutical kits useful in, for example, the treatment of pain, which comprise a therapeutically effective amount of a compound of the invention and/or other therapeutic compounds described herein, in one or more sterile containers, are also within the ambit of the present invention. Sterilization of the container may be carried out using conventional

sterilization methodology well known to those skilled in the art. The sterile containers of materials may comprise separate containers, or one or more multi-part containers, as exemplified by the UNIVIAL™ two-part container (available from Abbott Labs, Chicago, Illinois), as desired. The compound of the invention and/or other therapeutic compound as described herein may be separate, or combined into a single dosage form as described above. Such kits may further include, if desired, one or more of various conventional pharmaceutical kit components, such as for example, one or more pharmaceutically acceptable carriers, additional vials for mixing the components, etc., as will be readily apparent to those skilled in the art. Instructions, either as inserts or as labels, indicating quantities of the components to be administered, guidelines for administration, and/or guidelines for mixing the components, may also be included in the kit.

The compounds of the present invention may be used in methods to bind histamine receptors, more preferably histamine H₃ receptors. Such binding may be accomplished by contacting the receptor with an effective amount of a compound of Formula I, I*, I**, I(a-i), and/or II. The histamine receptors may be located in the central nervous system or located peripherally to the central nervous system or in both locations. Preferably, the contacting step conducted in an aqueous medium, preferably at physiologically relevant ionic strength, pH, and the like.

In yet another aspect, the invention is directed to methods of binding histamine receptors, more preferably histamine H₃ receptors, comprising the step of administering to a patient in need thereof, an effective amount of a compound of the invention including, for example, a compound of Formula I, I*, I**, I(a-i), and/or II, or any combination thereof.

In certain preferred aspects, the methods comprise the step of administering to said patient an therapeutically effective amount of a compound of Formula I, I*, I**, I(a-i), and/or II, or any combination thereof.

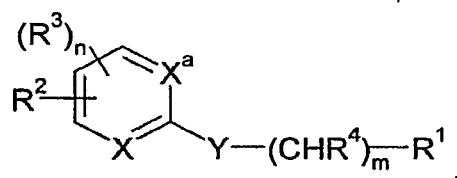
In some preferred embodiments, the histamine receptors are H³ histamine receptors. In certain more preferred embodiments, the compound selectively binds H³ histamine receptors relative to H₁, H₂ and/or H₄ receptors. In certain preferred embodiments, the H³ histamine receptors are located in the central nervous system. In some other preferred embodiments, the compound of Formula I, I*, I**, I(a-i), and/or II, or any combination thereof exhibits activity toward the histamine receptors. In certain preferred embodiments, the binding agonizes the activity of the cannabinoid receptors. In other preferred embodiments, the binding antagonizes the activity of the cannabinoid receptors, more

preferably as a neutral antagonist. In still other preferred embodiments, the binding inversely agonizes the activity of the cannabinoid receptors.

In yet other preferred embodiments, the compounds of Formula I, I*, I**, I(a-i), and/or II, or any combination thereof exhibit activity toward the histamine receptors *in vivo*.

5 In alternatively preferred embodiments, the compounds of Formula I, I*, I**, I(a-i), and/or II, or any combination thereof, exhibit activity toward the histamine receptors *in vitro*.

In certain other preferred aspects of the invention, there are provided methods of treating a disease, disorder or condition that may be affected, modulated or controlled through the binding of histamine, preferably H₃ histamine receptors. More preferably these
 10 diseases, disorders, and/or conditions selected from the group consisting of narcolepsy or sleep/wake disorders, feeding behavior, eating disorders, obesity, cognition, arousal, memory, mood disorders, mood attention alteration, attention deficit hyperactivity disorder (ADHD), Alzheimer's disease/dementia, schizophrenia, pain, stress, migraine, motion sickness, depression, psychiatric disorders, epilepsy, gastrointestinal disorders, respiratory
 15 disorders, inflammation, and myocardial infarction. The methods herein provided comprise administering to a subject in need of such treatment a therapeutically effective amount of a compound of the invention, preferably a compound of formula:



more preferably a compound of formula I, I*, I**, I(a-i), and/or II, or any combination
 20 thereof.

In certain preferred embodiments, the disorder is narcolepsy or sleep/wake disorders. Alternatively the disorder treated is attention deficit hyperactivity disorder.

As those skilled in the art will appreciate, numerous modifications and variations of the present invention are possible in light of the above teachings. It is therefore understood
 25 that within the scope of the appended claims, the invention may be practiced otherwise than as specifically described herein, and the scope of the invention is intended to encompass all such variations.

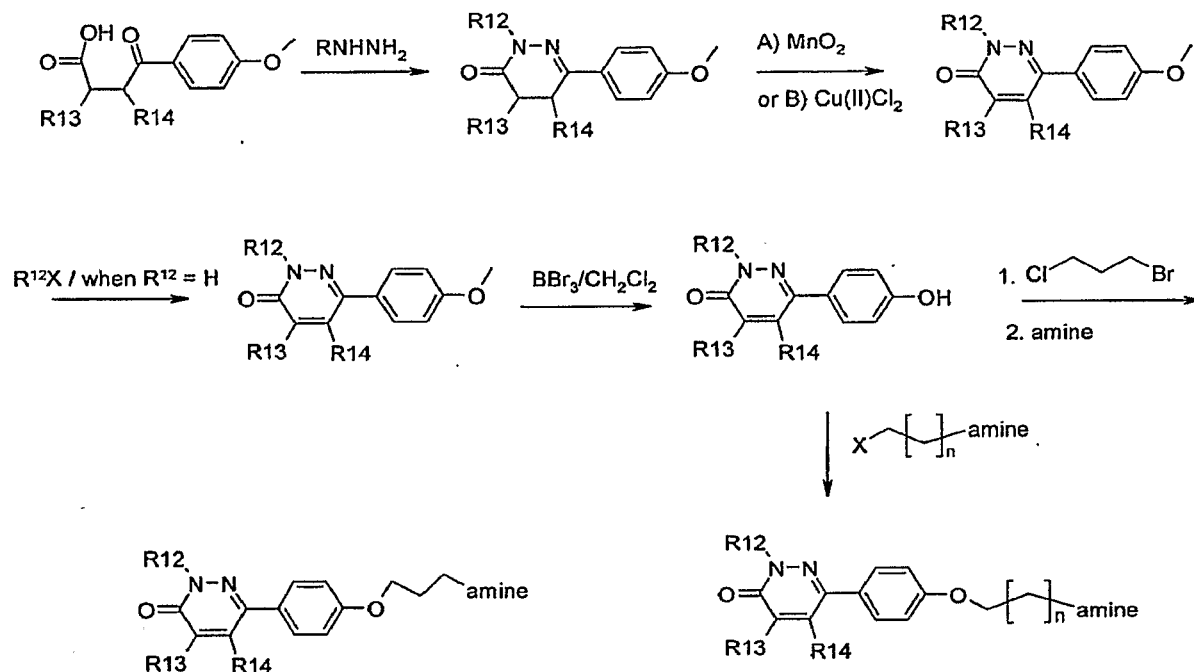
Synthesis

The compounds of the present invention may be prepared in a number of methods well known to those skilled in the art, including, but not limited to those described below, or through modifications of these methods by applying standard techniques known to those skilled in the art of organic synthesis. All processes disclosed in association with the present invention are contemplated to be practiced on any scale, including milligram, gram, multigram, kilogram, multikilogram or commercial industrial scale.

The general routes to prepare the examples shown herein are shown in the Schemes 1 and 2. The reagents and starting materials are commercially available, or readily synthesized by well-known techniques by one of ordinary skill in the arts. All substituents in the synthetic Schemes, unless otherwise indicated, are as previously defined.

Condensation of 4-(4-methoxyphenyl)-4-oxobutyric acid or ester, or a derivative thereof, with hydrazine or an N-substituted hydrazine derivative in a solvent such as ethanol or 2-propanol provided a route to 4,5-dihydropyridazinone intermediates. Keto-acid intermediates with substitution at the 4- and 5-position (Examples with $R^{13/13a}$ and $R^{14/14a}$) may be readily prepared (Heterocycles, 2002, 57, 39; Indian J. Chem, 1977, 16B, 631; Chem Pharm Bull, 1980, 42, 1850; J. Med. Chem. 2003, 46, 2008). Pyridazinones with $R^{13/13a}$ and $R^{14/14a}$ fused with heteroaryl or cycloalkyl were readily prepared from the corresponding anhydrides. NH (N2) pyridazinones were alkylated with alkyl or substituted alkyl groups using an R^{12} -halide, a base, for example K_2CO_3 , Cs_2CO_3 or NaH, in an inert solvent such as DMF or CH_3CN .

In cases where R^{13} or R^{14} substituted 4,5-dihydropyridazinone formed a mixture of isomers, the isomers were separated by standard methods known in the art. Intermediates wherein R^{12} is H may be converted to analogs wherein R^{12} is aryl or heteroaryl by standard palladium or copper coupling reactions using the appropriate aryl or heteroaryl halide. The 4,5-dihydropyridazinone may be oxidized to an aromatic pyridazinone using MnO_2 , $CuCl_2$, DDQ, selenium oxide, DMSO / base or sodium 3-nitrobenzenesulfonate in the presence of sodium hydroxide.

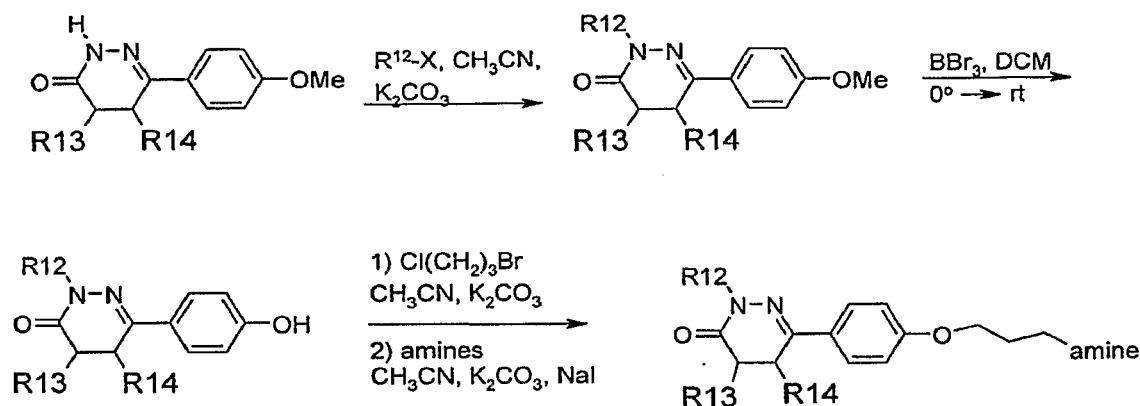
Scheme 1. General synthesis of N2 H and substituted examples

5 In Scheme 1, examples of compounds disclosed herein may be obtained by condensation of an intermediate keto acid for example, 4-(4-methoxyphenyl)-4-oxobutyric acid (or an ester derivative) with hydrazine or an n-substituted hydrazine derivative in a solvent such as ethanol or 2-propanol to produce a dihydropyridazinone intermediate. The keto-acid intermediates not commercially available are readily prepared and described using

10 literature methods. Keto-acid intermediates with R¹³ or R¹⁴ groups in the 4 or 5-positions or fused aryl or heteroaryl groups are described (Heterocycles, 2002, 57, 39; Indian J. Chem, 1977, 16B, 631; Chem Pharm Bull, 1980, 42, 1850; J. Med. Chem. 2003, 46, 2008). The N2 position may be substituted with alkyl or substituted alkyl groups using a base, for example K₂CO₃, Cs₂CO₃ or NaH in an inert solvent such as DMF or CH₃CN. In cases

15 where R¹³ or R¹⁴ substituted dihydropyridazinone form isomers, the individual isomers may be separated using conventional methods known to the art. R¹³ aryl or heteroaryl groups may be introduced by standard palladium or copper coupling reactions using the appropriate aryl or heteroaryl halide. Alternatively, the 4,5-position may be oxidized to the pyridazinone intermediate using for example MnO₂, CuCl₂, DDQ or selenium oxide as the

20 oxidizing agent. The N2 nitrogen may be H, or further substituted using methods outlined previously.

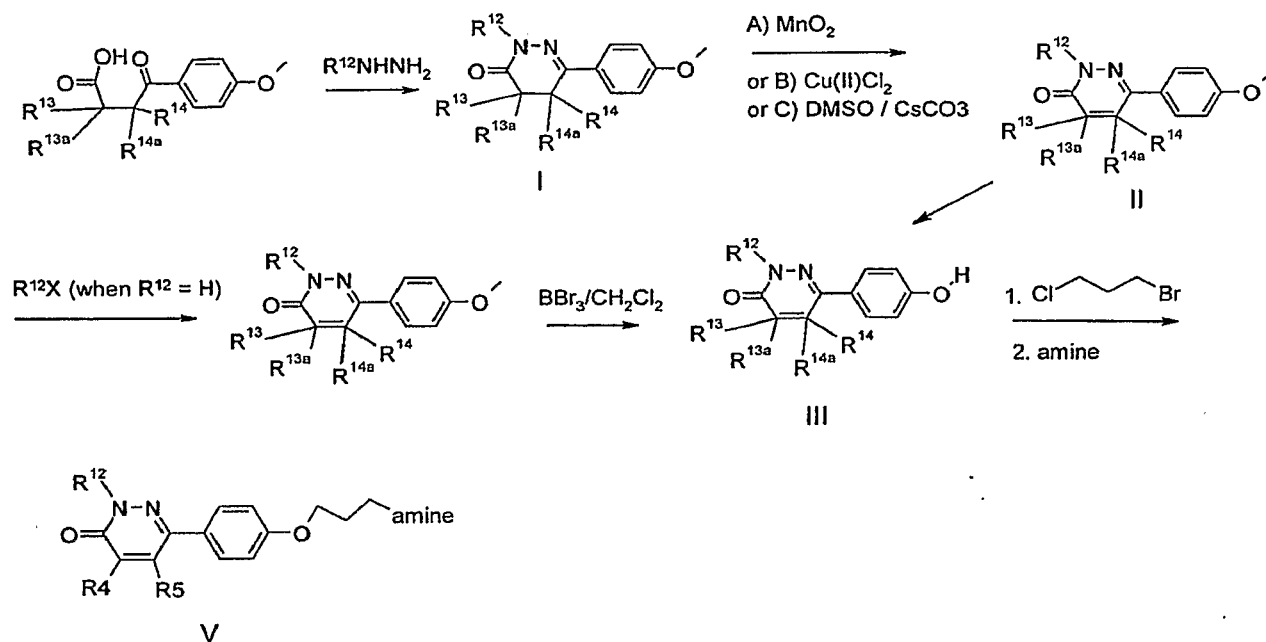
Scheme 2. General synthesis of 4,5-dihydro examples

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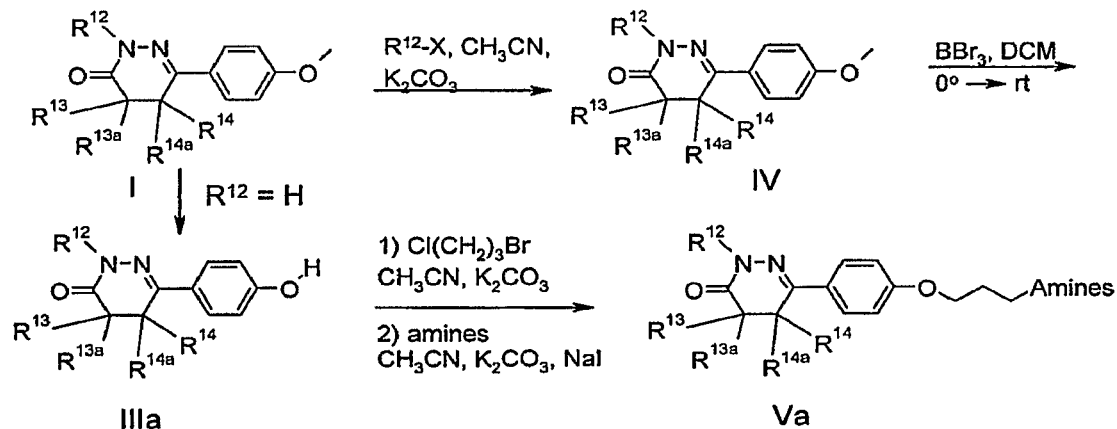
As outlined in Scheme 1 and 2, the pyridazinone or dihydro pyridazinone methoxy intermediate is demethylated using BBr_3 in dichloromethane to produce the phenol. Alkylation of the phenol with bromochloropropane or a dibromoalkane intermediate in a suitable solvent such as DMF, acetone, butanone or CH_3CN with K_2CO_3 produces the halogen intermediate. Alkylation of the halide intermediate with an amine gives the target dihydropyridazinone examples of the invention. Other suitable leaving groups may be used such as mesylates as precursors to amines. Mitsunobo reactions with cyclic amino-ethers such as 4-hydroxypiperidine, 3-hydroxypyrrolidine or substituted amino alcohols produce the corresponding examples. Alkyl bridged analogs or linker group with hetero atoms can readily be prepared for example from methoxy indanones, tetralones, benzocycloheptanones, dihydro-2H-benzo[b]oxepinones, dihydro-2H-benzo[b]thiepinones, chromanones, or thiochromanones.

As outlined in Schemes 3 and 4, the pyridazinone or 4,5-dihydropyridazinone was demethylated using BBr_3 in dichloromethane to produce phenol intermediates III and IIIa. Alkylation of the phenol intermediates with 3-bromo-1-chloropropane or a dibromo intermediate in a suitable solvent such as DMF, acetone, butanone or CH_3CN with K_2CO_3 produced the corresponding alkylated intermediate. Displacement of the halide with an amine gave the target dihydropyridazinone examples of general structures V and Va.

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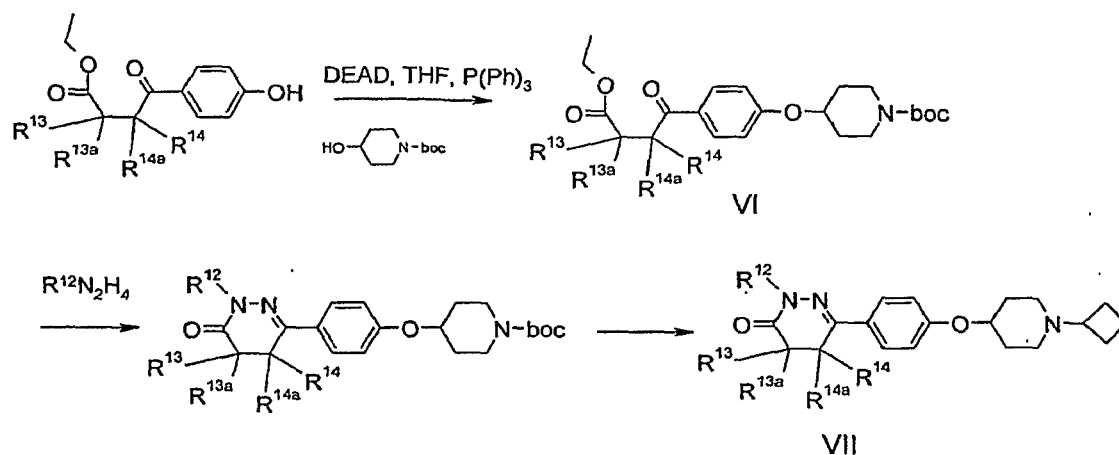
Scheme 3. General synthesis of R¹² H and substituted examples

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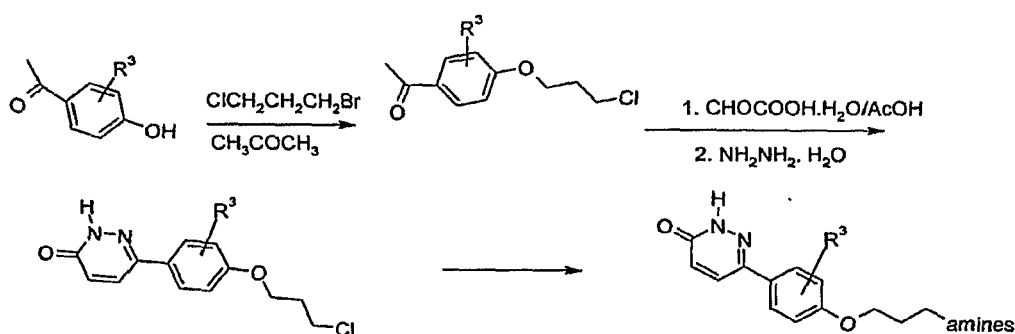
Scheme 4. General synthesis of 4,5-dihydro examples

10

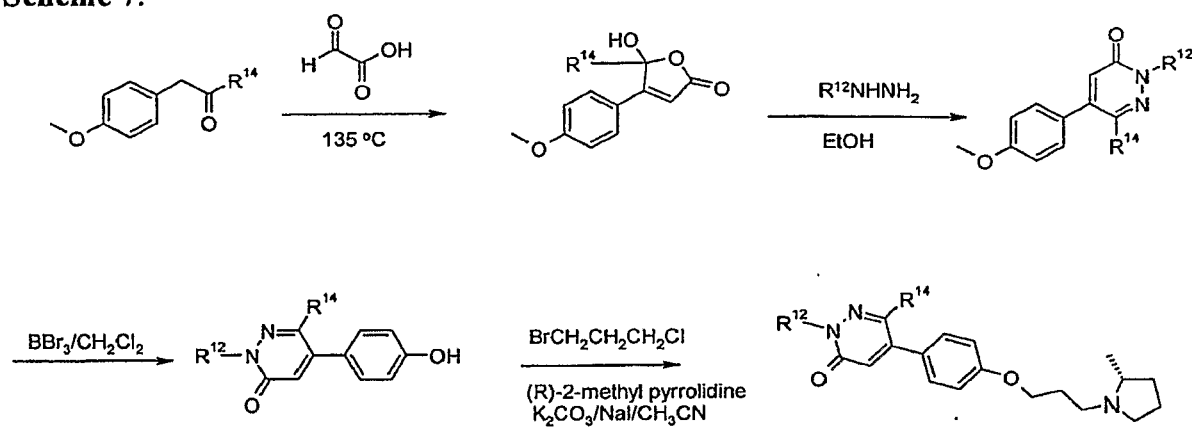
As outlined in Scheme 5, the phenol intermediate was coupled under Mitsunobu conditions with hydroxypiperidines, pyrrolidines or azepines to give the piperidine or cyclic amine derivatives of general structure VI. Using reaction conditions described previously, examples of general structure VII was prepared.

Scheme 5. General synthesis of 4,5-dihydro examples

- 5 Scheme 6 discloses an Aldol condensation route to examples wherein R^{12} is H. 4-Hydroxy-acetophenone or a derivative thereof was condensed with a keto-acid, for example glycolic acid in acetic acid, and cyclized with hydrazine to give an aromatic pyridazinone (*J. Med. Chem.*, 1989, 32, 528).

10 **Scheme 6.**

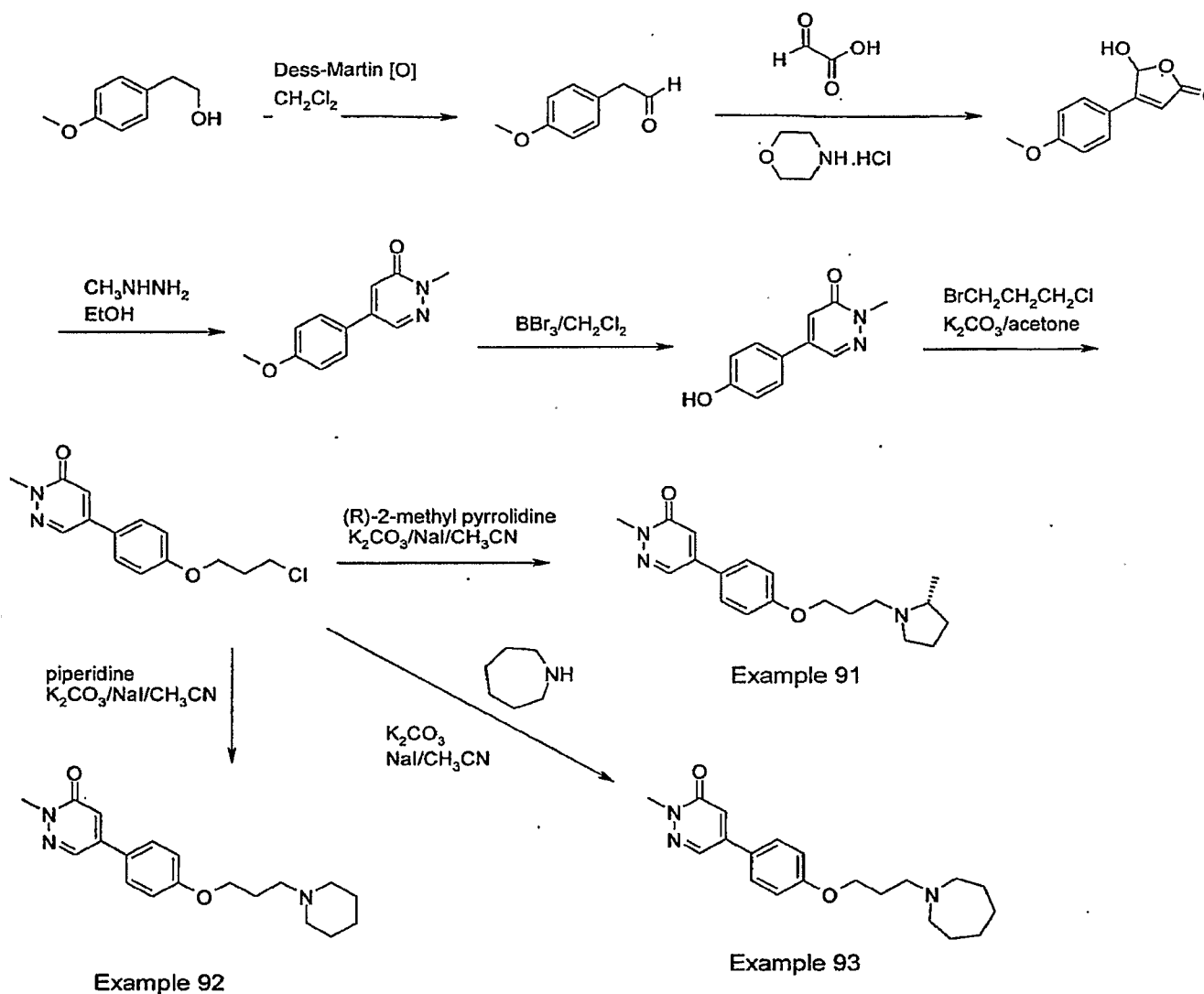
- 15 5-Aryl pyridazinone examples were synthesized as outlined in Schemes 7 and 8. Condensation of 4-methoxyphenyl acetone ($R^{14} = \text{Me}$) with glyoxylic acid (Scheme 7), followed by cyclization with hydrazine hydrate or *N*-substituted hydrazine derivatives afforded 5-(4-methoxy-phenyl)-6-methyl-2H-pyridazin-3-one, and *N*- R^{12} examples (*Farmaco*, 1996, 51, 693-688).

Scheme 7.

5-Aryl examples where R^{14} is H were prepared as outlined in Scheme 8 starting from 4-methoxyphenylacetaldehyde using conditions shown in Scheme 7.

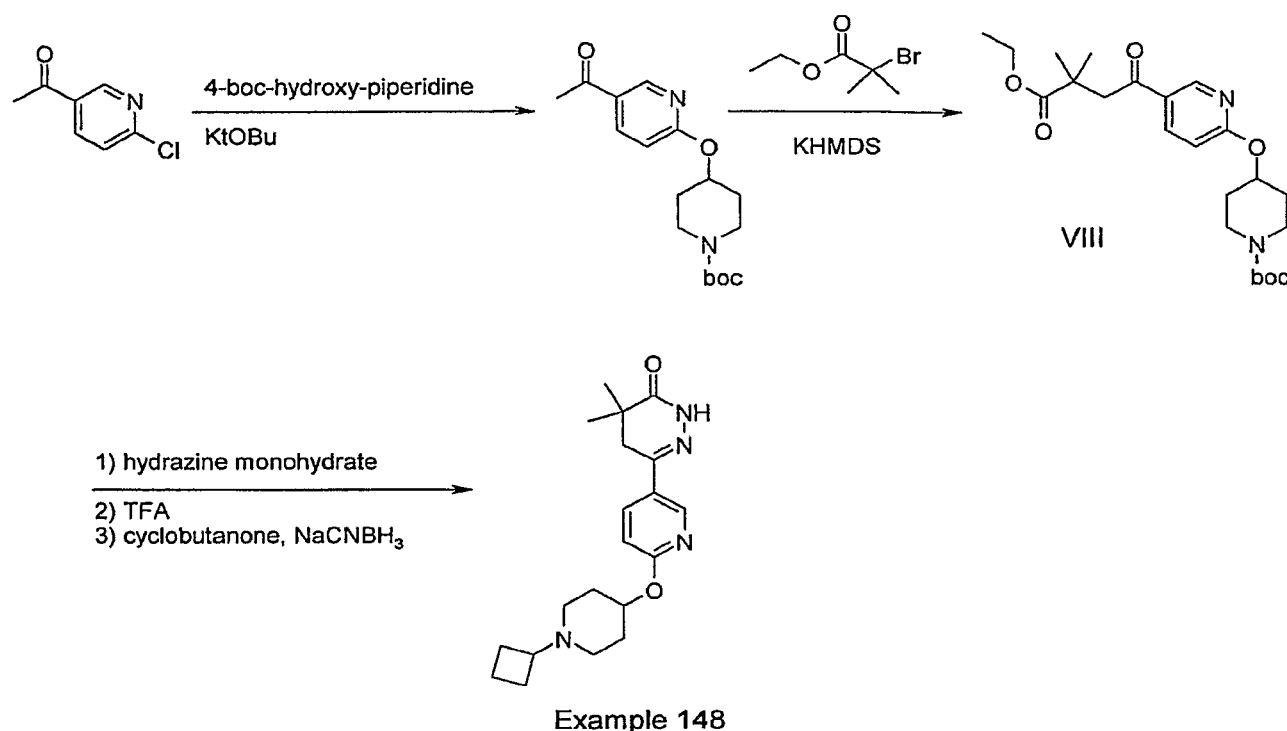
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Scheme 8. Synthesis of 5-Aryl Example 91 to 93

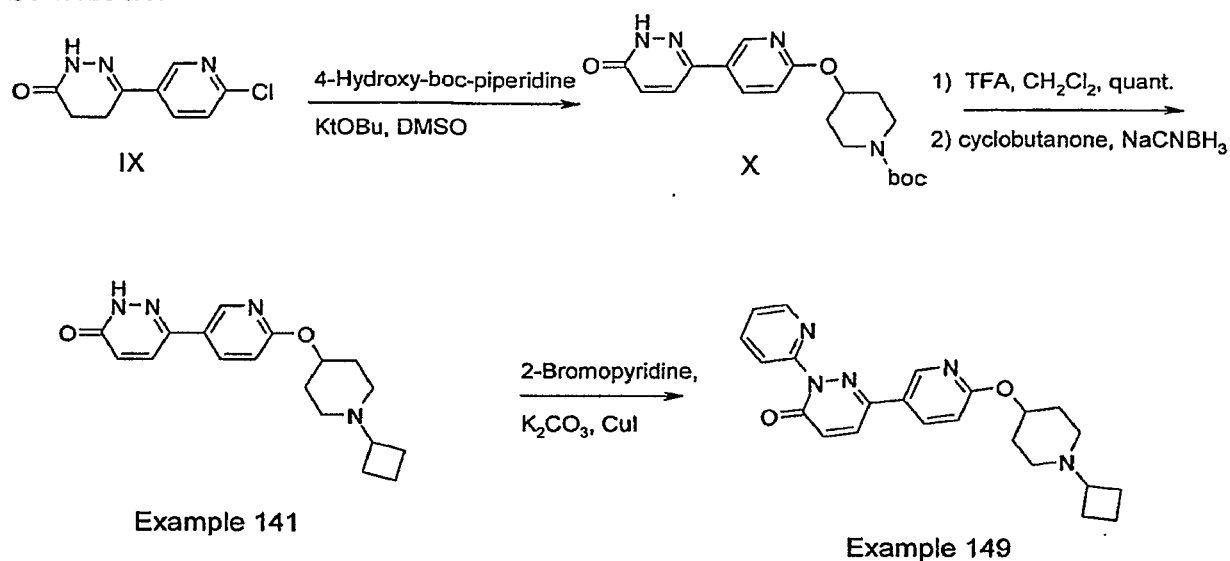


Aza examples ($X = \text{N}$) where R^{13} and R^{13a} are each methyl were prepared as outlined in Scheme 9 by alkylation of 1-(6-chloropyridin-3-yl)ethanone with 4-hydroxy-N-Boc-piperidine and a base such as NaH, potassium *tertiary* butoxide, or KHMDS in DMSO, DMF or THF. A second alkylation step using potassium bis(trimethylsilyl)amide in toluene and, for example 2-bromo-2-methyl-propionic acid ethyl ester, produced the keto-ester intermediates VIII. Example 148 was produced as shown in Scheme 9 using conditions described previously.

Scheme 9.

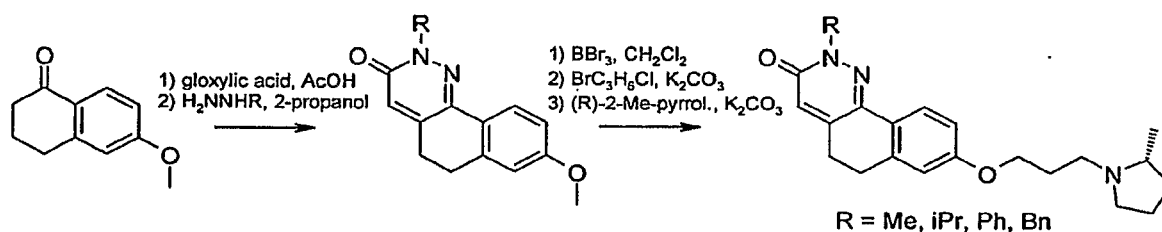


Scheme 10 shows the route to aza (X = N) examples where R¹² is heteroaryl (For example, Example 149 (6-[6-(1-Cyclobutyl-piperidin-4-yloxy)-pyridin-3-yl]-2-pyridin-2-yl-2H-pyridazin-3-one). 6-(6-Chloropyridin-3-yl)-4,5-dihydro-2H-pyridazin-3-one intermediate IX, prepared from ethyl 4-(4-chloro-3-pyridyl)-4-oxobutyrates and hydrazine in ethanol was alkylated with 4-hydroxy-boc-piperidine and a base (KHMDS, DMSO) to intermediate X and converted to example 141 using methods described previously. Treatment of Example 141 with 2-bromopyridine in the presence of copper(I)iodide gives Example 149. Using aryl halides or heteroaryl halides gave examples where R¹² is aryl or heteroaryl.

Scheme 10.

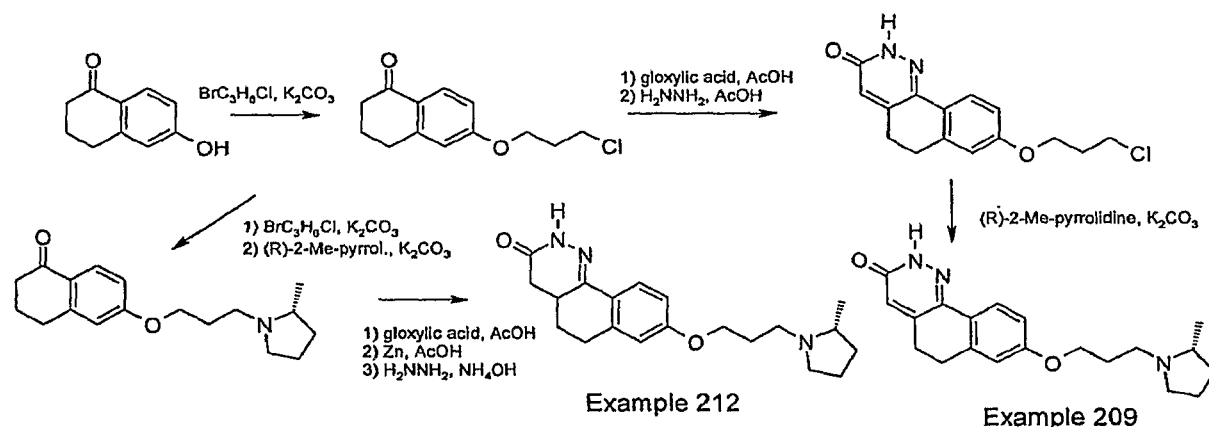
- 5 Bridged examples (Scheme 11) were prepared using methoxy tetralones and glycolic acid in an aldol synthesis. Phenol formation and alkylations as described previously produced the N-substituted examples. Alternatively, the use of β -tetralones provided a route to pyridazinone regioisomers.

10

Scheme 11.

- 15 Scheme 12 shows bridged analogs where R¹² is H, prepared by varying the order of the reactions. Addition of Zn dust to the aldol/ring closure procedure gave a one-pot synthesis of the dihydropyridazinone.

Scheme 12.



5

The present invention will now be illustrated by reference to the following specific, non-limiting examples. Those skilled in the art of organic synthesis may be aware of still other synthetic routes to the invention compounds. The reagents and intermediates used herein are commercially available or may be prepared according to standard literature procedures.

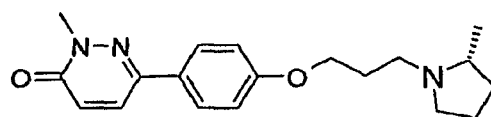
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EXAMPLES

Other features of the invention will become apparent in the course of the following descriptions of exemplary embodiments as shown below. The compounds shown herein have activity in the targets described herein at concentrations ranging from 0.1 nM to 10 μ M. These examples are given for illustration of the invention and are not intended to be limiting thereof.

15

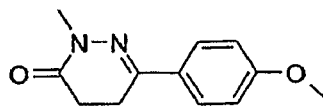
Example 1.



2-Methyl-6-{4-[3-((R)-2-methyl-pyrrolidin-1-yl)-propoxy]-phenyl}-2H-pyridazin-3-one

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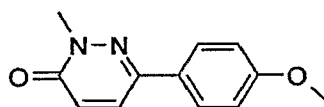
Step 1.



6-(4-Methoxy-phenyl)-2-methyl-4,5-dihydro-2H-pyridazin-3-one

In a 500 mL round bottom flask, 4-(4-methoxyphenyl)-4-oxobutyric acid (27 g, 132 mmol) and methylhydrazine (7.3 g, 8.5 mL, 159 mmol) in 2-propanol (150 mL) were stirred at reflux 12 h. The solvent was concentrated to about 50 mL, ether was added (~ 50 mL) and the product collected by filtration, washed 1x with ether and dried under house vacuum. Yield 27 g (94%, purity >95%), mp 133-135 °C. ¹H NMR (CDCl₃) δ 2.57 (m, 2H), 2.9 (m, 2H), 3.4 (s, 3H), 3.8 (s, 3H), 6.9 (d, 2H), 7.6 (d, 2H). MS m/z = 218 (M + H).

Step 2.



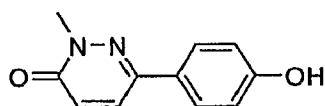
6-(4-Methoxy-phenyl)-2-methyl-2H-pyridazin-3-one

Method A: In a 1L round bottom flask, 6-(4-methoxyphenyl)-2-methyl-4,5-dihydro-2H-pyridazin-3-one (27 g, 124 mmol) and MnO₂ (30 g, 345 mmol) in xylene (250 mL) was stirred at vigorous reflux 14 h. The reaction was cooled to rt and filtered through a pad of celite. The xylene was concentrated and the resulting yellow solid was triturated with ether/hexane (1:2) and collected to produce 20 g (75%, HPLC 98% purity) of product. The celite/MnO₂ pad was washed with CHCl₃:MeOH 9:1 (2x ~100 mL), filtered and concentrated. The residue was triturated with ether/hexane (1:2) and collected to give a second crop (4 g, 15%, 96% purity) total yield 24g (90%). mp 109-110 °C. ¹H NMR (DMSO-*d*₆) δ 3.75 (s, 3H), 3.85 (s, 3H), 7.0-7.05 (d, 2H, d, 1H), 7.82 (d, 2H), 8.01 (d, 1H); MS m/z = 216 (M + H).

Method B: A mixture of 6-(4-methoxyphenyl)-2-methyl-4,5-dihydro-2H-pyridazin-3-one (3.27g, 15 mmol) and Cu(II)Cl₂ (3.96g, 2 eq., anhydrous, Acros) in 45ml of anhydrous acetonitrile was refluxed for 2 hr. HPLC indicated the completion of the reaction (rt (product) = 7.66 min, rt (SM) = 7.88 min). The reaction was cooled to rt and poured into

ice-water (~100 ml) and the acetonitrile removed at reduced pressure. The resulting off-white solid was filtered off, washed with water, and then crystallized from EtOH:Et₂O to give the product (2.47 g, 76%).

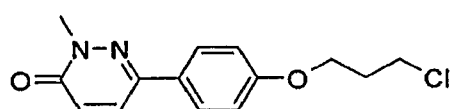
5 **Step 3.**



6-(4-Hydroxy-phenyl)-2-methyl-2H-pyridazin-3-one

To 6-(4-methoxyphenyl)-2-methyl-2H-pyridazin-3-one (10 g, 46.3 mmol) in 15 mL
10 DCM cooled on an ice-water bath to ~5 °C was added 93 mL of BBr₃ (1M soln in DCM)
over 5 min. The ice bath was removed and the solution stirred at rt for 4 h. The reaction was
cooled on an ice-bath and saturated NH₄Cl solution (100 mL) added slowly. After the
addition was complete, the DCM was removed under reduced pressure, excess water added
and the product collected, washed 1x with MeOH (~20 mL) and dried to give 9.2 g (98%):
15 Mp 242-245 °C. ¹H NMR (DMSO-*d*₆) δ 3.8 (s, 3H), 6.85 (d, 2H), 7.0 (d, 1H), 7.7 (d, 2H),
7.95 (d, 1H), 9.8 (s, 1H); MS *m/z* = 203 (M + H).

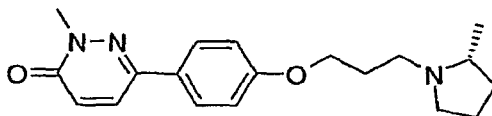
Step 4.



20 6-[4-(3-Chloro-propoxy)-phenyl]-2-methyl-2H-pyridazin-3-one

Phenol from step 3 (500 mg, 2.3 mmol), 3-bromo-1-chloropropane (720 mg, 4.6
mmol) and K₂CO₃ (950 mg) in CH₃CN (25 mL) was stirred at reflux 20 h. The reaction was
filtered and concentrated. The resulting oil was dissolved in Et₂O, and washed with water,
25 NaCl solution, dried (MgSO₄) and concentrated. The product was triturated with Et₂O-
hexanes to yield 580 mg (91%) mp 186-187 °C. ¹H NMR (DMSO-*d*₆) δ 2.2 (t, 2H), 3.7 (s,
3H), 3.8 (t, 2H), 4.15 (t, 2H), 7.0-7.1 (m, 3H), 7.8 (d, 2H), 8.0 (d, 1H). MS *m/z* = 279 (M +
H).

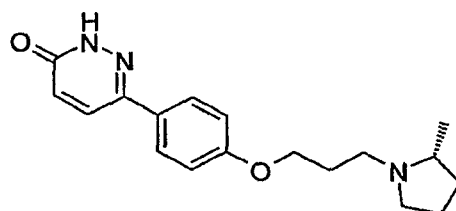
30 **Step 5. Example 1**



2-Methyl-6-{4-[3-((R)-2-methyl-pyrrolidin-1-yl)-propoxy]-phenyl}-2H-pyridazin-3-one

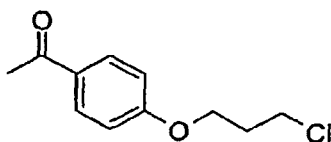
6-[4-(3-Chloropropoxy)phenyl]-2-methyl-2H-pyridazin-3-one (1.5 g, 5.4 mmol), K_2CO_3 (2.2g 16.2 mmol), NaI (805 mg, 5.4 mmol) R-methylpyrrolidine HCl (1.3 g, 10.8 mmol) in CH_3CN (30 mL) was heated under N_2 at 90 °C for 2 days. The reaction was filtered and concentrated. The residue was dissolved in EtOAc and washed with 2N Na_2CO_3 (1x), NaCl solution (1x) dried ($MgSO_4$) and concentrated. The product was purified by ISCO chromatography (80g silica gel column, 95:5 DCM: MeOH). The fractions were combined and concentrated to yield 850 mg (48%) of free base. The HCl was prepared by adding a 1N HCl-ether solution to the based in ether. The product was collected, and recrystallized from CH_3CN -ether. mp 183-185 °C. 1H NMR ($DMSO-d_6$) δ 1.38 (d, 3H), 1.62 (m, 1H), 1.92-1.3.1 (m, 3H), 3.4 (m, 3H), 3.7 (m, 1H), 3.7 (s, 3H), 4.15 (m, 2H), 7.0-7.17 (m, 3H), 7.8 (d, 2H), 8.0 (d, 1H), 10.1 (s, 1H). MS m/z = 328 (M + H).

Example 11



6-{4-[3-((R)-2-Methyl-pyrrolidin-1-yl)-propoxy]-phenyl}-2H-pyridazin-3-one

Step 1.



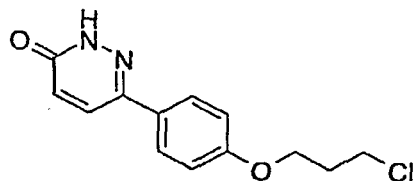
1-[4-(3-Chloro-propoxy)-phenyl]-ethanone

A mixture of 1-(4-hydroxyphenyl)ethanone (20.4 g, 150 mmol), K_2CO_3 (62.1 g, 3.0 eq.), and 3-bromo-1-chloropropane (29.6 mL, 2.0 eq.) in CH_3COCH_3 (200 mL) was heated

to 65 °C overnight. The mixture was filtered, washed with acetone, and concentrated to dryness. The crude product was dissolved in 150 mL of CH₂Cl₂, and washed with saturated NaHCO₃, NaCl solution and dried over Na₂SO₄. Concentration to dryness under vacuum afforded product (31.5 g, 99 % yield): MS m/z 213 (M + H).

5

Step 2.

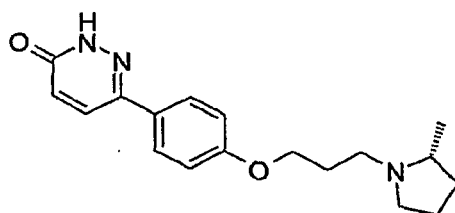


6-[4-(3-Chloro-propoxy)-phenyl]-2H-pyridazin-3-one

A mixture of the product from step 1 (4.6 g, 1.0 eq.) and glyoxalic acid monohydrate (4.6g, 1.0 eq.) was stirred in 15 mL of acetic acid at 100 °C for 2 h. The solvent was evaporated and to the residue was added 25 mL of water, and cooled to 0 °C while conc. aqueous NH₄OH was added to pH 8. To this mixture, hydrazine hydrate (4.76 mL, 2 eq.) was added and heated to 100 °C for 1 h. The resulting solid was filtered, washed with water. The crude material was dissolved in CH₂Cl₂/MeOH and purified by column chromatography with CH₂Cl₂ to 10 % MeOH in CH₂Cl₂; Mp 191-3 °C; MS m/z 265 (M + H).

15

Step 3.



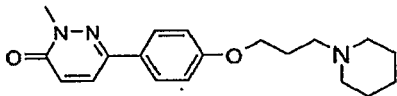
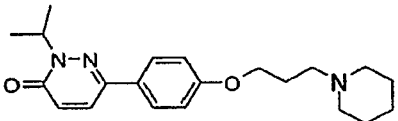
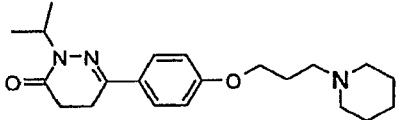
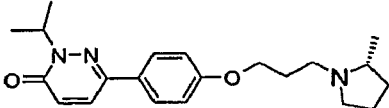
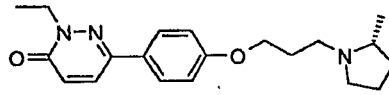
6-[4-[3-((R)-2-Methyl-pyrrolidin-1-yl)-propoxy]-phenyl]-2H-pyridazin-3-one

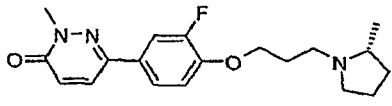
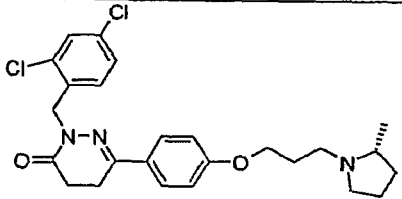
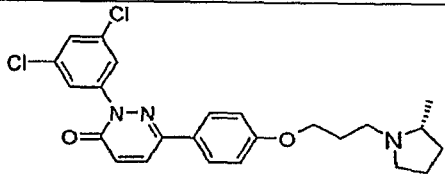
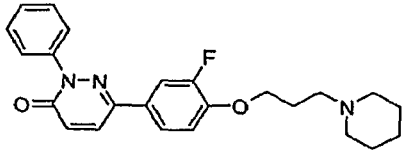
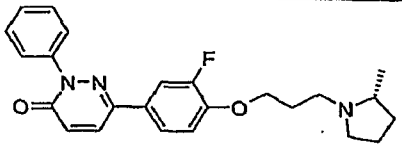
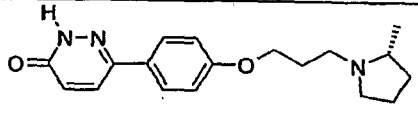
A mixture of the product from step 2 (5.5 g, 21 mmol), K₂CO₃ (3.5 eq, 10.1 g), 100 mg of NaI, and R-2-methylpyrrolidine hydrochloride (2 eq., 5.1 g) in 250 mL of acetonitrile was heated to 80 °C for 2 days. The reaction mixture was then filtered, washed with CH₂Cl₂ (2 x 50mL), and concentrated. The residue was dissolved in 200 mL of CH₂Cl₂, and washed with saturated NaHCO₃, saturated NaCl, dried with Na₂SO₄ and concentrated. The residue was purified by ISCO graduate chromatography with 100% CH₂Cl₂ to 5%MeOH: 95% CH₂Cl₂:0.5 mL of 2-aminopropane and then to 10%MeOH: 90% CH₂Cl₂:0.5 mL of 2-

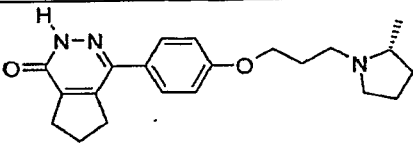
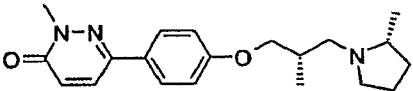
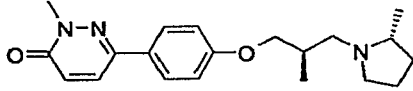
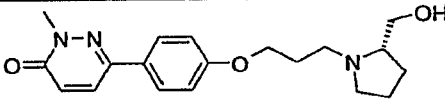
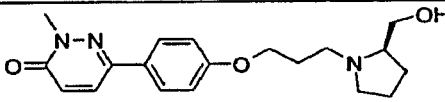
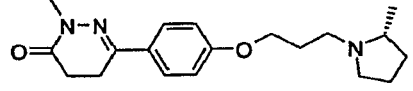
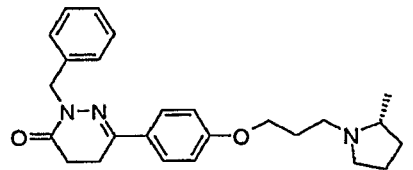
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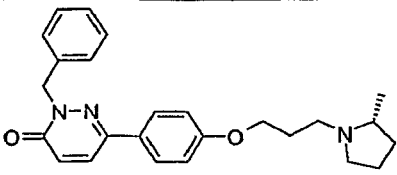
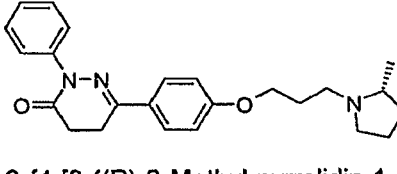
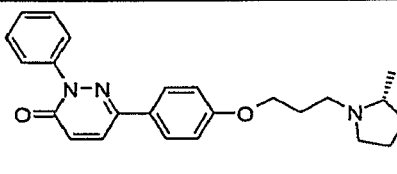
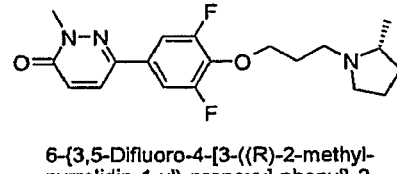
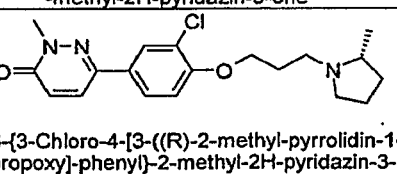
aminopropane to give the product. The product was dissolved in 15 mL of MeOH and then added 30 mL of 0.5 N HCl in EtOH. Evaporation of the solvent, and crystallization from MeOH: Et₂O afforded the example 11 as the HCl salt (2.65g, 41%): Mp 240-2 °C; MS m/z 314 (M + H).

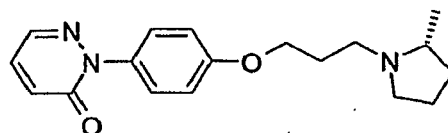
- 5 The following examples were prepared as HCl salts unless noted using methods for example 1 and example 11. The 4,5-dihydro examples were prepared using the method for step 3 on the product from step 1.

Example	Structure	Mp (°C)	MS m/z
2	 2-Methyl-6-[4-(3-piperidin-1-yl-propoxy)-phenyl]-2H-pyridazin-3-one	200-201	328 (M + H)
3	 2-Isopropyl-6-[4-(3-piperidin-1-yl-propoxy)-phenyl]-2H-pyridazin-3-one	118-122	356 (M + H)
4	 2-Isopropyl-6-[4-(3-piperidin-1-yl-propoxy)-phenyl]-4,5-dihydro-2H-pyridazin-3-one	76-77	358 (M + H)
5	 2-Isopropyl-6-[4-[3-((R)-2-methyl-pyrrolidin-1-yl)-propoxy]-phenyl]-2H-pyridazin-3-one	60-64 (tartrate)	356 (M + H)
6	 2-Ethyl-6-[4-[3-((R)-2-methyl-pyrrolidin-1-yl)-propoxy]-phenyl]-2H-pyridazin-3-one	58-62 (tartrate)	342 (M + H)

Example	Structure	Mp (°C)	MS m/z
7	 6-{3-Fluoro-4-[3-((R)-2-methyl-pyrrolidin-1-yl)-propoxy]-phenyl}-2-methyl-2H-pyridazin-3-one	140-142	346 (M + H)
8	 2-(2,4-Dichloro-benzyl)-6-{4-[3-((R)-2-methyl-pyrrolidin-1-yl)-propoxy]-phenyl}-4,5-dihydro-2H-pyridazin-3-one	140-146	375 (M + H)
9	 2-(3,5-Dichloro-phenyl)-6-{4-[3-((R)-2-methyl-pyrrolidin-1-yl)-propoxy]-phenyl}-2H-pyridazin-3-one	214-222	450 (M + H)
10	 6-{3-Fluoro-4-(3-piperidin-1-yl-propoxy)-phenyl}-2-phenyl-2H-pyridazin-3-one	230-232	408 (M + H)
81	 6-{3-Fluoro-4-[3-((R)-2-methyl-pyrrolidin-1-yl)-propoxy]-phenyl}-2-phenyl-2H-pyridazin-3-one	190-191	408 (M + H)
11	 6-{4-[3-((R)-2-Methyl-pyrrolidin-1-yl)-propoxy]-phenyl}-2H-pyridazin-3-one	240-2	314 (M + H)

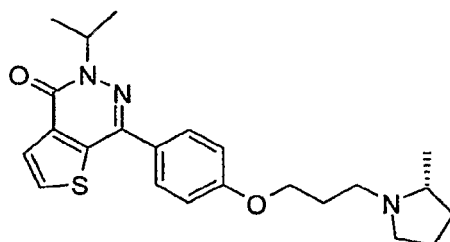
Example	Structure	Mp (°C)	MS m/z
12	 4-{4-[3-((R)-2-Methyl-pyrrolidin-1-yl)-propoxy]-phenyl}-2,5,6,7-tetrahydro-cyclopenta[d]pyridazin-1-one	147	354 (M + H)
13	 2-Methyl-6-{4-[(S)-2-methyl-3-((R)-2-methyl-pyrrolidin-1-yl)-propoxy]-phenyl}-2H-pyridazin-3-one	188-190	342 (M + H)
82	 2-Methyl-6-{4-[(R)-2-methyl-3-((R)-2-methyl-pyrrolidin-1-yl)-propoxy]-phenyl}-2H-pyridazin-3-one	76-78	342 (M + H)
14	 6-{4-[3-((S)-2-Hydroxymethyl-pyrrolidin-1-yl)-propoxy]-phenyl}-2-methyl-2H-pyridazin-3-one	169	344 (M + H)
15	 6-{4-[3-((R)-2-Hydroxymethyl-pyrrolidin-1-yl)-propoxy]-phenyl}-2-methyl-2H-pyridazin-3-one	166-7	344 (M + H)
16	 2-Methyl-6-{4-[3-((R)-2-methyl-pyrrolidin-1-yl)-propoxy]-phenyl}-4,5-dihydro-2H-pyridazin-3-one	145-147	330 (M + H)
17	 2-Benzyl-6-{4-[3-((R)-2-methyl-pyrrolidin-1-yl)-propoxy]-phenyl}-4,5-dihydro-2H-pyridazin-3-one	56-58	406 (M + H)

Example	Structure	Mp (°C)	MS m/z
18	 2-Benzyl-6-{4-[3-((R)-2-methyl-pyrrolidin-1-yl)-propoxy]-phenyl}-2H-pyridazin-3-one	228-230	404 (M + H)
19	 6-{4-[3-((R)-2-Methyl-pyrrolidin-1-yl)-propoxy]-phenyl}-2-phenyl-2H-pyridazin-3-one	213-215	392 (M + H)
20	 6-{4-[3-((R)-2-Methyl-pyrrolidin-1-yl)-propoxy]-phenyl}-2-phenyl-2H-pyridazin-3-one	82-86	390 (M + H)
84	 6-{3,5-Difluoro-4-[3-((R)-2-methyl-pyrrolidin-1-yl)-propoxy]-phenyl}-2-methyl-2H-pyridazin-3-one	175-178 base	364 (M + H)
85	 6-{3-Chloro-4-[3-((R)-2-methyl-pyrrolidin-1-yl)-propoxy]-phenyl}-2-methyl-2H-pyridazin-3-one	178 dec.	362 (M + H)

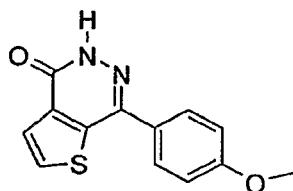
Example 21.

2-{4-[3-((R)-2-Methyl-pyrrolidin-1-yl)-propoxy]-phenyl}-2H-pyridazin-3-one

A mixture of R-1-[3-(4-bromo-phenoxy)-propyl]-2-methyl-pyrrolidine (560 mg, 1.87 mmol), 2H-pyridazin-3-one (180 mg, 1.87 mmol), K_2CO_3 (775 mg, 5.61 mmol), copper powder (120 mg, 1.87 mmol) in pyridine (75 mL) was stirred at reflux under nitrogen for 18 h. The reaction was cooled to rt and concentrated at reduced pressure. The
5 residue was dissolved onto fluorsil for elution and purification by ISCO silica gel chromatography (95:5:1/ DCM, MeOH, isopropyl amine). The fractions containing pure product were collected and concentrated. The solid was recrystallized from Et_2O -hexanes to give 210 mg of Example 21 as a white solid; Mp 106-107 °C. The HCl salt was prepared by dissolving the base in MeOH and adding 1N Et_2O -HCl: Mp 175-177 °C (MeOH- Et_2O);
10 MS m/z 314 (M + H).

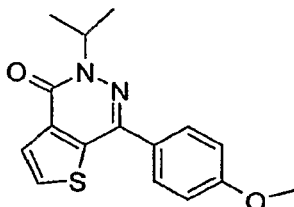
Example 22

5-Isopropyl-7-{4-[3-((R)-2-methyl-pyrrolidin-1-yl)-propoxy]-phenyl}-5H-thieno[2,3-d]pyridazin-4-one

5 Step 1.

7-(4-Methoxy-phenyl)-5H-thieno[2,3-d]pyridazin-4-one

A solution of 3-thiophenecarboxylic acid (10 g, 78 mmol) in 250 mL of THF at 0 °C under N₂ was added 2.0 M LDA (2.2 eq., 86 mL) dropwise. After 10 min at 0 °C, *p*-anisaldehyde (10.6 mL, 1.12 eq.) was added and the mixture was slowly warmed to room temperature overnight. The reaction was stirred for ~ 14 h, after which 100 mL of ice-water was added, and the solvent was evaporated. The aqueous solution was washed with EtOAc (2 x 40 mL), and then added KMnO₄ (2 eq., 12.4 g) dropwise at 0 °C. The ice-bath was removed and the reaction was heated to 60 °C for 3 h. The solid was collected and washed with hot water. The aqueous layer was acidified to pH ~3, extracted with EtOAc (3 x 50 mL). The combined EtOAc was dried and evaporated. The crude solid was dissolved in 50 mL of EtOH, and NH₂NH₂·H₂O (1.5 eq., 1.5 mL) was added dropwise. The reaction was heated to 80 °C for 3 h, and the resulting solid was collected and washed with EtOH to give 3.6 g (36%): MS m/z 259 (M + H).

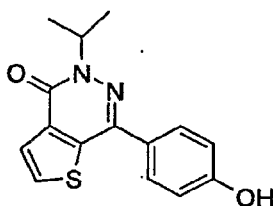
Step 2.

5-Isopropyl-7-(4-methoxy-phenyl)-5H
-thieno[2,3-d]pyridazin-4-one

5

A solution of the product from step 1 in 10 mL of DMF was added Cs_2CO_3 (2 eq. 1.95g) and 2-iodopropane (1.2 eq., 360 μL). The reaction was heated to 80 °C for 2 h, and then filtered through celite, washed with MeOH: CH_2Cl_2 (95:5). The filtrate was concentrated and purified by silica gel flash chromatography (MeOH: CH_2Cl_2 , 97:3) to afford 585 mg (65%) of the product: Mp 124-6 °C; MS m/z 301 (M + H).

10

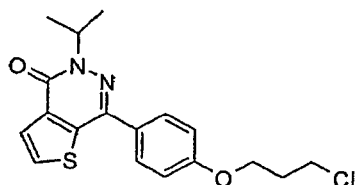
Step 3.

7-(4-Hydroxy-phenyl)-5-isopropyl-5H
-thieno[2,3-d]pyridazin-4-one

15

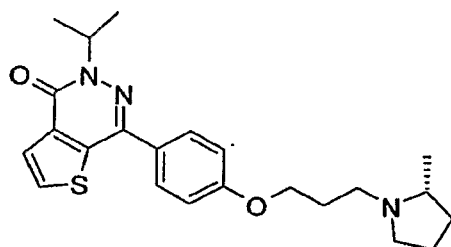
A solution of the product from step 2 (1.0 g, 3.3 mmol) in 25 mL of CH_2Cl_2 was cooled to 0 °C and BBr_3 (1M in DCM, 16.7 mL) was added dropwise. The ice-bath was removed and the reaction was stirred at rt for 1 h. The reaction mixture was then poured into 50 mL of ice cold saturated NH_4Cl solution with stirring. The resulting solid was collected, washed with water (3 x 15 mL), and Et_2O (2 x 15 mL) to give the product of step 3 (868 mg, 92%): Mp 256-257 °C; MS m/z 287 (M + H).

20

Step 4.

7-[4-(3-Chloro-propoxy)-phenyl]-5-isopropyl-5H-thieno[2,3-d]pyridazin-4-one

A solution of the product of step 3 (858 mg, 3 mmol), K_2CO_3 (1.24 g, 3.0 eq.), and 3-bromo-1-chloropropane (0.3 mL, 1.05 eq.) in acetone:DMF (25 mL:3 mL) was heated to 80 °C overnight. The mixture was then filtered, washed with acetone, and concentrated to dryness to afford the product of step 4 (1.17 mg, 98% yield): Mp 92-4 °C; MS m/z 363 (M + H).

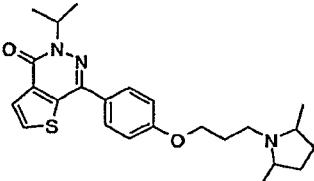
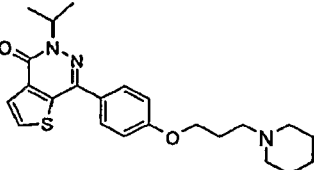
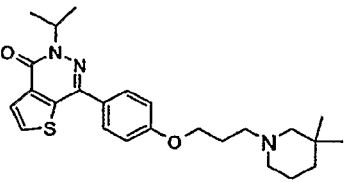
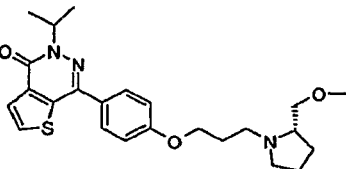
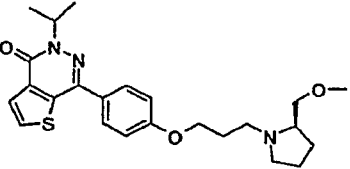
Step 5.

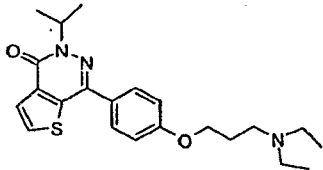
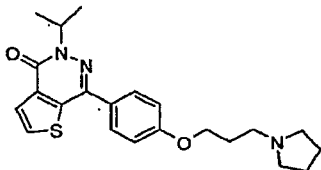
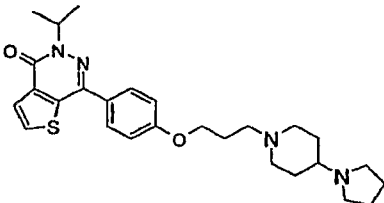
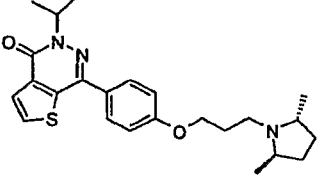
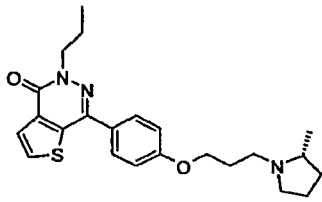
5-Isopropyl-7-{4-[3-((R)-2-methylpyrrolidin-1-yl)-propoxy]-phenyl}-5H-thieno[2,3-d]pyridazin-4-one

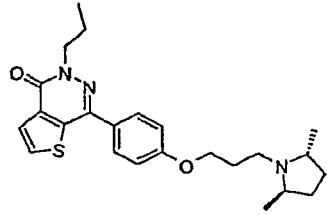
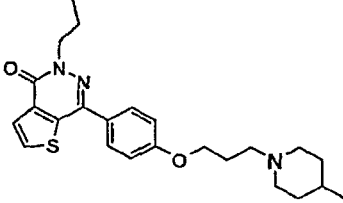
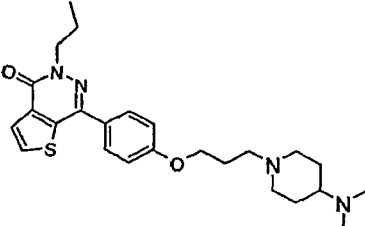
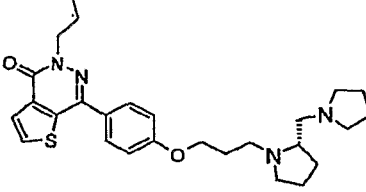
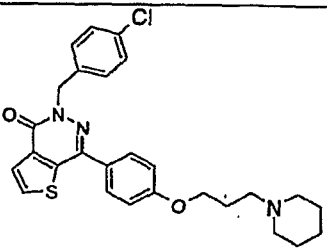
A mixture of the product of step 4 (109 mg, 0.3 mmol), K_2CO_3 (3.5 eq, 145 mg), 50 mg of NaI, and *R*-2-methylpyrrolidine hydrochloride (1.2 eq., 44 mg) in 10 mL of acetonitrile was heated to 80 °C for 2 days. The reaction mixture was then filtered, washed with CH_2Cl_2 (2 x 20mL) and concentrated. The residue was dissolved in 20 mL of CH_2Cl_2 , and washed with saturated $NaHCO_3$ solution, saturated NaCl solution, dried with Na_2SO_4 , and concentrated. The residue was purified by preparative TLC or ISCO graduate silica gel chromatography (MeOH: CH_2Cl_2 :2-aminopropane; 5:95:0.5) to give the product. The product was dissolved in 5 mL of MeOH, and added 0.5 mL of 1N HCl in EtOH.

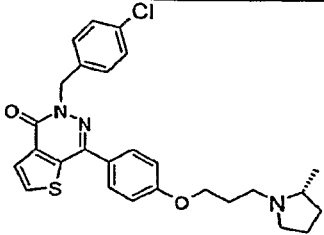
Evaporation of the solvent, and crystallization from MeOH: Et_2O afforded the HCl salt of example 22 (5-isopropyl-7-(4-(3-((*R*)-2-methyl-pyrrolidin-1-yl)propoxy) phenyl)-5H-thieno[2,3-d]pyridazin-4-one) (52 mg, 42%): Mp 123-4 °C; MS m/z 412 (M + H).

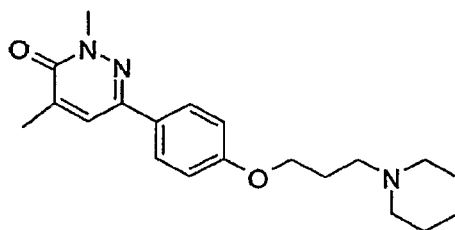
The following examples were prepared as HCl salts using methods of example 22.

Example	Structure	Mp (°C)	MS m/z
23	 7-(4-[3-(2,5-Dimethyl-pyrrolidin-1-yl)-propoxy]-phenyl)-5-isopropyl-5H-thieno[2,3-d]pyridazin-4-one	158-159	426 (M + H)
24	 5-Isopropyl-7-[4-(3-piperidin-1-yl-propoxy)-phenyl]-5H-thieno[2,3-d]pyridazin-4-one	195-196	412 (M + H)
25	 7-(4-[3-(3,3-Dimethyl-piperidin-1-yl)-propoxy]-phenyl)-5-isopropyl-5H-thieno[2,3-d]pyridazin-4-one	100-102	440 (M + H)
26	 5-Isopropyl-7-[4-[3-((S)-2-methoxyethyl-pyrrolidin-1-yl)-propoxy]-phenyl]-5H-thieno[2,3-d]pyridazin-4-one	83 dec.	442 (M + H)
27	 5-Isopropyl-7-[4-[3-((R)-2-methoxyethyl-pyrrolidin-1-yl)-propoxy]-phenyl]-5H-thieno[2,3-d]pyridazin-4-one	9-96	442 (M + H)

Example	Structure	Mp (°C)	MS m/z
28	 7-[4-(3-Diethylamino-propoxy)-phenyl]-5-isopropyl-5H-thieno[2,3-d]pyridazin-4-one	188-190	400 (M + H)
29	 5-Isopropyl-7-[4-(3-pyrrolidin-1-yl-propoxy)-phenyl]-5H-thieno[2,3-d]-pyridazin-4-one	144	398 (M + H)
30	 5-Isopropyl-7-[4-[3-(4-pyrrolidin-1-yl-piperidin-1-yl)-propoxy]-phenyl]-5H-thieno[2,3-d]pyridazin-4-one	283 dec.	481 (M + H)
31	 7-[4-[3-((2R,5R)-2,5-Dimethyl-pyrrolidin-1-yl)-propoxy]-phenyl]-5-isopropyl-5H-thieno[2,3-d]pyridazin-4-one	106 dec.	426 (M + H)
32	 7-[4-[3-((R)-2-Methyl-pyrrolidin-1-yl)-propoxy]-phenyl]-5-propyl-5H-thieno[2,3-d]pyridazin-4-one	151-153	412 (M + H)

Example	Structure	Mp (°C)	MS m/z
33	 7-{4-[3-((2R,5R)-2,5-Dimethyl-pyrrolidin-1-yl)-propoxy]-phenyl}-5-propyl-5H-thieno[2,3-d]pyridazin-4-one	84 dec.	426 (M + H)
34	 7-{4-[3-(4-Methyl-piperidin-1-yl)-propoxy]-phenyl}-5-propyl-5H-thieno[2,3-d]pyridazin-4-one	168-170	426 (M + H)
35	 7-{4-[3-(4-Dimethylamino-piperidin-1-yl)-propoxy]-phenyl}-5-propyl-5H-thieno[2,3-d]pyridazin-4-one	207-209	455 (M + H)
36	 5-Propyl-7-{4-[3-((S)-2-pyrrolidin-1-ylmethyl-pyrrolidin-1-yl)-propoxy]-phenyl}-5H-thieno[2,3-d]pyridazin-4-one	123 dec.	481 (M + H)
37	 5-(4-Chloro-benzyl)-7-{4-[3-piperidin-1-yl-propoxy]-phenyl}-5H-thieno[2,3-d]pyridazin-4-one	227-229	494 (M + H)

Example	Structure	Mp (°C)	MS m/z
38	 5-(4-Chloro-benzyl)-7-[4-[3-((R)-2-methyl-pyrrolidin-1-yl)-propoxy]-phenyl]-5H-thieno[2,3-d]pyridazin-4-one	223-224	494 (M + H)

Example 39

2,4-Dimethyl-6-[4-(3-piperidin-1-yl-propoxy)-phenyl]-2H-pyridazin-3-one

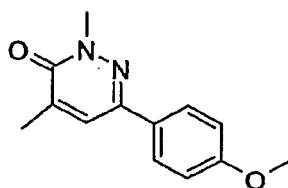
5

Step 1. A solution of 2-methoxy-4-oxo-4-(4'-methoxyphenyl) butyric acid (2.22 g, 10 mmol) and hydrazine hydrate (1.5 eq., 688 μ L) in 20 mL of EtOH was stirred at 80 °C overnight. The solvent was removed and the solid was collected and washed with cold EtOH to give 6-(4-methoxy-phenyl)-4-methyl-4,5-dihydro-2H-pyridazin-3-one (2.05 g, 94%): Mp 203-6 °C.

10

Step 2. A mixture of the product from step 1 (6-(4-methoxy-phenyl)-4-methyl-4,5-dihydro-2H-pyridazin-3-one; 1.96 g, 9 mmol) and Cu(II)Cl₂ (2.48 g, 2 eq.) in of acetonitrile (15 mL) was heated to 70 °C for 2 h. The reaction was quenched with ice-water (~100 mL), the resulting solid was collected and crystallized from isopropanol to give 1.42 g (73%) of 6-(4-methoxy-phenyl)-4-methyl-2H-pyridazin-3-one: Mp 265-7 °C; MS m/z 217 (M + H).

15



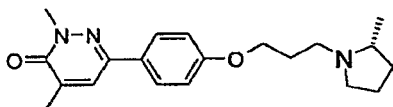
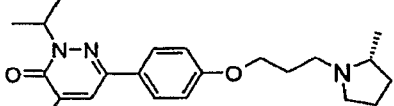
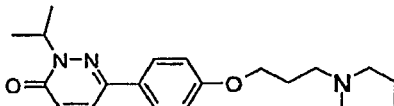
6-(4-Methoxy-phenyl)-2,4-dimethyl-2H-pyridazin-3-one

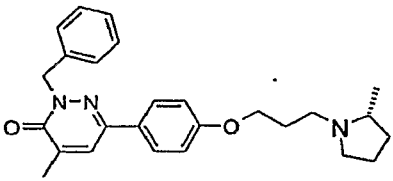
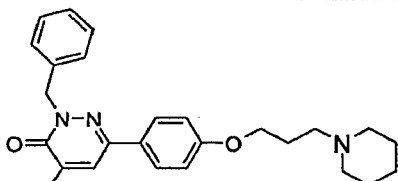
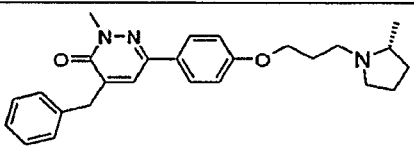
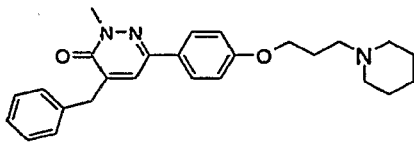
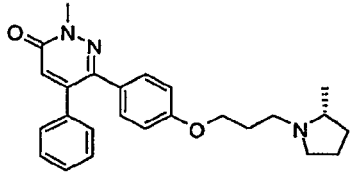
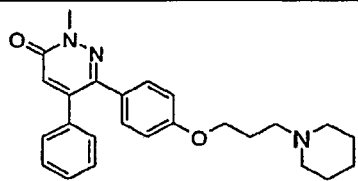
Step 3. The product of step 2 (6-(4-methoxy-phenyl)-2,4-dimethyl-2H-pyridazin-3-one) was prepared as described for example 22 step 2 using 6-(4-methoxy-phenyl)-4-methyl-4,5-dihydro-2H-pyridazin-3-one, MeI and Cs₂CO₃.

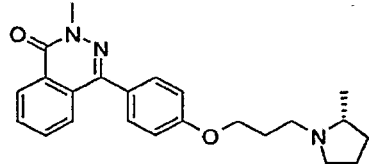
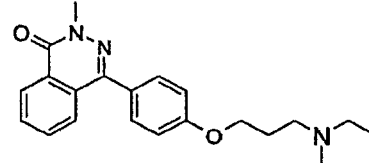
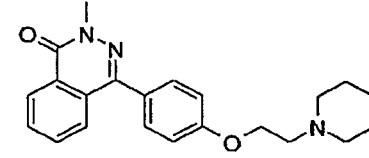
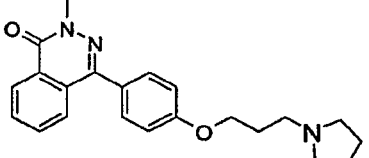
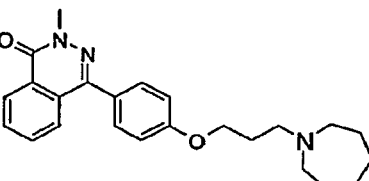
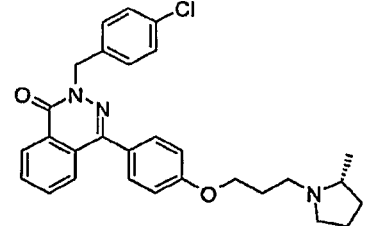
Example 39.

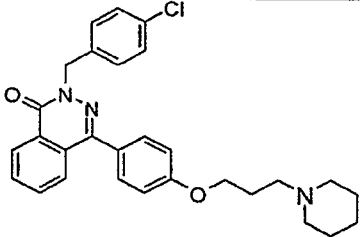
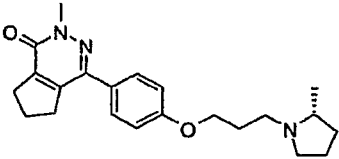
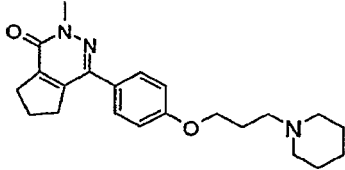
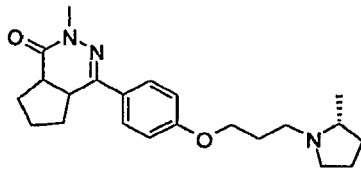
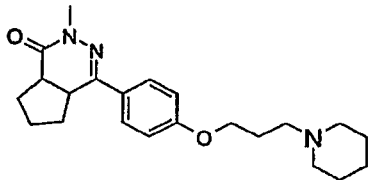
6-(4-(3-Chloropropoxy)-phenyl)-2,4-dimethyl-2H-pyridazin-3-one was prepared from the product of step 3 and 3-bromo-1-chloropropane using the procedure described for Example 22 step 4. Example 39 (2,4-dimethyl-6-[4-(3-piperidin-1-yl-propoxy)-phenyl]-2H-pyridazin-3-one) was prepared using 6-(4-(3-chloropropoxy)-phenyl)-2,4-dimethyl-2H-pyridazin-3-one and piperidine by the methods described for example 22 step 5. The hydrochloride salt was prepared; Mp 222-3 °C; MS m/z 342 (M + H).

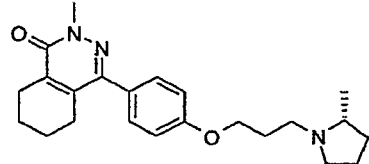
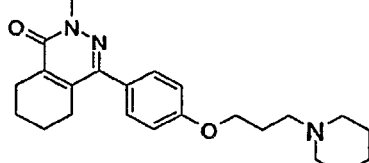
The following examples as HCl salts were prepared using methods described for example 1 and example 22.

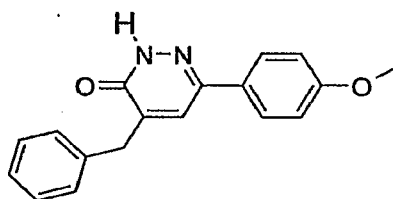
Example	Structure	Mp (°C)	MS m/z
40	 2,4-Dimethyl-6-[4-[3-((R)-2-methyl-pyrrolidin-1-yl)-propoxy]-phenyl]-2H-pyridazin-3-one	175-176	342 (M + H)
41	 2-Isopropyl-4-methyl-6-[4-[3-((R)-2-methyl-pyrrolidin-1-yl)-propoxy]-phenyl]-2H-pyridazin-3-one	54-155	370 (M + H)
42	 2-Isopropyl-4-methyl-6-[4-(3-piperidin-1-yl-propoxy)-phenyl]-2H-pyridazin-3-one	197-198	370 (M + H)

Example	Structure	Mp (°C)	MS m/z
43	 2-Benzyl-4-methyl-6-[4-[3-((R)-2-methyl-pyrrolidin-1-yl)-propoxy]-phenyl]-2H-pyridazin-3-one	190-192	418 (M + H)
44	 2-Benzyl-4-methyl-6-[4-(3-piperidin-1-yl-propoxy)-phenyl]-2H-pyridazin-3-one	232-233	418 (M + H)
45	 4-Benzyl-2-methyl-6-[4-[3-((R)-2-methyl-pyrrolidin-1-yl)-propoxy]-phenyl]-2H-pyridazin-3-one	232-233	418 (M + H)
46	 4-Benzyl-2-methyl-6-[4-(3-piperidin-1-yl-propoxy)-phenyl]-2H-pyridazin-3-one	186-187	418 (M + H)
47	 2-Methyl-6-[4-[3-((R)-2-methyl-pyrrolidin-1-yl)-propoxy]-phenyl]-5-phenyl-2H-pyridazin-3-one	207-209	404 (M + H)
48	 2-Methyl-5-phenyl-6-[4-(3-piperidin-1-yl-propoxy)-phenyl]-2H-pyridazin-3-one	212-214	404 (M + H)

Example	Structure	Mp (°C)	MS m/z
49	 2-Methyl-4-{4-[3-((R)-2-methyl-pyrrolidin-1-yl)-propoxy]-phenyl}-2H-phthalazin-1-one	216-217	378 (M + H)
50	 2-Methyl-4-[4-(3-piperidin-1-yl-propoxy)-phenyl]-2H-phthalazin-1-one	241-242	378 (M + H)
51	 2-Methyl-4-[4-(2-piperidin-1-yl-ethoxy)-phenyl]-2H-phthalazin-1-one	253-254	364 (M + H)
52	 2-Methyl-4-[4-(3-pyrrolidin-1-yl-propoxy)-phenyl]-2H-phthalazin-1-one	201-203	364 (M + H)
53	 4-[4-(3-Azepan-1-yl-propoxy)-phenyl]-2-methyl-2H-phthalazin-1-one	238-240	392 (M + H)
54	 2-(4-Chloro-benzyl)-4-{4-[3-((R)-2-methyl-pyrrolidin-1-yl)-propoxy]-phenyl}-2H-phthalazin-1-one	217-218	489 (M + H)

Example	Structure	Mp (°C)	MS m/z
55	 2-(4-Chloro-benzyl)-4-[4-(3-piperidin-1-yl-propoxy)-phenyl]-2H-phthalazin-1-one	216-217	489 (M + H)
56	 2-Methyl-4-{4-[3-((R)-2-methyl-pyrrolidin-1-yl)-propoxy]-phenyl}-2,5,6,7-tetrahydro-cyclopenta[d]pyridazin-1-one	212-214	368 (M + H)
57	 2-Methyl-4-[4-(3-piperidin-1-yl-propoxy)-phenyl]-2,5,6,7-tetrahydro-cyclopenta[d]pyridazin-1-one	214-216	368 (M + H)
58	 2-Methyl-4-{4-[3-((R)-2-methyl-pyrrolidin-1-yl)-propoxy]-phenyl}-2,4a,5,6,7,7a-hexahydro-cyclopenta[d]pyridazin-1-one	<50	370 (M + H)
59	 2-Methyl-4-[4-(3-piperidin-1-yl-propoxy)-phenyl]-2,4a,5,6,7,7a-hexahydro-cyclopenta[d]pyridazin-1-one	<50	370 (M + H)

Example	Structure	Mp (°C)	MS m/z
60	 2-Methyl-4-{4-[3-((R)-2-methyl-pyrrolidin-1-yl)-propoxy]-phenyl}-5,6,7,8-tetrahydro-2H-phthalazin-1-one	156-158	382 (M + H)
61	 4-{4-[3-(Butyl-ethyl-amino)-propoxy]-phenyl}-2-methyl-5,6,7,8-tetrahydro-2H-phthalazin-1-one	196-198	382 (M + H)

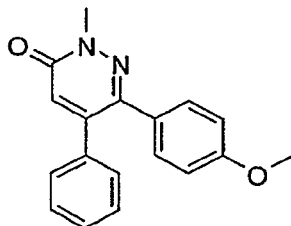


4-Benzyl-6-(4-methoxy-phenyl)-2H-pyridazin-3-one

5

6-(4-methoxy-phenyl)-4,5-dihydro-2H-pyridazin-3-one (1.65 g, 7.5 mmol) in 15 mL of EtOH was heated to 80 °C as 20 mL of 4 % of KOH /EtOH solution was added dropwise. After 5 min., benzaldehyde (1.0 eq. 0.76 mL) was added and the mixture stirred at 80 °C for 2 h. The reaction was cooled to rt., poured into ice-H₂O (75 mL) and the resulting solid was collected and crystallized from EtOH to give 1.67 g (76 %) of intermediate 4-benzyl-6-(4-methoxy-phenyl)-2H-pyridazin-3-one: MS m/z 293 (M+H). This intermediate was used to prepare examples 45 and example 46.

10



6-(4-Methoxy-phenyl)-2-methyl-5-phenyl-2H-pyridazin-3-one

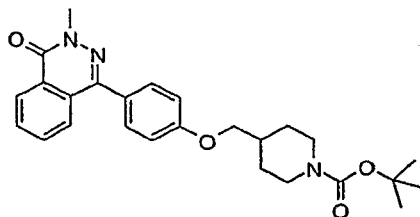
Step 1. A suspension of NaH (12.8 mmol, 512 mg) in DMSO (23 mL) was added 4'-methoxy-2-phenylacetophenone (12.8 mmol, 2.89 g) in 10 ml toluene dropwise under argon. After 30 minutes of stirring, ethyl bromoacetate (1.4 mL, 1 eq.) in 10 mL of toluene was added and the mixture was stirred at rt overnight. The reaction was quenched by addition of 2N HCl (4 mL), and then 60 mL of water. The mixture was extracted with CH₂Cl₂ (3 x 30 mL), dried over MgSO₄ and concentrated under vacuum overnight to afforded 4.0 g (99%) of 4-(4-methoxy-phenyl)-4-oxo-3-phenyl-butyric acid ethyl ester.

Step 2. A solution of 4-(4-methoxy-phenyl)-4-oxo-3-phenyl-butyric acid ethyl ester (5.0 g, 16 mmol) in EtOH:H₂O (60 mL 1:1) was stirred as 10N NaOH (16 mL) was added dropwise. The reaction was stirred at rt for 1 hr. The solvent was evaporated and the residue was diluted with water (50 mL) and extracted with CH₂Cl₂ (2 x 20 mL). The aqueous layer was then acidified with 3N HCl to pH ~2-3, extracted with CH₂Cl₂ (3 x 30 mL). The CH₂Cl₂ extracts were dried over MgSO₄, and the oil was crystallized from Et₂O/MeOH to give 4.5 g (99%) of 4-(4-methoxy-phenyl)-4-oxo-3-phenyl-butyric acid: mp 157-9 °C; MS m/z 283 (M - H).

Step 3. A solution of 4-(4-methoxy-phenyl)-4-oxo-3-phenyl-butyric acid (1.5 g, 5.28 mmol) and hydrazine hydrate (1.5 eq., 363 µL) in 20 mL of EtOH was stirred at 80 °C overnight. The solvent was reduced and the solid was filtered and then washed with cold EtOH to give 6-(4-methoxy-phenyl)-5-phenyl-4,5-dihydro-2H-pyridazin-3-one (1.46 g, 99%): mp 176-7 °C; MS m/z 281 (M + H).

Examples 47 and 48 were prepared from 6-(4-methoxy-phenyl)-5-phenyl-4,5-dihydro-2H-pyridazin-3-one as described in Example 39.

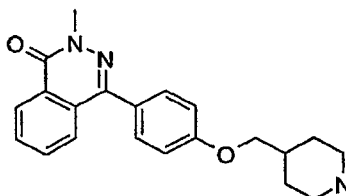
Example 62.



4-[4-(3-Methyl-4-oxo-3,4-dihydro-phthalazin-1-yl)-phenoxy]methyl-piperidine-1-carboxylic acid tert-butyl ester

A suspension of 4-(4-hydroxy-phenyl)-2-methyl-2H-phthalazin-1-one (252 mg, 1.0 mmol) and of 4-bromomethyl piperidine-1-carboxylic acid t-butyl ester (786 mg, 3 eq) in 1 mL of 4N NaOH and 8 mL of DMSO was stirred at rt for 24 h. The reaction was diluted with water (20 mL), extracted with EtOAc (3 x 10 mL), and the combined extracts were washed with NaHCO₃ solution, NaCl solution and dried over MgSO₄. The product was purified by ISCO graduate chromatography (100% CH₂Cl₂ to 95:5 CH₂Cl₂: MeOH) to afford 198 mg (50%) of 4-(4-(1(3-methyl-4-oxo-3,4-dihydro-phthalazin-1-yl)-phenoxy)methyl)-piperidine-1-carboxylic acid *t*-butyl ester: Mp 167-9 °C; MS *m/z* 450 (M + H).

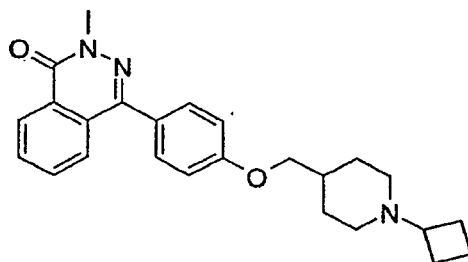
Example 63.



2-Methyl-4-[4-(piperidin-4-ylmethoxy)-phenyl]-2H-phthalazin-1-one

A solution of example 62 (4-(4-(1(3-methyl-4-oxo-3,4-dihydro-phthalazin-1-yl)-phenoxy)methyl)-piperidine-1-carboxylic acid tert-butyl ester) (180 mg, 0.4 mmol) and 4N HCl (2 mL) in dioxane (5 mL) and water (0.5 mL) was heated to 50 °C for 2 h. The solvent was evaporated, and the product was triturated with Et₂O to give 117 mg (84%) of example 63 (2-methyl-4-(4-(piperidin-4-ylmethoxy)-phenyl)-2H-phthalazin-1-one) HCl: Mp 207-9 °C; MS *m/z* 350 (M+H).

Example 64.

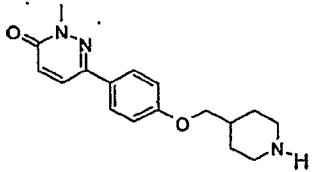
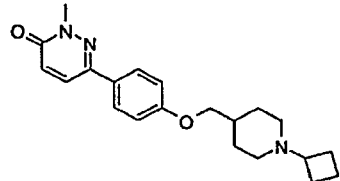
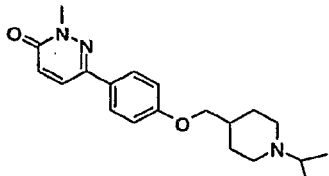
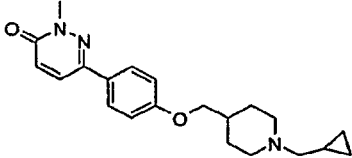
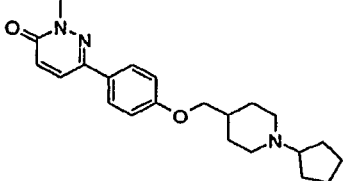
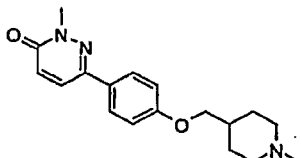


4-[4-(1-Cyclobutyl-piperidin-4-ylmethoxy)-phenyl]-2-methyl-2H-phthalazin-1-one

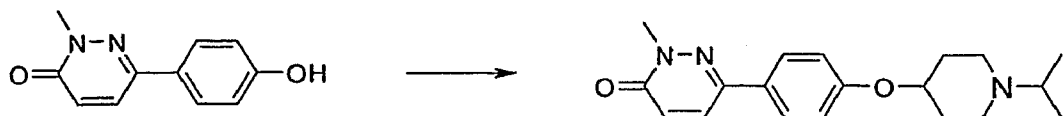
A solution of example 63 (2-methyl-4-(4-(piperidin-4-ylmethoxy)-phenyl)-2H-phthalazin-1-one) (90 mg, 0.23 mg) and NaCNBH_3 in DMF: MeOH: AcOH (3: 6 mL: 0.25 mL) was stirred under N_2 as cyclobutanone (81.7 mg, 5 eq.) was added. The reaction was stirred at 60 °C for 1.5 h, quenched with 3 mL of water, extracted with CH_2Cl_2 (3 x 10 mL), washed with NaHCO_3 , NaCl solution, dried and concentrated. The crude product was purified by silica gel chromatography using 5% MeOH: 95% CH_2Cl_2 : 0.5 mL of isopropyl amine. The fractions were collected, concentrated and the product dissolved in 5 mL of MeOH, and added 0.5 mL of 1N HCl in EtOH. The solvent was evaporated, and the HCl product crystallized from MeOH-Et₂O to give example 64 (4-(4-(1-cyclobutyl-piperidin-4-ylmethoxy)-phenyl)-2-methyl-2H-phthalazin-1-one HCl) (53 mg, 57%): Mp 256-7 °C; MS m/z 404 (M + H).

The following examples as HCl salts were prepared from 6-(4-hydroxy-phenyl)-2-methyl-2H-pyridazin-3-one using the procedures for examples 62-64. Example 65 is the base.

Example	Structure	Mp (°C)	MS m/z
65	4-[4-(1-Methyl-6-oxo-1,6-dihydro-pyridazin-3-yl)-phenoxy]methyl-piperidine-1-carboxylic acid tert-butyl ester	164-166	400 (M + H)

Example	Structure	Mp (°C)	MS m/z
66	 2-Methyl-6-[4-(piperidin-4-ylmethoxy)-phenyl]-2H-pyridazin-3-one	249-251	300 (M + H)
67	 6-[4-(1-Cyclobutyl-piperidin-4-ylmethoxy)-phenyl]-2-methyl-2H-pyridazin-3-one	250-252	354 (M + H)
68	 6-[4-(1-Isopropyl-piperidin-4-ylmethoxy)-phenyl]-2-methyl-2H-pyridazin-3-one	187-189	342 (M + H)
69	 6-[4-(1-Cyclopropylmethyl-piperidin-4-ylmethoxy)-phenyl]-2-methyl-2H-pyridazin-3-one	230-231	354 (M + H)
70	 6-[4-(1-Cyclopentyl-piperidin-4-ylmethoxy)-phenyl]-2-methyl-2H-pyridazin-3-one	250-251	368 (M + H)
71	 2-Methyl-6-[4-(1-methyl-piperidin-4-ylmethoxy)-phenyl]-2H-pyridazin-3-one	257-258	314 (M + H)

Example 72.

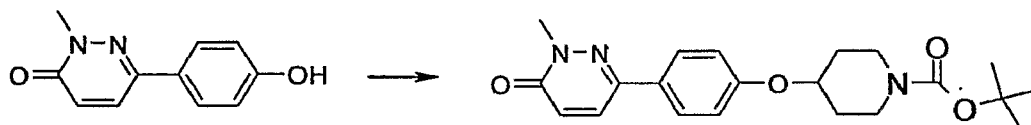


6-(4-Hydroxy-phenyl)-2-methyl-2H-pyridazin-3-one

6-[4-(1-Isopropyl-piperidin-4-yloxy)-phenyl]-2-methyl-2H-pyridazin-3-one

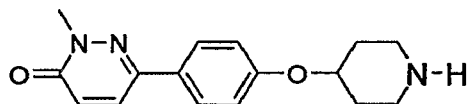
A mixture of 6-(4-hydroxy-phenyl)-2-methyl-2H-pyridazin-3-one (500 mg, 2.6 mmol), triphenylphosphine (1.35 g, 5.2 mmol), 4-hydroxy-N-*i*Pr-piperidine (745 mg, 10.4 mmol) in THF (50 mL) was added DEAD (1.1 g, 6.5 mmol) dropwise. The reaction was stirred at rt overnight, then concentrated. The product was purified by ISCO silica gel chromatography (95:5. DCM: MeOH). The HCl salt was prepared by addition of 1M Et₂O HCl to a methanol solution of the base. mp 108-110 °C. MS m/z 328 (M + H).

10 Example 73.



6-(4-Hydroxy-phenyl)-2-methyl-2H-pyridazin-3-one

4-[4-(1-Methyl-6-oxo-1,6-dihydro-pyridazin-3-yl)-phenoxy]-piperidine-1-carboxylic acid tert-butyl ester

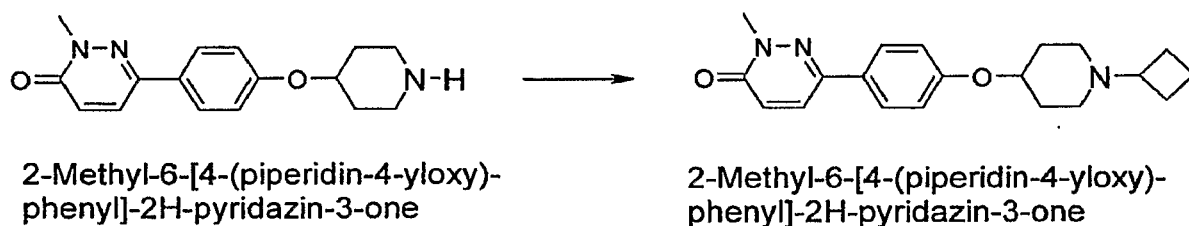


2-Methyl-6-[4-(piperidin-4-yloxy)-phenyl]-2H-pyridazin-3-one

A solution of 6-(4-hydroxy-phenyl)-2-methyl-2H-pyridazin-3-one (1.0 mg, 4.6 mmol), triphenylphosphine (1.44 g, 5.5 mmol), 4-hydroxy-N-*BOC*-piperidine (1.1 mg, 5.5 mmol), in THF (40 mL) was added DEAD (0.96 g, 5.5 mmol) dropwise on an ice-batch. The batch was removed and the reaction was stirred at rt 2-days. The reaction was concentrated at reduced pressure and Et₂O (40 mL) was added and stirred 2 h and the solids removed by filtration. The solution was concentrate and the product was purified by ISCO silica gel chromatography (95:5. DCM: MeOH). The resulting 4-[4-(1-methyl-6-oxo-1,6-dihydro-pyridazin-3-yl)-phenoxy]-piperidine-1-carboxylic acid t-butyl ester was dissolved in dioxane (5 mL) and 4N HCl in dioxane (4 mL) as added and stirred 2 h. The solution was

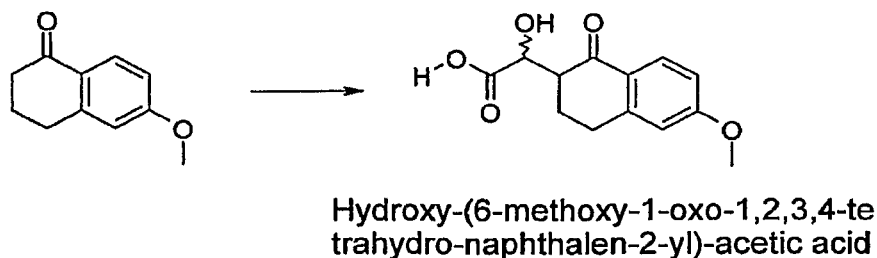
concentrated and 2N Na₂CO₃ added to pH 9. The aqueous solution was added solid sodium chloride until saturated, then extracted with EtOAc (2 x 50 mL), dried (MgSO₄) and concentrated. The HCl salt was prepared by addition of 1M HCl Et₂O solution to a methanol solution of the base. Mp > 210 °C. MS m/z 386 (M + H).

Example 74.



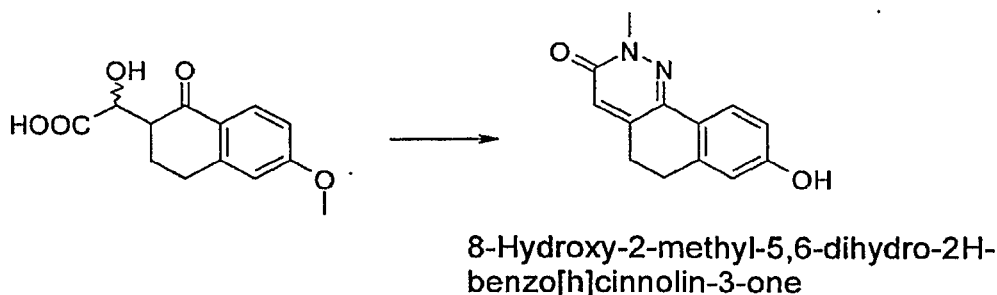
To a solution of example 73 (0.25 g, 0.9 mmol) and cyclobutanone in MeOH (10 mL) was added HOAc (0.5 mL) then solid sodium cyanoborohydride (560 mg, 62.8 mmol). The reaction was stirred 4 h then concentrated. Na₂CO₃ solution was added, and extracted with EtOAc (2 x 50 mL), dried over MgSO₄, filtered and concentrated. To the residue in CH₃CN (3 mL) was added a 1N HCl/Et₂O solution and concentrated. Example 74 was recrystallized from CH₃CN-Et₂O to give 180 mg of a white solid. Mp 250-252 °C. MS m/z 340 (M + H).

Example 75. Step 1.



A mixture of 6-methoxy-1-tetralone (20 g, 114 mmol) and glyoxylic acid monohydrate (10.5g, 114 mmol) was heated at 120 °C in a melt for 5 min. After slight cooling, EtOAc (100 mL) was carefully added. The solid which precipitated was collected to afford 8.5 g (30%) of hydroxyl-(6-methoxy-1-oxo-1,2,3,4-tetrahydro-naphthalen-2-yl)-acetic acid; Mp 212-214 °C, MS m/z 251 (M + H).

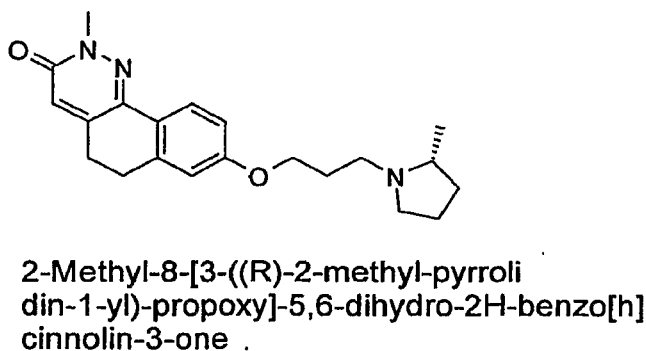
Step 2.



5 A solution of the product from step 1 (700 mg, 2.8 mmol) and N-methylhydrazine (0.3 mL) in 2-propanol (10 mL) was heated to reflux 18 h. The solvent was removed under vacuum and the solid was triturated with methanol (2 mL), collected and then suspended in methylene chloride (2 mL) at 0 °C. BBr₃ (10 mL of 1M solution in DCM, 10 mmol) was slowly added dropwise and the ice bath removed. After 3 h at ambient temperature,

10 saturated NH₄Cl solution (10 mL) was added. The DCM was removed under vacuum and the resulting slurry was carefully neutralized with saturated NaHCO₃ solution and washed with water. The solids were collected to afford 8-hydroxy-2-methyl-5,6-dihydro-2H-benzo[h]cinnolin-3-one (175 mg, 27%) as a white solid; m p >300 °C MS m/z 229 (M + H).

15 Step 3.

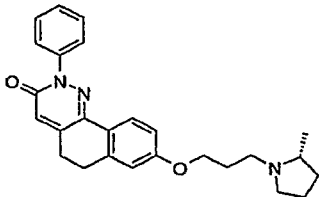
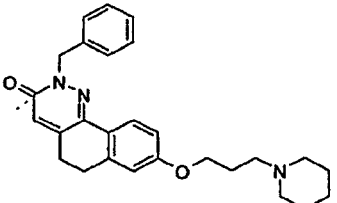
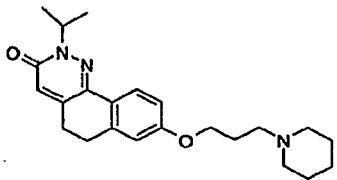


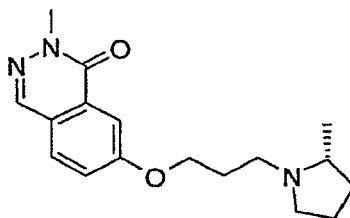
20 To a slurry of the product from step 2 (166 mg, 0.7 mmol) 1-bromo-3-chloropropane (126 mg, 0.9 mmol) and K₂CO₃ (110 mg, 0.8 mmol) in acetonitrile (5 mL) was stirred 18 h at 100 °C. The solvent was removed under vacuum and the solids were partitioned between EtOAc (10 mL) and water (10 mL). The organics were washed with EtOAc (2 x 10 mL), dried over MgSO₄ and the solvent was removed under vacuum. Silica

25 gel chromatography with EtOAc/hexanes as eluent afforded 196 mg of the intermediate 3-

chloropropylether (88%) as a white solid. The chloro intermediate was slurred (196 mg, 0.6 mmol) in acetonitrile (4 mL) and added *R*-2-methyl-pyrrolidine tartrate (227 mg, 0.9 mmol), KI (20 mg, 0.1 mmol) and K₂CO₃ (355 mg, 2.4 mmol). The reaction was stirred 18 h at 100 °C, and the solvent was removed under vacuum. The solids were partitioned between CH₂Cl₂ (10 mL) and water (10 mL). The water layer was washed with CH₂Cl₂ (3 x 10 mL). The combined organic layers were dried over Na₂SO₄ and concentrated under vacuum. Silica gel chromatography using CH₂Cl₂/MeOH (95:5) as eluent gave the product as an oil. The HCl salt was prepared from EtOH and 1M HCl in Et₂O to give 130 mg (52%) of example 75 as a white solid; Mp 192-194 °C; MS m/z 354 (M + H).

The following examples were prepared as HCl salts using the methods described for example 75.

Example	Structure	Mp (°C)	MS m/z
76	 8-[3-((<i>R</i>)-2-Methyl-pyrrolidin-1-yl)-propoxy]-2-phenyl-5,6-dihydro-2H-benzo[h]cinnolin-3-one	140-142	416 (M + H)
77	 2-Benzyl-8-(3-piperidin-1-yl-propoxy)-5,6-dihydro-2H-benzo[h]cinnolin-3-one	206-208	438 (M + H)
78	 2-Isopropyl-8-(3-piperidin-1-yl-propoxy)-5,6-dihydro-2H-benzo[h]cinnolin-3-one	250-252	354 (M + H)

Example 79

2-Methyl-7-[3-((R)-2-methyl-pyrrolidin-1-yl)-propoxy]-2H-phthalazin-1-one

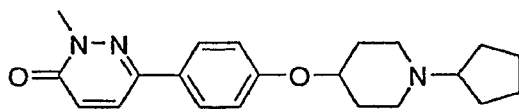
Step 1. A solution of 2-formyl-5-methoxy-benzoic acid (1.0 g, 6.10 mmol) and methyl hydrazine (0.481 mL, 1.5 eq.) in ethanol (15 mL) was stirred at 85 °C for 1.5 days. The solvent was removed and the solid was collected and washed with cold EtOH to give 7-methyl-2-methyl-2H-phthalazin-1-one (780 mg): MS m/z 191 (M + H).

Step 2-3. 7-(3-Chloro-propoxy)-2-methyl-2H-phthalazin-1-one was prepared from 7-methyl-2-methyl-2H-phthalazin-1-one using the procedure described in Example 22 Step 3, and Step 4.

The hydrochloride salt of example 79 (2-methyl-7-(3-(R)-2-methyl-pyrrolidin-1-yl)-propoxy)-2H-phthalazin-1-one) was prepared using the procedure as described in Example 22 Step 5: Mp 252-3 °C; MS m/z 302 (M + H).

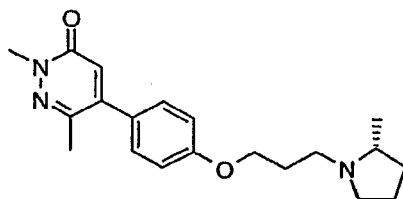
The following examples were prepared as HCl salts using methods of example 79.

Example	Structure	Mp (°C)	MS m/z
79	2-Methyl-7-[3-((R)-2-methyl-pyrrolidin-1-yl)-propoxy]-2H-phthalazin-1-one	252-253	302 (M + H)
80	2-Methyl-7-(3-piperidin-1-yl-propoxy)-2H-phthalazin-1-one	251-252	302 (M + H)

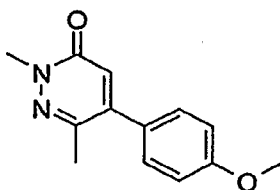
Example 83.

6-[4-(1-Cyclopentyl-piperidin-4-yloxy)-phenyl]-
2-methyl-2H-pyridazin-3-one

This compound was prepared using the same method as example 74 using example
73 and cyclopentanone in MeOH (10 mL) / HOAc (0.5 mL) followed by solid sodium
cyanoborohydride. The reaction was stirred 4 h then concentrated. Na₂CO₃ solution was
added, and extracted with EtOAc (2 x 50 mL), dried over MgSO₄, filtered and concentrated.
Example 83 was recrystallized from CH₃CN-Et₂O to give a white solid. Mp 129-132 °C.
MS m/z 354 (M + H).

Example 86.

2,6-Dimethyl-5-{4-[3-((R)-2-methyl-
pyrrolidin-1-yl)-propoxy]-phenyl}-2
H-pyridazin-3-one

Step 1.

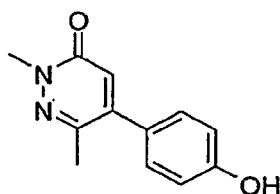
5-(4-Methoxy-phenyl)-2,6-dimethyl-2
H-pyridazin-3-one

A mixture of 1-(4-methoxyphenyl)propan-2-one (16.4 g, 100 mmol) and glyoxalic
acid hydrate (9.20g, 100 mmol) were heated to 135 °C overnight, then the water was
distilled off at 120 °C for 2 h. The residue was taken up in 40 mL of ethanol with stirring
as methylhydrazine (10.5 mL, 200 mmol) was added dropwise. The reaction was heated to
85 °C overnight. The solvent was evaporated and the residue was dissolved in 200 mL of
methylene chloride and washed with 5% NaHCO₃ solution (2 x 20 mL), saturated NaCl

solution, then dried over Na_2SO_4 and concentrated. The residue was purified by silica gel chromatography (2% MeOH in CH_2Cl_2) to give 5-(4-methoxyphenyl)-2,6-dimethyl-2H-pyridazin-3-one (4.2 g) MS m/z 231 (M + H).

Step 2.

5

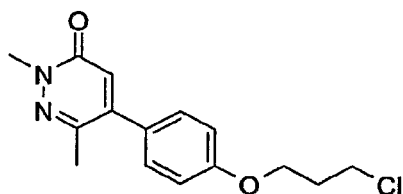


5-(4-Hydroxy-phenyl)-2,6-dimethyl-2H-pyridazin-3-one

A solution of the product from step 1 (3.2 g, 14 mmol) in CH_2Cl_2 (40 mL) was cooled to 0 °C and BBr_3 (6.6 mL, 5.0 eq.) was added dropwise. The ice-bath was removed and the reaction was stirred at rt for 1 h, after which the reaction mixture was poured into 50 mL of ice cold saturated NH_4Cl solution with stirring. The resulting solid was filtered, and washed with water (3 x 15 mL) then Et_2O (2 x 15 mL) to give the product of step 2 (0.66 g, 22%): MS m/z 217 (M + H).

10

Step 3.



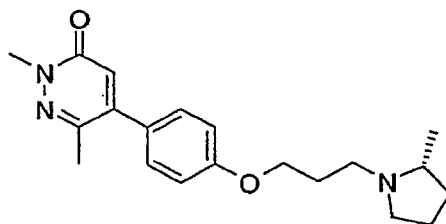
5-[4-(3-Chloro-propoxy)-phenyl]-2,6-dimethyl-2H-pyridazin-3-one

15

A solution of the product from step 2 (710 mg, 3.29 mmol), K_2CO_3 (1.36 g, 3.0 eq.) and 3-bromo-1-chloropropane (0.39 mL, 1.2 eq.) in CH_3COCH_3 (30 mL) was heated to 80 °C overnight. The mixture was then filtered, washed with acetone and concentrated to dryness to afford the product of step 3 (950 mg, 98%): MS m/z 293 (M + H).

20

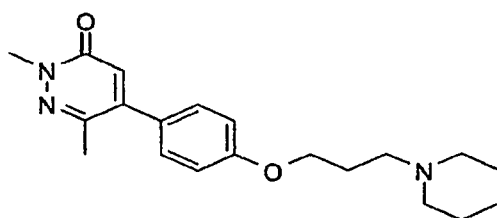
Step 4.



2,6-Dimethyl-5-{4-[3-((R)-2-methylpyrrolidin-1-yl)propoxy]-phenyl}-2H-pyridazin-3-one

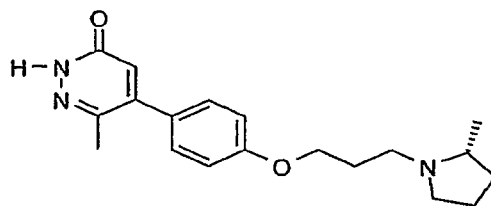
A mixture of the product of step 3 (481mg, 1.65 mmol), K_2CO_3 (3.5 eq, 795 mg), 50 mg of NaI, and R-2-methylpyrrolidine hydrochloride (2.0 eq., 773 mg) in acetonitrile (10 mL) was heated to 80 °C for 2 days. The reaction was then filtered, washed with CH_2Cl_2 (2 x 20mL) and concentrated. The residue was dissolved in 30 mL of CH_2Cl_2 and washed with saturated $NaHCO_3$, saturated NaCl solution, dried with Na_2SO_4 and then concentrated. The residue was purified by preparative TLC (10%MeOH: 90% CH_2Cl_2 :0.5 mL 2-aminopropane) to give the product. The product was dissolved in 10 mL of MeOH, and was added 2.5 mL of 1N HCl in EtOH. The solvents were evaporated and the product crystallized from MeOH:Et₂O to give example 86 as the HCl salt (231 mg, 41%): Mp 176-8 °C; MS m/z 342 (M + H).

Example 87

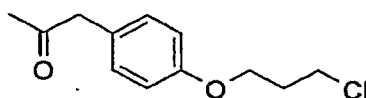


2,6-Dimethyl-5-[4-(3-piperidin-1-ylpropoxy)-phenyl]-2H-pyridazin-3-one

This compounds was prepared using the procedure for example 86 using the product of step 3 and piperidine to give the hydrochloride salt; Mp 210-211 °C; MS m/z 342 (M + H).

Example 88

6-Methyl-5-{4-[3-((R)-2-methyl-pyrrolidin-1-yl)-propoxy]-phenyl}-2H-pyridazin-3-one

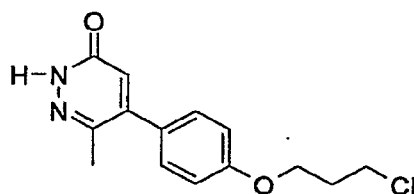
Step 1.

1-[4-(3-Chloro-propoxy)-phenyl]-propan-2-one

5

A solution of 4-hydroxyphenylacetone (4.5 g, 30 mmol) and potassium carbonate (4.14g, 3.0 eq.) in 50 mL of acetone was stirred under N₂ as 1-bromo-3-chloro-propane was added dropwise. The reaction was heated to 80 °C overnight. The mixture was then filtered through celite, washed with acetone and concentrated to afford 1-[4-(3-chloro-propoxy)phenyl]propan-2-one (6.3g, 93% yield): MS m/z 227 (M + H).

10

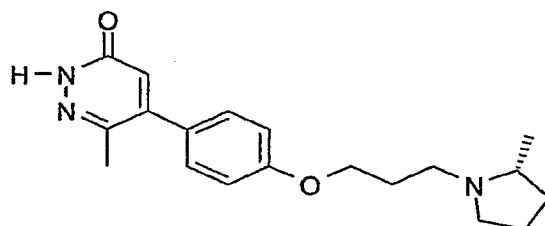
Step 2.

5-[4-(3-Chloropropoxy)phenyl]-6-methyl-2H-pyridazin-3-one

15

5-[4-(3-Chloropropoxy)phenyl]-6-methyl-2H-pyridazin-3-one was prepared from the product from step 1 using the procedure described in Example 86 step1.

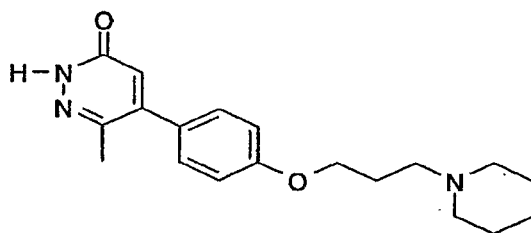
Step 3.



6-Methyl-5-{4-[3-((R)-2-methyl-pyrrolidin-1-yl)-propoxy]-phenyl}-2H-pyridazin-3-one

6-Methyl-5-{4-[3-(α -2-methyl-pyrrolidin-1-yl)-propoxy]-phenyl}-2H-pyridazin-3-one hydrochloride salt was prepared from 5-[4-(3-chloropropoxy)phenyl]-6-methyl-2H-pyridazin-3-one and R-2-methylpyrrolidine hydrochloride using the procedure described in Example 86 Step 4; Mp 115 °C (dec), MS m/z 329 (M + H).

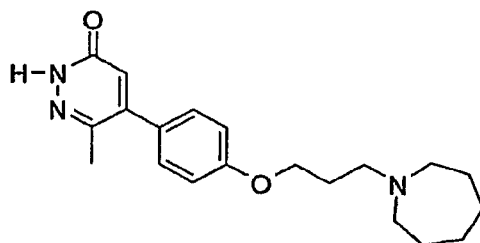
Example 89



6-Methyl-5-[4-(3-piperidin-1-yl-propoxy)-phenyl]-2H-pyridazin-3-one

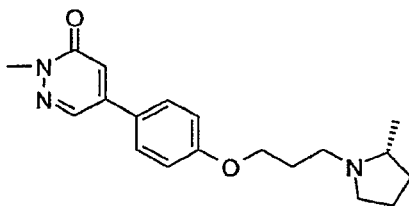
This compound was prepared using the procedure for example 88 using the product of step 2 and piperidine to give the hydrochloride salt Mp dec 123 (dec.) °C; MS m/z 328 (M + H).

Example 90

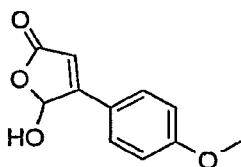


5-[4-(3-Azepan-1-yl-propoxy)-phenyl]-6-methyl-2H-pyridazin-3-one

This compound was prepared using the procedure for example 88 to give the hydrochloride salt Mp 204-6 °C; MS m/z 342 (M + H).

Example 91

2-Methyl-5-{4-[3-((R)-2-methyl-pyrrolidin-1-yl)-propoxy]-phenyl}-2H-pyridazin-3-one

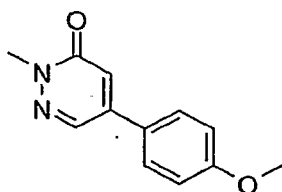
5 **Step 1.**

5-Hydroxy-4-(4-methoxy-phenyl)-5H-furan-2-one

A solution of 4-methoxyphenyl ethanol (15.0 g, 98.2 mmol) in 150 mL of methylene chloride was stirred at 0 °C while Dess-Martin periodinane (50 g, 1.2 eq.) was added in small portions. The ice-bath was removed and the reaction was stirred at rt for 1 h. The reaction mixture was then diluted with methylene chloride (100 mL), washed with 10% sodium thiosulfate, saturated NaHCO₃ solution, water, saturated NaCl solution, and dried over Na₂SO₄. The product was purified using silica gel chromatography (100% hexanes to 20% EtOAc / hexanes) to afford 5.3 g (34%) of 4-methoxyphenyl acetaldehyde.

A suspension of glyoxalic acid hydrate (2.45 g, 26.6 mmol) and morpholine hydrochloride (3.28 g, 26.35 mmol) in dioxane (25 mL) was stirred as water (2 mL) was added. The homogeneous solution and 4-methoxyphenyl acetaldehyde (3.8 g, 25.3 mmol) was then added and the solution was stirred at reflux for 24 h. The solvent was evaporated and a solid was formed after addition of 20 mL of water. The solid was collected and washed with water to give 5.1 g (98%) of the product: MS m/z 189 (M-17 + H).

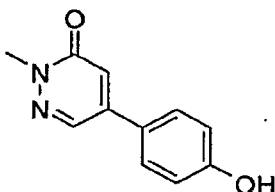
Step 2.



5-(4-Methoxy-phenyl)-2-methyl-2H-pyridazin-3-one

A suspension of 5-hydroxy-4-(4-methoxyphenyl)-5H-furan-2-one (2.06 g, 10 mmol) in 30 mL of ethanol was stirred as methylhydrazine (0.78 mL, 1.5 eq) was added dropwise. The reaction was heated to reflux at 85 °C for 2 h, then the solvent was reduced at reduced pressure to give a solid, which was collected and washed with cold EtOH to give 1.0 g (46%) of 5-(4-methoxy-phenyl)-2-methyl-2H-pyridazin-3-one: MS m/z 217 (M + H).

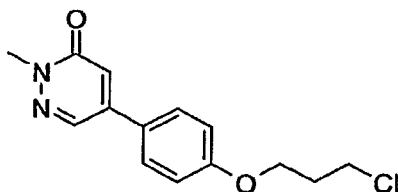
Step 3.



5-(4-Hydroxy-phenyl)-2-methyl-2H-pyridazin-3-one

5-(4-Hydroxyphenyl)-2-methyl-2H-pyridazin-3-one was prepared from 5-(4-methoxy-phenyl)-2-methyl-2H-pyridazin-3-one with BBr₃ using the procedure described in Example 86 Step 2; Mp 296-8 °C; MS m/z 203 (M + H).

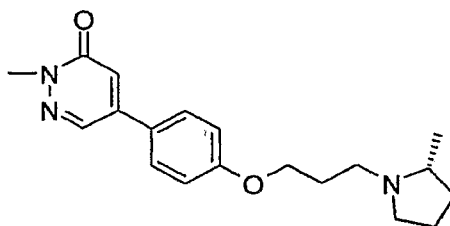
Step 4.



5-[4-(3-Chloro-propoxy)-phenyl]-2-methyl-2H-pyridazin-3-one

5-[4-(3-Chloro-propoxy)-phenyl]-2-methyl-2H-pyridazin-3-one was prepared from 5-(4-hydroxy-phenyl)-2-methyl-2H-pyridazin-3-one with 1-bromo-3-chloro-propane using the procedure described in Example 86 Step 3; Mp 90-91 °C; MS m/z 279 (M + H).

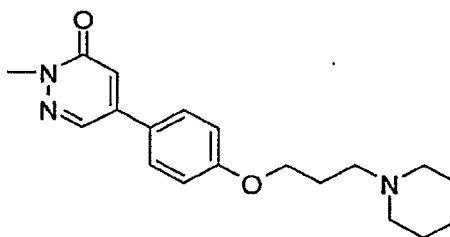
Step 5.



2-Methyl-5-{4-[3-((R)-2-methyl-pyrrolidin-1-yl)-propoxy]-phenyl}-2H-pyridazin-3-one

- 5 This compound was prepared as the hydrochloride salt from 5-[4-(3-chloropropoxy)-phenyl]-2-methyl-2H-pyridazin-3-one and R-2-methylpyrrolidine using the procedure described in Example 86 Step 4; Mp 222-3 °C; MS m/z 328 (M + H).

Example 92



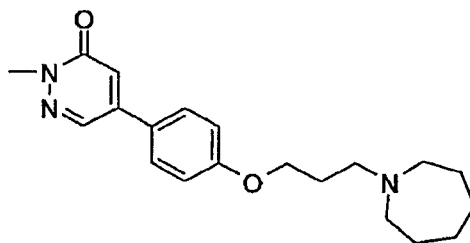
2-Methyl-5-[4-(3-piperidin-1-yl-propoxy)-phenyl]-2H-pyridazin-3-one

10

This compound was prepared as the hydrochloride salt using 5-[4-(3-chloropropoxy)-phenyl]-2-methyl-2H-pyridazin-3-one and piperidine using the procedure described in Example 91 Step 5; Mp 253-4 °C; MS m/z 328 (M + H).

15

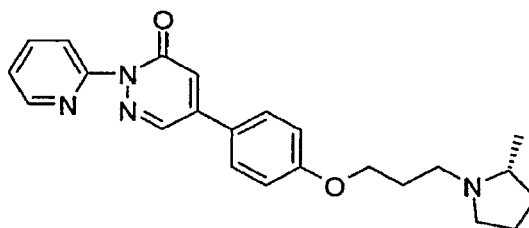
Example 93



5-[4-(3-Azepan-1-yl-propoxy)-phenyl]-2-methyl-2H-pyridazin-3-one

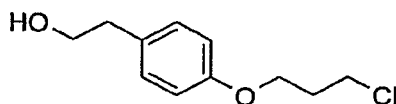
This compound was prepared as the hydrochloride salt using 5-[4-(3-chloropropoxy)-phenyl]-2-methyl-2H-pyridazin-3-one and azepine using the procedure described in Example 91 Step 5; Mp 247-8 °C; MS m/z 342 (M + H).

5 Example 94



5-{4-[3-((R)-2-Methyl-pyrrolidin-1-yl)-propoxy]-phenyl}-2-pyridin-2-yl-2H-pyridazin-3-one

Step 1.



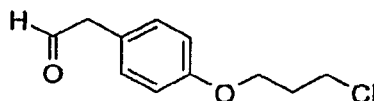
2-[4-(3-Chloro-propoxy)-phenyl]-ethanol

10

A mixture of 2-(4-hydroxyphenyl)ethanol (13.82 g, 100.0 mmol) and potassium carbonate (34.0 g, 250.0 mmol) in 125.0 mL of acetone was stirred as 1-bromo-3-chloropropane (24.0 g, 150.0 mmol) was added dropwise. The reaction was stirred at 60 °C overnight, and then filtered through celite, washed with acetone and concentrated. The residue was dissolved in EtOAc (250 mL) and washed with 2N Na₂CO₃, water, and saturated NaCl solution. After drying over Na₂SO₄ the solution was concentrated to give 21 g (98 %): Mp 49-50 °C; MS m/z 197 (M – H).

15

Step 2.



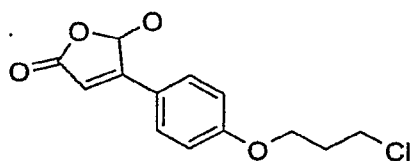
[4-(3-Chloro-propoxy)-phenyl]-acetaldehyde

20

A solution of Dess-Martin periodinane (20.4 g, 48.0 mmol) in 200 mL of methylene chloride was stirred as 2-[4-(3-chloropropoxy)ethanol (8.59 g, 40.0 mmol) in 60.0 mL of methylene chloride was added dropwise via addition funnel. The reaction was stirred at rt

for 1 h, diluted with ether (400 mL) and poured into 200 mL of 1.3 M NaOH solution. The ether layer was separated and washed with 1.3 M NaOH solution (100 mL), water until pH 7, and dried over Na₂SO₄. The product was purified using silica gel flash chromatography with 20% Et₂O in hexane to give 6.75 g (79.3%) of [4-(3-chloro-propoxy)phenyl]acetaldehyde: MS m/z 213 (M + H).

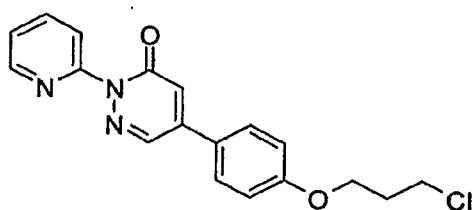
Step 3.



4-[4-(3-Chloro-propoxy)-phenyl]-5-hydroxy-5H-furan-2-one

A suspension of glyoxalic acid hydrate (3.04 g, 33.1 mmol) and morpholine hydrochloride (4.09 g, 33.1 mmol) in dioxane (48 mL) was stirred as 4.5 mL of water was added. To the homogeneous solution [4-(3-chloropropoxy)phenyl]acetaldehyde (6.70 g, 31.5 mmol) was then added and the solution was stirred at reflux for 24 h. The solvent was evaporated and 50 mL of water was added. The solid was collected and washed with water to give 8.3 g (98%): MS m/z 251 (M - 17 + H).

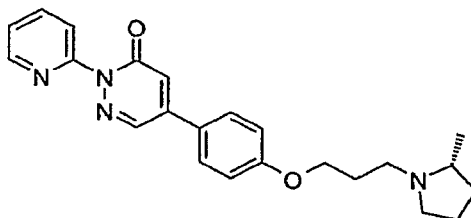
Step 4.



5-[4-(3-Chloro-propoxy)-phenyl]-2-pyridin-2-yl-2H-pyridazin-3-one

A solution of the product from step 3 (8.0 g, 29.8 mmol) and 2-hydrazinopyridine (9.75 g, 3.0 mmol) in 80 mL of acetic acid was stirred at 110 °C for 24 h. The solvent was evaporated and the residue was purified with ISCO Combiflash chromatography with 2% MeOH in methylene chloride. The product was crystallized from EtOH and ether to give 5.88 g (58%) of 5-[4-(3-chloropropoxy)-phenyl]-5-hydroxy-5H-furan-2-one: Mp 219-220 °C; MS m/z 391 (M + H).

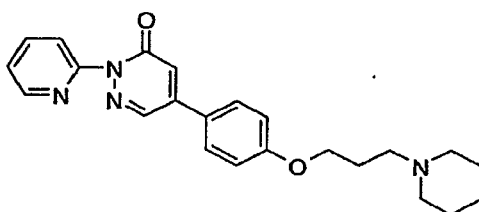
Step 5.



5-[4-[3-((R)-2-Methyl-pyrrolidin-1-yl)-propoxy]-phenyl]-2-pyridin-2-yl-2H-pyridazin-3-one

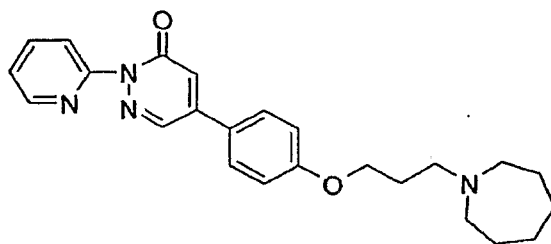
A mixture of the product from step 4, R-2-methyl-pyrrolidine benzenesulfonic acid salt (12.0 g, 51.0 mmol), potassium carbonate (8.2 g, 59.0 mmol) and sodium iodide (50 mg, 0.334 mmol) in 150.0 mL of acetonitrile was heated to 80 °C for 24 h. The reaction mixture was then filtered, washed with methylene chloride (2 x 20 mL) and concentrated. The residue was dissolved in 100 mL of methylene chloride and washed with saturated NaHCO₃, saturated NaCl solution, dried over Na₂SO₄ and concentrated. The residue was purified by ISCO graduate silica gel chromatography with 10% MeOH in CH₂Cl₂ with 0.5% of iPrNH₂ to give the product. The product was dissolved in MeOH and added 40.0 mL of 1N HCl in EtOH and concentrated to dryness. Crystallization using MeOH and CH₃CN afforded the HCl salt (5.45 g, 75%) Mp 219-220 °C; MS m/z 391 (M + H).

Example 95



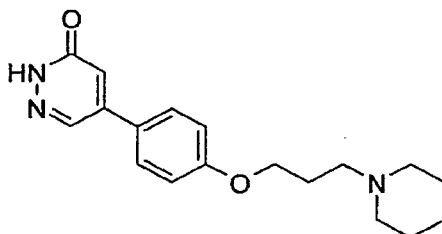
5-[4-(3-Piperidin-1-yl-propoxy)-phenyl]-2-pyridin-2-yl-2H-pyridazin-3-one

This compound was prepared using the procedure for example 94 to give the HCl salt; Mp 266-8 °C; MS m/z 391 (M + H).

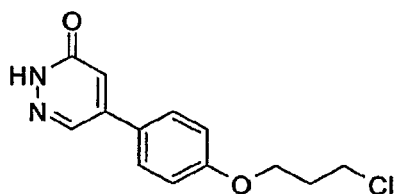
Example 96

5-[4-(3-Azepan-1-yl-propoxy)-phenyl]
2-pyridin-2-yl-2H-pyridazin-3-one

This compound was prepared using the procedure for example 94 to give the HCl
5 salt; Mp 230-2 °C; MS m/z 405 (M + H).

Example 97

2-Methyl-5-[4-(3-piperidin-1-yl-propoxy)-phenyl]-2H-pyridazin-3-one

Step 1.

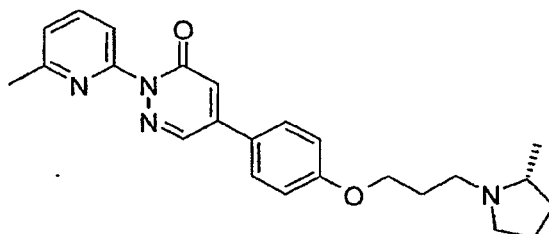
5-[4-(3-Chloro-propoxy)-phenyl]-2H-pyridazin-3-one

10

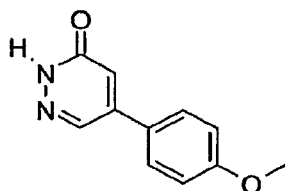
A solution of the product from example 94 step 3 (2.0 g, 7.45 mmol) and hydrazine
hydrate (0.59 g, 1.5 eq.) in 20 mL of EtOH was stirred at 85 °C for 2 h. The solvent was
reduced and the solid was collected and washed with cold EtOH to give 1.2 g (61%) of 5-
15 [4-(3-chloropropoxy)phenyl]-2H-pyridazin-3-one: Mp 197-9 °C; MS m/z 265 (M + H).

Step 2.

This compound was prepared from the product of step 1 (5.8 g, 17.0 mmol) and
20 piperidine using the procedure for example 88. The hydrochloride salt of the product was
prepared; Mp 249-250 °C; MS m/z 314 (M + H).

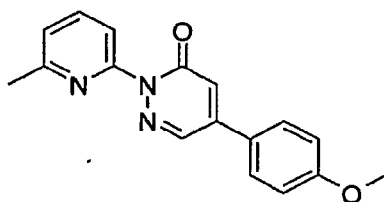
Example 98

2-(6-Methyl-pyridin-2-yl)-5-{4-[3-((R)-2-methyl-pyrrolidin-1-yl)-propoxy]-phenyl}-2H-pyridazin-3-one

5 Step 1.

5-(4-Methoxy-phenyl)-2H-pyridazin-3-one

A suspension of 5-hydroxy-4-(4-methoxyphenyl)-5H-furan-2-one (2.00 g, 9.7 mmol) in 15 mL of ethanol was stirred as hydrazine hydrate (0.97g, 2.0 eq) was added in dropwise. The reaction was stirred at 85 °C overnight, and then the solvent was reduced. The solid was collected and washed with cold EtOH to give 1.7 g (87%) of 5-(4-methoxyphenyl)-2H-pyridazin-3-one: MS m/z 203 (M + H).

15 Step 2.

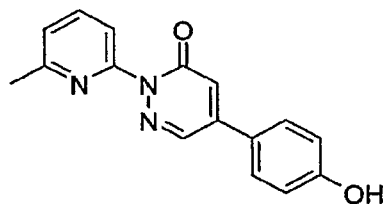
5-(4-Methoxy-phenyl)-2-(6-methyl-pyridin-2-yl)-2H-pyridazin-3-one

A mixture of the product from step 1 (1.34 g, 6.62 mmol), copper (I) iodide (0.4 g, 2.0 mmol) and potassium carbonate (1.4 g, 9.9 mmol) in DMF (15 mL) was stirred and degassed with N₂ for 3 min. Then 2-bromo-6-methylpyridine was added dropwise. After stirred at 120 °C overnight, the mixture was filtered through celite, washed with 50 mL of

CH₂Cl₂, 15% of NH₄OH solution (3 x 15 mL), water, saturated NaCl solution, and dried over Na₂SO₄. The residue was purified by ISCO graduate chromatography (5% MeOH in CH₂Cl₂) to give 5-(4-methoxyphenyl)-2-(6-methylpyridin-2-yl)-2H-pyridazin-3-one (0.30 g, 15%); Mp 167-8 °C; MS m/z 294 (M + H).

5

Step 3.



5-(4-Hydroxy-phenyl)-2-(6-methyl-pyridin-2-yl)-2H-pyridazin-3-one

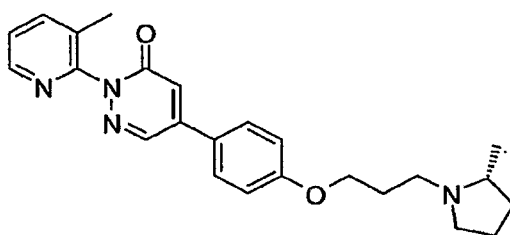
This compound was prepared using the procedure described for Example 91 step 3;

10 MS m/z = 280 (M + H).

Step 4

Example 98 was prepared from the product of step 3 using procedures described in Example 91 Step 4 and Step 5; Mp 118-120 °C; MS m/z 405 (M + H).

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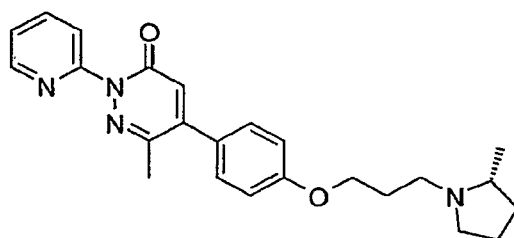
Example 99

2-(3-Methyl-pyridin-2-yl)-5-{4-[3-((R)-2-methylpyrrolidin-1-yl)-propoxy]-phenyl}-2H-pyridazin-3-one

Example 99 was prepared as the hydrochloride salt using procedures described for

20 Example 98; Mp 98-100 °C; MS m/z 405 (M + H).

Example 100

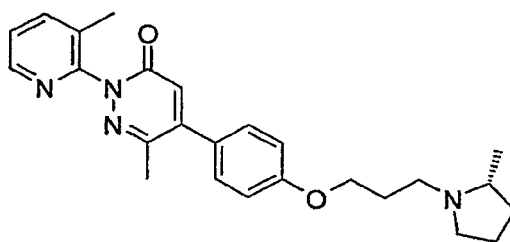


6-Methyl-5-{4-[3-((R)-2-methyl-pyrrolidin-1-yl)-propoxy]-phenyl}-2-pyridin-2-yl-2H-pyridazin-3-one

Example 100 was prepared as the hydrochloride salt using procedures described for Example 98; Mp 155-7 °C; MS m/z 405 (M + H).

5

Example 101



6-Methyl-2-(3-methyl-pyridin-2-yl)-5-{4-[3-((R)-2-methyl-pyrrolidin-1-yl)-propoxy]-phenyl}-2H-pyridazin-3-one

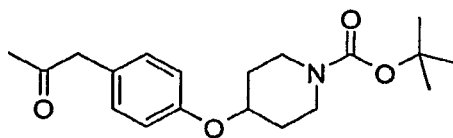
Example 101 was prepared as the hydrochloride salt using procedures described for Example 98; Mp 106 °C (dec.); MS m/z 419(M + H).

10

Example 102

Step 1.

15



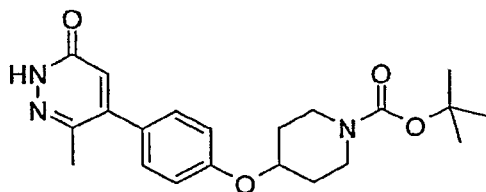
4-[4-(2-Oxo-propyl)-phenoxy]-piperidine-1-carboxylic acid tert-butyl ester

A solution of triphenylphosphine (18.5 g, 70.6 mmol) and 40% DEAD in toluene (12.3 g, 70.6 mmol) in 125.0 mL of tetrahydrofuran was cooled to 0 °C under N₂ as a solution of 1-(4-hydroxy-phenyl)-propan-2-one (6.54 g, 43.6 mmol) and 4-hydroxy-

20

piperidine-1-carboxylic acid tert-butyl ester (10.7 g, 53.2 mmol) in 125.0 mL of tetrahydrofuran was added dropwise via addition funnel. After stirred at rt overnight, the solvent was evaporated. The residue was stirred in hexane/EtOAc, the solid formed was filtered. The hexane/EtOAc solution was concentrated and purified by ISCO graduate chromatography (hexane-20% EtOAc in hexane) to give 4-[4-2-oxo-propyl)-phenoxy]-
5 piperidine-1-carboxylic acid tert-butyl ester (8.52 g, 59%).

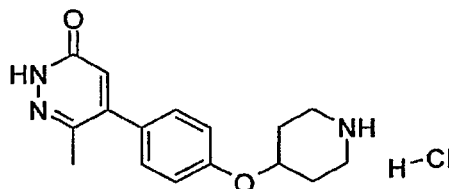
Step 2.



4-[4-(3-Methyl-6-oxo-1,6-dihydro-pyridazin-4-yl)-phenoxy]-piperidine-1-carboxylic acid tert-butyl ester

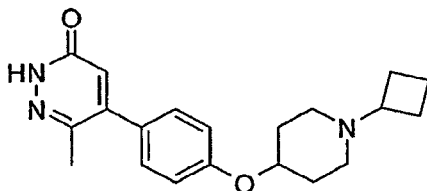
A mixture of 4-[4-(2-oxo-propyl)-phenoxy]-piperidine-1-carboxylic acid tert-butyl ester (7.01 g, 21.03 mmol) and glyoxalic acid hydrate (1.9 g, 21 mmol) was heated to 100 °C for 5 h. The resulting dark thick oil was stirred in 30 mL of EtOH as hydrazine hydrate (2.1 g, 42 mmol) was added. After stirred at 90 °C for 5 hr, the reaction was cooled to rt, and the solvent was evaporated. The crude product was purified by flash chromatography (10% MeOH in CH₂Cl₂), followed by trituration with ether to give 4-[4-(3-methyl-6-oxo-1,6-dihydro-pyridazin-4-yl)-phenoxy]-piperidine-1-carboxylic acid tert-butyl ester (3.25 g, 46%): Mp 184-6 °C; MS m/z 386(M+H).

Example 102



6-Methyl-5-[4-(piperidin-4-yloxy)-phenyl]-2H-pyridazin-3-one; hydrochloride

A solution of the product from step 2 (4-[4-(3-methyl-6-oxo-1,6-dihydro-pyridazin-4-yl)-phenoxy]-piperidine-1-carboxylic acid tert-butyl ester) (7.6 g, 20 mmol) in 30 mL of dioxane and 3.0 mL of water was cooled to 0 °C as 24 mL of 4M HCl in dioxane was added dropwise. After stirring at 50 °C for 1 h, the solvent was evaporated. The white solid was triturated with ether to give 6-methyl-5-[4-(piperidin-4-yloxy)-phenyl]-2H-pyridazin-3-one HCl (6.2 g, 92%): Mp 225-7 °C; MS m/z 286 (M + H).

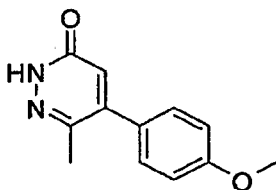
Example 103

5-[4-(1-Cyclobutyl-piperidin-4-yloxy)-phenyl]-6-methyl-2H-pyridazin-3-one

A solution of example 102 (5.4 g, 18.9 mmol), sodium cyanoborohydride (2.4 g, 38 mmol) and cyclobutanone (6.6 g, 95 mmol) in 40.0 mL of DMF, 80.0 mL of MeOH and 5.0 mL of acetic acid was stirred at 60 °C for 1 h. The reaction was cooled to rt, quenched with ice-water and the solvent evaporated. The residue was diluted with 100 mL of CH₂Cl₂, washed with saturated NaHCO₃ solution (3 x 30 mL), water (2 x 20 mL), NaCl solution (30 mL) and dried over Na₂SO₄. The crude product was purified by Combiflash chromatography (CH₂Cl₂ to 10% MeOH in CH₂Cl₂ with 0.5% of iPrNH₂) to give the free base of the product. The product was then dissolved in MeOH and filtered. Then 30 mL of 1N HCl was added and the solution evaporated. The hydrochloride salt was crystallized from MeOH and Et₂O to give example 103 HCl (6.03 g, 90%): Mp 296-7 °C; MS m/z 340 (M + H).

Example 104

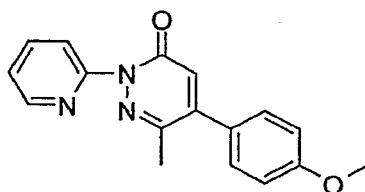
Step 1.



5-(4-Methoxy-phenyl)-6-methyl-2H-pyridazin-3-one

5-(4-methoxyphenyl)-6-methyl-2H-pyridazin-3-one was prepared from 1-(4-methoxy-phenyl)propan-2-one and glyoxalic acid and hydrazine hydrate using the procedure described in Example 86 Step 1; Mp 255-256 °C; MS m/z 203 (M + H).

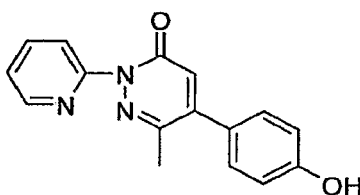
Step 2.



5-(4-Methoxy-phenyl)-6-methyl-2-pyridin-2-yl-2H-pyridazin-3-one

5-(4-Methoxy-phenyl)-6-methyl-2-pyridin-2-yl-2H-pyridazin-3-one was prepared from 5-(4-methoxy-phenyl)-6-methyl-2H-pyridazin-3-one and 2-bromopyridine in the presence of copper iodide using the procedure described in Example 98 Step 2; Mp 156-7 °C; MS m/z 294 (M + H).

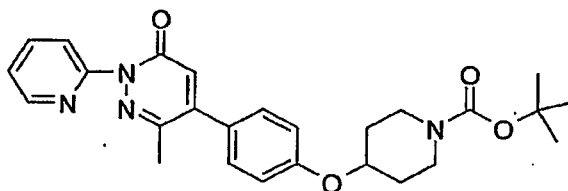
Step 3.



5-(4-Hydroxy-phenyl)-6-methyl-2-pyridin-2-yl-2H-pyridazin-3-one

5-(4-Hydroxy-phenyl)-6-methyl-2-pyridin-2-yl-2H-pyridazin-3-one was prepared from 5-(4-Methoxy-phenyl)-6-methyl-2-pyridin-2-yl-2H-pyridazin-3-one and BBr₃ in CH₂Cl₂ using the procedure described in Example 91 Step 3; Mp 252-4 °C; MS m/z 280 (M + H).

Step 4.

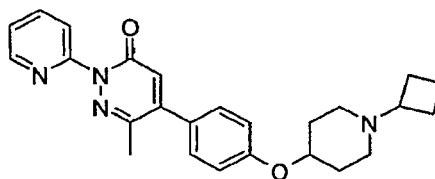


4-[4-(3-Methyl-6-oxo-1-pyridin-2-yl-1,6-dihydro-pyridazin-4-yl)-phenoxyl]-piperidine-1-carboxylic acid tert-butyl ester

A mixture of 5-(4-hydroxyphenyl)-6-methyl-2-pyridin-2-yl-2H-pyridazin-3-one (97.7g, 28 mmol), t-butyl 4-methanesulfonyloxypiperidine-1-carboxylic acid ester (15 g, 55 mmol) and cesium carbonate (18 g, 55 mmol) in 75 mL of DMF was stirred at 100 °C

overnight. The reaction mixture was cooled to rt, filtered through celite, and concentrated. The crude product was diluted with 100 mL of CH₂Cl₂, washed with 2N NaCO₃, water, NaCl solution, then dried over Na₂SO₄, and concentrated. The product was purified by flash chromatography (5% MeOH in CH₂Cl₂) and triturated with EtOAc and hexane to give
 5 4-[4-(3-methyl-6-oxo-1-pyridin-2-yl-1,6-dihydropyridazin-4-yl)-phenoxy]-piperidine-1-carboxylic acid tert-butyl ester (6.7 g, 72%): MS m/z 463 (M + H).

Example 104

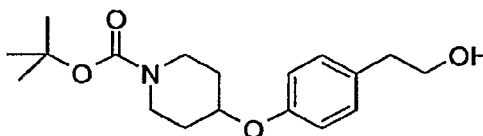


5-[4-(1-Cyclobutyl-piperidin-4-yloxy)-phenyl]-6-methyl-2-pyridin-2-yl-2H-pyridazin-3-one

10 This compound was prepared using the product from step 4 and the procedures described in Example 103 Step 3 and Step 4; HCL salt mp 285-6 °C; MZ m/z 417 (M + H).

Example 105

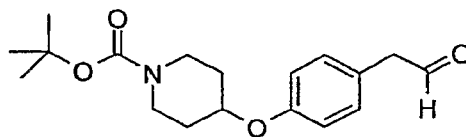
Step 1.



4-[4-(2-Hydroxy-ethyl)-phenoxy]-piperidine-1-carboxylic acid tert-butyl ester

A mixture of 2-(4-hydroxyphenyl)ethanol (4.15 g, 30 mmol), 4-methanesulfonyloxy-piperidine-1-carboxylic acid t-butyl ester (10.51 g, 37.6 mmol) and cesium carbonate (19.6 g, 60 mmol) in 100 mL of DMF was stirred at 100 °C overnight.
 20 The reaction mixture was cooled to rt, filtered through celite and concentrated. The crude product was diluted with 100 mL of CH₂Cl₂, washed with 2N Na₂CO₃, water, NaCl solution, dried over Na₂SO₄, and concentrated. The product was purified by flash chromatography (60% EtOAc in hexanes) to give 4-[4-(2-hydroxy-ethyl)-phenoxy]-piperidine-1-carboxylic ester (8.2 g, 59%): MS m/z 222 (M-Boc+H).

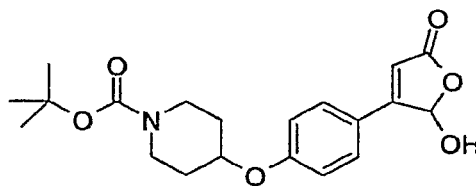
25 Step 2.



4-[4-(2-Oxo-ethyl)-phenoxy]-piperidine-1-carboxylic acid tert-butyl ester

A solution of 4-[4-(2-hydroxyethyl)-phenoxy]piperidine-1-carboxylic acid tert-butyl ester (8.10 g, 25.2 mmol) in 90 mL of CH₂Cl₂ was cooled to 0 °C as Dess-Martin periodinane (11.2 g, 26.5 mmol) was added in portions. After stirred at rt overnight, the reaction was diluted with 100 mL of CH₂Cl₂, and washed with saturated NaHCO₃ (5 x 100 mL), water, and dried over Na₂SO₄. Flash chromatography with 60% Et₂O in hexane gave 2.83 g (35%) of 4-[4-(2-oxo-ethyl)-phenoxy]-piperidine-1-carboxylic acid tert-butyl ester: MS m/z 220 (M-Boc+H).

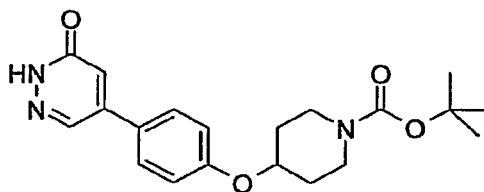
Step 3.



4-[4-(2-Hydroxy-5-oxo-2,5-dihydro-furan-3-yl)-phenoxy]-piperidine-1-carboxylic acid tert-butyl ester

4-[4-(2-hydro-5-oxo-2,5-dihydro-furan-3-yl)-phenoxy]-piperidine-1-carboxylic acid tert-butyl ester was prepared from 4-[4-(2-oxo-ethyl)-phenoxy]-piperidine-1-carboxylic acid tert-butyl ester and glyoxalic acid hydrate using procedure described in Example 94 Step 3; MS m/z 275 (M-Boc+H).

Step 4.

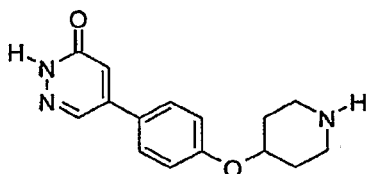


4-[4-(6-Oxo-1,6-dihydro-pyridazin-4-yl)-phenoxy]-piperidine-1-carboxylic acid tert-butyl ester

A solution of the product from step 3 (1.0 g, 2.7 mmol) and hydrazine hydrate (0.27g, 5.3 mmol) in 12 mL of MeOH was stirred at 80 °C overnight. After being cooled to

rt, the solvent was reduced and the solid was filtered and washed with cold EtOH to give 0.63 g (57%) of 4-[4-(6-oxo-1,6-dihydro-pyridazin-4-yl)-phenoxy]piperidine-1-carboxylic acid tert-butyl ester: Mp 222-3 °C; MS m/z 372 (M + H).

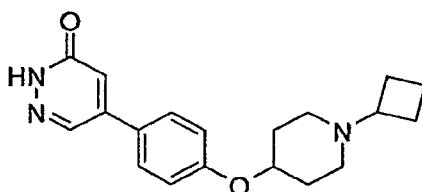
5 Example 105



5-[4-(Piperidin-4-yloxy)-phenyl]-2H-pyridazin-3-one

This compound was prepared using the procedure for example 102; Mp °C; MS m/z 272 (M + H).

10 Example 106

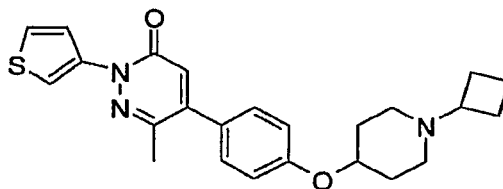


5-[4-(1-Cyclobutyl-piperidin-4-yloxy)-phenyl]-2H-pyridazin-3-one

This compound was prepared as the HCl salt using the procedure for example 103; Mp 296-8 °C; MS m/z 326 (M + H).

15

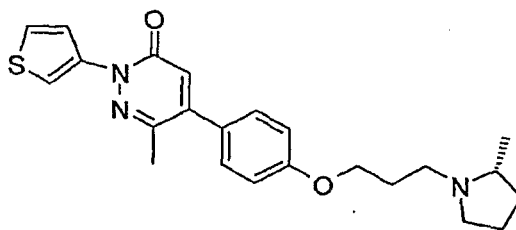
Example 107



5-[4-(1-Cyclobutyl-piperidin-4-yloxy)-phenyl]-6-methyl-2-thiophen-3-yl-2H-pyridazin-3-one

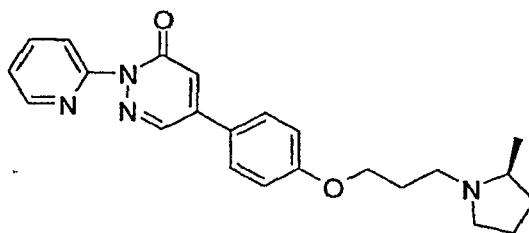
20

This compound was prepared as the HCl salt using the procedure for example 104; Mp 277-9 °C; MS m/z 422 (M + H).

Example 108

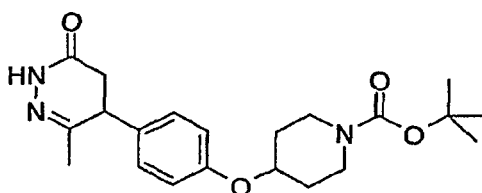
6-Methyl-5-{4-[3-((R)-2-methyl-pyrrolidin-1-yl)-propoxy]-phenyl}-2-thiophen-3-yl-2H-pyridazin-3-one

- 5 This compound was prepared as the HCl salt using the procedure for example 98; Mp 212-3 °C; MS m/z 410 (M + H).

Example 109

5-{4-[3-((S)-2-Methyl-pyrrolidin-1-yl)-propoxy]-phenyl}-2-pyridin-2-yl-2H-pyridazin-3-one

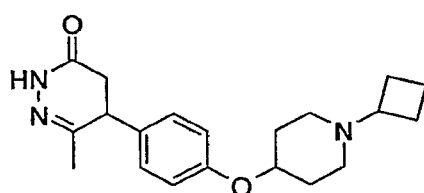
- 10 Example 109 was prepared using the same procedure as Example 94 except using S-2-methylpyrrolidine HCl; Mp 218-220 °C; MS m/z 391 (M + H).

Example 110.
Step 1.

4-[4-(3-Methyl-6-oxo-1,4,5,6-tetrahydro-pyridazin-4-yl)-phenoxy]-piperidine-1-carboxylic acid tert-butyl ester

- 15 A solution of the intermediate from Example 102 step 1 (1.0 g, 3.0 mmol) in THF (10 mL) at -78 °C under N₂ was added KHMDS (0.5 M in toluene, 9.0 mL) dropwise. After 30 min at -78 °C, ethyl bromoacetate (0.75 g, 4.5 mmol) was added drop wise. After 1 hr at 20 -78 °C, the reaction was quenched with 1 N HCl (4.0 mL), diluted with 20 mL of EtOAc

and the layers separated. The EtOAc layer was washed with 5% NaHCO₃, NaCl solution, then dried over Na₂SO₄ and concentrated. To the crude solid in 10 mL of EtOH was added hydrazine hydrate (0.22 g, 0.45 mmol) and the reaction then stirred at 85 °C for 2 h. The mixture was cooled to rt, the solvent was reduced and the solid was filtered and washed with cold EtOH to give 0.65 g (56%) of 4-[4-(3-methyl-6-oxo-1,4,5,6-tetrahydro-pyridazin-4-yl)-phenoxy]-piperidine-1-carboxylic acid tert-butyl ester: Mp 165-7 °C; MS m/z 288 (M-Boc + H).

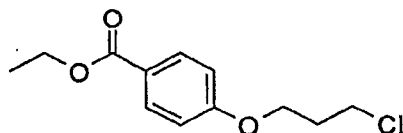


5-[4-(1-Cyclobutyl-piperidin-4-yloxy)-phenyl]-6-methyl-4,5-dihydro-2H-pyridazin-3-one

Example 110 was prepared from the product of step 1 using procedures described in Example 102 and Example 103; Mp 178-9 °C; MS m/z 342 (M + H).

Example 111

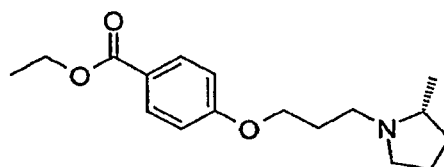
Step 1.



4-(3-Chloro-propoxy)-benzoic acid ethyl ester

A suspension of 4-hydroxybenzoic acid ethyl ester (5.0 g, 30 mmol), 1-bromo-3-chloropropane (7.1 g, 45 mmol) and potassium carbonate (14 g, 100 mmol) in 50 mL of acetone using the procedure described in Example 88 Step 1 gave the product as a clear oil.

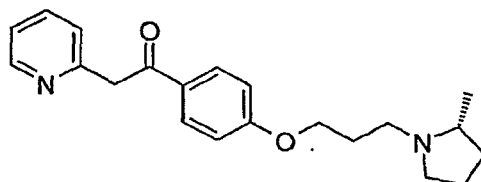
Step 2.



4-[3-((R)-2-Methyl-pyrrolidin-1-yl)-propoxy]-benzoic acid ethyl ester

A mixture of the product from step 1 (6.5 g, 27 mmol), R-2-methylpyrrolidine benzene sulfonic acid (16 g, 67 mmol), potassium carbonate (11 g, 80 mmol) and sodium iodide (50mg, 0.3 mmol) in 100 mL of acetonitrile was stirred at 80 °C overnight. The reaction mixture was filtered through celite, washed with CH₂Cl₂, combined and concentrated. The residue was dissolved in CH₂Cl₂, washed with saturated NaHCO₃, water, saturated NaCl, then dried over Na₂SO₄ to give 7.5 g (96%) of 4-[3-R-2-methylpyrrolidin-1-yl-propoxy]benzoic acid ethyl ester; MS m/z 292 (M + H).

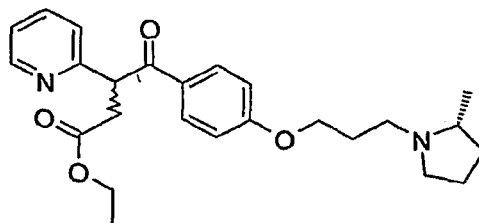
Step 3.



1-{4-[3-((R)-2-Methyl-pyrrolidin-1-yl)-propoxy]-phenyl}-2-pyridin-2-yl-ethanone

A solution of the product from step 2 (4.0 g, 14 mmol) and 2-methylpyridine (2.6 g, 27 mmol) in 60 mL of THF was cooled to 0 °C, then LiHMDS (1.0 M, 27 mmol) was added dropwise. After addition, the reaction was stirred at 45 °C overnight. The reaction was quenched with ice-water, extracted with CH₂Cl₂ (3 x 50 mL), combined, washed with saturated NaHCO₃, water, then dried over Na₂SO₄. Flash chromatography using 10% MeOH in CH₂Cl₂ gave the product (3.7 g, 78%); Mp 40-42 °C; MS m/z 339 (M + H).

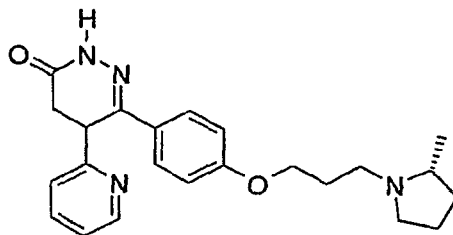
Step 4.



4-{4-[3-((R)-2-Methyl-pyrrolidin-1-yl)-propoxy]-phenyl}-4-oxo-3-pyridin-2-yl-butanoic acid ethyl ester

A mixture of sodium hydride (0.092 g, 3.8 mmol) in 10 mL of DMSO was stirred under N₂ as the product from step 3 (1.0g, 3.8 mmol) in 5.0 mL of DMSO was added dropwise. After the reaction was stirred for 30 min, a solution of ethyl bromoacetate (0.64

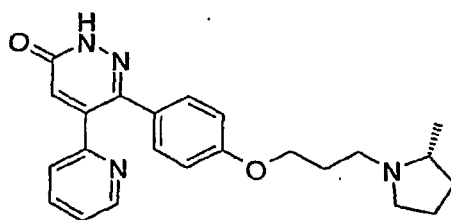
g, 8.83 mmol) in 6.0 mL of toluene was added dropwise, and the reaction was stirred at rt for 1 h. The reaction was then quenched with NH_4Cl solution and the solvent was evaporated. The residue was extracted with CH_2Cl_2 (3 x 20 mL), combined, washed with saturated NaHCO_3 , saturated NaCl then dried over Na_2SO_4 . The crude product was purified by flash chromatography using 10% MeOH in CH_2Cl_2 to give the product (0.65 g, 52%).



6-{4-[3-((R)-2-Methyl-pyrrolidin-1-yl)-propoxy]-phenyl}-5-pyridin-2-yl-4,5-dihydro-2H-pyridazin-3-one

A solution of the ester intermediate (4-{4-[3-R-2-methyl-pyrrolidin-1-yl]-phenyl}-4-oxo-3-pyridin-2-yl-butyric acid ethyl ester) (9.2 g, 22 mmol) and hydrazine hydrate (2.2 g, 43 mmol) in 150 mL of EtOH was stirred at reflux overnight. Flash chromatography using 15% MeOH in CH_2Cl_2 with 0.5% of $i\text{PrNH}_2$ followed by treatment of the product with 1N HCl in EtOH gave hydrochloride of 6-{4-[3-R-2-methyl-pyrrolidin-1-yl]-propoxy]-phenyl}-5-pyridin-2-yl-4,5dihydro-2H-pyridazin-3-one (6.1 g, 71%); Mp 133 °C (dec.); MS m/z 393 (M + H).

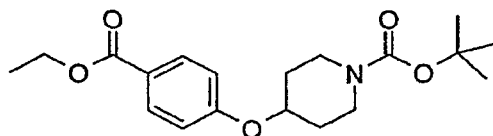
Example 112



6-{4-[3-((R)-2-Methyl-pyrrolidin-1-yl)-propoxy]-phenyl}-5-pyridin-2-yl-2H-pyridazin-3-one

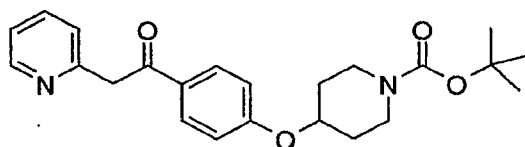
A mixture of example 111 (0.39 g, 1.0 mmol) in 4.0 mL of water was added sodium 3-nitrobenzenesulfonate (0.18 g, 0.78 mmol) and NaOH (0.12 g, 3.0 mmol). The reaction was heated to 100 °C as 2.5 mL of EtOH was added to make the reaction homogeneous. After 2 h at 100 °C, the reaction was cooled to rt. 2N HCl was added to adjust pH to ~6, then the reaction was extracted with CH_2Cl_2 (3 x 20 mL), which was washed with saturated NaHCO_3 , saturated NaCl , and then dried over Na_2SO_4 . The product was purified by

preparative TLC using 10% MeOH in CH_2Cl_2 and 0.5% of iPrNH_2 to give the product. The hydrochloride salt was prepared by treating the free base with 1N HCl in EtOH (0.14 g, 35%); Mp 234 °C (dec.); MS m/z 391 (M + H).

Example 113**Step 1.**

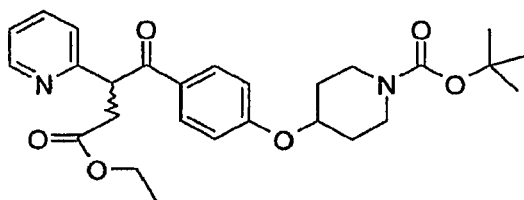
4-(4-Ethoxycarbonyl-phenoxy)-piperidine-1-carboxylic acid tert-butyl ester

4-(4-Ethoxycarbonylphenoxy)piperidine-1-carboxylic acid tert-butyl ester was prepared from 4-hydroxybenzoic acid ethyl ester and 4-hydroxypiperidine-1-carboxylic acid tert-butyl ester using the procedure described in Example 103 step 1; Mp 76-78 °C; MS m/z 350 (M + H).

Step 2.

4-[4-(2-Pyridin-2-yl-acetyl)-phenoxy]piperidine-1-carboxylic acid tert-butyl ester

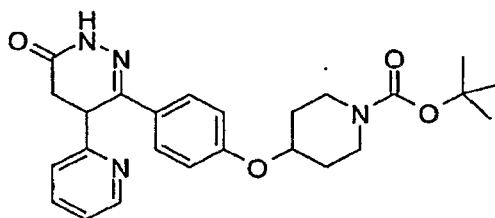
A solution of 4-(4-ethoxycarbonylphenoxy)piperidine-1-carboxylic acid tert-butyl ester (3.5 g, 10 mmol) and 2-methylpyridine (1.9g, 2.0 mmol) in 50 mL of THF was stirred at 0 °C as LiHMDS (1.0M, 22 mL) was added dropwise. The reaction was stirred at 45 °C overnight, then quenched with ice-water and the solvent evaporated. The residue was extracted with CH₂Cl₂ (3 x 30 mL), and the combined CH₂Cl₂ layers were washed with saturated NaHCO₃, saturated NaCl solution, dried over Na₂SO₄, and concentrated to give the product; Mp 138-140 °C; MS m/z 397 (M + H).

Step 3.

4-[4-(3-Ethoxycarbonyl-2-pyridin-2-yl-propionyl)-phenoxy]piperidine-1-carboxylic acid tert-butyl ester

A mixture of sodium hydride (0.21 g, 8.8 mmol) in 10 mL of DMSO was stirred under N₂ as 4-[4-(2-pyridine-2-yl-acetyl)-phenoxy]-piperidine-1-carboxylic acid tert-butyl ester (3.50 g, 8.83 mmol) in 15 mL of DMSO was added dropwise. After 30 min, a solution of ethyl bromoacetate (1.47g, 8.83 mmol) in 8.0 mL of toluene was added dropwise. The reaction was stirred at rt for 2 h and then quenched with saturated NH₄Cl solution, and the solvent was evaporated. The residue was extracted with CH₂Cl₂ (3 x 20 mL), combined, washed with saturated NaHCO₃, saturated NaCl solution and dried over Na₂SO₄. The crude product was purified by Combiflash chromatography (CH₂Cl₂ to 1% MeOH in CH₂Cl₂) to give the product (4.0 g, 94%): Mp 118-120 °C; MS m/z 483 (M + H).

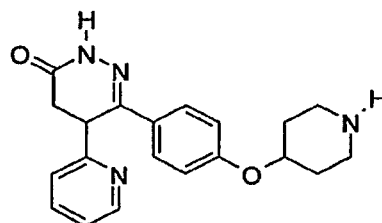
Step 4.



4-[4-(6-Oxo-4-pyridin-2-yl-1,4,5,6-tetrahydro-pyridazin-3-yl)-phenoxy]-piperidine-1-carboxylic acid tert-butyl ester

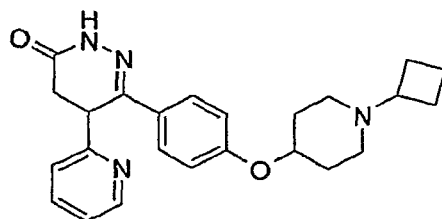
A solution of the product from step 3 (4.0g, 8.3 mmol) and hydrazine hydrate (0.83 g, 16 mmol) in 30 mL of EtOH was stirred at 90 °C overnight. The yellow suspension was reduced to ~15 mL of EtOH. The solid was collected and washed with cold EtOH to give the product (2.05 g, 55%): Mp 213-214 °C; MS m/z 395 (M-tBu + H).

Example 113



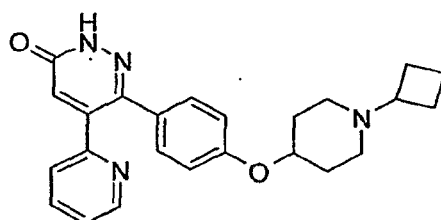
6-[4-(Piperidin-4-yloxy)-phenyl]-5-pyridin-2-yl-4,5-dihydro-2H-pyridazin-3-one

This compound was prepared from the product of step 4 using procedures described in Example 102 Step 3 MS m/z 351 (M + H).

Example 114

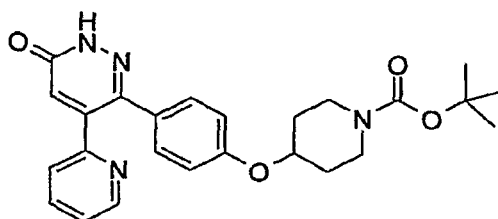
6-[4-(1-Cyclobutyl-piperidin-4-yloxy)-phenyl]-5-pyridin-2-yl-4,5-dihydro-2H-pyridazin-3-one

This compound was prepared using the procedure for Example 103; Mp 199 °C (dec); MS m/z 405 (M + H).

Example 115

6-[4-(1-Cyclobutyl-piperidin-4-yloxy)-phenyl]-5-pyridin-2-yl-2H-pyridazin-3-one

Step 1.

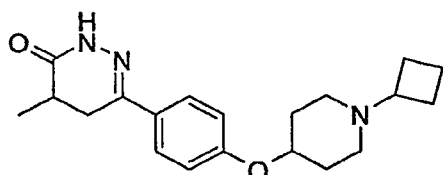


4-[4-(6-Oxo-4-pyridin-2-yl-1,6-dihydro-pyridazin-3-yl)-phenoxy]-piperidine-1-carboxylic acid tert-butyl ester

A mixture of the product from Example 113 step 4 (0.3 g, 0.67 mmol) and cesium carbonate (0.65 g, 2 mmol) in 4.0 mL of DMSO was heated under air at 150 °C for 0.5 h. The reaction was cooled to rt, filtered, washed with CH₂Cl₂ (3 x 15mL) and combined. The CH₂Cl₂ solution was washed with saturated NaHCO₃, water and dried over Na₂SO₄. The crude product was crystallized from MeOH and ether to give the Boc product; Mp 210-2 °C; MS m/z 449 (M + H).

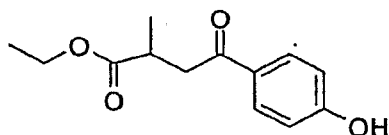
6-[4-(1-Cyclobutyl-piperidin-4-yloxy)-phenyl]-5-pyridin-2-yl-2H-pyridazin-3-one was prepared from the product in step 1 using procedures described in Example 102 Step 3 and Example 103; Mp 203 °C (dec.); MS m/z 403(M + H).

5 Example 116



6-[4-(1-Cyclobutyl-piperidin-4-yloxy)-phenyl]-4-methyl-4,5-dihydro-2H-pyridazin-3-one

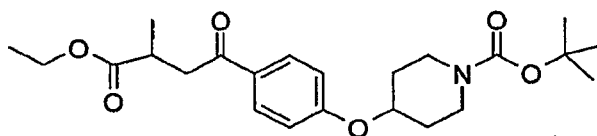
Step 1.



4-(4-Hydroxy-phenyl)-2-methyl-4-oxo-butylric acid ethyl ester

A solution of 4-(4-methoxyphenyl)-2-methyl-4-oxobutyric acid (10 g, 45 mmol) and 150 mL of 48% HBr in 20 mL of AcOH was heated to 100 °C for 48 h. The solvent was evaporated and EtOH (3 x 30 mL) was added and evaporated to give 4-(4-methoxyphenyl)-2-methyl-4-oxobutyric acid ethyl ester (9.96 g, 93%); MS m/z 259 (M + 23).

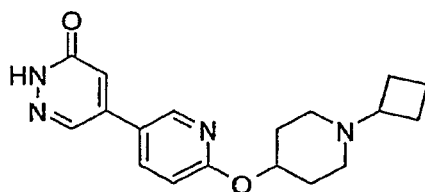
Step 2.



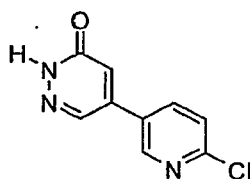
4-[4-(3-Ethoxycarbonyl-butyl)-phenoxy]-piperidine-1-carboxylic acid tert-butyl ester

4-[4-(3-Ethoxycarbonyl-butyl)-phenoxy]piperidine-1-carboxylic acid tert-butyl ester was prepared using procedure described in Example 102 step 1; MS m/z 442 (M + 23).

The final product 6-[4-(1-cyclobutylpiperidin-4-yloxy)phenyl]-4-methyl-4,5-dihydro-2H-pyridazin-3-one HCl was prepared from 4-[4-(3-ethoxycarbonyl-butyl)phenoxy]-piperidine-1-carboxylic acid tert-butyl ester using procedures described in Example 102 Step 3 and Example 103; Mp 257-9 °C; MS m/z 342 (M + H).

Example 117

5-[6-(1-Cyclobutyl-piperidin-4-yloxy)-
pyridin-3-yl]-2H-pyridazin-3-one

Step 1.

5-(6-Chloro-pyridin-3-yl)-2H-
pyridazin-3-one

5

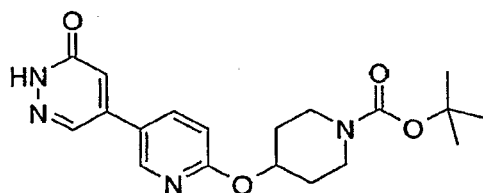
4,5-Dichloropyridazin-6-one (10 g, 60.6 mmol) and 57 wt.% hydroiodic acid in water (80 mL, 1.0 mmol) was heated to 150 °C for 24 h. The reaction was cooled to rt, the solid was washed with sodium thiosulfate. The crude product was triturated with CH₂Cl₂:
10 MeOH (1:1) and filtered to give 5-iodo-2H-pyridazin-3-one (4.64g, 35%).

A mixture of 5-iodo-2H-pyridazin-3-one (4.64g, 21 mmol) and 30% formaldehyde in water was heated to reflux for overnight. The reaction was cooled to rt, and the resulting solid was filtered to give 2-hydromethyl-5-iodo-2H-pyridazin-3-one (5.2 g, 99%).

A mixture of 2-hydromethyl-5-iodo-2H-pyridazin-3-one (1.15 g, 4.56 mmol) and 2-
15 chloro-5-pyridineboronic acid (0.72 g, 4.57 mmol), tetrakis(triphenylphosphine)-
palladium(0) (0.53 g, 0.46 mmol) and potassium carbonate (1.89 g, 13.7 mmol) in 30 mL of 1,2-dimethoxyethane and 10 mL of water was degassed for 3 min, then heated to 85 °C overnight. The reaction was cooled to rt, filtered and washed with ethyl acetate. The organic layer was separated, concentrated, and triturated with ether to give 5-(6-chloro-
20 pyridin-3-yl)-2H-pyridazin-3-one (0.4 g, 36%); MS m/z 208 (M + H).

25

Step 2.

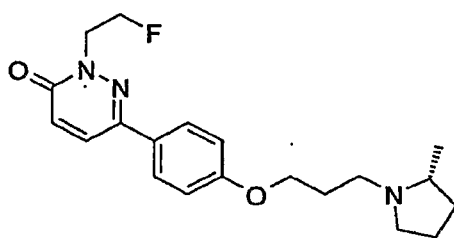


4-[5-(6-Oxo-1,6-dihydro-pyridazin-4-yl)-pyridin-2-yloxy]piperidine-1-carboxylic acid tert-butyl ester

A solution of 5-(6-chloropyridin-3-yl)-2H-pyridazin-3-one (73 mg, 0.35 mmol) and
 5 4-hydroxypiperidine-1-carboxylic acid tert-butyl ester (140 mg, 0.70 mmol) in 2.7 mL of
 DMSO was stirred as K_{OT}Bu in 2-methyl-2-propanol (1.0 M, 14.4 mL) was added
 dropwise. After stirring at 110 °C overnight, the reaction was cooled to rt, and 2 mL of
 water was added. The mixture was extracted with CH₂Cl₂ (3 x 10 mL), the extracts
 combined and dried over Na₂SO₄. The crude product was purified by prep. TLC with 10%
 10 MeOH in CH₂Cl₂ to give 71 mg (54%) of 4-[5-(6-oxo-1,6-dihydropyridazin-4-yl)-pyridin-
 2-yloxy]piperidine-1-carboxylic acid tert-butyl ester; MS m/z 273 (M-Boc-H).

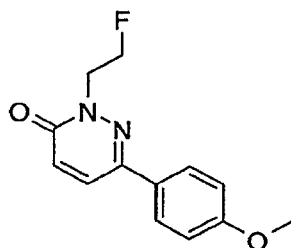
Example 117 hydrochloride was prepared from the product in step 2 using
 procedures described in Example 102 Step 3 and Example 103; Mp 232-4 °C; MS m/z 327
 15 (M + H).

Example 118



2-(2-Fluoro-ethyl)-6-{4-[3-((R)-2-methyl-pyrrolidin-1-yl)-propoxy]-phenyl}-2H-pyridazin-3-one

Step 1.



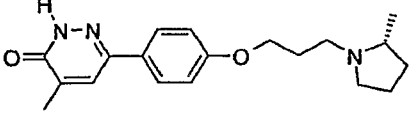
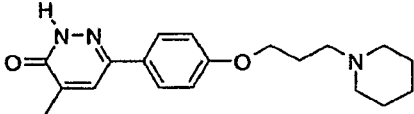
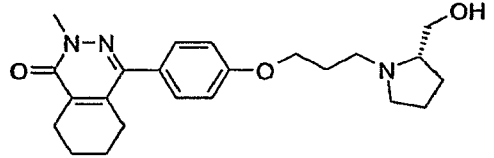
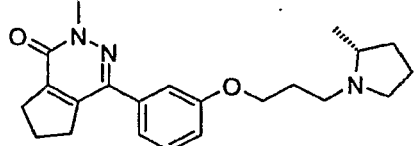
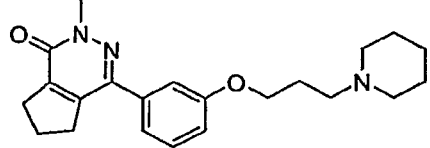
2-(2-Fluoro-ethyl)-6-(4-methoxy-phenyl)-2H-pyridazin-3-one

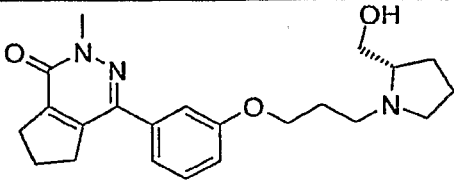
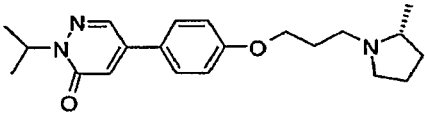
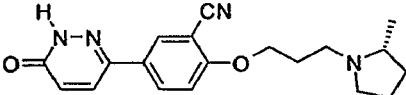
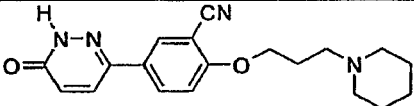
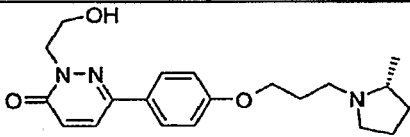
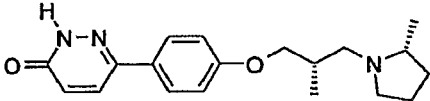
A mixture of 6-(4-methoxyphenyl)-2H-pyridazin-3-one (170 mg, 0.83 mmol), 1-bromo-2-fluoroethane (122.5 mg, 1.5 eq.), NaI (20 mg) and cesium carbonate (553 mg, 2.0 eq.) in 5 mL of CH₃CN was heated to 70 °C overnight. The reaction mixture was filtered and concentrated. The product was purified by ISCO combiflash with 50% hexane and EtOAc to give 2-(2-fluoroethyl)-6-(4-methoxyphenyl)-2H-pyridazin-3-one (200 mg, 97%); MS m/z 349 (M + H).

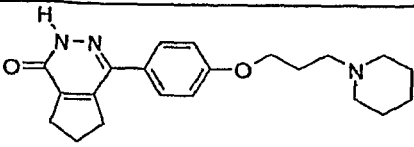
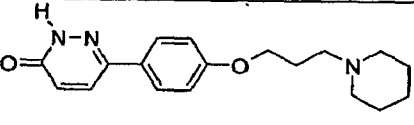
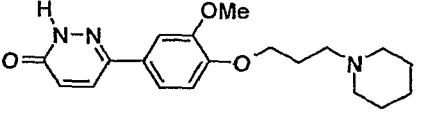
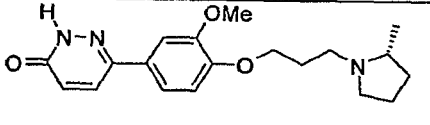
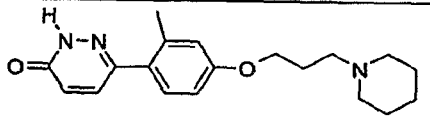
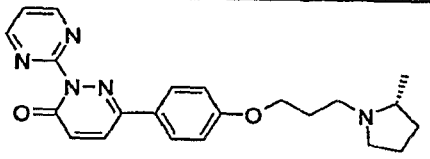
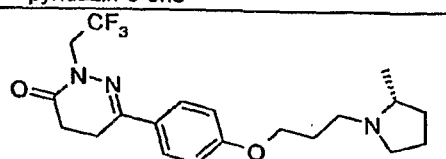
Example 118 hydrochloride was prepared from the product in step 1 using procedures described in Example 1 and example 86; mp 135-6 °C; MS m/z 360 (M + H).

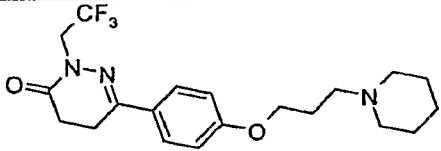
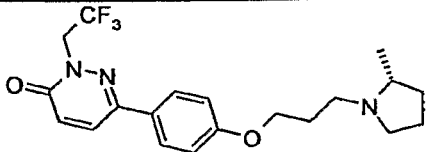
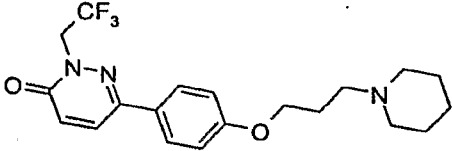
The following compounds were prepared as HCl salts unless noted using methods for example 1, example 11 or example 91.

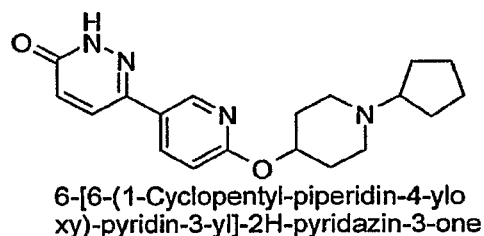
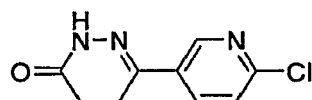
Example	Structure	Mp (°C)	MS m/z
119	6-[3-Fluoro-4-[3-((R)-2-methyl-pyrrolidin-1-yl)-propoxy]-phenyl]-2H-pyridazin-3-one	252-3	332 (M + H)
120	6-[3-Fluoro-4-(3-piperidin-1-yl-propoxy)-phenyl]-2H-pyridazin-3-one	240-2	332 (M + H)
121	4-Methyl-6-[4-[3-((R)-2-methyl-pyrrolidin-1-yl)-propoxy]-phenyl]-4,5-dihydro-2H-pyridazin-3-one	201-3	330 (M + H)

Example	Structure	Mp (°C)	MS m/z
122	 4-Methyl-6-[4-[3-((R)-2-methylpyrrolidin-1-yl)-propoxy]-phenyl]-2H-pyridazin-3-one	207-8	328 (M + H)
123	 4-Methyl-6-[4-(3-piperidin-1-yl-propoxy)-phenyl]-2H-pyridazin-3-one	227-9	328 (M + H)
124	 4-[4-[3-((S)-2-Hydroxymethylpyrrolidin-1-yl)-propoxy]-phenyl]-2-methyl-5,6,7,8-tetrahydro-2H-phthalazin-1-one	120-2	398 (M + H)
125	 2-Methyl-4-[3-[3-((R)-2-methylpyrrolidin-1-yl)-propoxy]-phenyl]-2,5,6,7-tetrahydro-cyclopenta[d]pyridazin-1-one	172-4	368 (M + H)
126	 2-Methyl-4-[3-(3-piperidin-1-yl-propoxy)-phenyl]-2,5,6,7-tetrahydro-cyclopenta[d]pyridazin-1-one	189-190	368 (M + H)

Example	Structure	Mp (°C)	MS m/z
127	 4-{3-[3-((S)-2-Hydroxymethyl-pyrrolidin-1-yl)-propoxy]-phenyl}-2-methyl-1,2,5,6,7-tetrahydro-cyclopenta[d]pyridazin-1-one	193-4	384 (M + H)
128	 2-Isopropyl-5-{4-[3-((R)-2-methyl-pyrrolidin-1-yl)-propoxy]-phenyl}-2H-pyridazin-3-one	251-3	356 (M + H)
129	 2-[3-((R)-2-Methyl-pyrrolidin-1-yl)-propoxy]-5-(6-oxo-1,6-dihydro-pyridazin-3-yl)-benzonitrile	>200 dec. base	339 (M + H)
130	 2-[3-(piperidin-1-yl)-propoxy]-5-(6-oxo-1,6-dihydro-pyridazin-3-yl)-benzonitrile	207-9 base	339 (M + H)
131	 2-(2-Hydroxy-ethyl)-6-{4-[3-((R)-2-methyl-pyrrolidin-1-yl)-propoxy]-phenyl}-2H-pyridazin-3-one	95-98 base	358 (M + H)
132	 6-{4-[(S)-2-Methyl-3-((R)-2-methyl-pyrrolidin-1-yl)-propoxy]-phenyl}-2H-pyridazin-3-one	163-7 base	328 (M + H)

Example	Structure	Mp (°C)	MS m/z
133	 4-[4-(3-Piperidin-1-yl-propoxy)-phenyl]-2,5,6,7-tetrahydro-cyclopenta[d]pyridazin-1-one	134 dec. base	354 (M + H)
134	 6-[4-(3-Piperidin-1-yl-propoxy)-phenyl]-2H-pyridazin-3-one	186 dec. base	314 (M + H)
135	 6-[3-Methoxy-4-(3-piperidin-1-yl-propoxy)-phenyl]-2H-pyridazin-3-one	175 dec. base	344 (M + H)
136	 6-[3-Methoxy-4-[3-((R)-2-methyl-pyrrolidin-1-yl)-propoxy]-phenyl]-2H-pyridazin-3-one	148 dec. base	344 (M + H)
137	 6-[2-Methyl-4-(3-piperidin-1-yl-propoxy)-phenyl]-2H-pyridazin-3-one	114 dec. base	328 (M + H)
138	 6-[4-[3-((R)-2-Methyl-pyrrolidin-1-yl)-propoxy]-phenyl]-2-pyrimidin-2-yl-2H-pyridazin-3-one	> 200 tartrate	392 (M + H)
168	 6-[4-[3-((R)-2-Methyl-pyrrolidin-1-yl)-propoxy]-phenyl]-2-(2,2,2-trifluoroethyl)-4,5-dihydro-2H-pyridazin-3-one	76-78 base	398 (M + H)

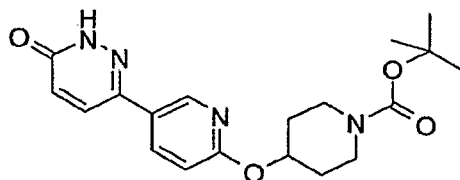
Example	Structure	Mp (°C)	MS m/z
169	 6-{4-[3-(2,2,2-trifluoroethyl)-4,5-dihydro-2H-pyridazin-3-yl]-phenyl}-2-(2,2,2-trifluoroethyl)-4,5-dihydro-2H-pyridazin-3-one	87-89 base	398 (M + H)
170	 6-{4-[3-((R)-2-Methyl-pyrrolidin-1-yl)-propoxy]-phenyl}-2-(2,2,2-trifluoroethyl)-4,5-dihydro-2H-pyridazin-3-one	121-123 base	396 (M + H)
171	 6-{4-[3-(Piperidin-1-yl)-propoxy]-phenyl}-2-(2,2,2-trifluoroethyl)-4,5-dihydro-2H-pyridazin-3-one	128-130 base	396 (M + H)

Example 139**5 Step 1**

6-(6-Chloro-pyridin-3-yl)-4,5-dihydro-2H-pyridazin-3-one

To ethyl-4-(4-chloro-3-pyridyl)-4-oxobutrate (5 g, 20.7 mmol) in ethanol (30 mL) was added hydrazine monohydrate (964 μ M, 31 mmol). After overnight stirring at 80 °C, the reaction was concentrated to half of the volume and the resulting yellow solid was filtered off and dried to give 3.4 g of product (77%); MS m/z 210 (M + H).

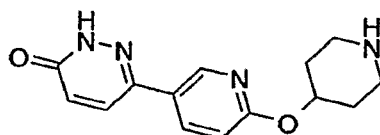
Step 2



4-[5-(6-Oxo-1,6-dihydro-pyridazin-3-yl)-pyridin-2-yloxy]-piperidine-1-carboxylic acid tert-butyl ester

- 5 To 6-(6-chloro-pyridin-3-yl)-4,5-dihydro-2H-pyridazin-3-one (3 g, 14.4 mmol) in DMSO (40 mL) was added 4-hydroxy-boc-piperidine (2.9 g, 14.4 mmol), followed by 1M KtOBu (19 mL). After overnight stirring at 100 °C open to air, the reaction was cooled, diluted with dichloromethane and washed several times with water/brine, dried over sodium sulfate, and concentrated under vacuum to obtain 4.9 g crude product (92%); MS m/z 373 (M + H).
- 10

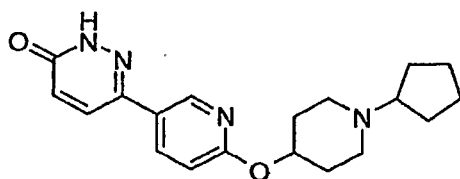
Step 3



6-[6-(Piperidin-4-yloxy)-pyridin-3-yl]-2H-pyridazin-3-one

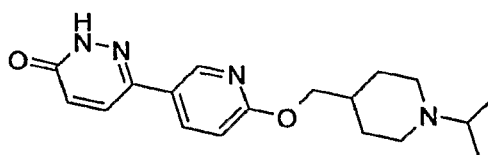
- 15 To 4-[5-(6-oxo-1,6-dihydro-pyridazin-3-yl)-pyridin-2-yloxy]-piperidine-1-carboxylic acid tert-butyl ester (4.9 g, 13.2 mmol) in dioxane (30 mL) was added 4N HCl/dioxane (6.6 mL, 3 mmol). After overnight stirring at 60 °C, the reaction was concentrated under vacuum to obtain 4 g of product as the HCl salt (quantitative); MS m/z 327 (M + H).
- 20

Step 4 Example 139



6-[6-(1-Cyclopentyl-piperidin-4-yloxy)-pyridin-3-yl]-2H-pyridazin-3-one

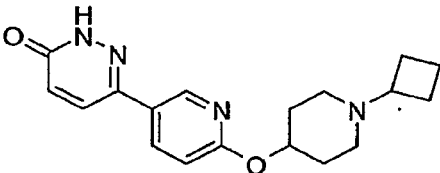
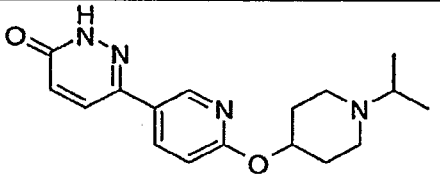
6-[6-(piperidin-4-yloxy)-pyridin-3-yl]-2H-pyridazin-3-one hydrochloride (407 mg, 1.18 mmol) in a mixture of DMF (5 mL), methanol (15 mL), and acetic acid (250 μ L) was added cyclopentanone (314 μ L, 3.54 mmol), followed by sodium cyanoborohydride (371 mg, 5.9 mmol). After stirring at 60 $^{\circ}$ C for 2 h, the reaction was concentrated, partitioned
5 between dichloromethane/1N sodium carbonate, washed with water/brine, dried over sodium sulfate, and concentrated. The product was purified using prep TLC plates (9:1 dichloromethane:methanol) (25%); Mp 233-237 $^{\circ}$ C; MS m/z 341 (M + H).

Example 140

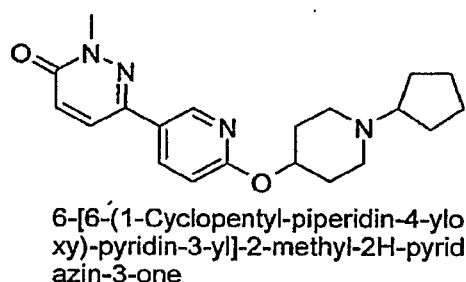
6-[6-(1-isopropyl-piperidin-4-ylmethoxy)-
pyridin-3-yl]-2H-pyridazin-3-one

To the product from step 1 Example 139 (115 mg, 0.55 mmol) in DMSO (5 mL) was added (1-isopropanol-piperidin-4-yl)methanol (130 mg, 0.83 mmol) and 1M KtOBu (1.1 mL, 1.1 mmol). After overnight stirring at 100 $^{\circ}$ C, the reaction was diluted with
15 dichloromethane, washed with water/brine several times, dried over sodium sulfate, and concentrated. The product was purified by prep TLC plates to obtain 64 mg (35%); Mp 188-191 $^{\circ}$ C; MS m/z 329 (M + H).

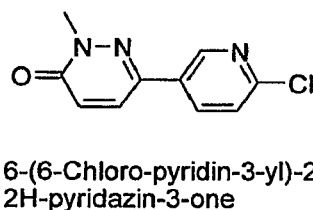
The following examples were prepared using methods for example 139

Example	Structure	Mp (°C)	MS m/z
141	 6-[6-(1-Cyclobutyl-piperidin-4-yloxy)-pyridin-3-yl]-2H-pyridazin-3-one	217-219	327 (M+H)
142	 6-[6-(1-Isopropyl-piperidin-4-yloxy)-pyridin-3-yl]-2H-pyridazin-3-one	195-197	315 (M+H)

5 Example 143

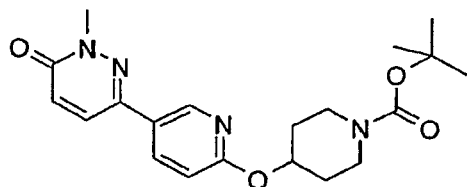


Step 1



To 6-(6-chloropyridin-3-yl)-4,5-dihydro-2H-pyridazin-3-one (1.03 g, 4.93 mmol) in DMSO (40 mL) was added iodomethane (460 μ L, 7.4 mmol) and cesium carbonate (3.2 g, 9.86 mmol). After overnight stirring at 100 °C open to air, the reaction was cooled, diluted with dichloromethane, washed several times with water/brine, dried over sodium sulfate, and concentrated under vacuum to obtain 835 mg product (79%); MS m/z 222 (M + H).

Step 2

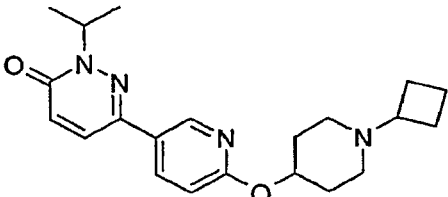


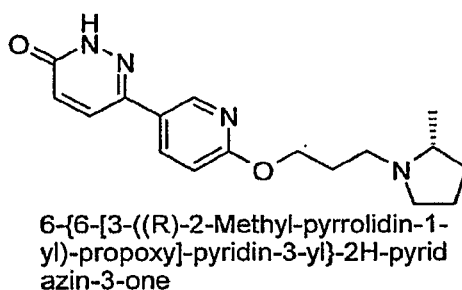
4-[5-(1-Methyl-6-oxo-1,6-dihydro-pyridazin-3-yl)-pyridin-2-yloxy]-piperidine-1-carboxylic acid tert-butylester

To 6-(6-chloro-pyridin-3-yl)-2-methyl-2H-pyridazin-3-one (3 g, 13.6 mmol) in
 5 toluene (50 mL) was added 4-hydroxy-boc-piperidine (2.7 g, 13.6 mmol) and 1M KtOBu (16.3 mL, 16.3 mmol). After overnight stirring at 80 °C, the reaction was concentrated, partitioned between dichloromethane/1N sodium carbonate, washed with water/brine, dried over sodium sulfate, and concentrated. The product was purified by column chromatography (99:1 dichloromethane:methanol) to obtain 2.7 g (51%); MS m/z 387 (M + H).
 10 H).

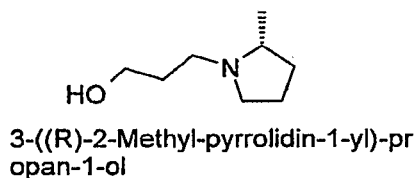
Example 143-145 were synthesized using Example 139 step 3 and step 4 (deprotection and reductive amination) and Example 143 Step 1 alkylation.

Example	Structure	Mp (°C)	MS m/z
143	6-[6-(1-Cyclopentyl-piperidin-4-yloxy)-pyridin-3-yl]-2-methyl-2H-pyridazin-3-one	154-157	355 (M + H)
144	6-[6-(1-Cyclobutyl-piperidin-4-yloxy)-pyridin-3-yl]-2-methyl-2H-pyridazin-3-one	175-180	341 (M + H)

Example	Structure	Mp (°C)	MS m/z
145	 6-[6-(1-Cyclobutyl-piperidin-4-yloxy)-pyridin-3-yl]-2-isopropyl-2H-pyridazin-3-one	113-115	369 (M + H)

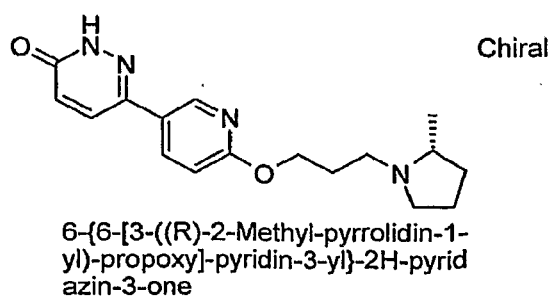
Example 146

5

Step 1

10 To 3-chloro-1-propanol (1.00 g, 10.6 mmol) in 2-butanone (10.00 mL) was added R-2-methyl-pyrrolidine hydrochloride (1.93 g, 15.9 mmol), potassium carbonate (3.65 g, 26.44 mmol), and potassium iodide (1.76 g, 10.6 mmol). After overnight stirring at 100 °C, the reaction was filtered, partitioned between dichloromethane/water, washed with brine, dried over sodium sulfate, and concentrated under vacuum to obtain 495 mg product (33%); MS

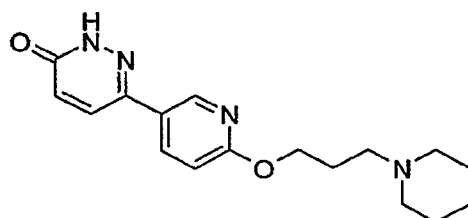
15 m/z 144 (M + H).



Step 2

To 6-(6-chloro-pyridin-3-yl)-4,5-dihydro-2H-pyridazin-3-one (599 mg, 2.86 mmol) (step 1 example 139) in DMSO (15 mL) was added 3-(R)-2-methylpyrrolidin-1-yl)-propan-1-ol (495 mg, 3.46 mmol) and 1M KOtBu (5.72 mL). After overnight stirring at 110 °C open to air, the reaction mixture was cooled and poured into water, extracted with dichloromethane, washed with brine, dried over sodium sulfate, and concentrated. The product was purified using prep TLC plates (9:1 dichloromethane:methanol) to obtain 68 mg; Mp 178-181 °C; MS m/z 315 (M + H).

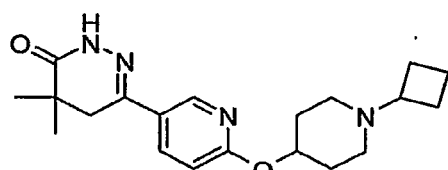
Example 147



6-[6-(3-Piperidin-1-yl-propoxy)-pyridin-3-yl]-2H-pyridazin-3-one

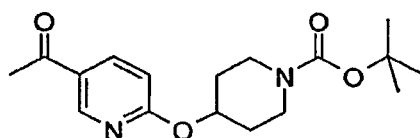
This compound was prepared using the intermediate from step 1 example 139 and 3-piperidin-1-yl-propanol using methods described for example 146; Mp 155-158 °C MS m/z 315 (M + H).

Example 148



6-[6-(1-Cyclobutyl-piperidin-4-yloxy)-pyridin-3-yl]-4,4-dimethyl-4,5-dihydro-2H-pyridazin-3-one

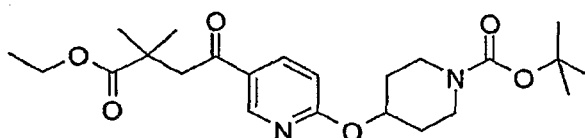
Step 1



4-(5-Acetyl-pyridin-2-yloxy)-piperidine-1-carboxylic acid tert-butyl ester

To 4-hydroxy-boc-piperidine (1.55 g, 7.71 mmol) in DMSO (12 mL) was added 1M KtOBu (8.36 mL), followed by 1-(6-chloropyridin-3-yl)ethanone (1.00 g, 6.43 mmol). After overnight stirring at 100 °C, the reaction was poured into water, extracted with dichloromethane, washed with brine, dried over sodium sulfate, and concentrated. The product was purified using a Single Step column (7:3 hexanes:ethyl acetate) to obtain 0.5 g (25%); MS m/z 321 (M + H).

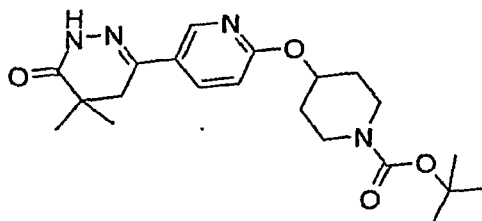
Step 2



4-[5-(3-Ethoxycarbonyl-3-methyl-but-1-en-1-yl)-pyridin-2-yloxy]-piperidine-1-carboxylic acid tert-butyl ester

To 4-(5-acetyl-pyridin-2-yloxy)-piperidine-1-carboxylic acid tert-butyl ester (1.36 g, 4.24 mmol) in THF (15 mL) at -78 °C was added 0.5M potassium bis(trimethylsilyl)amide in toluene (17 mL) and stirred for 30 min before adding 2-bromo-2-methyl-propionic acid ethyl ester (1.25 mL, 8.49 mmol) at -78 °C. After overnight stirring at r.t., the reaction was quenched with 1N HCl, extracted with dichloromethane, washed with water/brine, dried over sodium sulfate, and concentrated. The product was purified using a Single Step column (7:3 hexanes:ethyl acetate) to obtain 0.458 g (25%); MS m/z 435 (M + H).

Step 3

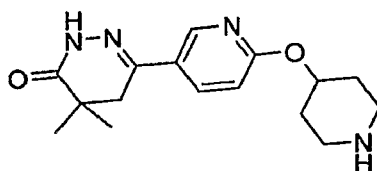


4-[5-(5,5-Dimethyl-6-oxo-1,4,5,6-tetrahydropyridazin-3-yl)-pyridin-2-yloxy]-piperidine-1-carboxylic acid tert-butyl ester

To 4-[5-(3-ethoxycarbonyl-3-methyl-butyryl-pyridin-2-yloxy)]piperidine-1-carboxylic acid tert-butyl ester (0.318 g, 0.732 mmol) in 2-propanol (8 mL) was added hydrazine monohydrate (2 mL). After overnight stirring at 120 °C, the reaction was

partitioned between dichloromethane/water, washed with brine, dried over sodium sulfate, and concentrated under vacuum to obtain 0.235 mg product (80%); MS m/z 403 (M + H).

Step 4

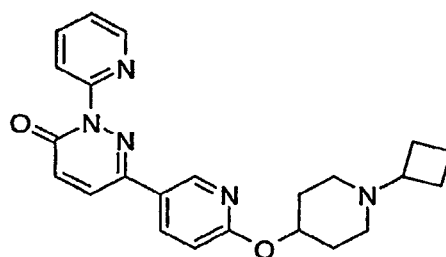


4,4-Dimethyl-6-[6-(piperidin-4-yloxy)-pyridin-3-yl]-4,5-dihydro-2H-pyridazin-3-one

To 4-[5-(5,5-dimethyl-6-oxo-1,4,5,6-tetrahydro-pyridazin-3-yl)-pyridin-2-yloxy]-piperidine-1-carboxylic acid tert-butyl ester (0.340 g, 0.845 mmol) in dichloromethane (5 mL) was added TFA (0.700 mL). After stirring at r.t. for ~3 h, the reaction was concentrated under vacuum to obtain product as the TFA salt (quantitative); MS m/z 303 (M + H).

Example 148 was prepared using the product from step 4 and cyclobutanone using the procedure for example 139 step 4 ; m 240-245; MS m/z 357 (M + H).

Example 149



6-[6-(1-Cyclobutyl-piperidin-4-yloxy)-pyridin-3-yl]-2-pyridin-2-yl-2H-pyridazin-3-one

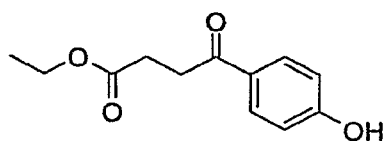
Step 1

To example 141 (0.509 g, 1.56 mmol) in DMF (8 mL) was added potassium carbonate (0.431 g, 3.12 mmol), 2-bromopyridine (0.223 mL, 2.34 mmol), and copper(I) iodide (0.0297 g, 0.156 mmol). After stirring at 150 °C for 4 h, the reaction was cooled, diluted with dichloromethane, washed with water/brine, dried over sodium sulfate, and concentrated. The product was purified using Prep. TLC plates (9:1

dichloromethane:methanol), dissolved in methanol with 1N HCl/ether (~2 mL) added, concentrated, and recrystallized from methanol/ether as the HCl salt to give 0.223 mg (33%); Mp 261-262 °C; MS m/z 404 (M + H).

Example 150

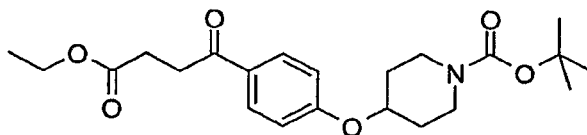
Step 1



4-(4-Hydroxy-phenyl)-4-oxo-butyric acid ethyl ester

To 4-(4-methoxy-phenyl)-4-oxo-butyric acid ethyl ester (4.5 g, 19.0 mmol) was added 48% HBr (50 mL). After overnight stirring at 120 °C, the reaction was concentrated and ethanol was added several times and concentrated to obtain 4.18 g product (94%); MS m/z 223 (M + H).

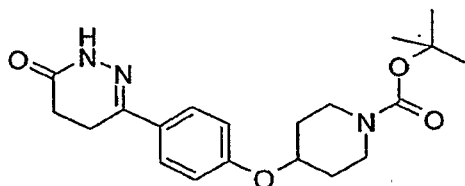
Step 2



4-[4-(3-Ethoxycarbonyl-propionyl)-phenoxy]-piperidine-1-carboxylic acid tert-butyl ester

To triphenylphosphine (2.48 g, 9.48 mmol) in THF (25 mL) was added 40% w/w DEAD in toluene (4.00 mL, 8.95 mmol) and the reaction was cooled at 0 °C before adding a mixture of 4-hydroxy-boc-piperidine (1.44, 7.14 mmol) and 4-(4-hydroxyphenyl)-oxo-butyric acid ethyl ester (1.3 g, 5.8 mmol) in THF (25 mL). After overnight stirring at r.t., the reaction was concentrated and the product was purified using a Single Step column (7:3 hexanes:ethyl acetate) to obtain 2.17 g (91%); MS m/z 406 (M + H).

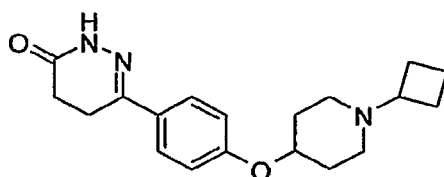
Step 3



4-[4-(6-Oxo-1,4,5,6-tetrahydro-pyridazin-3-yl)-phenoxy]-piperidine-1-carboxylic acid tert-butyl ester

To 4-[4-(3-ethoxycarbonyl-propionyl)-phenoxy]-piperidine-1-carboxylic acid tert-butyl ester (2.68 g, 6.61 mmol) in 2-propanol (25 mL) was added hydrazine monohydrate (0.662 g, 13.2 mmol). After overnight stirring at 120 °C, the reaction was concentrated down, partitioned between dichloromethane/water, washed with brine, dried over sodium sulfate, and concentrated under vacuum to obtain 2.18 g product (88%); MS m/z 374 (M + H).

Example 150

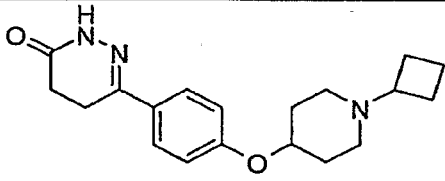
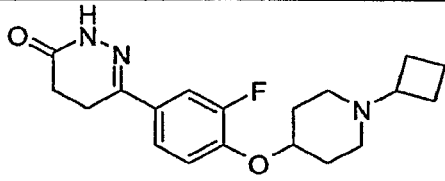
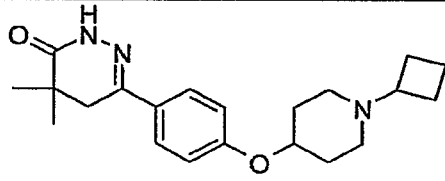
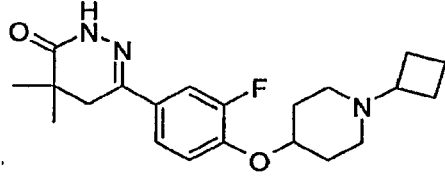


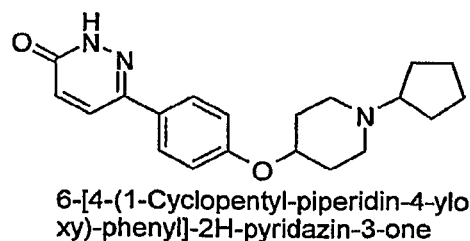
6-[4-(1-Cyclobutyl-piperidin-4-yloxy)-phenyl]-4,5-dihydro-2H-pyridazin-3-one

6-[4-(piperidin-4-yloxy)-phenyl]-4,5-dihydro-2H-pyridazin-3-one trifluoroacetate was prepared using conditions for Example 148 step 4.

To 6-[4-(piperidin-4-yloxy)-phenyl]-4,5-dihydro-2H-pyridazin-3-one trifluoroacetate (6.50 g, 23.8 mmol) in DMF (10 mL), methanol (50 mL), and acetic acid (2 mL) was added cyclobutanone (5.33 mL, 71.3 mmol) and sodium cyanoborohydride (7.47 g, 119 mmol) in portions. After stirring at 60 °C for 4 h, the reaction was concentrated, diluted with dichloromethane, washed with water/brine, dried over sodium sulfate, and concentrated. The product was purified using a Single Step column (9:1 dichloromethane:methanol) and recrystallized from chloroform/ether to obtain 2.2 g (40%); Mp = 196-198 °C; MS m/z 328 (M+H).

Examples 151-153 were synthesized using procedures for Example 150.

Example	Structure	Mp (°C)	MS m/z
150	 6-[4-(1-Cyclobutyl-piperidin-4-yloxy)-phenyl]-4,5-dihydro-2H-pyridazin-3-one	196-198	328 (M + H)
151	 6-[4-(1-Cyclobutyl-piperidin-4-yloxy)-3-fluoro-phenyl]-4,5-dihydro-2H-pyridazin-3-one	195-197	346 (M + H)
152	 6-[4-(1-Cyclobutyl-piperidin-4-yloxy)-phenyl]-4,4-dimethyl-4,5-dihydro-2H-pyridazin-3-one	157-158	356 (M + H)
153	 6-[4-(1-Cyclobutyl-piperidin-4-yloxy)-3-fluoro-phenyl]-4,4-dimethyl-4,5-dihydro-2H-pyridazin-3-one	147-149	374 (M + H)

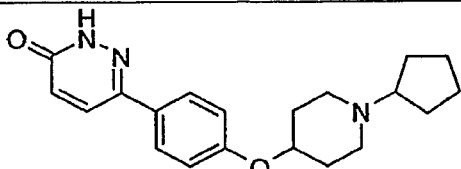
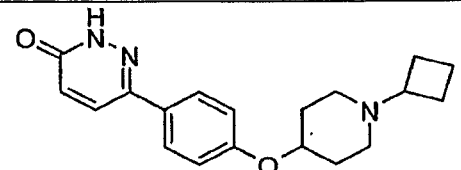
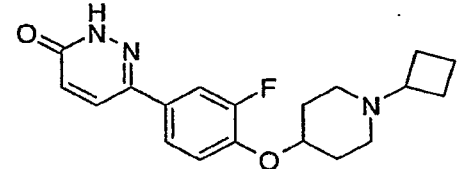
Example 154

5

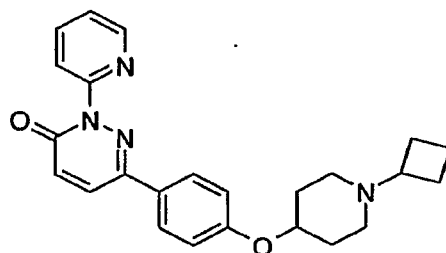
To example 150 (130 mg, 3.81 mmol) in DMSO (3 mL) was added cesium carbonate (248 mg, 7.61 mmol). After stirring at 130 °C for 2 h open to air, the reaction was filtered, diluted with dichloromethane, washed with water/brine, dried over sodium sulfate, and concentrated. The product was purified using Prep. TLC plates (9:1 dichloromethane: methanol) to obtain 48 mg (37 %); Mp 211-213 °C; MS m/z 340 (M + H).

10

Examples 155-156 were synthesized using methods for example 154.

Example	Structure	Mp (°C)	MS m/z
154	 6-[4-(1-Cyclopentyl-piperidin-4-yloxy)-phenyl]-2H-pyridazin-3-one	211-213	340 (M + H)
155	 6-[4-(1-Cyclobutyl-piperidin-4-yloxy)-phenyl]-2H-pyridazin-3-one	215-220	326 (M + H)
156	 6-[4-(1-Cyclobutyl-piperidin-4-yloxy)-3-fluoro-phenyl]-2H-pyridazin-3-one	236-238	344 (M + H)

5 Example 157

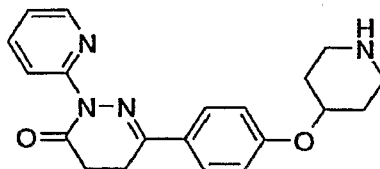


To example 150 (1.50 g, 4.58 mmol) in DMSO (20 mL) was added potassium carbonate (1.90 g, 13.7 mmol), 2-bromopyridine (0.872 mL, 9.16 mmol), and copper(I) iodide (0.0872 g, 0.458 mmol). After overnight stirring at 150 °C open to air, the reaction was filtered, diluted with dichloromethane, washed with water/brine, dried over sodium sulfate, and concentrated. The product was purified using a single step column (9:1 dichloromethane:methanol), dissolved in methanol and 1N HCl/ether (~2 mL) was added,

concentrated, and the product was recrystallized from methanol/ether as the HCl salt to obtain 53 mg; Mp >240 °C (dec.); MS m/z 403 (M + H).

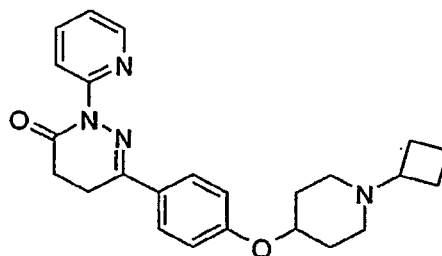
Example 158

Step 1



6-[4-(Piperidin-4-yloxy)-phenyl]-2-pyridin-2-yl-4,5-dihydro-2H-pyridazin-3-one

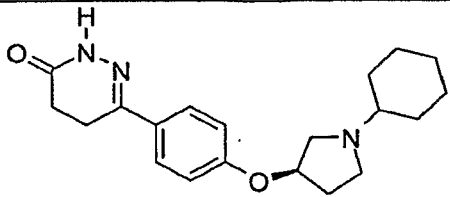
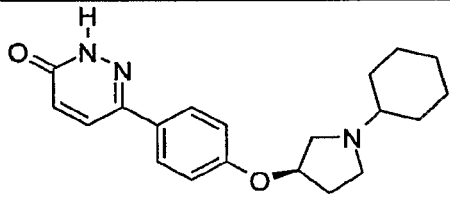
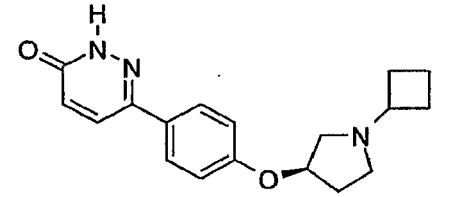
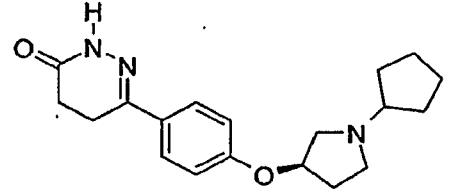
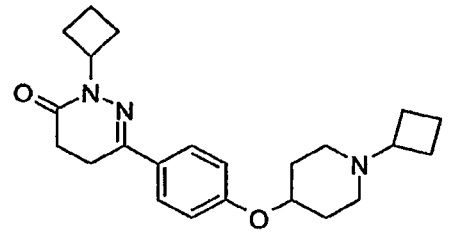
To 4-[4-(3-carboxy-propionyl)-phenoxy]-piperidine-1-carboxylic acid tert-butyl ester (1.34 g, 3.55 mmol) in acetic acid (20 mL) was added 2-hydrazinopyridine (1.94 g, 17.8 mmol). After overnight stirring at 120 °C, the reaction was concentrated under vacuum and the product was purified using a Single Step column (9:1 dichloromethane:methanol) to obtain 295 mg; MS m/z 351 (M + H).

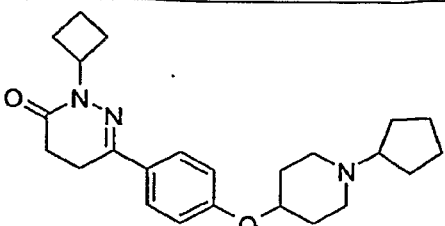
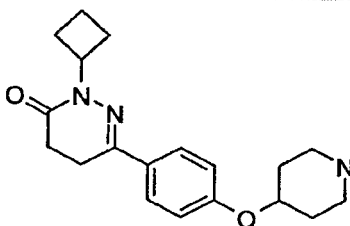
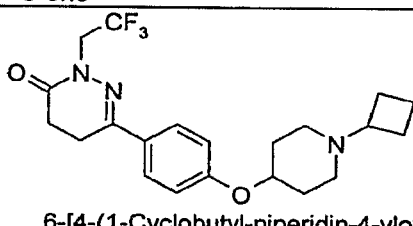
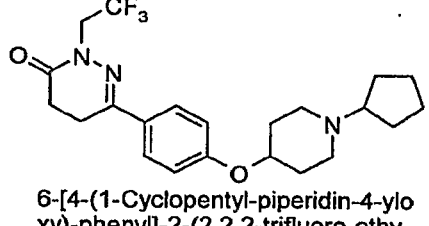


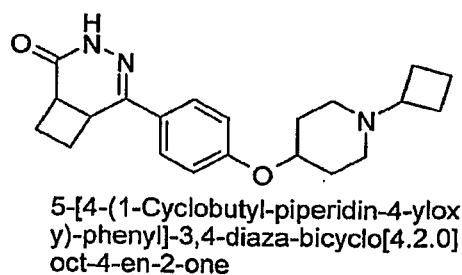
6-[4-(1-Cyclobutyl-piperidin-4-yloxy)-phenyl]-2-pyridin-2-yl-4,5-dihydro-2H-pyridazin-3-one

Example 158 was synthesized from the product in step 1 by reductive amination described for example 150 and forming the HCl salt; Mp 263-265 MS m/z 405 (M + H).

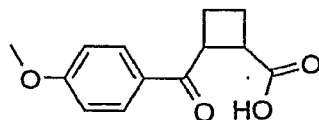
Examples 159-167 were prepared using methods described for examples 150-157.

Example	Structure	Mp (°C)	MS m/z
159	 6-[4-((R)-1-Cyclohexyl-pyrrolidin-3-yloxy)-phenyl]-4,5-dihydro-2H-pyridazin-3-one	184-6	342 (M + H)
160	 6-[4-((R)-1-Cyclohexyl-pyrrolidin-3-yloxy)-phenyl]-2H-pyridazin-3-one	200-2	340 (M + H)
161	 6-[4-((R)-1-Cyclobutyl-pyrrolidin-3-yloxy)-phenyl]-2H-pyridazin-3-one	----	311 (M + H)
162	 6-[4-((R)-1-Cyclopentyl-pyrrolidin-3-yloxy)-phenyl]-4,5-dihydro-2H-pyridazin-3-one	----	328 (M + H)
163	 2-Cyclobutyl-6-[4-(1-cyclobutyl-piperidin-4-yloxy)-phenyl]-4,5-dihydro-2H-pyridazin-3-one	120-123	382 (M + H)

Example	Structure	Mp (°C)	MS m/z
164	 2-Cyclobutyl-6-[4-(1-cyclopentyl-piperidin-4-yloxy)-phenyl]-4,5-dihydro-2H-pyridazin-3-one	100-104	396 (M + H)
165	 2-Cyclobutyl-6-[4-(piperidin-4-yloxy)-phenyl]-4,5-dihydro-2H-pyridazin-3-one	168-170	328 (M + H)
166	 6-[4-(1-Cyclobutyl-piperidin-4-yloxy)-phenyl]-2-(2,2,2-trifluoro-ethyl)-4,5-dihydro-2H-pyridazin-3-one	146-147	410 (M + H)
167	 6-[4-(1-Cyclopentyl-piperidin-4-yloxy)-phenyl]-2-(2,2,2-trifluoro-ethyl)-4,5-dihydro-2H-pyridazin-3-one	225-227	424 (M + H)

Example 172

Step 1



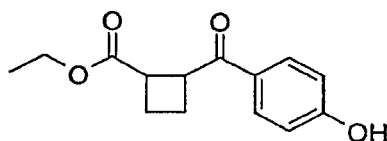
2-(4-Methoxy-benzoyl)-cyclobutanecarboxylic acid

5

To 3-oxabicyclo[3.2.0]heptane-2,4-dione (8.00 g, 63.4 mmol) in THF (90.00 mL) at -78 °C was added 0.500 M of p-anisyl magnesium bromide (133 mL, 66.6 mmol) in THF (90 mL) dropwise. After stirring at -78 °C for 2 h, the reaction was quenched with ice cold water and concentrated. The aqueous layer was acidified and the white solid was filtered off and dried to obtain 9.72 g product (65%); MS m/z 233 (M - H).

10

Step 2



2-(4-Hydroxy-benzoyl)-cyclobutanecarboxylic acid ethyl ester

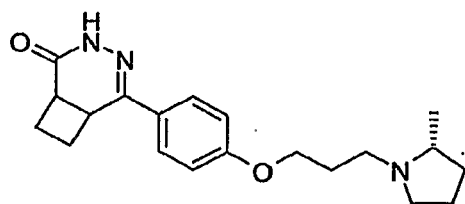
15

To 2-(4-methoxy-benzoyl)-cyclobutanecarboxylic acid (10.28 g, 43.88 mmol) was added 48% hydrogen bromide in water (50 mL) and acetic acid (50 mL). After overnight stirring at 120 °C, the reaction was concentrated, stirred with ethanol a few times, and the product was purified using a Single Step column (7:3 hexanes:ethyl acetate) to obtain 7.70 g (71%); MS m/z 247 (M - H)

20

Example 172 HCl was synthesized from the product in step 2 using procedures described for example 150; Mp 285-288 °C; MS m/z 354 (M + H)

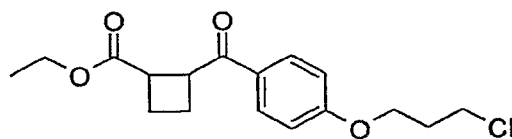
Example 173



5-{4-[3-((R)-2-Methyl-pyrrolidin-1-yl)-propoxy]-phenyl}-3,4-diazabicyclo[4.2.0]oct-4-en-2-one

25

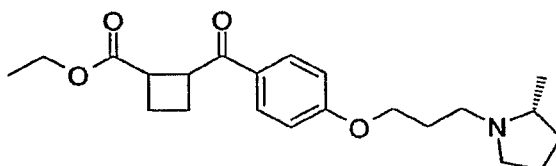
Step 1



2-[4-(3-Chloro-propoxy)-benzoyl]-cyclobutanecarboxylic acid ethyl ester

To 2-(4-hydroxy-benzoyl)-cyclobutanecarboxylic acid ethyl ester (0.55 g, 2.20 mmol) in acetone (10 mL) was added potassium carbonate (0.91 g, 6.58 mmol) and 1-bromo-chloropropane (0.26 mL, 2.63 mmol). After overnight stirring at 70 °C, the reaction was filtered, partitioned between dichloromethane/water, washed with brine, dried over sodium sulfate, and concentrated. The product was purified using a Single Step column (9:1 hexanes:ethyl acetate) to obtain 0.30 g (42%); MS m/z 325 (M + H).

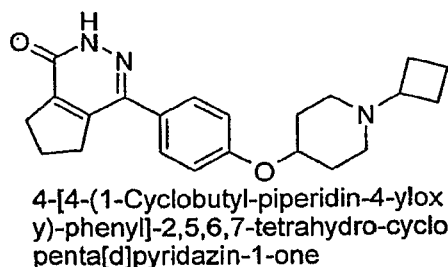
Step 2



2-[4-[3-((R)-2-Methyl-pyrrolidin-1-yl)-propoxy]-benzoyl]-cyclobutanecarboxylic acid ethyl ester

To 2-[4-(3-chloro-propoxy)-benzoyl]-cyclobutanecarboxylic acid ethyl ester (0.300 g, 0.924 mmol) in acetonitrile (15 mL) was added (R)-2-methyl-pyrrolidine, benzenesulfonic acid salt (0.337 g, 1.38 mmol), potassium carbonate (0.383 g, 2.77 mmol), and potassium iodide (0.153 g, 0.924 mmol). After overnight stirring at 80 °C, the reaction was filtered, diluted with dichloromethane, washed with water/brine, dried over sodium sulfate, and concentrated. The product was purified using a Single Step column (5% methanol/dichloromethane) to obtain 0.213 g (62%); MS m/z 374 (M+H).

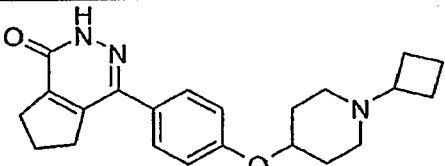
Example 173 was synthesized using methods described for example 1 and example 11.

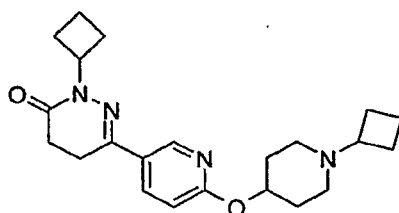
Example 176

- 5 To example 174 (0.500 g, 1.36 mmol) in DMSO (5 mL) was added cesium carbonate (0.887 g, 2.72 mmol). After overnight stirring at 140 °C open to air, the reaction was poured into water, extracted with dichloromethane, washed with water/brine, dried over sodium sulfate, and concentrated. The product was purified using Prep. TLC plates (9:1 dichloromethane:methanol); Mp = 210-213 °C; MS m/z 366 (M + H).

10

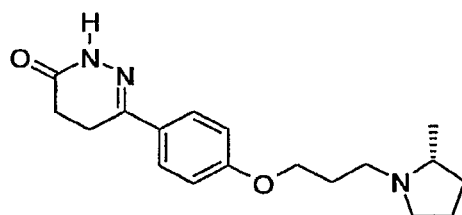
Example	Structure	Mp (°C)	MS m/z
172	5-[4-(1-Cyclobutyl-piperidin-4-yloxy)-phenyl]-3,4-diaza-bicyclo[4.2.0]oct-4-en-2-one	285-288	354 (M + H)
173	5-[4-[3-((R)-2-Methyl-pyrrolidin-1-yl)-propoxy]-phenyl]-3,4-diaza-bicyclo[4.2.0]oct-4-en-2-one	218-220	342 (M + H)
174	4-[4-(1-Cyclobutyl-piperidin-4-yloxy)-phenyl]-2,4a,5,6,7,7a-hexahydro-cyclopenta[d]pyridazin-1-one	dec.>255	368 (M + H)
175	4-[4-[3-((R)-2-Methyl-pyrrolidin-1-yl)-propoxy]-phenyl]-2,4a,5,6,7,7a-hexahydro-cyclopenta[d]pyridazin-1-one	218-219	356 (M + H)

Example	Structure	Mp (°C)	MS m/z
176	 4-[4-(1-Cyclobutyl-piperidin-4-yloxy)-phenyl]-2,5,6,7-tetrahydro-cyclopenta[d]pyridazin-1-one	210-213	366 (M + H)

Example 177

2-Cyclobutyl-6-[6-(1-cyclobutyl-piperidin-4-yloxy)-pyridin-3-yl]-4,5-dihydro-2H-pyridazin-3-one

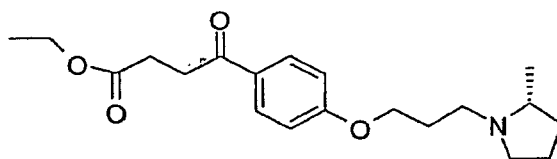
This compound was prepared using ethyl-4-(4-chloro-3-pyridyl)-4-oxobutyrates and cyclobutyl hydrazine using methods described for examples 139 and 143; Mp 146-49 MS m/z 384 (M + H).

**Example 178
Method A**

6-[4-[3-((R)-2-Methyl-pyrrolidin-1-yl)-propoxy]-phenyl]-4,5-dihydro-2H-pyridazin-3-one

Step 1 4-(4-Hydroxy-phenyl)-4-oxo-butyric acid ethyl ester (3.0 g, 13.5 mmol), 1-bromo-3-chloropropane (4.2 g, 27 mmol) and K₂CO₃ (5.6 g, 41 mmol) in acetonitrile (50 mL) was stirred at reflux for 12 h. The reaction was filtered, concentrated and purified by silica gel chromatography to give 3.2 g (80%).

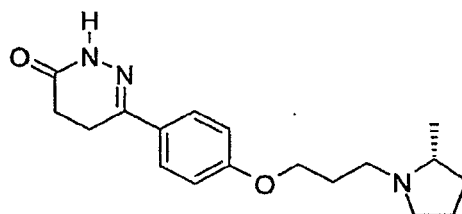
Step 2



4-{4-[3-((R)-2-Methyl-pyrrolidin-1-yl)-propoxy]-phenyl}-4-oxo-butyric acid ethyl ester

The product from step 1 (3.1 g, 10.4 mmol), R-2-methylpyrrolidine HCl (2.5g, 21 mmol), KI (0.9 g) and K₂CO₃ (4.1 g, 2.9 mmol) in acetonitrile (75 mL) was stirred at 90 °C for 2 days. The reaction was cooled, filtered and concentrated. The residue was dissolved in Et₂O (75 mL) and washed with water and NaCl solution, dried (MgSO₄) and concentrated to an oil; MS m/e 348 (M + H).

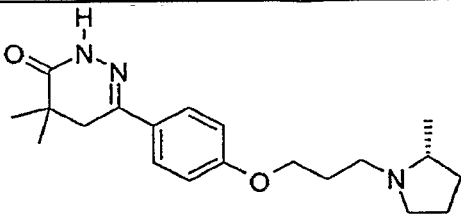
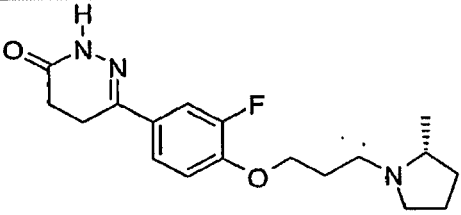
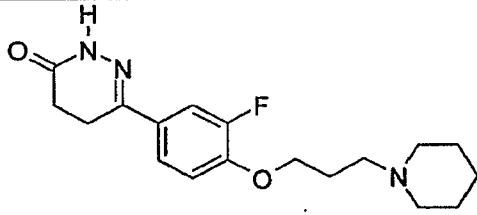
Step 3.

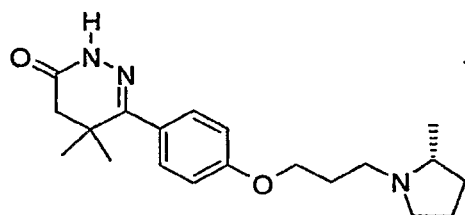


6-{4-[3-((R)-2-Methyl-pyrrolidin-1-yl)-propoxy]-phenyl}-4,5-dihydro-2H-pyridazin-3-one

The product from step 2 (3.0 g, 8.6 mmol) and hydrazine hydrate (0.33 g, 10 mmol) in isopropanol (50 mL) was stirred at 95 °C for 24 h. The reaction was cooled to rt, concentrated and the product recrystallized from EtOAc – hexane; Mp 142-45; MS m/z 316 (M + H).

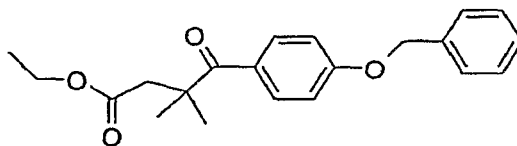
The examples in the following table were synthesized using conditions for example 178 starting with 4-(4-hydroxy-phenyl)-2,2-dimethyl-4-oxo-butyric acid ethyl ester or 4-(3-fluoro-4-hydroxy-phenyl)-4-oxo-butyric acid ethyl ester.

Example	Structure	Mp (°C)	MS m/z
179	 4,4-Dimethyl-6-{4-[3-((R)-2-methyl-pyrrolidin-1-yl)-propoxy]-phenyl}-4,5-dihydro-2H-pyridazin-3-one	140-2 base	344 (M + H)
180	 6-{3-Fluoro-4-[3-((R)-2-methyl-pyrrolidin-1-yl)-propoxy]-phenyl}-4,5-dihydro-2H-pyridazin-3-one	132-3 base	334 (M + H)
181	 6-[3-Fluoro-4-(3-piperidin-1-yl-propoxy)-phenyl]-4,5-dihydro-2H-pyridazin-3-one	164-166 base	334 (M + H)

Example 182

5,5-Dimethyl-6-{4-[3-((R)-2-methyl-pyrrolidin-1-yl)-propoxy]-phenyl}-4,5-dihydro-2H-pyridazin-3-one

Step 1.

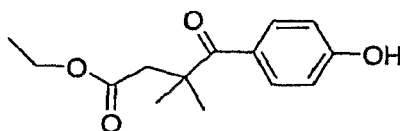


4-(4-Benzyloxy-phenyl)-3,3-dimethyl
-4-oxo-butanoic acid ethyl ester

(4-Benzyloxy-phenyl)-trimethylsilanyloxy-acetonitrile (3.0 g, 9.63 mmol) in THF (100 mL) under a nitrogen atmosphere was added LDA (7.2 mL of 2 M in THF) at -72 °C.

- 5 After 0.5 h, methyl 3-methylbut-2-enoate (1.23 mL, 10.1 mmol) in 1 THF (15 mL) was added dropwise. The reaction was stirred at 0 °C for 4 h, and then saturated NH₄Cl was added. The THF was removed at reduced pressure; Et₂O was added (50 mL) and washed with saturated NH₄Cl, water, dried (Na₂SO₄), and concentrated to give an oil. The oil was dissolved in THF (50 mL) and TBAF (10.1 mL of 1 M THF solution) was added at 0 °C
- 10 dropwise. After stirring 12 h at rt the reaction was concentrated, dissolved in Et₂O and washed with water, NaCl solution and dried (MgSO₄). The product was purified by silica gel chromatography (10-20% EtOAc/hexanes) to give 1.5 g; Mp 72-73.

Step 2.



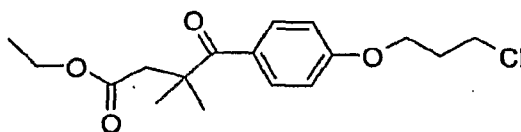
4-(4-Hydroxy-phenyl)-3,3-dimethyl-4
-oxo-butanoic acid ethyl ester

15

The product from step 1 (1.25 g, 3.83 mmol) and 10% Pd/C (0.3 g) in MeOH (50 mL) was hydrogenated on a Parr apparatus until TLC indicated completion of the reaction. The mixture was filtered, concentrated to an oil and used directly in the next step; MS m/z

20 204 (M - OMe).

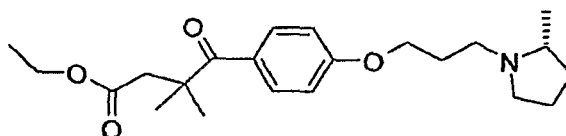
Step 3.



4-[4-(3-Chloro-propoxy)-phenyl]-3,3
-dimethyl-4-oxo-butanoic acid ethyl
ester

The product from step 2 (1.0 g, 4.2 mmol), 1-bromo-3-chloropropane (1.0 g, 8 mmol) and K_2CO_3 in acetonitrile (20 mL) was heated to reflux for 24 h. The reaction was cooled, filtered, concentrated to an oil and purified by ISCO silica gel chromatography (10% EtOAc/hexanes) to give 0.7 g.

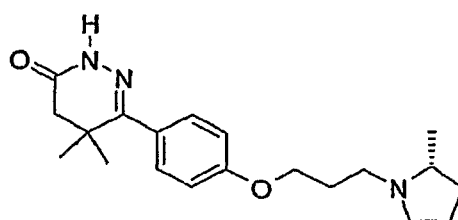
Step 4.



3,3-Dimethyl-4-{4-[3-((R)-2-methylpyrrolidin-1-yl)propoxy]phenyl}-4-oxo-butyric acid ethyl ester

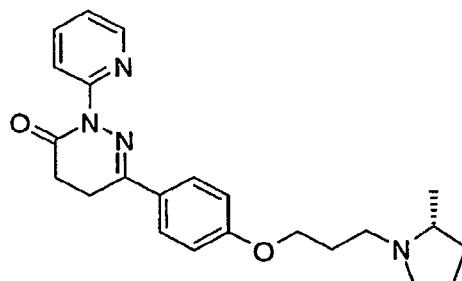
The product from step 3 (0.75 g, 2.4 mmol), R-2-methylpyrrolidine benzene sulfonic acid salt (1.0 g, 5 mmol), K_2CO_3 (1 g, 7 mmol) and KI (0.1 g) in acetonitrile (25 mL) were heated at 90 °C for 2 days. The reaction was filtered, concentrated, dissolved in Et₂O and washed with water, NaCl solution and dried ($MgSO_4$) to give 0.7 g as an oil; MS m/z 376 (M + H).

Example 182. Step 5.

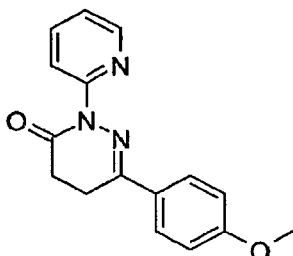


5,5-Dimethyl-6-{4-[3-((R)-2-methylpyrrolidin-1-yl)propoxy]phenyl}-4,5-dihydro-2H-pyridazin-3-one

The product from step 4 (0.75 g, 2.1 mmol) and hydrazine hydrate (2.0 mL) in acetonitrile (25 mL) were heated to reflux for 24 h. The reaction was cooled, concentrated and the product recrystallized using Et₂O-hexanes to give 600 mg (71%); Mp 118-121; MS m/z 344 (M + H).

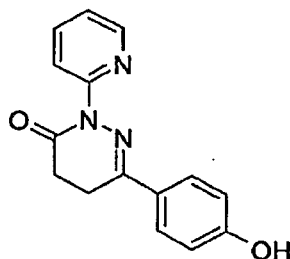
Example 183

6-{4-[3-((R)-2-Methyl-pyrrolidin-1-yl)-propoxy]-phenyl}-2-pyridin-2-yl-4,5-dihydro-2H-pyridazin-3-one

5 Step 1.

6-(4-Methoxy-phenyl)-2-pyridin-2-yl-4,5-dihydro-2H-pyridazin-3-one

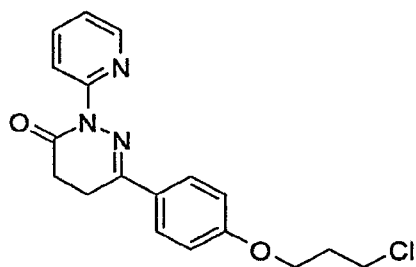
In a 1 neck round bottom flask equipped with a Dean-Stark trap and condenser, 4-(4-methoxyphenyl)-4-oxo-butyric acid (5.0 g, 20 mmol), 2-hydrazinopyridine (3.9 g, 36 mmol) and p-toluene sulfonic acid (0.3 g) in 100 mL benzene were heated to reflux for 2 h while water was removed. The reaction was cooled to rt, an equal volume of Et₂O was added and the product collected; Mp > 300 °C. This solid was dissolved in HOAc (50 mL) and heated at 100 °C for 6 h. The reaction was concentrated, dissolved in EtOAc and washed with saturated NaHCO₃ solution, water, NaCl solution and dried (MgSO₄). The solvent was concentrated to a thick oil; MS m/z 282 (M + H).

15 Step 2.

6-(4-Hydroxy-phenyl)-2-pyridin-2-yl-4,5-dihydro-2H-pyridazin-3-one

The product from step 1 (1.25 g, 4.4 mmol) in DCM (30 mL) was added BBr₃ (30 mL, 1 M in DCM) dropwise at 0 °C. After stirring 4 h at rt, the mixture was cooled to 0-5 °C on an ice-bath while saturated NH₄Cl solution (30 mL) was added dropwise. Additional
 5 water was added and the DCM was removed at reduced pressure. The solid was collected and dried to give 1.1 g (93%) of a tan solid; Mp > 220 °C; MS m/z 268 (M + H).

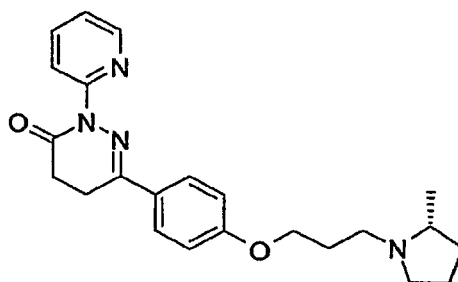
Step 3.



6-[4-(3-Chloro-propoxy)-phenyl]-2-pyridin-2-yl-4,5-dihydro-2H-pyridazin-3-one

The product from step 3 (5.0 g, 20 mmol), 1-bromo-3-chloropropane (5.9 g, 37.4 mmol) and K₂CO₃ (7.8 g, 56 mmol) in acetonitrile (50 mL) was heated to reflux for 24 h. The reaction was cooled to rt, filtered and concentrated to a thick oil. The product was dissolved in EtOAc and washed with water, NaCl solution and dried (MgSO₄). The product
 15 was purified by ISCO silica gel chromatography (95/5/1 DCM/MeOH/i-propylamine) to give 3.7 g of a dark oil; MS m/z 344 (M + H).

Example 183, step 4.

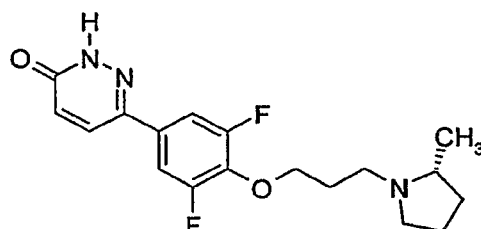


6-[4-[3-((R)-2-Methyl-pyrrolidin-1-yl)-propoxy]-phenyl]-2-pyridin-2-yl-4,5-dihydro-2H-pyridazin-3-one

The product from step 3 (3.7 g, 10.8 mmol), R-2-methylpyrrolidine benzene sulfonic acid salt (5.24 g, 21.5 mmol), K₂CO₃ (4.46 g, 32.3 mmol) and KI (0.9 g) in acetonitrile (50 mL) were heated to reflux for 2 days. The reaction was cooled, filtered and concentrated. The residue was purified by ISCO silica gel chromatography (95/5/1 DCM/MeOH/i-

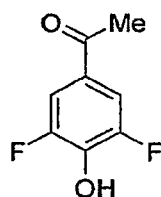
propylamine). The fractions were concentrated and the HCl salt was prepared using 2M HCl / ether and recrystallized from CH₃CN/ether; Mp 203-205 °C; MS m/z 393 (M + H).

Example 184



6-{3,5-Difluoro-4-[3-((R)-2-methylpyrrolidin-1-yl)-propoxy]-phenyl}-2H-pyridazin-3-one

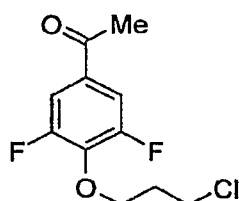
Step 1



1-(3,5-Difluoro-4-hydroxyphenyl)-ethanone

A mixture of 1-(3,5-difluoro-4-methoxyphenyl)ethanone (12 g, 64.5 mmol) and 48% aqueous HBr (32 mL) was stirred at reflux for 30 h. The reaction was cooled to rt and diluted with water and the aqueous layer was extracted twice with methylene chloride. The combined organics were dried (Na₂SO₄), filtered, and concentrated to give 1-(3,5-difluoro-4-hydroxyphenyl)ethanone (10 g, 91%), mp 141-143 °C; MS m/z 171 (M - H).

Step 2

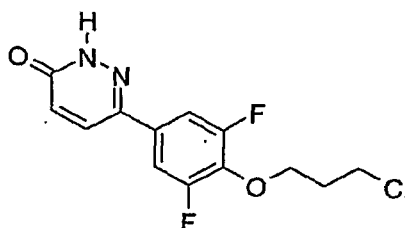


1-[4-(3-Chloro-propoxy)-3,5-difluoro-phenyl]-ethanone

A mixture of 1-(3,5-difluoro-4-hydroxyphenyl)ethanone (8.1 g, 47 mmol), 3-bromo-1-chloropropane (14.7 g, 93 mmol) and K₂CO₃ (21.3 g, 154 mmol) in acetone (120 mL) was stirred at reflux for 20 h. The reaction was cooled to rt and concentrated at reduced pressure,

then partitioned between water and methylene chloride. The aqueous layer was extracted twice with methylene chloride to obtain 1-[4-(3-chloropropoxy)-3,5-difluorophenyl]ethanone (12.9 g, quantitative yield); MS m/z 249 ($M + H$).

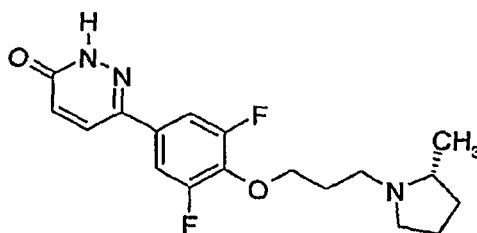
5 Step 3



6-[4-(3-Chloro-propoxy)-3,5-difluorophenyl]-2H-pyridazin-3-one

A mixture of 1-(4-(3-chloropropoxy)-3,5-difluorophenyl]ethanone (11 g, 44.7 mmol) and glyoxalic acid monohydrate (4.2 g, 46.5 mmol) in acetic acid (16 mL) was stirred at 100 °C for 4 h. The acetic acid was evaporated at reduced pressure and diluted with water then cooled to 0 °C and neutralized with ammonium hydroxide to pH 8. To this mixture, hydrazine monohydrate (4.3 mL, 86 mmol) was added and heated at 100 °C for 1 h. The reaction was cooled to rt and the solid was filtered, then dried to give a crude product. The crude product was triturated sequentially with 5% aqueous sodium bicarbonate solution and with a mixture of methylene chloride, methanol, ether and hexane to provide relatively pure product. The product was purified by ISCO (120 g silica gel column) chromatography using 2 to 8% methanol in methylene chloride to furnish 6-[4-(3-chloropropoxy)-3,5-difluorophenyl]-2H-pyridazin-3-one (7.9 g, 59%), MS m/z 301 ($M + H$).

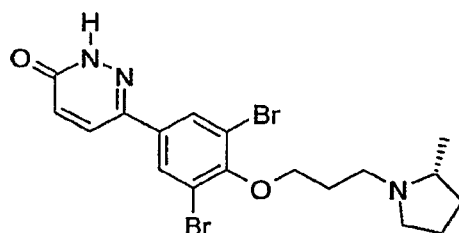
Step 4



6-{3,5-Difluoro-4-[3-((R)-2-methylpyrrolidin-1-yl)-propoxy]-phenyl}-2H-pyridazin-3-one

A mixture of 6-[4-(3-chloropropoxy)-3,5-difluorophenyl]-2H-pyridazin-3-one (7.9 g, 26.3 mmol), K₂CO₃ (12.7 g 91.9 mmol), NaI (144 mg, 0.96 mmol) and *R*-methylpyrrolidinium benzenesulfonate (13.4 g, 55.3 mmol) in CH₃CN (200 mL) was heated under argon at 80 °C for 35 h. The mixture was filtered over celite and concentrated at reduced pressure and partitioned between saturated aqueous sodium bicarbonate solution and methylene chloride. The aqueous layer was extracted twice with methylene chloride and the combined organics were washed with brine, dried (Na₂SO₄), and concentrated. The crude product was purified by ISCO (120 g silica gel column) chromatography using 2 to 5% methanol in methylene chloride to 10% methanol containing 0.25% ammonium hydroxide in methylene chloride to obtain 6-{3,5-difluoro-4-[3-(*R*)-2-methylpyrrolidin-1-yl]propoxy}-phenyl}-2H-pyridazin-3-one (4.3 g). The product was precipitated using a mixture of ethanol and acetonitrile to provide a pure product (0.5 g). Mp 169-171 °C; MS m/z 350 (M + H).

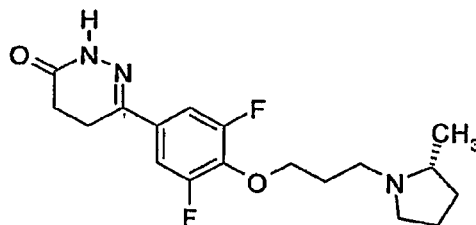
Example 185



6-{3,5-Dibromo-4-[3-((*R*)-2-methyl-pyrrolidin-1-yl)-propoxy]-phenyl}-2H-pyridazin-3-one

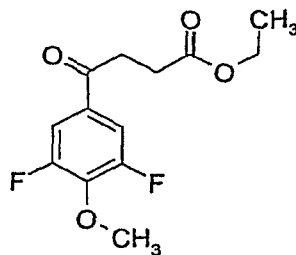
Example 185 was synthesized using the procedure for example 184; Mp 165-167 °C; MS m/z 472 (M + H).

Example 186



6-{3,5-Difluoro-4-[3-((*R*)-2-methyl-pyrrolidin-1-yl)-propoxy]-phenyl}-4,5-dihydro-2H-pyridazin-3-one

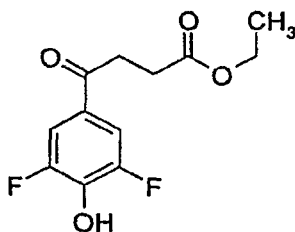
Step 1



4-(3,5-Difluoro-4-methoxy-phenyl)-4-oxo-butanoic acid ethyl ester

A mixture of 1,3-difluoro-2-methoxybenzene (2.5 g, 17.3 mmol) and ethyl succinyl chloride (4.29 g, 26 mmol) in 1, 2-dichloroethane (25 mL) was cooled to 0 °C. Aluminum chloride (8 g, 60.1 mmol) was added slowly at 0 °C then stirred at rt for 2 h and quenched with ice and aqueous 2N HCl at 0 °C. The aqueous layer was extracted twice with methylene chloride and the combined organics were washed with brine, dried (Na₂SO₄), filtered, and concentrated to provide a crude product. The crude product was purified by ISCO (80 g silica gel column) chromatography using 8.5% EtOAc in hexane to furnish 4-(3,5-difluoro-4-methoxyphenyl)-4-oxo-butanoic acid ethyl ester (2.9 g, 61%),

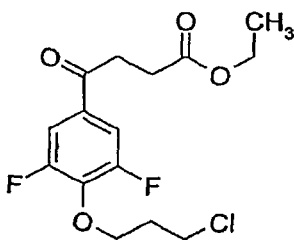
Step 2



4-(3,5-Difluoro-4-hydroxy-phenyl)-4-oxo-butanoic acid ethyl ester

A mixture of 4-(3,5-difluoro-4-methoxy-phenyl)-4-oxo-butanoic acid ethyl ester (2.9 g, 10.6 mmol) and 48% aqueous HBr (15 mL) in acetic acid (30 mL) was stirred at reflux for 8 h. The reaction was cooled to rt and treated three times with ethanol and then concentrated at reduced pressure to provide a crude material. The crude material was dissolved in methylene chloride and washed with water, brine, dried (Na₂SO₄), filtered, and concentrated to afford 4-(3,5-difluoro-4-hydroxyphenyl)-4-oxo-butanoic acid ethyl ester (2.5 g, 92%), MS m/z 257 (M + H).

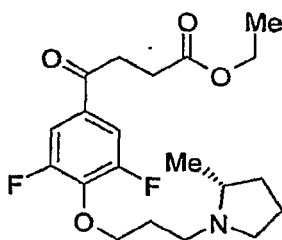
Step 3



4-[4-(3-Chloro-propoxy)-3,5-difluorophenyl]-4-oxo-butanoic acid ethyl ester

5 A mixture of 4-[4-(3-chloropropoxy))-4-oxo-butanoic acid ethyl ester (2.5 g, 9.6 mmol), 3-bromo-1-chloropropane (1.9 mL, 18.5 mmol) and K_2CO_3 (4 g, 28.9 mmol) in acetone (25 mL) was stirred at reflux for 15 h. The reaction was cooled to rt and concentrated at reduced pressure, then partitioned between water and methylene chloride. The aqueous layer was extracted twice with methylene chloride and the combined organics were washed with brine, dried (Na_2SO_4), filtered, and concentrated to obtain a crude product. The crude product was purified by ISCO (80 g silica gel column) chromatography using 10 to 12.5% EtOAc in hexane to provide 4-[4-(3-chloro-propoxy)-3,5-difluorophenyl]-4-oxo-butanoic acid ethyl ester (3.1 g, 96%).

Step 4

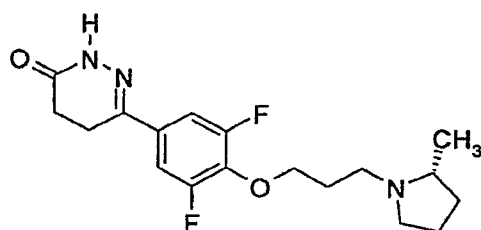


4-{3,5-Difluoro-4-[3-((R)-2-methylpyrrolidin-1-yl)-propoxy]-phenyl}-4-oxo-butanoic acid ethyl ester

20 A mixture of 4-[4-(3-chloropropoxy)-3,5-difluorophenyl]-4-oxo-butanoic acid ethyl ester (5 g, 14.9 mmol), K_2CO_3 (7.2 g, 52.1 mmol), NaI (220 mg, 1.4 mmol), and Benzenesulfonate; (R)-methylpyrrolidinium (8 g, 33 mmol) in CH_3CN (110 mL) was heated under argon at 80 °C for 36 h. The reaction was concentrated and partitioned between saturated aqueous sodium bicarbonate solution and methylene chloride. The aqueous layer was extracted twice with methylene chloride and the combined organics was washed with brine, dried (Na_2SO_4), filtered, and concentrated to provide a crude material (96% purity).

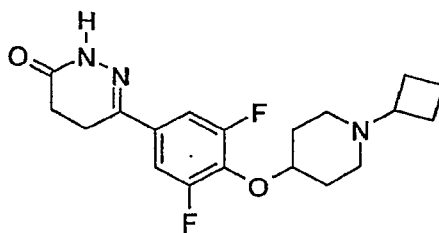
The crude material was purified by ISCO (80 g silica gel column) chromatography using 2% to 9% methanol in methylene chloride to 10% methanol containing 0.1% ammonium hydroxide in methylene chloride. The isolated material was dissolved in methylene chloride and washed with saturated aqueous sodium bicarbonate solution, brine, dried (Na_2SO_4), filtered, and concentrated. The isolated material was crystallized with a mixture of methylene chloride, ether and hexane to obtain 4-{3,5-difluoro-4[3-(*R*)-2-methyl-pyrrolidin-1-yl]-propoxy}-phenyl}-4-oxo-butyric acid ethyl ester (3.97 g, 70%, 99% purity), MS m/z = 384 ($M + H$).

Step 5

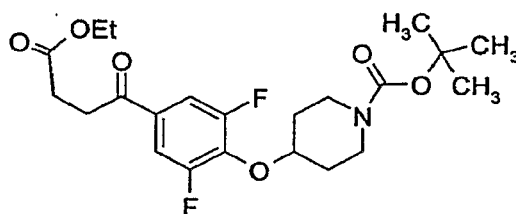


6-{3,5-Difluoro-4-[3-((*R*)-2-methyl-pyrrolidin-1-yl)-propoxy]-phenyl}-4,5-dihydro-2H-pyridazin-3-one

A mixture of 4-{3, 5-difluoro-4[3-(*R*)-2-methyl-pyrrolidin-1-yl]-propoxy}-phenyl}-4-oxo-butyric acid ethyl ester (3.97 g, 10.4 mmol) and hydrazine monohydrate (1 mL, 20.7 mmol) in isopropanol (25 mL) was heated at 110 °C for 17 h. Isopropanol was evaporated at reduced pressure and partitioned between saturated aqueous sodium bicarbonate solution and methylene chloride. The aqueous layer was extracted twice with methylene chloride and the combined organics was washed with brine, dried (Na_2SO_4), filtered, and concentrated to provide a crude material. The crude material was purified by ISCO (80 g) chromatography using 2 to 8% methanol in methylene chloride to 10% methanol containing 0.2% ammonium hydroxide in methylene chloride. The isolated material was dissolved in methylene chloride and washed with saturated aqueous sodium bicarbonate solution, brine, dried (Na_2SO_4), filtered, and concentrated. The pure material was crystallized using a mixture of methylene chloride, ether and hexane to obtain 6-{3,5-difluoro-4-[3-(*R*)-2-methyl-pyrrolidin-1-yl]-propoxy}-phenyl}-4,5-dihydro-2H-pyridazin-3-one (2 g, 55%, 98% purity), mp 102-104 °C, MS m/z 352 ($M + H$).

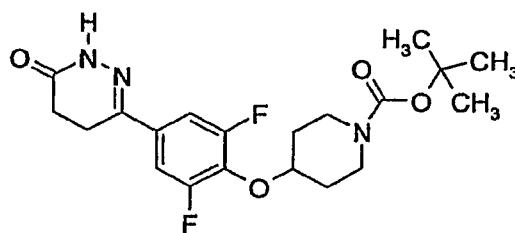
Example 187

6-[4-(1-Cyclobutyl-piperidin-4-yloxy)-3,5-difluoro-phenyl]-4,5-dihydro-2H-pyridazin-3-one

5 Step 1

4-[4-(3-Ethoxycarbonyl-propionyl)-2,6-difluoro-phenoxy]-piperidine-1-carboxylic acid tert-butyl ester

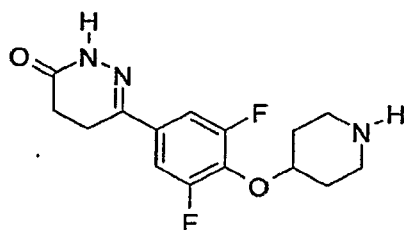
To a solution of triphenylphosphine (5.79 g, 22.1 mmol) in THF (35 mL) was added 40% w/w DEAD in toluene (10 mL, 15 mmol). The mixture was cooled to 0 °C and a mixture of 4-(3,5-difluoro-4-hydroxy-phenyl)-4-oxo-butyric acid ethyl ester (example 186 step 2) (3.8 g, 14.7 mmol) and 4-hydroxy-piperidine-1-carboxylic acid tert-butyl ester (3.6 g, 18 mmol) in THF (35 mL) was added dropwise under argon. After the addition, the cooling bath was removed and stirred at rt overnight. The reaction mixture was concentrated at reduced pressure and purified by ISCO (120 g) chromatography using 15 to 30% EtOAc in hexane to provide 4-[4-(3-ethoxycarbonyl-propionyl)-2,6-difluoro-phenoxy]-piperidine-1-carboxylic acid tert-butyl ester (3.21 g, 49% yield).

Step 2

4-[2,6-Difluoro-4-(6-oxo-1,4,5,6-tetrahydro-pyridazin-3-yl)-phenoxy]-piperidine-1-carboxylic acid tert-butyl ester

A mixture of 4-[4-(3-ethoxycarbonyl-propionyl)-2,6-difluoro-phenoxy]-piperidine-1-carboxylic acid tert-butyl ester (3.21 g, 7.27 mmol) and hydrazine monohydrate (0.7 mL, 14.1 mmol) in isopropanol (20 mL) was stirred at reflux overnight. Isopropanol was concentrated at reduced pressure and partitioned between saturated aqueous sodium bicarbonate solution and methylene chloride. The aqueous layer was extracted twice with methylene chloride and the combined organics was washed with brine, dried (Na_2SO_4), filtered, and concentrated to provide a crude material. The crude material was purified by ISCO (80 g silica gel column) chromatography using 15 to 60% EtOAc in hexane to obtain 4-[2,6-difluoro-4-(6-oxo-1,4,5,6-tetrahydro-pyridazin-3-yl)-phenoxy]-piperidine-1-carboxylic acid tert-butyl ester (0.42 g, 14%).

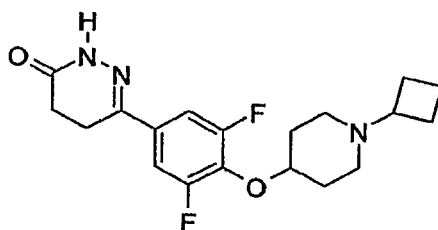
Step 3



6-[3,5-Difluoro-4-(piperidin-4-yloxy)-phenyl]-4,5-dihydro-2H-pyridazin-3-one

A solution of 4-[2,6-difluoro-4-(6-oxo-1,4,5,6-tetrahydro-pyridazin-3-yl)-phenoxy]-piperidine-1-carboxylic acid tert-butyl ester (0.42 g, 1 mmol) in methylene chloride (5 mL) was treated with trifluoro acetic acid (10 mL). The mixture was stirred at RT for 3 h and TFA was concentrated at reduced pressure to give 6-[3,5-difluoro-4-(piperidin-4-yloxy)-phenyl]-4,5-dihydro-2H-pyridazin-3-one (0.35 g, quantitative yield), MS m/z 310 ($M + H$).

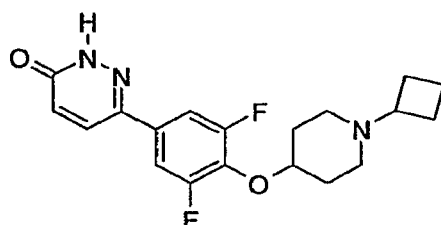
Step 4



6-[4-(1-Cyclobutyl-piperidin-4-yloxy)-3,5-difluoro-phenyl]-4,5-dihydro-2H-pyridazin-3-one

A solution of 6-[3,5-difluoro-4-(piperidin-4-yloxy)-phenyl]-4,5-dihydro-2H-pyridazin-3-one (350 mg, 1.1 mmol) in a mixture of DMF (2 mL) and MeOH (9 mL) was stirred under argon. Cyclobutanone (0.38 mL, 5 mmol), sodium cyanoborohydride (0.53 g, 8.45 mmol) and acetic acid (0.4 mL, 7 mmol) were added sequentially and stirred at 60 °C for 3 h. The reaction mixture was concentrated at reduced pressure and partitioned between aqueous 1M sodium carbonate solution and methylene chloride. The aqueous layer was extracted twice with methylene chloride and the combined organics was washed with brine, dried (Na₂SO₄), filtered and concentrated to provide a crude product. The crude product was purified by ISCO (40 g) chromatography using 2 to 5% methanol in methylene chloride to 10% methanol containing 0.2% ammonium hydroxide in methylene chloride. The recovered product was dissolved in methylene chloride and washed with saturated aqueous sodium bicarbonate solution, brine, dried (Na₂SO₄), filtered, and concentrated to furnish a pure product. The pure product was crystallized with a mixture of methylene chloride, ethanol, ether and hexane to obtain 6-[4-(1-cyclobutyl-piperidin-4-yloxy)-3,5-difluoro-phenyl]-4,5-dihydro-2H-pyridazin-3-one (110 mg, yield), mp 162-164 °C; MS m/z 364 (M + H)

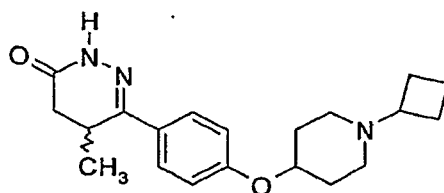
Example 188



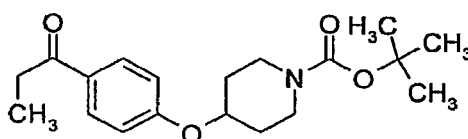
6-[4-(1-Cyclobutyl-piperidin-4-yloxy)-3,5-difluoro-phenyl]-2H-pyridazin-3-one

A mixture of 6-[4-(1-cyclobutyl-piperidin-4-yloxy)-3,5-difluoro-phenyl]-4,5-dihydro-2H-pyridazin-3-one (137 mg, 0.37 mmol) and cesium carbonate (232 mg, 0.71 mmol) in dimethyl sulfoxide (5 mL) was heated at 130 °C 45 min. The mixture was cooled to rt and partitioned between water and methylene chloride. The aqueous layer was extracted twice with methylene chloride and the combined organics was washed with brine, dried (Na₂SO₄), filtered, and concentrated to provide a crude product. The crude product was purified by ISCO (40 g silica gel column) chromatography using 2% to 8% methanol in methylene chloride to 10% methanol containing 0.2% ammonium hydroxide in methylene chloride. The recovered product was dissolved in methylene chloride and washed with

saturated aqueous sodium bicarbonate solution, brine, dried (Na_2SO_4), filtered, and concentrated. The product was crystallized using a mixture of ethanol, ethyl acetate, ether and hexane to give 6-[4-(1-cyclobutyl-piperidin-4yloxy)-3,5-difluoro-phenyl]-2H-pyridazin-3-one (40 mg, 29%); Mp 195-197 °C; MS m/z 362 (M + H).

Example 189

6-[4-(1-Cyclobutyl-piperidin-4-yloxy)-phenyl]
-5-methyl-4,5-dihydro-2H-pyridazin-3-one

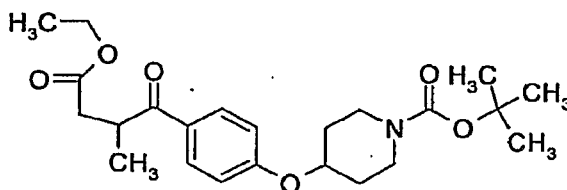
Step 1

4-(4-Propionyl-phenoxy)-piperidine-
1-carboxylic acid tert-butyl ester

A solution of triphenylphosphine (22.4 g, 85.2 mmol) and 40% w/w DEAD in toluene

(12.6 mL, 79.9 mmol) in tetrahydrofuran (100 mL) was cooled to 0 °C. A mixture of *p*-
propiophenol (8 g, 53.3 mmol) and 4-hydroxypiperidine-1-carboxylic acid tert-butyl ester
(12.9 g, 63.9 mmol) in THF (75 mL) was added dropwise at 0 °C. After the addition, the
cooling bath was removed and stirred at rt overnight. The reaction mixture was
concentrated at reduced pressure and purified by ISCO (120 g silica gel column)

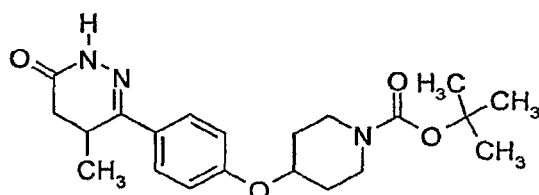
chromatography using 5 to 30% EtOAc in hexane to provide an impure product (12 g). The
product was again treated with triphenylphosphine and 40% w/w DEAD in toluene, after
the completion, the reaction was concentrated at reduced pressure. The crude residue was
trituated with a mixture of methylene chloride and hexane and filtered and the filtrate was
concentrated at reduced pressure and purified by ISCO (120 g silica gel column)
chromatography using 5 to 30% EtOAc in hexane to provide 4-(4-propionylphenoxy)-
piperidine-1-carboxylic acid tert-butyl ester (10 g, 56%).

Step 2

4-[4-(3-Ethoxycarbonyl-2-methyl-pro
pionyl)-phenoxy]-piperidine-1-carbo
xylic acid tert-butyl ester

A solution of 4-(4-propionyl-phenoxy)-piperidine-1-carboxylic acid ethyl ester (5 g, 15 mmol) in tetrahydrofuran (40 mL) was cooled to 0 °C. Lithium diisopropylamide, (2M solution in THF) (8 mL, 16.4 mmol) was added dropwise and warmed to rt for 30 min. The reaction was cooled again to 0 °C and ethyl bromoacetate (1.8 mL, 16 mmol) was added dropwise and warmed to rt for 30 min and then quenched with aqueous 1M HCl acid at 0 °C. The aqueous layer was extracted twice with methylene chloride and the combined organics were washed with brine, dried (Na₂SO₄), filtered, and concentrated to give 4-[4-(3-ethoxycarbonyl-2-methyl-propionyl)-phenoxy]-piperidine-1-carboxylic acid tert-butyl ester (5.8 g, 92%), MS m/z 364 (M - 55).

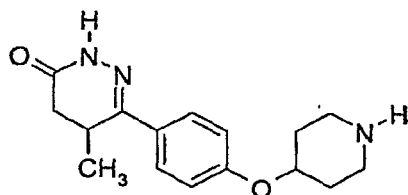
Step 3



4-[4-(4-Methyl-6-oxo-1,4,5,6-tetrahydro-pyridazin-3-yl)-phenoxy]-piperidine-1-carboxylic acid tert-butyl ester

A mixture of crude 4-[4-(3-ethoxycarbonyl-2-methyl-propionyl)-phenoxy]-piperidine-1-carboxylic acid tert-butyl ester (9 g, 21.4 mmol) and hydrazine monohydrate (3.58 mL, 71.6 mmol) in isopropanol (70 mL) was heated at 90 °C for 2 days and concentrated at reduced pressure to give a crude residue. The crude residue was dissolved in methylene chloride and washed with saturated aqueous sodium bicarbonate solution, brine, dried (Na₂SO₄), filtered, and concentrated to give a crude product. The crude product was purified by ISCO (120 g silica gel column) chromatography using 2 to 5% methanol in methylene chloride to obtain 4-[4-(4-methyl-6-oxo-1,4,5,6-tetrahydro-pyridazin-3-yl)-phenoxy]-piperidine-1-carboxylic acid tert-butyl ester (4.4 g, 53%), MS m/z 388 (M + H)

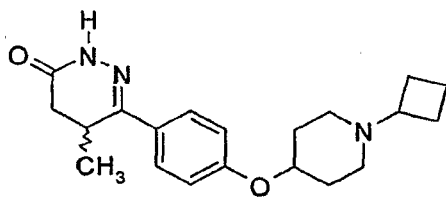
Step 4



5-Methyl-6-[4-(piperidin-4-yloxy)-phenyl]-4,5-dihydro-2H-pyridazin-3-one

A solution of 4-[4-(4-methyl-6-oxo-1,4,5,6-tetrahydro-pyridazin-3-yl)-phenoxy]-piperidine-1-carboxylic acid tert-butyl ester (1 g, 2.5 mmol) in methylene chloride at RT was treated with trifluoroacetic acid (3 mL, 38.9 mmol) and stirred at RT for 3 h. TFA was evaporated at reduced pressure to obtain 5-methyl-6-[4-(piperidin-4-yloxy)-phenyl]-4,5-dihydro-2H-pyridazin-3-one (0.35 g, 47%), MS m/z 288 (M + H).

Step 5



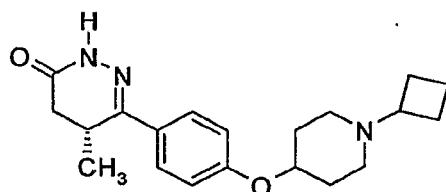
6-[4-(1-Cyclobutyl-piperidin-4-yloxy)-phenyl]-5-methyl-4,5-dihydro-2H-pyridazin-3-one

A solution of 5-methyl-6-[4-(piperidin-4-yloxy)-phenyl]-4,5-dihydro-2H-pyridazin-3-one (3.2 mg, 11 mmol) in a mixture of DMF (4 mL) and MeOH (20 mL) was stirred under argon. Cyclobutanone (4.2 mL, 56 mmol), sodium cyanoborohydride (7 g, 111 mmol) and acetic acid (1.5 mL, 26 mmol) were added sequentially and stirred at 60 °C for 20 h. The reaction mixture was concentrated at reduced pressure then quenched with 1M sodium carbonate solution at 0 °C and extracted twice with methylene chloride to provide a crude product. The crude product was purified by ISCO (40 g silica gel column) chromatography using 2 to 5% methanol in methylene chloride to 10% methanol containing 0.2% ammonium hydroxide in methylene chloride. The recovered product was dissolved in methylene chloride and washed with saturated aqueous sodium bicarbonate solution, brine, dried (Na₂SO₄), filtered, and concentrated to furnish a pure product. The pure product was crystallized using from a mixture of EtOAc, ethanol, ether and hexane to obtain 6-[4-(1-

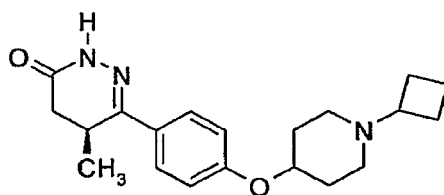
cyclobutyl-piperidin-4-yloxy)-3,5-difluoro-phenyl]-4,5-dihydro-2H-pyridazin-3-one (640 mg, 17%), mp 163-165 °C; MS m/z 342 (M + H).

Example 190

5



(R)-6-[4-(1-Cyclobutyl-piperidin-4-yloxy)-phenyl]-5-methyl-4,5-dihydro-2H-pyridazin-3-one

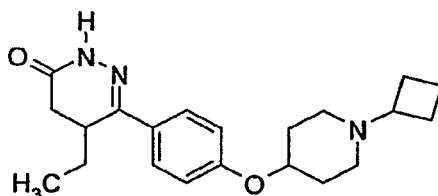
Example 191

(S)-6-[4-(1-Cyclobutyl-piperidin-4-yloxy)-phenyl]-5-methyl-4,5-dihydro-2H-pyridazin-3-one

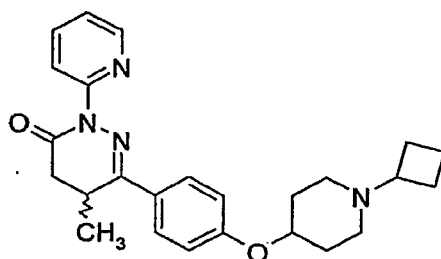
5 Racemic Example 189 (660 mg) was separated into two enantiomers by chiral chromatography using chiralPak and 0.1% diethylamine in methanol.

Example 190: *R*(-)-6-[4-(cyclobutyl-piperidin-4-yloxy)-phenyl]-5-methyl-4,5-dihydro-2H-pyridazin-3-one mp 188-190 °C, MS *m/z* 342 (*M* + *H*), Hg 365 = -29.2, Conc. ~0.1 g/mL

10 Example 191: *S*(+)-6-[4-(cyclobutyl-piperidin-4-yloxy)-phenyl]-5-methyl-4,5-dihydro-2H-pyridazin-3-one mp 188-190 °C, MS *m/z* 342 (*M* + *H*), Hg 365 = +30.5, Conc. ~0.1 g/mL).

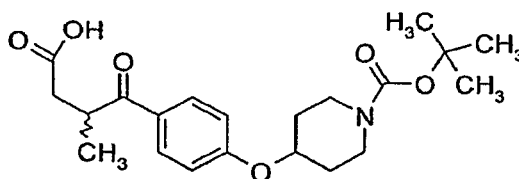
Example 192

15 Example 192 was synthesized from 1-(4-methoxyphenyl)butan-1-one using procedures for example 189; Mp 152-154 °C; MS *m/z* 356 (*M* + *H*).

Example 193

6-[4-(1-Cyclobutyl-piperidin-4-yloxy)-phenyl]-5-methyl-2-pyridin-2-yl-4,5-dihydro-2H-pyridazin-3-one

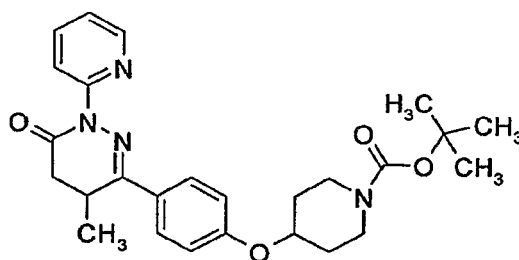
20 Step 1



4-[4-(3-Carboxy-2-methyl-propionyl)-
-phenoxy]-piperidine-1-carboxylic a
cid tert-butyl ester

A mixture of 4-[4-(3-ethoxycarbonyl-2-methyl-propionyl)-phenoxy]-piperidine-1-carboxylic acid tert-butyl ester (Example 189 step 2) (5.7 g, 14 mmol) and 1N NaOH (18 mL) in methanol was heated at 65 °C for 1 h. Methanol was evaporated at reduced pressure and diluted with water then cooled to 0 °C. The aqueous layer was neutralized carefully with citric acid and extracted twice with methylene chloride to obtain a crude 4-[4-(3-carboxy-2-methyl-propionyl)phenoxy]-piperidine-1-carboxylic acid tert-butyl ester (4.3 g, 81%), MS m/z 390 (M - 1)

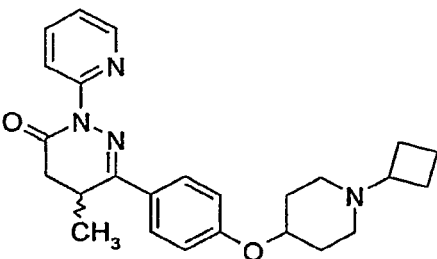
Step 2

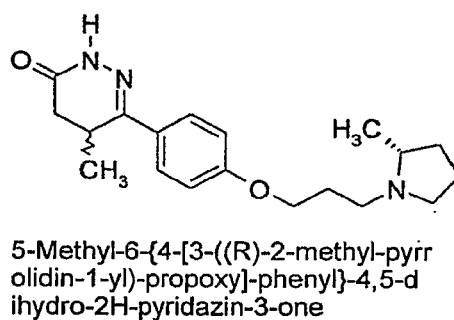
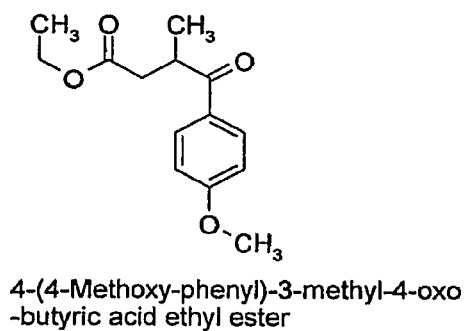


4-[4-(4-Methyl-6-oxo-1-pyridin-2-yl-
-1,4,5,6-tetrahydro-pyridazin-3-yl)-
-phenoxy]-piperidine-1-carboxylic a
cid tert-butyl ester

A mixture of 4-[4-(3-carboxy-2-methyl-propionyl)-phenoxy]-piperidine-1-carboxylic acid tert-butyl ester (4.3 g, 11 mmol) and 2-hydrazinopyridine (1.5 g, 14 mmol) in isopropanol (45 mL) was heated in a microwave reactor (300 Watts) at 160 °C for 150 min. Isopropanol was evaporated at reduced pressure and triturated with ether (150 mL) to obtain an orange solid (3 g). The filtrate was concentrated and purified by ISCO (80 g silica gel column) chromatography using 1.5 to 3.5% methanol in methylene chloride to obtain 4-[4-(4-methyl-6-oxo-1-pyridin-2-yl-1,4,5,6-tetrahydropyridazin-3-yl)phenoxy]-piperidine-1-carboxylic acid tert-butyl ester (0.3 g), mp 164-166 °C, MS m/z 465 (M + H).

Example 193 was synthesized using the product from step 2 and methods described for example 189 step 4 and step 5.

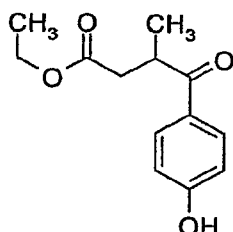
Example	Structure	Mp (°C)	MS m/z
193	 6-[4-(1-Cyclobutyl-piperidin-4-yloxy)-phenyl]-5-methyl-2-pyridin-2-yl-4,5-dihydro-2H-pyridazin-3-one	143-5 HCl	419 (M + H)

Example 194**Step 1**

A solution of 4-methoxypropiophenone (24 g, 140 mmol) in tetrahydrofuran (220 mL) was cooled to 0 °C. Lithium diisopropylamide, (2M solution in THF) (126 mL, 248 mmol) was added dropwise and warmed to rt for 30 min. The reaction was cooled again to 0 °C and ethyl bromoacetate (18 mL, 161 mmol) was added dropwise and warmed to rt for 30 min and then quenched with aqueous 1M HCl acid at 0 °C. The aqueous layer was extracted twice with methylene chloride and the combined organics were washed with

brine, dried (Na_2SO_4), filtered, and concentrated to give 4-(4-methoxyphenyl)-3-methyl-4-oxobutyric acid ethyl ester (44 g), MS m/z 205 (M - 45)

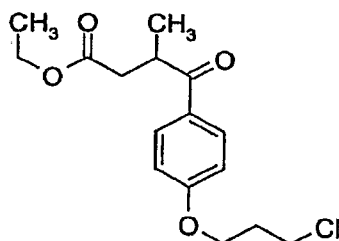
Step 2



4-(4-Hydroxy-phenyl)-3-methyl-4-oxo-butylric acid ethyl ester

A mixture of crude 4-(4-methoxy-phenyl)-3-methyl-4-oxo-butyric acid ethyl ester (44 g, 175.8 mmol), acetic acid (300 mL) and 48% aqueous HBr (150 mL) was stirred at reflux for 10 h. The reaction was cooled to rt, concentrated at reduced pressure then partitioned between methylene chloride and water and the aqueous layer was extracted three times with methylene chloride and concentrated to provide a crude material. The crude material was dissolved in ethanol (125 mL) and added amberlyst then heated at 85 °C for 15 h. The reaction mixture was filtered over celite at rt and the filtrate was concentrated at reduced pressure and then partitioned between water and methylene chloride. The aqueous layer was extracted twice with methylene chloride to furnish a crude product and the crude product was purified by ISCO (330 g silica gel column) chromatography using 20 to 30% EtOAc in hexane to obtain a mixture (19 g) of 4-(4-hydroxyphenyl)-3-methyl-4-oxo-butyric acid ethyl ester (MS m/z 235 (M - H) and p-hydroxypropiophenone. The mixture was used for the next reaction without further purification.

Step 3

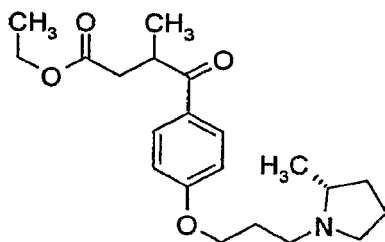


4-[4-(3-Chloro-propoxy)-phenyl]-3-methyl-4-oxo-butyric acid ethyl ester

A mixture of 4-(4-hydroxyphenyl)-3-methyl-4-oxo-butyric acid ethyl ester (12.5 g, 52.9 mmol), 1-bromo-3-chloropropane (11.3 mL, 114.6 mmol) and K_2CO_3 (21.9 g, 159

mmol) in acetone (200 mL) was stirred at 60 °C for 15 h. The reaction was cooled to RT and filtered over celite and the filtrate was evaporated at reduced pressure to give a crude residue. The crude residue was partitioned between methylene chloride and saturated aqueous sodium bicarbonate solution and the aqueous layer was extracted twice with methylene chloride. The combined organics was washed with brine, dried (Na₂SO₄), filtered, and concentrated to provide a crude product. The crude product was purified by ISCO (330 g) chromatography using 15% EtOAc in hexane to produce 4-[4-(3-chloro-propoxy)-phenyl]-3-methyl-4-oxo-butyric acid ethyl ester (9.7 g, 56%), MS m/z 267 (M - 45)

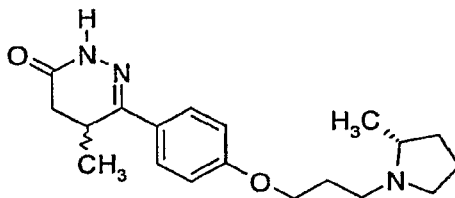
Step 4



3-Methyl-4-{4-[3-((R)-2-methyl-pyrrolidin-1-yl)-propoxy]-phenyl}-4-oxo-butyric acid ethyl ester

A mixture of 4-[4-(3-chloro-propoxy)-phenyl]-3-methyl-4-oxo-butyric acid ethyl ester (7 g, 22 mmol), K₂CO₃ (9.3 g, 67 mmol), NaI (330 mg, 2.2 mmol), and (R)-methyl-pyrrolidinium benzenesulfonate (11 g, 47 mmol) in CH₃CN (160 mL) was heated under argon at 80 °C for 36 h. The reaction mixture was concentrated at reduced pressure and partitioned between saturated aqueous sodium bicarbonate solution and methylene chloride. The aqueous layer was extracted twice with methylene chloride and the combined organics was washed with brine, dried (Na₂SO₄), filtered, and concentrated to provide a crude material. The crude material was purified by ISCO (80 g silica gel column) chromatography using 2% to 9% methanol in methylene chloride to 10% methanol containing 2.5 mL ammonium hydroxide in methylene chloride to afford a pure product. The pure product was dissolved in methylene chloride and washed with saturated aqueous sodium bicarbonate solution, brine, dried (Na₂SO₄), filtered, and concentrated to give 3-methyl-4-{4-R-2methyl-pyrrolidin-1-yl)-propoxy]-phenyl}-4-oxo-butyric acid ethyl ester (8.39 g, quantitative yield), MS m/z 362 (M + H).

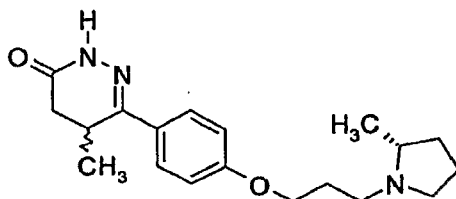
Step 5



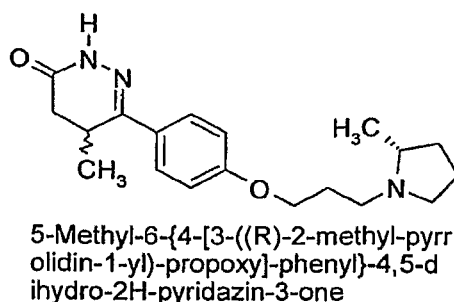
5-Methyl-6-{4-[3-((R)-2-methyl-pyrrolidin-1-yl)-propoxy]-phenyl}-4,5-dihydro-2H-pyridazin-3-one

- 5 A mixture of 3-methyl-4-{4-*R*-2methyl-pyrrolidin-1-yl)-propoxy]-phenyl}-4-oxo-butyrac acid ethyl ester (8.39 g, 23.2 mmol) and hydrazine monohydrate (5 mL, 100 mmol) in isopropanol was heated at 100 °C for 36 h. Isopropanol was evaporated at reduced pressure and quenched with saturated aqueous sodium bicarbonate solution and extracted twice with methylene chloride. The combined organics was washed with brine, dried (Na₂SO₄), filtered, and concentrated to afford a crude product. The crude product was purified by ISCO (80 g) chromatography using 2 to 10% methanol in methylene chloride to 10% methanol containing 4 mL ammonium hydroxide in methylene chloride to afford a pure product. The pure product was dissolved in methylene chloride and washed with saturated aqueous sodium bicarbonate solution, brine, dried (Na₂SO₄), filtered, and concentrated to give 5-methyl-6-{4-[3-*R*-2-methyl-pyrrolidin-1-yl)propoxy]-phenyl}-4,5-dihydro-2H-pyridazin-3-one (6.1 g, 80%, > 95% purity). The product was dissolved in a mixture of ethanol and ethyl acetate and 1M HCl (18 mL) in ether was added and the mixture was concentrated at reduced pressure. Fresh ethanol and ethyl acetate were added and concentrated under vacuum and again dissolved in ethanol and slowly added ethyl acetate, ether and hexane. After stirring for 15 min at RT solid separated, and the solid was filtered, washed with ether and dried at 85 °C in a ChemDry for 15 h to provide example 194 HCl as an off-white solid (5.8 g), mp 169-171 °C, MS m/z 330 (M + H).

Example 195



5-Methyl-6-{4-[3-((R)-2-methyl-pyrrolidin-1-yl)-propoxy]-phenyl}-4,5-dihydro-2H-pyridazin-3-one

Example 196

Racemic example 194 (5.8 g) of was separated into two diastereomers using
 5 chiralCel and 0.1% diethylamine in methanol.

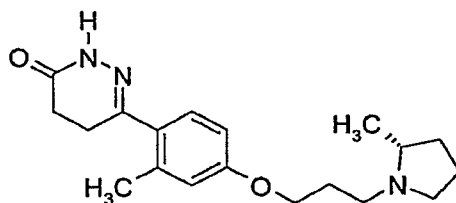
Example 195: 5-methyl-6-[4-[3-(*R*)-2-methyl-pyrrolidin-1-yl]-propoxy]-phenyl]-4,5-dihydro-2H-pyridazin-3-one HCl (2.4 g), mp 149-151 °C, MS m/z 367 (M + H).

Example 196: 5-methyl-6-[4-[3-(*S*)-2-methyl-pyrrolidin-1-yl]-propoxy]-phenyl]-4,5-dihydro-2H-pyridazin-3-one HCl (2.6 g), mp 189-191 °C, MS m/z 367 (M + H)

10 Example 197 (racemic) and example 198 (racemic) were synthesized as HCl salts using methods described for example 194.

Example	Structure	mp (°C)	MS m/z
197	5-Methyl-6-[4-(3-piperidin-1-yl-propoxy)-phenyl]-4,5-dihydro-2H-pyridazin-3-one	223-225 HCl	330 (M + H)
198	5-Methyl-6-[4-(3-pyrrolidin-1-yl-propoxy)-phenyl]-4,5-dihydro-2H-pyridazin-3-one	161-163 HCl	316 (M + H)

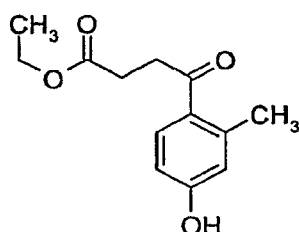
Example 199



6-((R)-2-Methyl-4-([3-(2-methyl-pyrrolidin-1-yl)-propoxy]-phenyl)-4,5-dihydro-2H-pyriazin-3-one

Step 1

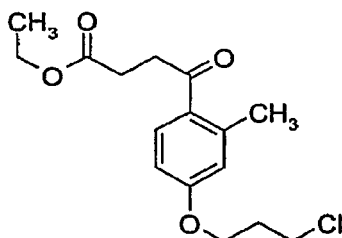
5



4-(4-Hydroxy-2-methyl-phenyl)-4-oxo-butanoic acid ethyl ester

A mixture of 4-(4-methoxy-2-methyl-phenyl)-4-oxo-butanoic acid (2 g, 9 mmol), acetic acid (30 mL) and 48% aqueous HBr (10 mL) was heated at 130 °C for 5.5 h. The reaction was cooled to rt and concentrated at reduced pressure and azeotrope twice with benzene to give a crude residue. The crude residue was dissolved in ethanol (25 mL) and added amberlyst then heated at 90 °C for 18 h. The reaction was filtered over celite and evaporated ethanol at reduced pressure then quenched with water and extracted twice with methylene chloride to obtain 4-(4-hydroxy-2-methyl-phenyl)-4-oxo-butanoic acid ethyl ester (1.6 g, 75%). The crude material was used for the next reaction without purification.

Step 2

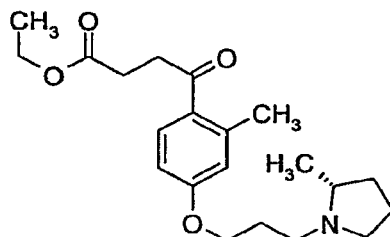


4-(4-(3-Chloro-propoxy)-2-methyl-phenyl)-4-oxo-butanoic acid ethyl ester

20

4-[4-(3-chloro-propoxy)-2-methyl-phenyl]-4-oxo-butyrac acid ethyl ester was prepared from 4-(4-hydroxy-2-methyl-phenyl)-4-oxo-butyrac acid ethyl ester according to the procedure in step 3 example 184 MS m/z 267 (M - 45).

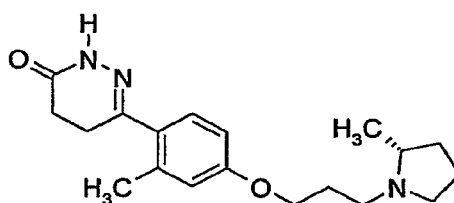
5 Step 3



4-{2-Methyl-4-[3-((R)-2-methyl-pyrrolidin-1-yl)-propoxy]-phenyl}-4-oxo-butyrac acid ethyl ester

10 4-{2-methyl-4-[3-((R)-2-methyl-pyrrolidin-1-yl)-propoxy]-phenyl}-4-oxo-butyrac acid ethyl ester (0.28 g, 67%) was prepared from 4-[4-(3-chloro-propoxy)-2-methyl-phenyl]-4-oxo-butyrac acid ethyl ester (0.36 g, 1.15 mmol) according to the procedure in step 4 of example 184; MS m/z 362 (M + H).

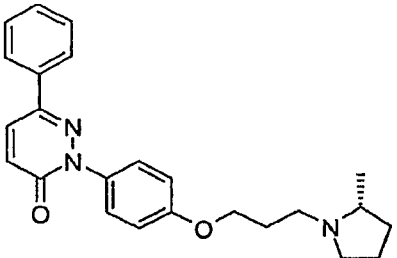
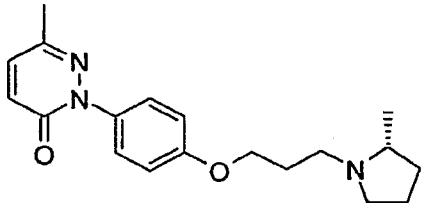
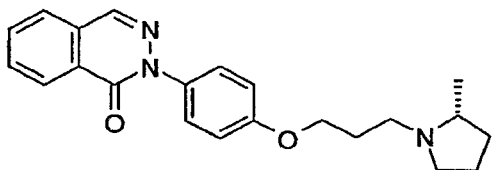
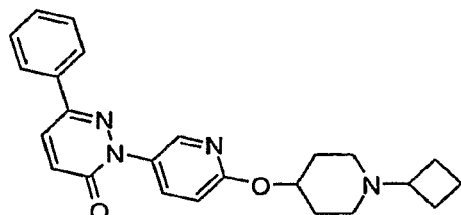
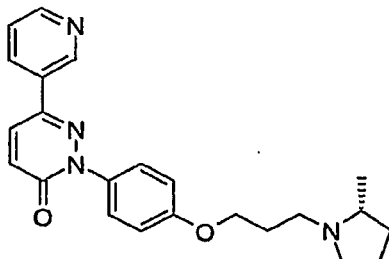
15 Step 4

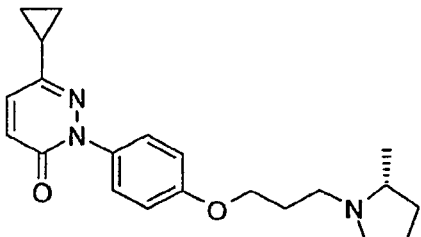


6-((R)-2-Methyl-4-[3-(2-methyl-pyrrolidin-1-yl)-propoxy]-phenyl)-4,5-dihydro-2H-pyridazin-3-one

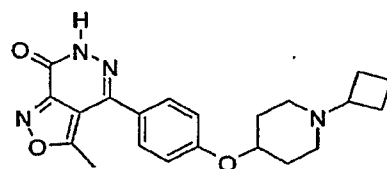
20 6-((R)-2-methyl-4-[3-(2-methyl-pyrrolidin-1-yl)-propoxy]-phenyl)-4,5-dihydro-2H-pyridazin-3-one was prepared from 4-[4-(3-chloro-propoxy)-2-methyl-phenyl]-4-oxo-butyrac acid ethyl ester (0.28 g, 0.77 mmol) according to the procedure in step 5 of example 184 HCl; Mp 121-123 °C; MS m/z = 330 (M + H).

25 Examples 200-204 were synthesized using Cu(0) coupling methods according to Example 21 or CuI / dioxane / 1,2-diaminocyclohexane / Cs₂CO₃ and starting with R-1-[3-(4-bromo-phenoxy)propyl]-2-methyl-pyrrolidine or 4-(5-bromopyridin-2-yloxy)-piperidine-1-carboxylic acid tert-butyl ester.

Example	Structure	Mp (°C)	MS m/z
200	 2-{4-[3-((R)-2-Methyl-pyrrolidin-1-yl)-propoxy]-phenyl}-6-phenyl-2H-pyridazin-3-one	86-9	390 (M + H)
201	 6-Methyl-2-{4-[3-((R)-2-methyl-pyrrolidin-1-yl)-propoxy]-phenyl}-2H-pyridazin-3-one	168-70 fumarate	328 (M + H)
202	 2-{4-[3-((R)-2-Methyl-pyrrolidin-1-yl)-propoxy]-phenyl}-2H-phthalazin-1-one	70-3	364 (M + H)
203	 2-[6-(1-Cyclobutyl-piperidin-4-yloxy)-pyridin-3-yl]-6-phenyl-2H-pyridazin-3-one	155-9 fumarate	403 (M + H)
204	 2-{4-[3-((R)-2-Methyl-pyrrolidin-1-yl)-propoxy]-phenyl}-6-pyridin-3-yl-2H-pyridazin-3-one	87-90	391 (M + H)

Example	Structure	Mp (°C)	MS m/z
262	 6-Cyclopropyl-2-{4-[3-((R)-2-methyl-pyrrolidin-1-yl)-propoxy]-phenyl}-2H-pyridazin-3-one	51-55 fumarate	354 (M + 1)

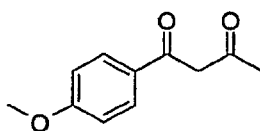
Example 205



4-[4-(1-Cyclobutyl-piperidin-4-yloxy)-phenyl]-3-methyl-6H-isoxazolo[3,4-d]pyridazin-7-one

5

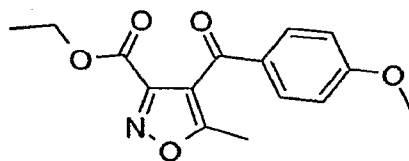
Step1



1-(4-Methoxy-phenyl)-butane-1,3-dione

To 9.80 mL of ethyl acetate (100 mmol) in 40 mL dry THF at room temperature was added 2.0 g of 60% sodium hydride (49.9 mmol), 7.50 g of 4'-methoxyacetophenone (49.9 mmol), 100.0 mg of 18-crown-6 (0.40 mmol), and 2 drops of ethanol. After 30 minutes, the reaction was refluxed for 1 h, and then 100 mL of dry THF was added. After an additional 1 h, 30 mL THF was added. After 1 h the reaction was cooled to 0 °C and 25 mL of 10% aqueous sulfuric acid was added. The product was extracted with diethyl ether. The ether extracts were dried with Na₂SO₄, filtered, and concentrated *in vacuo*. The crude material was purified *via* silica gel chromatography eluting with 4:1 hexane:ethyl acetate to give 5.8 g of 1-(4-methoxyphenyl)butane-1,3-dione containing 30% starting material (*via* ¹H NMR 42% yield).

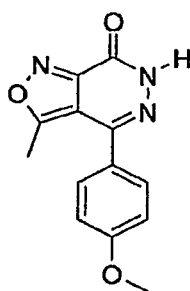
Step 2



4-(4-Methoxy-benzoyl)-5-methyl-isoxazole-3-carboxylic acid ethyl ester

To 7.04 mL of 21% sodium ethoxide in ethanol (18.8 mmol) in 60 mL ethanol at 0 °C was added 4.70 g of 1-(4-methoxyphenyl)butane-1,3-dione (17.1 mmol) in 60 mL ethanol dropwise over 24 minutes. After 30 min a solution of 2.59 g of ethyl chloro-(hydroximino)acetate (17.1 mmol) in 30 mL ethanol was added dropwise over 6 minutes. The reaction was warmed to room temperature slowly. When TLC indicated the reaction was complete, the reaction was concentrated *in vacuo*. Water and saturated NaHCO₃ was added and the product extracted with ethyl acetate. The ethyl acetate extracts were dried with Na₂SO₄, filtered, and concentrated *in vacuo*. The crude material was purified *via* silica gel chromatography eluting with 8:1 hexane:ethyl acetate to give 4-(4-methoxybenzoyl)-5-methylisoxazole-3-carboxylic acid ethyl ester which was dried overnight under high vacuum to give 3.74 g (71.8%).

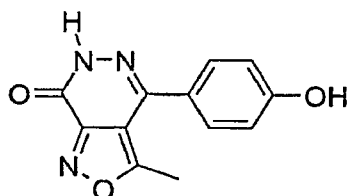
Step 3.



4-(4-Methoxyphenyl)-3-methyl-6H-isoxazolo[3,4-d]pyridazin-7-one

A solution of 2.47 g of 4-(4-methoxybenzoyl)-5-methylisoxazole-3-carboxylic acid ethyl ester (8.54 mmol) and 0.598 mL of hydrazine monohydrate (12.0 mmol) in 18.4 mL ethanol was stirred at room temperature for 19 hours. The heterogeneous reaction was cooled in an ice bath then filtered off the white solid, washing with cold ethanol then diethyl ether. Dried on under high vacuum to give 2.06 g (92%) of 4-(4-methoxyphenyl)-3-methyl-6 h-isoxazolo[3,4-d]pyridazin-7-one.

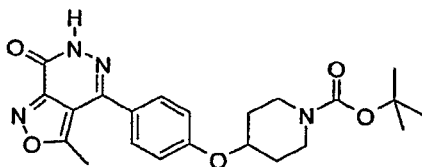
Step 4



4-(4-Hydroxy-phenyl)-3-methyl-6H-isoxazolo[3,4-d]pyridazin-7-one

To 1.05 g of 4-(4-methoxyphenyl)-3-methyl-6 h-isoxazolo[3,4-d]pyridazin-7-one (4.08 mmol) in 15 mL dry DMF was added 1.03 g of sodium ethanethiolate in 15 mL dry DMF at room temperature. The reaction was then heated at 100 °C for 2.5 h. Added water and 1M HCl until acidic. Extracted the product with diethyl ether and dried the extracts with Na₂SO₄, filtered, and concentrated *in vacuo*. The product was purified *via* silica gel chromatography eluting with 95:5 dichloromethane:methanol to give 533 mg of 4-(4-hydroxyphenyl)-3-methyl-6 h-isoxazolo[3,4-d]pyridazin-7-one; Mp 268-276 °C; MS m/z 216 (M-N₂ + H).

Step 5

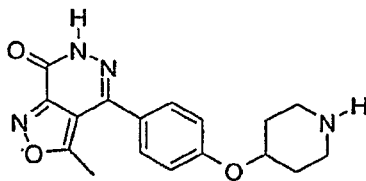


4-[4-(3-Methyl-7-oxo-6,7-dihydro-isoxazolo[3,4-d]pyridazin-4-yl)-phenoxy]-piperidine-1-carboxylic acid tert-butyl ester

To a solution of 805 mg of triphenylphosphine (3.07 mmol) in 10 mL dry THF at 0 °C was added 1.30 mL 40% w/w diethylazodicarboxylate in toluene (8.26 mmol). After 15 min, a solution of 524 mg of 4-(4-hydroxyphenyl)-3-methyl-6 h-isoxazolo[3,4-d]pyridazin-7-one (2.05 mmol) and 494 mg of 4-hydroxypiperidine-1-carboxylic acid tert-butyl ester (2.46 mmol) in 18 mL dry THF were added dropwise. The reaction was slowly warmed to room temperature. After 14 h water was added and the product was extracted with ethyl acetate. The extracts were dried with Na₂SO₄, filtered, and concentrated *in vacuo*. The product was purified *via* silica gel chromatography eluting with 1:1 hexane:ethyl acetate to give 985 mg of 4-[4-(3-methyl-7-oxo-6,7-dihydroisoxazole[3,4-d]pyridazin-4-yl)phenoxy]piperidine-1-carboxylic acid tert-butyl ester 65.4%.

Step 6

Example 206

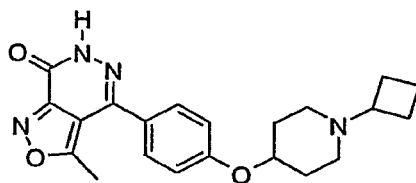


3-Methyl-4-[4-(piperidin-4-yloxy)-phenyl]-6H-isoxazolo[3,4-d]pyridazin-7-one

To 980 mg of 4-[4-(3-methyl-7-oxo-6,7-dihydroisoxazole[3,4-d]pyridazin-4-yl)phenoxy]-piperidine-1-carboxylic acid tert-butyl ester (1.3 mmol) in 20 mL of dichloromethane was added 1.0 mL of trifluoroacetic acid (13 mmol). After stirring at room temperature for 3 hours, an additional 0.5 mL of trifluoroacetic acid was added. The reaction was concentrated *in vacuo* as monitored by TLC and concentrated and triturated with diethyl ether to give 375 mg (98% pure) (63% yield) of example 206 as an off-white solid 3-methyl-4-[4-(piperidin-4-yloxy)phenyl]-6 h-isoxazolo-[3,4-d]pyridazin-7-one TFA salt. Mp 283-239 °C; MS m/z 299 (M-N₂ + H).

Step 7

Example 205

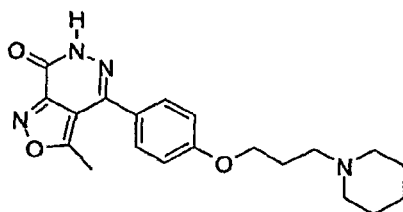


4-[4-(1-Cyclobutyl-piperidin-4-yloxy)-phenyl]-3-methyl-6H-isoxazolo[3,4-d]pyridazin-7-one

To 369 mg of example 206 (3-methyl-4-[4-(piperidin-4-yloxy)phenyl]-6 h-isoxazolo-[3,4-d]pyridazin-7-one trifluoroacetic acid salt) (0.838 mmol) and 84 µL acetic acid (1.5 mmol) in 6 mL dry methanol and 2 mL dry DMF at 0 °C was added 260 mg of sodium cyanoborohydride (4.2 mmol) and then 190 µL of cyclobutanone (2.5 mmol). The reaction was heated at 60 °C. After 1 h, the reaction was complete as determined by LC/MS and was concentrated *in vacuo*. Water and 2M Na₂CO₃ was added and the product was extracted with dichloromethane. The extracts were dried with Na₂SO₄, filtered, and concentrated *in vacuo*. The crude product was purified *via* silica gel chromatography eluting with 500:15:10 dichloromethane:methanol:7N ammonia in methanol to give a

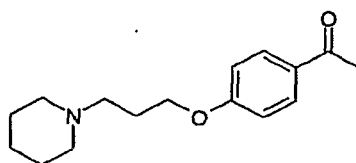
colorless oil which was re-concentrated *in vacuo* with diethyl ether. Added diethyl ether and upon standing, a white solid formed which was triturated with ether to yield 56 mg (17%) of example 205 Mp 182.5-184.0 °C; MS m/z 353 (M-N₂ + H).

5 Example 207



3-Methyl-4-[4-(3-piperidin-1-yl-propoxy)-phenyl]-6H-isoxazolo[3,4-d]pyridazin-7-one

Step 1

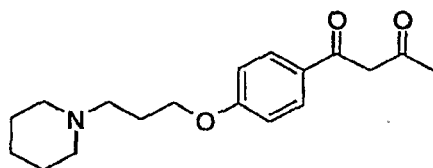


10

A mixture of 5.97 g of 4'-hydroxyacetophenone (43.8 mmol), 13.0 g of 1-(3-chloropropyl)-piperidine hydrochloride (65.8 mmol), 12.70 g of potassium carbonate (91.89 mmol), and 3.28 g of sodium iodide (21.9 mmol) in 100 mL dry acetone was stirred at reflux. After 1.5 h, the reaction was cooled to room temperature, filtered and concentrated. Ethyl acetate was added and the white solid that remained was filtered off. The filtrate was concentrated *in vacuo* and the crude residue was purified *via* silica gel chromatography using a gradient of ethyl acetate then 400:20:10 ethyl acetate: 7N ammonia in methanol:methanol to yield 583 mg of 1-[4-(3-piperidin-1-ylpropoxy)phenyl]ethanone as an oil. MS m/z 265 (M + H).

20

Step 2



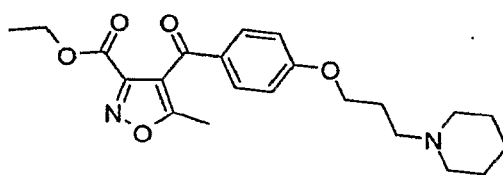
1-[4-(3-Piperidin-1-yl-propoxy)-phenyl]-butane-1,3-dione

To 430 µL of ethyl acetate (4.4 mmol) in 10 mL dry THF at room temperature was added 180 mg of 60% sodium hydride (4.4 mmol), 15.0 mg of 18-crown-6 (0.0568 mmol),

25

2 drops of ethanol, and then 578 mg (2.212 mmol) of 1-[4-(3-piperidin-1-ylpropoxy)phenyl]ethanone in 10 mL dry THF. After 30 min, the reaction was refluxed. An additional 18 mL of dry THF was added after 1.5 hours to reduce the viscosity of the reaction. After an additional 2 hours, 0.50 mL of 12.1 M aq. HCl was added to the reaction and the reaction was concentrated *in vacuo*. Water and saturated NaHCO₃ was added and the product extracted with ethyl acetate. The ethyl acetate extracts were dried with Na₂SO₄, filtered, and concentrated *in vacuo*. The crude material was purified *via* silica gel chromatography eluting with 500:20:12 dichloromethane: methanol: 7N ammonia in methanol to give a yellow oil which solidified to give 450mg (66%) of 1-[4-(3-piperidin-1-ylpropoxy)-phenyl]butane-1,3-dione as a yellow solid; Mp 43.0-45.5 °C; MS m/z 304 (M + H).

Step 3

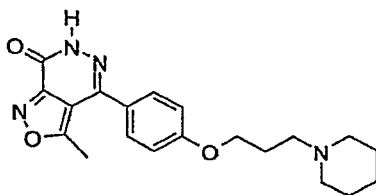


5-Methyl-4-[4-(3-piperidin-1-ylpropoxy)-benzoyl]-isoxazole-3-carboxylic acid ethyl ester

To 597 μ L of 21% sodium ethoxide in ethanol (1.595 mmol) in 4 mL ethanol at 0 °C was added 440 mg of 1-[4-(3-piperidin-1-ylpropoxy)phenyl]butane-1,3-dione (1.45 mmol) in 5.5 mL ethanol dropwise. After 30 min, a solution of 220 mg of ethyl chloro(hydroximino)acetate (1.45 mmol) in 3 mL ethanol was added dropwise. The reaction was warmed to room temperature slowly. After 19.5 h the reaction was concentrated *in vacuo*. Water and saturated NaHCO₃ was added and the product extracted with ethyl acetate. The ethyl acetate extracts were dried with Na₂SO₄, filtered, and concentrated *in vacuo*. The crude material was purified *via* silica gel chromatography eluting with 500:15:10 dichloromethane: methanol: 7N ammonia in methanol to give 300 mg (50%) of a gold oil determined to be 5-methyl-4-[4-(3-piperidin-1-ylpropoxy)benzoyl]-isoxazole-3-carboxylic acid ethyl ester; MS m/z 401 (M + H).

Step 4

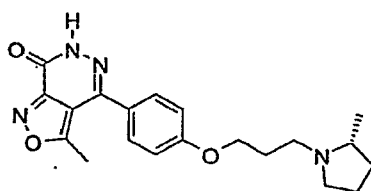
Example 207



3-Methyl-4-[4-(3-piperidin-1-yl-propoxy)-phenyl]-6H-isoxazolo[3,4-d]pyridazin-7-one

To 291.3 mg of 5-methyl-4-[4-(3-piperidin-1-ylpropoxy)benzoyl]isoxazole-3-carboxylic acid ethyl ester (0.7057 mmol) in 1.54 mL of ethanol at room temperature was added 49.4 μ L of hydrazine monohydrate (0.988 mmol). After 21 h, the heterogeneous reaction was cooled to 0 °C and filtered. The white solid was washed with cold ethanol then diethyl ether and dried at 65 °C under high vacuum. Yield 120 mg (46%) of a white solid Mp 178-9; MS m/z 369 (M + H).

Example 208



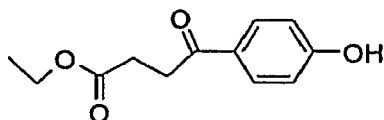
3-Methyl-4-[4-[3-((R)-2-methyl-pyrrolidin-1-yl)-propoxy]-phenyl]-6H-isoxazolo[3,4-d]pyridazin-7-one

Example 208 was prepared using methods described for example 207; Mp 169-70 °C; MS m/z 369 (M + H).

Example 178

Method B

Step 1



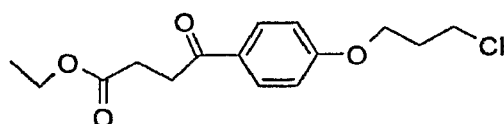
4-(4-Hydroxy-phenyl)-4-oxo-butyric acid ethyl ester

In a 1 L round bottom flask, 4-(4-methoxyphenyl)-4-oxo-butyric acid (25 g, 106 mmol) in 48% HBr (125 mL) and acetic acid (250 mL) was heated to reflux 18 h. The reaction was cooled slightly and ethanol (250 mL) was added. The solvent was concentrated under vacuum. Additional ethanol (100 mL) was added and solvent

concentrated under vacuum again. The resulting oil was crystallized from ethyl acetate/hexanes to produce 8.65 g (37%). MS m/z = 223 ($M + H$).

Step 2

5

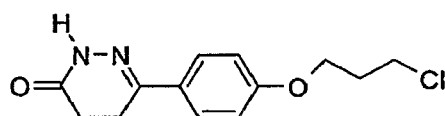


4-[4-(3-Chloro-propoxy)-phenyl]-4-oxo-butanoic acid ethyl ester

In a 1 L round bottom flask, 4-(4-hydroxyphenyl)-4-oxo-butanoic acid ethyl ester (8.65 g, 39.0 mmol), 1-bromo-3-chloro-propane (6.1 g, 61.0 mmol), and potassium carbonate (9.3 g, 67.1 mmol) in acetonitrile (300 mL) was heated to reflux 14 h. The reaction was cooled and the solvent concentrated under vacuum. The slurry was partitioned between methylene chloride and water, separated and dried over $MgSO_4$. Purification with silica gel chromatography eluting with hexanes/ethyl acetate (3:1) produced 7.9 g (68%). MS m/z 299 ($M + H$).

15

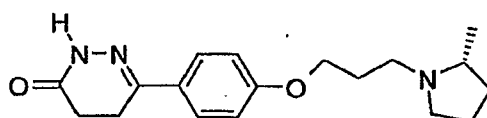
Step 3



6-[4-(3-Chloro-propoxy)-phenyl]-4,5-dihydro-2H-pyridazin-3-one

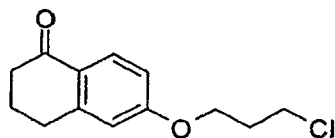
In a 500 mL round bottom flask, 4-[4-(3-chloro-propoxy)-phenyl]-4-oxo-butanoic acid ethyl ester (7.85 g, 26.3 mmol), and hydrazine monohydrate (2.55 mL, 52.7 mmol), in isopropanol (200mL) was heated to reflux 14 h. The reaction was cooled and the solvent concentrated under vacuum. Purification with silica gel chromatography eluting with methylene chloride/methanol (95:5) produced 5.2 g (74%). MS m/z 267 ($M + H$).

Example 178 Step 4



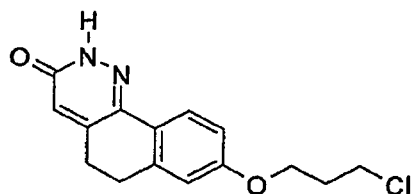
6-[4-{3-[(R)-2-Methyl-pyrrolidin-1-yl]-propoxy}-phenyl]-4,5-dihydro-2H-pyridazin-3-one

In a 500 mL round bottom flask, 6-[4-(3-hloro-propoxy)-phenyl]-4,5-dihydro-2H-pyridazin-3-one (5.2 g, 19.5 mmol), benzenesulfonate (R)-2-methyl-pyrrolidinium (9.5 g, 39.0 mmol), potassium carbonate (10.8g, 78.0 mmol), and potassium iodide (200 mg, 1.2 mmol) in acetonitrile (300 mL) was heated to reflux 14 h. The reaction was cooled and the solvent concentrated under vacuum. The slurry was partitioned between methylene chloride and water, then washed with water three times. The organics were extracted three times with 3% citric acid solution. The combined aqueous layers were basified with sat. NaHCO₃ sol. and extracted with methylene chloride, then dried over MgSO₄. Ethereal HCl was added and the solvents reduced under vacuum. Crystallization from MeOH/Et₂O produced 3.17 g (46%). Mp 221-223 °C. MS m/z 316 (M + H).

Example 209**Step 1**

6-(3-Chloro-propoxy)-3,4-dihydro-2H-naphthalen-1-one

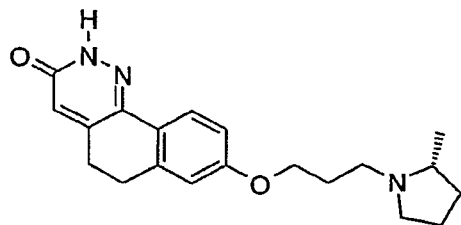
In a 500 mL round bottom flask, 6-hydroxy-3,4-dihydro-2H-naphthalen-1-one (10 g, 61.0 mmol), 1-bromo-3-chloro-propane (9.6 g, 61.0 mmol), and potassium carbonate (9.3 g, 67.1 mmol) in acetonitrile (300 mL) was heated to reflux 14 h. The reaction was cooled and the solvent concentrated under vacuum. The slurry was partitioned between methylene chloride and water, separated, dried over MgSO₄. Purification with silica gel chromatography eluting with hexanes/ethyl acetate (3:1) produced 10.6 g (73%). Mp 85-87 °C. MS m/z 239 (M + H).

Step 2

8-(3-Chloro-propoxy)-5,6-dihydro-2H-benzo[h]cinnolin-3-one

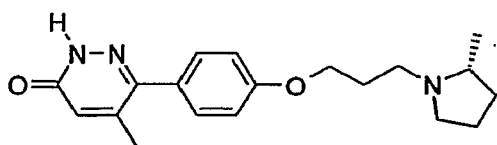
In a 100 mL round bottom flask, 6-(3-chloro-propoxy)-3,4-dihydro-2H-naphthalen-1-one (1 g, 4.2 mmol), and glyoxylic acid monohydrate (387 mg, 4.2 mmol), in acetic acid

(10 mL) was heated to reflux 6 h. The reaction was cooled and hydrazine monohydrate (0.41 mL, 8.4 mmol) was added and the reaction was heated to reflux 14 h. The reaction was cooled and the solvent concentrated under vacuum. The slurry was partitioned between methylene chloride and water, separated, dried over MgSO_4 . Purification with silica gel chromatography eluting with methylene chloride/methanol (95:5) produced 620 mg (51%).
5 MS m/z 291 (M + H).

Example 209 Step 3

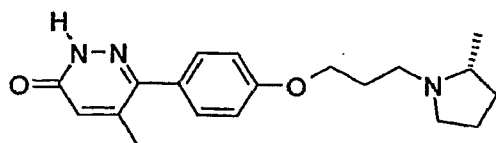
8-[3-((R)-2-Methyl-pyrrolidin-1-yl)-propoxy]-5,6-dihydro-2H-benzo[h]cinnolin-3-one

5 In a 100 mL round bottom flask, 8-(3-chloro-propoxy)-5,6-dihydro-2H-benzo[h]cinnolin-3-one (600 mg, 2.1 mmol), benzenesulfonate (R)-2-methyl-pyrrolidinium (1.02 g, 4.2 mmol), potassium carbonate (1.14 g, 8.3 mmol), and potassium iodide (10 mg, 0.06 mmol) in acetonitrile (60 mL) was heated to reflux 14 h. The reaction was cooled and the solvent concentrated under vacuum. The slurry was partitioned between methylene
 10 chloride and water, and then washed with water three times. The organics were extracted three times with 3% citric acid solution. The combined aqueous layers were basified with sat. NaHCO₃ sol. and extracted with methylene chloride, then dried over MgSO₄. Ethereal HCl was added and the solvents reduced under vacuum. Crystallization from MeOH/Et₂O produced 85 mg (11%). Mp 289-292 °C. MS m/z 340 (M + H).

Example 210

5-Methyl-6-{4-[3-((R)-2-methyl-pyrrolidin-1-yl)-propoxy]-phenyl}-2H-pyridazin-3-one

20 Following the procedure of Example 209: Mp 253-255 °C. MS m/z = 328 (M + H).

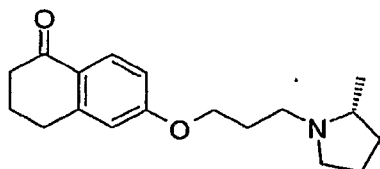
Example 211

5-Ethyl-6-{4-[3-((R)-2-methyl-pyrrolidin-1-yl)-propoxy]-phenyl}-2H-pyridazin-3-one

Following the procedure of Example 209: Mp 272-275 °C. MS m/z = 342 (M + H).

Example 212

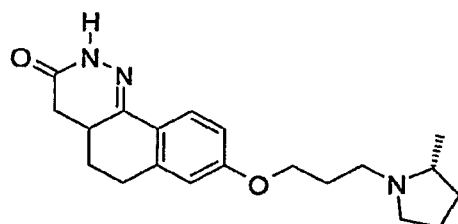
Step 1



6-[3-((R)-2-Methyl-pyrrolidin-1-yl)-propoxy]-3,4-dihydro-2H-naphthalen-1-one

In a 1 L round bottom flask, 6-(3-chloro-propoxy)-3,4-dihydro-2H-naphthalen-1-one (10.0 g, 41.9 mmol), benzenesulfonate (R)-2-methyl-pyrrolidinium (13.15 g, 84.0 mmol), potassium carbonate (23.15 g, 168 mmol), and potassium iodide (100 mg, 0.6 mmol) in acetonitrile (600 mL) was heated to reflux 14 h. The reaction was cooled and the solvent concentrated under vacuum. The slurry was partitioned between methylene chloride and water, then washed with water three times. The organics were extracted three times with 3% citric acid solution. The combined aqueous layers were basified with sat. NaHCO₃ sol. and extracted with methylene chloride, then dried over MgSO₄. Ethereal HCl was added and the solvents reduced under vacuum. Crystallization from MeOH/Et₂O produced 8.75 g (65%). Mp 183-185 °C. MS m/z = 288 (M + H).

Example 212 step 2



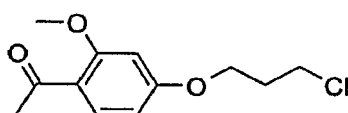
8-[3-(2-Methyl-pyrrolidin-1-yl)-propoxy]-4,4a,5,6-tetrahydro-2H-benzo[h]cinnolin-3-one

In a 250 mL round bottom flask, 6-[3-((R)-2-Methyl-pyrrolidin-1-yl)-propoxy]-3,4-dihydro-2H-naphthalen-1-one (3.0 g, 9.3 mmol), and glyoxylic acid monohydrate (1.28 g, 13.9 mmol), in acetic acid (60 mL) was heated to reflux 3h. The reaction was cooled and zinc dust (1.21 g, 18.5 mmol) was added and the reaction was heated to reflux 14 h. The reaction was cooled and diluted with water (120mL). The mixture was basified to pH 8

with NH_4OH and then hydrazine monohydrate (0.93 mL, 18.5 mmol) was added. The reaction was heated to reflux 2h. The reaction was cooled and re-basified with NaHCO_3 , then extracted with methylene chloride three times. The organics were dried over MgSO_4 , then ethereal HCL was added. The solvents were removed under vacuum and the product was crystallized with MeOH/ether to produce 1.16 g (33%). Mp 193-195 °C. MS m/z 342 (M + H).

Example 213

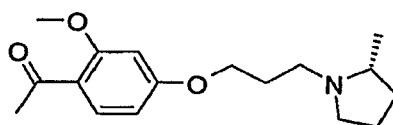
Step 1



1-[4-(3-chloropropoxy)-2-methoxy-phenyl]-ethanone

In a 250 mL round bottom flask, 1-(4-hydroxy-2-methoxy-phenyl)ethanone (5.0 g, 30.0 mmol), 1-bromo-3-chloro-propane (3.27 mL, 33.1 mmol), and potassium carbonate (4.75 g, 33.1 mmol) in acetonitrile (100 mL) was heated to reflux 14 h. The reaction was cooled and the solvent concentrated under vacuum. The slurry was partitioned between methylene chloride and water, separated, dried over MgSO_4 . Purification with silica gel chromatography eluting with hexanes/ethyl acetate (3:1) produced 6.18 g (85%). Mp 51-53 °C. MS m/z 243 (M + H).

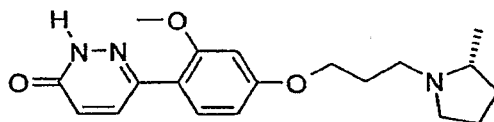
Step 2



1-[2-Methoxy-4-{3-[(R)-2-methyl-pyrrolidin-1-yl]-propoxy}-phenyl]-ethanone

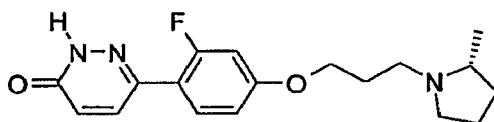
In a 250 mL round bottom flask, 1-[4-(3-chloropropoxy)-2-methoxy-phenyl]-ethanone (6.18 g, 25.5 mmol), benzenesulfonate (R)-2-methyl-pyrrolidinium (12.4 g, 50.9 mmol), potassium carbonate (14.1 g, 102 mmol), and potassium iodide (20 mg, 0.12 mmol) in acetonitrile (100 mL) was heated to reflux 14 h. The reaction was cooled and the solvent concentrated under vacuum. The slurry was partitioned between methylene chloride and water, then washed with water three times. The organics were extracted three times with 3% citric acid solution. The combined aqueous layers were basified with sat. NaHCO_3 sol.

and extracted with methylene chloride, then dried over MgSO_4 . The solvents were removed under vacuum to produce 4.25 g (57%) of oil. MS m/z 292 ($\text{M} + \text{H}$).

Example 213 Step 3

6-{2-Methoxy-4-[3-((R)-2-methyl-pyrrolidin-1-yl)-propoxy]-phenyl}-2H-pyridazin-3-one

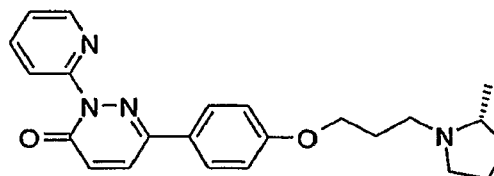
5 In a 100 mL round bottom flask, 1-{2-methoxy-4-[3-((R)-2-methyl-pyrrolidin-1-yl)-propoxy]-phenyl}-ethanone (4.24 g, 14.5 mmol), and glyoxylic acid monohydrate (2.01 g, 21.8 mmol), in acetic acid (20 mL) was heated to reflux 3h. The reaction was cooled and diluted with water (40mL). The mixture was basified to pH 8 with NH_4OH and then hydrazine monohydrate (1.41mL, 29.1 mmol) was added. The reaction was heated to reflux
 10 2h. The reaction was cooled and re-basified with NaHCO_3 , then extracted with methylene chloride three times. The organics were dried over MgSO_4 , then ethereal HCL was added. The solvents were removed under vacuum and the product was crystallized with MeOH/ether to produce 500 mg (9%). Mp 182-186 °C. MS m/z 344 (M + H).

Example 214

6-{2-Fluoro-4-[3-((R)-2-methyl-pyrrolidin-1-yl)-propoxy]-phenyl}-2H-pyridazin-3-one

Following the procedure of Example 213: Mp 220-222 °C. MS m/z 332 (M + H).

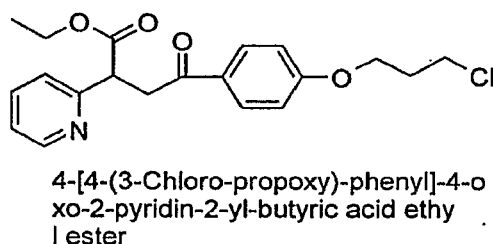
20

Example 215

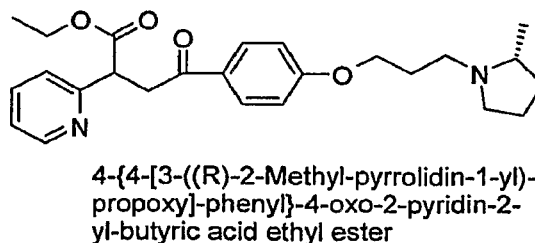
6-{4-[3-((R)-2-Methyl-pyrrolidin-1-yl)-propoxy]-phenyl}-2-pyridin-2-yl-2H-pyridazin-3-one

25 In a 50 mL round bottom flask, 6-{4-[3-((R)-2-methyl-pyrrolidin-1-yl)-propoxy]-phenyl}-2H-pyridazin-3-one (250 mg, 0.71 mmol), 2-bromopyridine (105 μL , 1.07 mmol),

copper(I)iodide (13.6 mg, 0.07 mmol), and potassium carbonate (296 mg, 2.14 mmol) in dimethylformamide (10 mL) was heated to reflux 14 h. The reaction was cooled and water (20 mL) was added. The sticky solids were filtered off and then partitioned between methylene chloride and water, separated, and dried over MgSO_4 . Purification with silica gel chromatography eluting with methylene chloride/methanol (95:5) produced 10 mg (2.4%) oil. MS m/z 391 ($M + H$).

Example 216**Step 1**

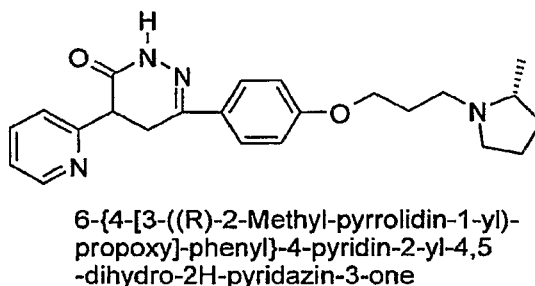
In a 500 mL round bottom flask ethyl 2-pyridylacetate (2.0 g, 12.1 mmol), and 60% sodium hydride (508 mg, 12.7 mmol) in dimethylformamide (50 mL) was stirred 1 h. 2-Bromo-1-[4-(3-chloro-propoxy)-phenyl]-ethanone (3.53 g, 12.1 mmol) was then added in dimethylformamide (50 mL) via dropping funnel. The reaction was stirred 14 h. Water (300mL) was added and the organics were extracted three times with ethyl acetate, and then dried over MgSO_4 . Purification with silica gel chromatography eluting with hexanes/ethyl acetate (3:1) produced 2.8 g (62%). MS m/z 376 ($M + H$).

Step 2

In a 100 mL round bottom flask, 4-[4-(3-chloro-propoxy)-phenyl]-4-oxo-2-pyridin-2-yl-butyric acid ethyl ester (2.77 g, 7.4 mmol), benzenesulfonate (R)-2-methyl-pyrrolidinium (3.59 g, 14.7 mmol), potassium carbonate (4.07 g, 29.5 mmol), and potassium iodide (100 mg, 0.6 mmol) in acetonitrile (100 mL) was heated to reflux 14 h. The reaction was cooled and the solvent concentrated under vacuum. The slurry was partitioned between methylene chloride and water, and then washed with water 3 times. The organics were

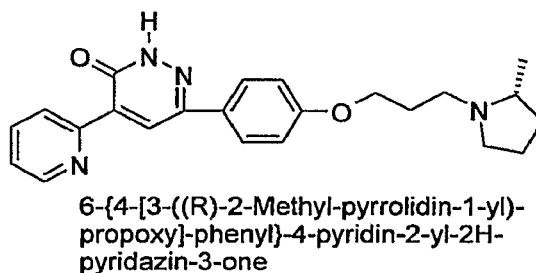
chromatographed through silica gel with methylene chloride/methanol (95:5) eluent. Etheral HCl was added to make the bis HCl salt and produce 960 mg (28%) of an amorphous solid. MS m/z 425 (M + H).

5 Example 216 Step 3

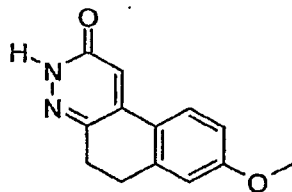


In a 50 mL round bottom flask, 4-{4-[3-((R)-2-methyl-pyrrolidin-1-yl)-propoxy]-phenyl}-4-oxo-2-pyridin-2-yl-butyric acid ethyl ester (950 mg, 1.84mmol), and hydrazine monohydrate (204 μ L, 4.2 mmol), in acetic acid (20 mL) was heated to reflux 14 h. The reaction was cooled and the solvent concentrated under vacuum. The slurry was partitioned between methylene chloride and NaHCO₃ sol., extracted three times, and then dried over MgSO₄. Purification with silica gel chromatography eluting with methylene chloride/methanol (95:5) produced 250 mg (33%). Etheral HCl was added to a methanol solution to produce crystals. Mp 231-233 °C. MS m/z 393 (M + H).

Example 217

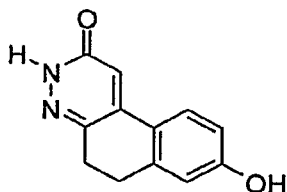


In a 10 mL round bottom flask, 6-{4-[3-((R)-2-methyl-pyrrolidin-1-yl)-propoxy]-phenyl}-4-pyridin-2-yl-4,5-dihydro-2H-pyridazin-3-one (120 mg, 0.31mmol), and cesium carbonate (197 mg, 0.62 mmol), in dimethylsulfoxide (3 mL) was heated to 135 °C 3 h. The reaction was cooled and the slurry was partitioned between methylene chloride and water extracted three times, and then dried over MgSO₄. Purification with silica gel chromatography eluting with methylene chloride/methanol (95:5), followed by HCl salt formation produced 120 mg (33%). Mp 157-161 °C. MS m/z 391 (M + H).

Example 218**Step 1**

8-Methoxy-5,6-dihydro-3H-benzo[f]cinnolin-2-one

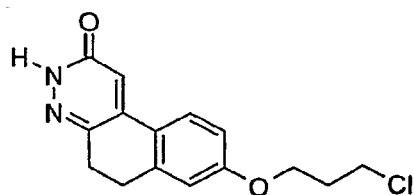
In a 50 mL round bottom flask, 6-methoxy-3,4-dihydro-1H-naphthalen-2-one (1.0 g, 5.68 mmol), and glyoxylic acid monohydrate (523 mg, 5.68 mmol), in acetic acid (10 mL) was heated to reflux 3h. The reaction was cooled and diluted with water (20mL). The mixture was basified to pH 8 with NH₄OH and then hydrazine monohydrate (0.55 mL, 11.4 mmol) was added. The reaction was heated to reflux 2h. The reaction was cooled and re-basified with NaHCO₃, then extracted with methylene chloride three times. The organics were dried over MgSO₄, and the solvents were removed under vacuum to produce 1.1 g (85%). mp dec. 270 °C. MS m/z = 229 (M + H).

Step 2

8-Hydroxy-5,6-dihydro-3H-benzo[f]cinnolin-2-one

In a 100 mL round bottom flask, 8-methoxy-5,6-dihydro-3H-benzo[f]cinnolin-2-one (1.05 g, 4.61 mmol) in methylene chloride (3 mL) was cooled to 0 °C. Boron tribromide (23 ml of a 1M sol. in methylene chloride) was added and the reaction warmed to ambient temperature for 4h. Re-cooled to 0 °C and sat. NH₄Cl sol. (23 mL) was added. The solvents were removed under vacuum and water was added. Solids were filtered off and washed with cold methanol to produce 587 mg (59%). Mp > 300 °C. MS m/z 215 (M + H).

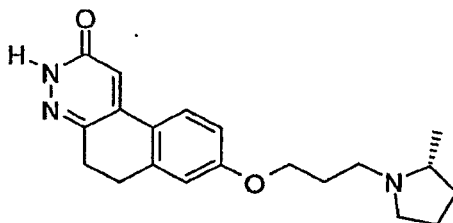
Step 3



8-(3-Chloro-propoxy)-5,6-dihydro-3H-benzo[f]cinnolin-2-one

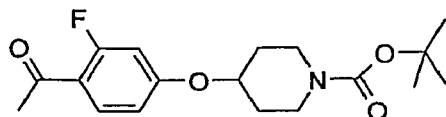
In a 50 mL round bottom flask, 8-hydroxy-5,6-dihydro-3H-benzo[f]cinnolin-2-one (575 mg, 2.69 mmol), 1-bromo-3-chloro-propane (0.27 mL, 2.69 mmol), and potassium carbonate (371 mg, 2.69 mmol) in acetonitrile (20 mL) was heated to reflux 14 h. The reaction was cooled and the solvent concentrated under vacuum. The slurry was partitioned between methylene chloride and water, separated, dried over MgSO₄. Purification with silica gel chromatography eluting with methylene chloride/methanol (95:5) produced 106 mg (14%) as an amorphous solid. MS m/z 291 (M + H).

Example 218, Step 4



8-[3-((R)-2-Methyl-pyrrolidin-1-yl)-propoxy]-5,6-dihydro-3H-benzo[f]cinnolin-2-one

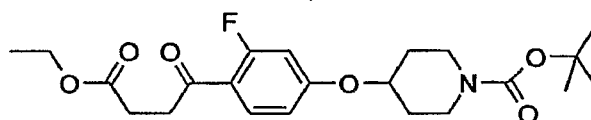
In a 25 mL round bottom flask, 8-(3-chloro-propoxy)-5,6-dihydro-3H-benzo[f]cinnolin-2-one (100 mg, 0.34 mmol), benzenesulfonate (R)-2-methyl-pyrrolidinium (168 mg, 0.68 mmol), potassium carbonate (190 mg, 1.36 mmol), and potassium iodide (1 mg, 0.006 mmol) in acetonitrile (10 mL) was heated to reflux 14 h. The reaction was cooled and the solvent concentrated under vacuum. The slurry was partitioned between methylene chloride and water, and then washed with water 3 times. The organics were chromatographed through silica gel with methylene chloride/methanol (95:5) eluent to produce 10 mg (9%). Mp 225 °C (dec.). MS m/z 340 (M + H).

Example 219**Step 1**

4-(4-Acetyl-3-fluoro-phenoxy)-piperidine-1-carboxylic acid tert-butyl ester

5

In a 500 mL round bottom flask, diethyl azodicarboxylate (16.9 g, 97.3 mmol) and triphenylphosphine (25.5 g, 97.3 mmol) in tetrahydrofuran (200 mL) were cooled to 0 °C. 1-(2-Fluoro-4-hydroxy-phenyl)-ethanone (10.0 g, 64.9 mmol) and 4-hydroxy-piperidine-1-carboxylic acid tert-butyl ester (15.67 g, 77.9 mmol) in tetrahydrofuran (100 mL) were added. The reaction was warmed to ambient temperature 14 h. The solvents were concentrated under vacuum and methylene chloride (100 mL) and hexanes (500 mL) were added. The solids were filtered off. The mother liquor was concentrated under vacuum and chromatographed through silica gel with hexanes/ethyl acetate (7:3) as eluent to produce 17.5 g (80%). Mp 72-73 °C.

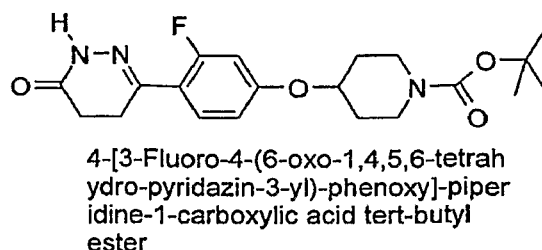
15 **Step 2**

4-[4-(3-Ethoxycarbonyl-propionyl)-3-fluoro-phenoxy]-piperidine-1-carboxylic acid tert-butyl ester

20 In a 250 mL round bottom flask, 4-(4-acetyl-3-fluoro-phenoxy)-piperidine-1-carboxylic acid tert-butyl ester (4.0 g, 12 mmol) in tetrahydrofuran (100 mL) were cooled to -78 °C. Lithium diisopropylamide (1.4 g, 13 mmol) was added and stirred 30 min. then warmed to 0 °C. Re-cooled to -78 °C and ethyl bromoacetate (1.4 mL, 13 mmol) in tetrahydrofuran (25 mL) was added. The reaction warmed to ambient temperature over 14 h.

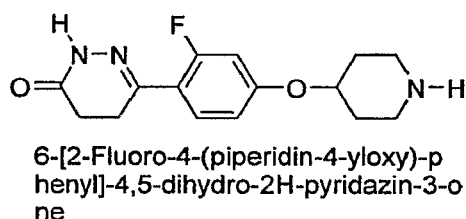
25 The reaction was quenched with NH₄Cl sol. and the solvents were concentrated under vacuum. The reaction was chromatographed through silica gel with hexanes/ethyl acetate (7:3) as eluent to produce 4.10 g (82%) of oil.

Step 3



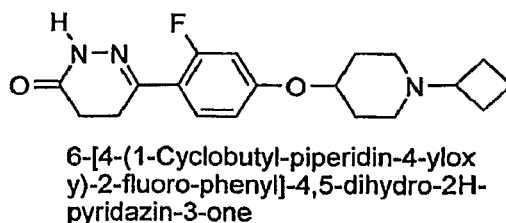
In a 250 mL round bottom flask, 4-[4-(3-ethoxycarbonyl-propionyl)-3-fluorophenoxy]-piperidine-1-carboxylic acid tert-butyl ester (4.1 g, 9.68 mmol), and hydrazine monohydrate (0.97 mL, 19.4 mmol), in isopropanol (100 mL) was heated to reflux 14 h. The reaction was cooled and the solvent concentrated under vacuum. Purification with silica gel chromatography eluting with methylene chloride/methanol (95:5) produced 945 mg (25%). Mp 146-148 °C. MS m/z 392 (M + H).

Step 4



In a 10 mL round bottom flask, 4-[3-fluoro-4-(6-oxo-1,4,5,6-tetrahydro-pyridazin-3-yl)-phenoxy]-piperidine-1-carboxylic acid tert-butyl ester (410 mg, 1.0 mmol) in trifluoroacetic acid (3 mL) was stirred 2h. The solvent concentrated under vacuum to produce 420 mg (100%) of the salt as an oil. MS m/z = 292 (M + H).

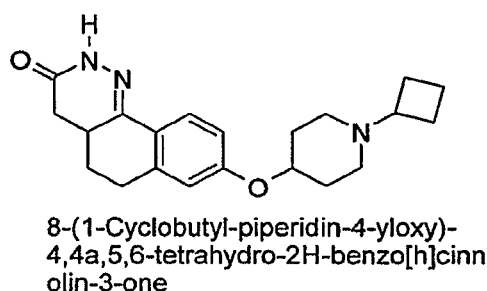
Example 219, Step 5



In a 25 mL round bottom flask, 6-[2-fluoro-4-(piperidin-4-yloxy)-phenyl]-4,5-dihydro-2H-pyridazin-3-one trifluoroacetic acid salt (420 mg, 1.0 mmol) was dissolved in methanol (10 mL), N,N-dimethylformamide (4 mL), and acetic acid (0.4 mL). Cyclobutanone (0.23 mL, 3.0 mmol), and then sodium cyanoborohydride (0.32 g, 5.0

mmol) were added. The reaction was heated to 60 °C for 2 h. The reaction was cooled and diluted with methylene chloride and NaHCO₃ sol. to pH 9. The organics were extracted three times and the solvent concentrated under vacuum. Purification with silica gel chromatography eluting with methylene chloride/methanol (95:5) followed by salt formation with ethereal HCl produced 210 mg (54%). Mp >300 °C. MS m/z 346 (M + H).

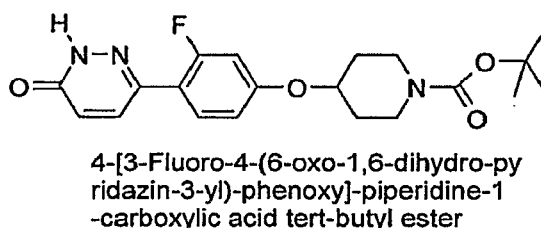
Example 220



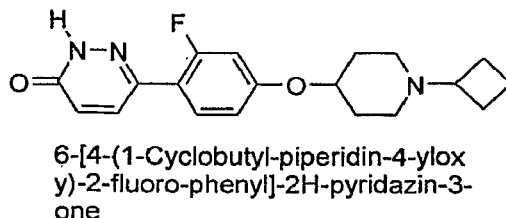
Following the procedure of Example 219: Mp >300 °C. MS m/z = 354 (M + H).

Example 221

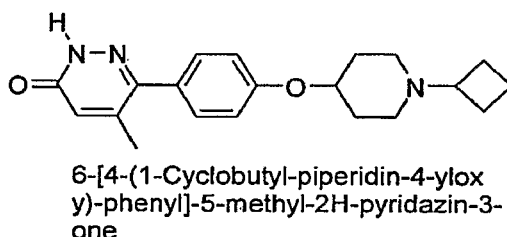
Step 1



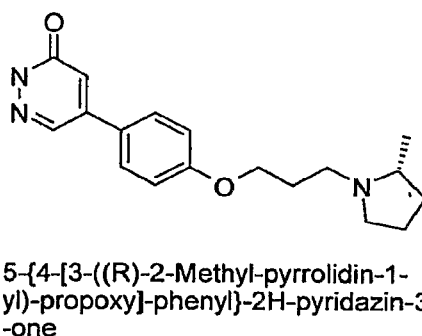
In a 10 mL round bottom flask, 4-[3-fluoro-4-(6-oxo-1,4,5,6-tetrahydro-pyridazin-3-yl)-phenoxy]-piperidine-1-carboxylic acid tert-butyl ester (525 mg, 1.34 mmol), and cesium carbonate (874 mg, 2.68 mmol), in dimethylsulfoxide (5 mL) was heated to 135 °C 3h. The reaction was cooled and the slurry was partitioned between methylene chloride and water extracted three times, and then dried over MgSO₄. Purification with silica gel chromatography eluting with methylene chloride/methanol (95:5) produced 500 mg (93%). Mp 117-119 °C. MS m/z 390 (M + H).

Example 221 step 2

5 Following the final two steps of Example 219: Mp >300 °C. MS m/z 344 (M + H).

Example 222

10 Following the procedure of Example 221: Mp >300 °C. MS m/z 340 (M + H).

Example 223

15
Step 1.
To a round-bottom flask was added 4-(4,4,5,5-tetramethyl-[1,3,2]dioxaborolan-2-yl)-phenol (11.0 g, 50 mmol), 1-bromo-3-chloropropane (9.88 mL, 100 mmol), potassium carbonate (20.7 g, 150 mmol), and acetonitrile (100 mL). The reaction mixture was heated to reflux for 24 h. The reaction was cooled to room temperature and was filtered. The filtrate was concentrated to give crude 2-[4-(3-chloro-propoxy)-phenyl]-4,4,5,5-tetramethyl-[1,3,2]dioxaborolane. This material was used for next step without purification.

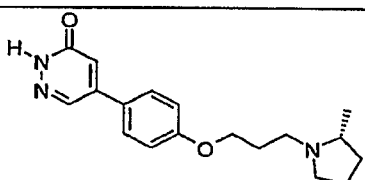
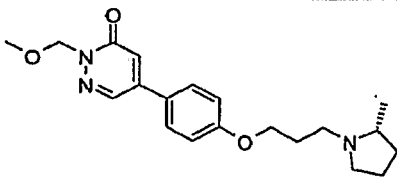
Step 2.

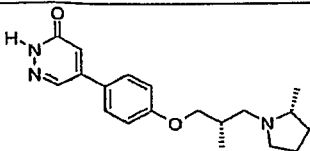
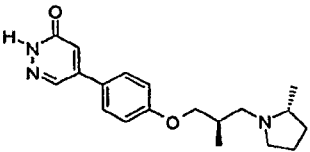
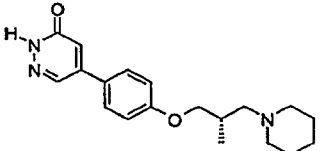
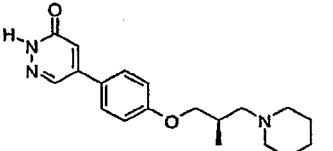
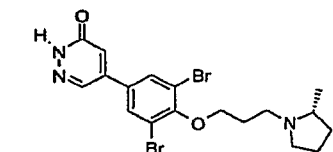
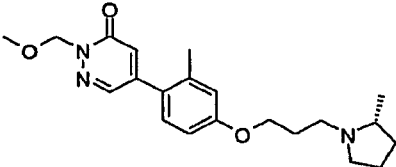
To a round-bottom flask was added crude 2-[4-(3-chloro-propoxy)-phenyl]-4,4,5,5-tetramethyl-[1,3,2]dioxaborolane, (R)-2-methyl-pyrrolidine, benzenesulfonic acid salt (24.3 g, 100 mmol), sodium iodide (7.49 g, 50 mmol), potassium carbonate (20.7 g, 150 mmol) and acetonitrile (100 mL). The reaction was heated to reflux for 2.5 days and was cooled to room temperature. The reaction was diluted with methylene chloride (100 mL) and was filtered. The filtrate was concentrated. Purification by column chromatography (5% MeOH in CH₂Cl₂) to give 11.3 g (65%, 2 steps) of (R)-2-methyl-1-{3-[4-(4,4,5,5-tetramethyl-[1,3,2]dioxaborolan-2-yl)-phenoxy]-propyl}-pyrrolidine.

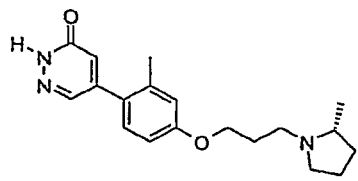
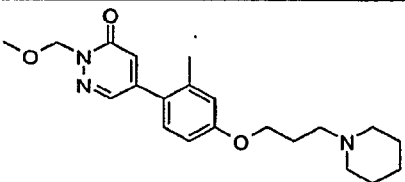
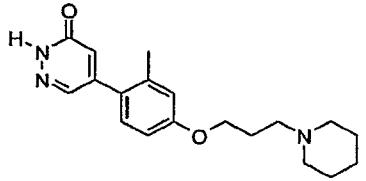
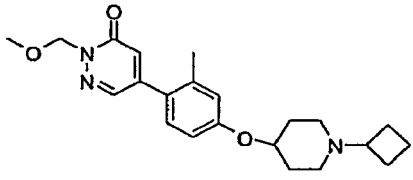
Step 3.

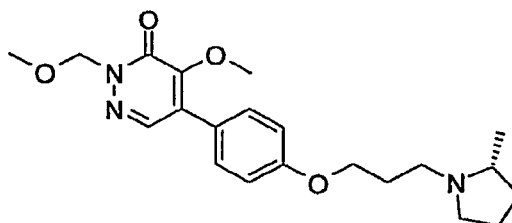
To a round-bottom flask was added 2-hydroxymethyl-5-iodo-2H-pyridazin-3-one (2.28 g, 9.05 mmol), (R)-2-methyl-1-{3-[4-(4,4,5,5-tetramethyl-[1,3,2]dioxaborolan-2-yl)-phenoxy]-propyl}-pyrrolidine (3.28 g, 9.50 mmol), tetrakis(triphenylphosphine)palladium(0) (2.1 g, 1.8 mmol), potassium carbonate (6.25 g, 45.2 mmol), 1,2-dimethoxyethane (80 mL), and water (40 mL). The reaction mixture was flushed with nitrogen for 30 min and was heated to reflux for 48 h. After cooled to room temperature, the reaction was filtered. The organic layer was separated and concentrated. Purification by column chromatography (CH₂Cl₂:MeOH:iPrNH = 9:1:0.1) to give 3.31 g (63.5%) of example 223 (5-{4-[3-((R)-2-methyl-pyrrolidin-1-yl)-propoxy]-phenyl}-2H-pyridazin-3-one).

The following examples were prepared using the procedure for example 223.

Example	Structure	Mp (°C)	MS m/z
223	 5-{4-[3-((R)-2-Methyl-pyrrolidin-1-yl)-propoxy]-phenyl}-2H-pyridazin-3-one	160-163	314 (M + H)
224	 2-Methoxymethyl-5-{4-[3-((R)-2-methyl-pyrrolidin-1-yl)-propoxy]-phenyl}-2H-pyridazin-3-one	183-185	358 (M + H)

Example	Structure	Mp (°C)	MS m/z
225	 5-[4-[(S)-2-Methyl-3-[(R)-2-methyl-pyrrolidin-1-yl]-propoxy]-phenyl]-2H-pyridazin-3-one	154-156	328 (M + H)
226	 5-[4-[(R)-2-Methyl-3-[(R)-2-methyl-pyrrolidin-1-yl]-propoxy]-phenyl]-2H-pyridazin-3-one	130-133	328 (M + H)
227	 5-[4-[(S)-2-Methyl-3-piperidin-1-yl-propoxy]-phenyl]-2H-pyridazin-3-one	145-148	328 (M + H)
228	 5-[4-[(R)-2-Methyl-3-piperidin-1-yl-propoxy]-phenyl]-2H-pyridazin-3-one	160-163	328 (M + H)
229	 5-[3,5-Dibromo-4-[3-[(R)-2-methyl-pyrrolidin-1-yl]-propoxy]-phenyl]-2H-pyridazin-3-one	175-180	472 (M + H)
230	 2-Methoxymethyl-5-[2-methyl-4-[3-[(R)-2-methyl-pyrrolidin-1-yl]-propoxy]-phenyl]-2H-pyridazin-3-one	139-40.5 HCl	372 (M + H)

Example	Structure	Mp (°C)	MS m/z
231	 5-[2-methyl-4-[3-((R)-2-methyl-pyrrolidin-1-yl)-propoxy]-phenyl]-2H-pyridazin-3-one	186-8 HCl	328 (M + H)
232	 2-Methoxymethyl-5-[2-methyl-4-(3-piperidin-1-yl-propoxy)-phenyl]-2H-pyridazin-3-one	185-97 (dec.) HCl	372 (M + H)
233	 5-[2-Methyl-4-(3-piperidin-1-yl-propoxy)-phenyl]-2H-pyridazin-3-one	112-113	328 (M + H)
234	 5-[4-(1-Cyclobutyl-piperidin-4-yloxy)-2-methyl-phenyl]-2-methoxymethyl-2H-pyridazin-3-one	119.5-123.5 HCl	384 (M + H)

Example 235

4-Methoxy-2-methoxymethyl-5-[4-[3-((R)-2-methyl-pyrrolidin-1-yl)-propoxy]-phenyl]-2H-pyridazin-3-one

Step 1.

To a stirred solution of 4,5-dichloropyridazin-6-one (5.00 g, 30.3 mmol) and *N,N*-diisopropylethylamine (7.92 mL, 45.5 mmol) in methylenechloride (50 mL) was added slowly, bromomethyl methyl ether (4.79 mL, 60.6 mmol) at room temperature (water-bath).

5 The reaction was stirred for 22 h and was then concentrated. Purification by column chromatography (1% MeOH in CH₂Cl₂) gave 4.74 g (74.8%) of 4,5-dichloro-2-methoxymethyl-2H-pyridazin-3-one.

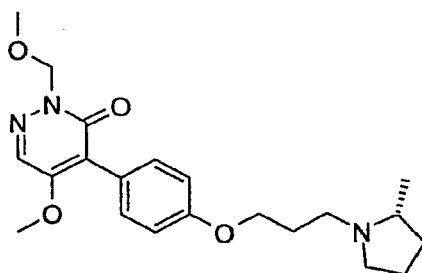
Step 2.

10 To a stirred solution of 4,5-dichloro-2-methoxymethyl-2H-pyridazin-3-one (1.00 g, 4.78 mmol) in 1,4-dioxane (25 mL) at room temperature was added sodium methoxide (271 mg, 5.02 mmol). After 19 h, the reaction was added additional 271 mg of sodium methoxide and was continued to stir for 6 h. The reaction was filtered and the filtrate was concentrated to give 915 mg (93% crude) 5-chloro-4-methoxy-2-methoxymethyl-2H-
15 pyridazin-3-one.

Step 3.

To a round-bottom flask was added 5-chloro-4-methoxy-2-methoxymethyl-2H-pyridazin-3-one (902 mg, 4.41 mmol), (R)-2-methyl-1-{3-[4-(4,4,5,5-tetramethyl-
20 [1,3,2]dioxaborolan-2-yl)-phenoxy]-propyl}-pyrrolidine (1.67 g, 4.85 mmol), tetrakis(triphenylphosphine)palladium(0) (510 mg, 0.44 mmol), potassium carbonate (2.34 g, 22.0 mmol), 1,2-dimethoxyethane (15 mL) and water (15 mL). The reaction mixture was flushed with nitrogen for 30 min and was then heated to reflux for 21 h. After cooled to room temperature, the reaction was extracted with CH₂Cl₂ (100 mL, 50 mL). The combined
25 organic layers were washed with water (50 mL), brine, dried (Na₂SO₄), and concentrated. Purification by column chromatography (5% MeOH in CH₂Cl₂) to give 744 mg (43.6%) of example 235 (4-methoxy-2-methoxymethyl-5-{4-[3-((R)-2-methyl-pyrrolidin-1-yl)-propoxy]-phenyl}-2H-pyridazin-3-one) as an oil. MS m/z 388 (M + H).

30 **Example 236**



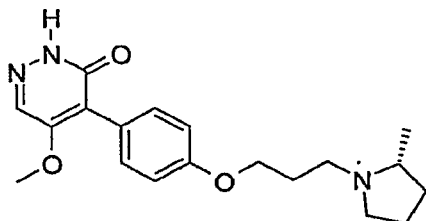
5-Methoxy-2-methoxymethyl-4-{4-[3-((R)-2-methyl-pyrrolidin-1-yl)-propoxy]-phenyl}-2H-pyridazin-3-one

Step 1.

To a stirred solution of 4,5-dichloro-2-methoxymethyl-2H-pyridazin-3-one (500 mg, 2.39 mmol) in methanol (12 mL) at room temperature was added sodium methoxide (258 mg, 4.78 mmol). After stirred for 2 h, the reaction was concentrated. To this residue was added water (20 mL), then extracted with CH₂Cl₂ (2 x 50 mL). The combined organic layer was dried (Na₂SO₄) and concentrated to give 480 mg (98%) 4-chloro-5-methoxy-2-methoxymethyl-2H-pyridazin-3-one.

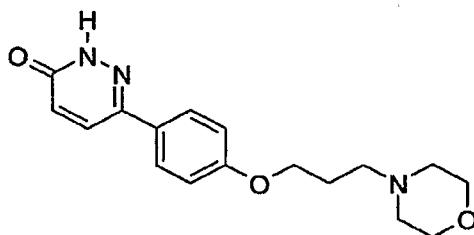
Step 2.

To a round-bottom flask was added 4-chloro-5-methoxy-2-methoxymethyl-2H-pyridazin-3-one (480 mg, 2.34 mmol), (R)-2-methyl-1-{3-[4-(4,4,5,5-tetramethyl-[1,3,2]dioxaborolan-2-yl)-phenoxy]-propyl}-pyrrolidine (890 mg, 2.60 mmol), tetrakis(triphenylphosphine)palladium(0) (270 mg, 0.23 mmol), potassium carbonate (1.24 g, 11.7 mmol), 1,2-dimethoxyethane (15 mL), and water (15 mL). The reaction mixture was flushed with nitrogen for 20 min and was then heated to reflux for 24 h. After cooled to room temperature, the reaction was extracted with CH₂Cl₂ (2 x 50 mL). The combined organic layers was washed brine, dried (Na₂SO₄), and concentrated. Purification by column chromatography (8% MeOH in CH₂Cl₂) to give 250 mg (26%) example 236 (5-methoxy-2-methoxymethyl-4-{4-[3-((R)-2-methyl-pyrrolidin-1-yl)-propoxy]-phenyl}-2H-pyridazin-3-one). Mp 44-45 °C. MS m/z 388 (M + H).

Example 237

5-Methoxy-4-{4-[3-((R)-2-methyl-pyrrolidin-1-yl)-propoxy]-phenyl}-2H-pyridazin-3-one

- 5 To a round-bottom flask was added example 231 (5-Methoxy-2-methoxymethyl-4-{4-[3-((R)-2-methyl-pyrrolidin-1-yl)-propoxy]-phenyl}-2H-pyridazin-3-one) (1.07 g, 2.76 mmol), methanol (10 mL), and concentrated HCl solution (10 mL). The reaction was heated to reflux for 3 days. After cooled to room temperature, the reaction was neutralized with 10 N NaOH then 5% NaOH solution to pH 7. The reaction was concentrated and the
- 10 residue was washed with CH₂Cl₂ (100 mL). The CH₂Cl₂ layer was concentrated. Purification by column chromatography (15% MeOH in CH₂Cl₂) to give 350 mg (37%) of 5-methoxy-4-{4-[3-((R)-2-methyl-pyrrolidin-1-yl)-propoxy]-phenyl}-2H-pyridazin-3-one. The product was converted to its hydrochloride salt. Mp 135-140. MS m/z 344 (M + H).

Example 238

6-[4-(3-Morpholin-4-yl-propoxy)-phenyl]-2H-pyridazin-3-one

Step 1.

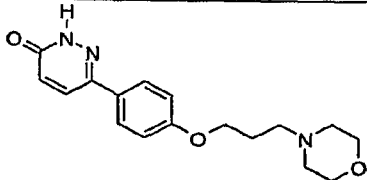
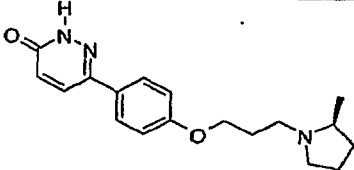
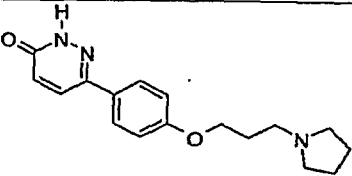
- 20 To a round-bottom flask was added 1-[4-(3-chloro-propoxy)-phenyl]-ethanone (10.0 g, 47.0 mmol), morpholine (6.15 mL, 70.5 mmol), sodium iodide (7.05 g, 47.0 mmol), potassium carbonate (19.5 g, 141 mmol), and acetonitrile (100 mL). The reaction mixture was heated to reflux for 23 h. The reaction was cooled to room temperature and was diluted with methylene chloride (100 mL). The reaction was filtered and the filtrate was

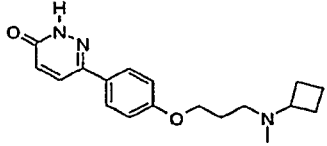
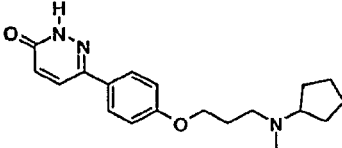
concentrated. Purification by column chromatography (2% MeOH in CH₂Cl₂) to give 10.5 g (85%) of 6-[4-(3-morpholin-4-yl-propoxy)-phenyl]-2H-pyridazin-3-one.

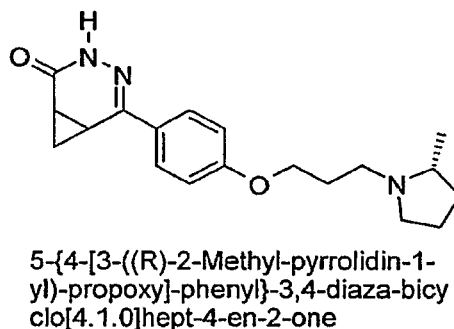
Step 2.

To a round-bottom flask was added 6-[4-(3-morpholin-4-yl-propoxy)-phenyl]-2H-pyridazin-3-one (5.00 g, 19.0 mmol), oxo-acetic acid, hydrate (3.51 g, 38.1 mmol), and acetic acid (15 mL). The reaction was heated to 111 °C for 2.5 h. After cooled to 0 °C, the reaction was added water (25 mL) and NH₄OH solution until pH~6. To this solution was added hydrazine hydrate (2.76 mL, 57.0 mmol) and was heated to reflux for 20 h (during which additional 3 eq of hydrazine hydrate was added). The reaction was cooled to room temperature and concentrated. Purification by column chromatography (20% MeOH in CH₂Cl₂) gave 2.53 g (42%) of example 238 6-[4-(3-morpholin-4-yl-propoxy)-phenyl]-2H-pyridazin-3-one.

The following examples were prepared.

Example	Structure	Mp (°C)	MS m/z
238	 6-[4-(3-Morpholin-4-yl-propoxy)-phenyl]-2H-pyridazin-3-one	156-159	316 (M + H)
239	 6-[4-[3-((S)-2-Methyl-pyrrolidin-1-yl)-propoxy]-phenyl]-2H-pyridazin-3-one	156-158	314 (M + H)
240	 6-[4-(3-Pyrrolidin-1-yl-propoxy)-phenyl]-2H-pyridazin-3-one	154-157	300 (M + H)

Example	Structure	Mp (°C)	MS m/z
241	 6-{4-[3-(Cyclobutyl-methyl-amino)-propoxy]-phenyl}-2H-pyridazin-3-one	<50	314 (M + H)
242	 6-{4-[3-(Cyclopentyl-methyl-amino)-propoxy]-phenyl}-2H-pyridazin-3-one	95-98	328 (M + H)

Example 243

5

Step 1.

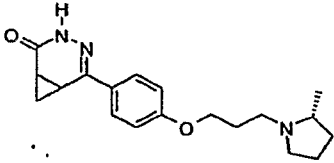
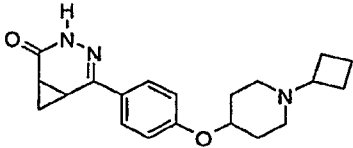
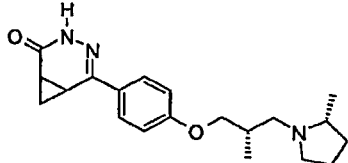
To a round-bottom flask was added phenol (5.0 g, 53.1 mmol), 1-bromo-3-chloropropane (5.52 mL, 55.8 mmol), potassium carbonate (22.0 g, 159 mmol), and acetonitrile (100 mL). The reaction mixture was heated to reflux for 15 h. To this reaction was then added (R)-2-methyl-pyrrolidine hydrochloride (12.9 g, 106 mmol) and sodium iodide (7.96 g, 53.1 mmol) at room temperature. The reaction was continued to reflux for 24 h. After cooled to room temperature, the reaction was filtered through a pad of Celite eluted with CH₂Cl₂ (100 mL). The filtrate was concentrated. Purification by column chromatography (5% MeOH in CH₂Cl₂) to give 9.02 g (77%) of (R)-2-methyl-1-(3-phenoxy-propyl)-pyrrolidine.

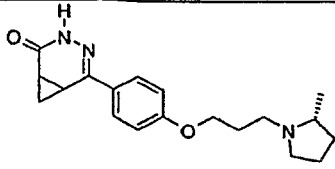
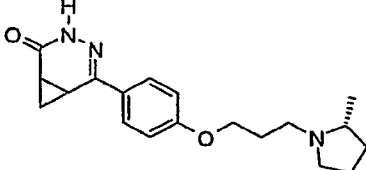
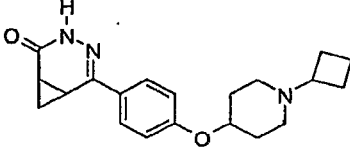
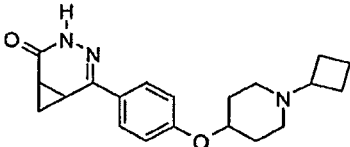
Step 2.

To a stirred solution of (R)-2-methyl-1-(3-phenoxy-propyl)-pyrrolidine (1.10 g, 5.02 mmol) and 3-oxa-bicyclo[3.1.0]hexane-2,4-dione (562 mg, 5.02 mmol) in 1,2-dichloroethane (25 mL) at 0 °C was added aluminum trichloride (2.01 g, 15.0 mmol) in

small portions. The reaction was heated at 80 °C for 18 h. After cooled to room temperature, the reaction was added crushed ice followed by concentrated HCl solution to break down the complex. The water layer was separated from the organic layer. To this water solution was added hydrazine hydrate (1 mL, 20.6 mmol) and was heated to reflux for 4 h. The reaction was cooled to room temperature and concentrated. Purification by column chromatography (10% MeOH in CH₂Cl₂) gave 1.38 g (76%) of example 243 (5-{4-[3-((R)-2-methyl-pyrrolidin-1-yl)-propoxy]-phenyl}-3,4-diaza-bicyclo[4.1.0]hept-4-en-2-one).

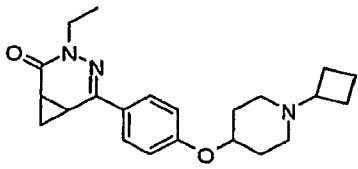
The following examples were synthesized. The racemic isomers of example 243 were separated into two enantiomers example 246 and example 247 and example 244 were separated into two enantiomers example 248 and example 249 by chiral chromatography using chiralPak and 0.1% diethylamine in methanol.

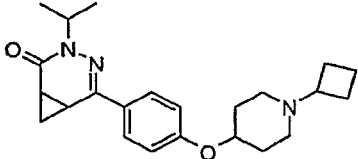
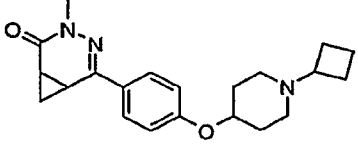
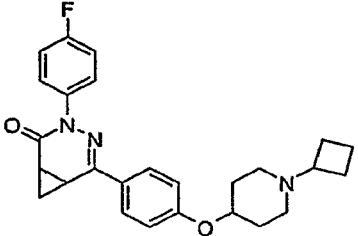
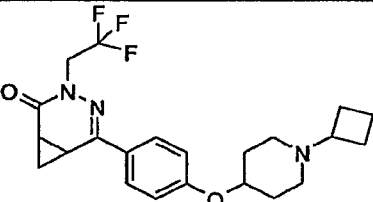
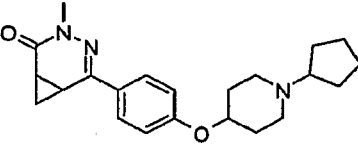
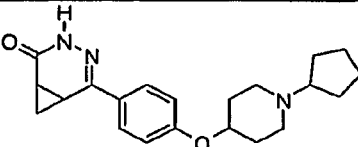
Example	Structure	Mp (°C)	MS m/z
243	 5-{4-[3-((R)-2-Methyl-pyrrolidin-1-yl)-propoxy]-phenyl}-3,4-diaza-bicyclo[4.1.0]hept-4-en-2-one	136-139 HCl	328 (M + H)
244	 5-{4-(1-Cyclobutyl-piperidin-4-yloxy)-phenyl}-3,4-diaza-bicyclo[4.1.0]hept-4-en-2-one	79-81	340 (M + H)
245	 5-{4-[(S)-2-Methyl-3-((R)-2-methyl-pyrrolidin-1-yl)-propoxy]-phenyl}-3,4-diaza-bicyclo[4.1.0]hept-4-en-2-one	112-115	342 (M + H)

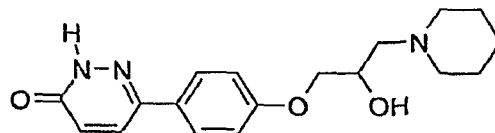
Example	Structure	Mp (°C)	MS m/z
246 single isomer	 5-[4-{3-((R)-2-Methyl-pyrrolidin-1-yl)-propoxy}-phenyl]-3,4-diaza-bicyclo[4.1.0]hept-4-en-2-one	210-211 HCl	328 (M + H)
247 single isomer	 5-[4-{3-((R)-2-Methyl-pyrrolidin-1-yl)-propoxy}-phenyl]-3,4-diaza-bicyclo[4.1.0]hept-4-en-2-one	197-198 HCl	328 (M + H)
248 single isomer	 5-[4-(1-Cyclobutyl-piperidin-4-yloxy)-phenyl]-3,4-diaza-bicyclo[4.1.0]hept-4-en-2-one	186-187	340 (M + H)
249 single isomer	 5-[4-(1-Cyclobutyl-piperidin-4-yloxy)-phenyl]-3,4-diaza-bicyclo[4.1.0]hept-4-en-2-one	185-186	340 (M + H)

Examples 250-254 were prepared as HCl salts following the method of example 243 and example 244.

5

Example	Structure	Mp (°C)	MS m/z
250	 5-[4-(1-Cyclobutyl-piperidin-4-yloxy)-phenyl]-3-ethyl-3,4-diaza-bicyclo[4.1.0]hept-4-en-2-one	246-248	368 (M + H)

Example	Structure	Mp (°C)	MS m/z
251	 5-[4-(1-Cyclobutyl-piperidin-4-yloxy)-phenyl]-3-isopropyl-3,4-diaza-bicyclo[4.1.0]hept-4-en-2-one	110-112	382 (M + H)
252	 5-[4-(1-Cyclobutyl-piperidin-4-yloxy)-phenyl]-3-methyl-3,4-diaza-bicyclo[4.1.0]hept-4-en-2-one	243-245	354 (M + H)
253	 5-[4-(1-Cyclobutyl-piperidin-4-yloxy)-phenyl]-3-(4-fluoro-phenyl)-3,4-diaza-bicyclo[4.1.0]hept-4-en-2-one	147-149	434 (M + H)
254	 5-[4-(1-Cyclobutyl-piperidin-4-yloxy)-phenyl]-3-(2,2,2-trifluoro-ethyl)-3,4-diaza-bicyclo[4.1.0]hept-4-en-2-one	110-121	422 (M + H)
260	 5-[4-(1-Cyclopentyl-piperidin-4-yloxy)-phenyl]-3-methyl-3,4-diaza-bicyclo[4.1.0]hept-4-en-2-one	264-266 HCl	368 (M + H)
261	 5-[4-(1-Cyclopentyl-piperidin-4-yloxy)-phenyl]-3,4-diaza-bicyclo[4.1.0]hept-4-en-2-one	288-290 HCl	354 (M + H)

Example 255

6-[4-(2-Hydroxy-3-piperidin-1-yl-propoxy)-phenyl]-2H-pyridazin-3-one

5 **Step1**

4-(4,4,5,5-Tetramethyl-1,3,2-dioxaborolan-2-yl)phenol (1.00 g, 4.50mmol) and anhydrous potassium carbonate (2.20 g, 15.90 mmol) were taken up in racemic epibromohydrin (45 mL).

10 Reaction mixture was refluxed for 12 h. Potassium carbonate was filtered off and epibromohydrin was evaporated under vacuum. Purification of the product using ISCO silica gel chromatography (hexanes/ethyl acetate 9:1) gave a white solid 1.25 g.

Step2

15 The product from step 1 (0.50 g, 1.80 mmol) and piperidine (0.23 g, 2.70 mmol) were dissolved in EtOH and refluxed for 5 h. The solvent was evaporated and the product was purified by ISCO silica gel chromatography eluting with EtOAc/MeOH 9:1 to give product as a white solid 0.49 g (75%).

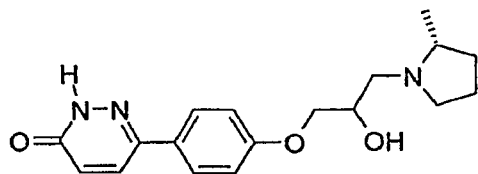
Step 3

20 THF anhydrous 15 mL was added to Pd(OAc)₂ (0.08g,, 0.35 mmol) and triphenylphosphine (0.38 g, 1.40 mmol) under N₂. The reaction was stirred for 5 min and 3,6-dichloropyridazine (1.00 g, 6.70 mmol) was added and reaction mixture was stirred for another 5 min. The product from step 2 (1-piperidin-1-yl-3-[4-(4,4,5,5-tetramethyl-[1,3,2]-dioxaborolan-2-yl)phenoxy]-propan-2-ol) (0.49 g, 1.35 mmol) in 9 mL of anhydrous THF and 5 mL of EtOH was added dropwise, followed by 15 mL of saturated NaHCO₃.

25 The reaction mixture was heated at 82 °C overnight. The solvent was removed and the residue was taken up in methylene chloride and washed with H₂O and saturated NaCl, dried over Na₂SO₄ and was evaporated. The product was purified by ISCO silica gel chromatography eluting with EtOAc/MeOH 9:1 to obtain 0.22 g (46%).

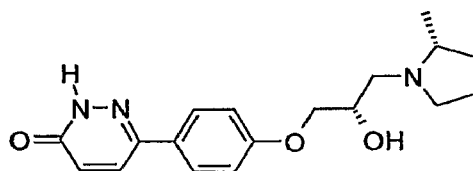
30 **Step 4**

The product from step 3 (0.18 g, 0.50 mmol) in 7 mL of glacial acetic acid and NaOAc (0.02 g, 0.25 mmol) was heated to 115° C for 2 h. The solvent was coevaporated with toluene and the residue was taken up in MeOH and catalytic amount of K₂CO₃ was added. After 1 h at reflux, the solvent was evaporated and the product was purified by ISCO
5 silica gel chromatography eluting with EtOAc/MeOH 9:1 to give a white solid 0.09 g (82%); Mp 185 °C; MS m/z 330 (M + H).

Example 256

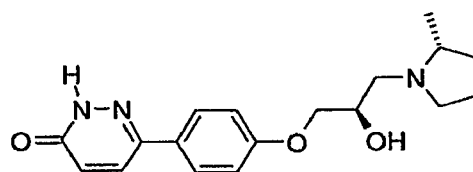
6-{4-[2-Hydroxy-3-((R)-2-methyl-pyrrolidin-1-yl)-propoxy]-phenyl}-2H-pyridazin-3-one

5 Example 256 was synthesized using the method for example 255 to give a white solid 0.07 g (54%); Mp 153 °C; MS m/z 330 (M + H).

Example 257

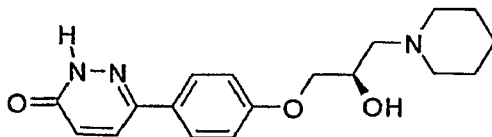
6-{4-[(S)-2-Hydroxy-3-((R)-2-methyl-pyrrolidin-1-yl)-propoxy]-phenyl}-2H-pyridazin-3-one

10 Example 257 was synthesized using the method for example 256 except using (S)-(+)-epichlorohydrin to give example 257 as a white solid 0.16 g (46%); Mp 156 °C; MS m/z 330 (M + H).

Example 258

6-{4-[(R)-2-Hydroxy-3-((R)-2-methyl-pyrrolidin-1-yl)-propoxy]-phenyl}-2H-pyridazin-3-one

15 Example 258 was synthesized using the method for example 256 except using (R)-(-)-epichlorohydrin to give example 258 as a white solid 0.16 g, (44%); Mp 147 °C; MS m/z
20 330 (M + H).

Example 259

6-[4-((R)-2-Hydroxy-3-piperidin-1-yl-propoxy)-phenyl]-2H-pyridazin-3-one

5 Example 259 was synthesized using the method for example 255 using (R)-(-)-epichlorohydrin to give example 259 as a white solid 0.14 g, (48%); Mp 167 °C; MS m/z 330 (M + H).

Utility

10 The compounds of the present invention are useful, *inter alia*, as therapeutic agents. Particularly, the compounds are useful for interacting with the H₃ receptor. In one embodiment, the present invention provides a method for treating or preventing diseases and disorders, such as those disclosed herein, which comprises administering to a subject in need of such treatment or prevention a therapeutically effective amount of a compound of the present invention.

15 In an additional embodiment, the present invention provides a method for inhibiting H₃ activity comprising providing a compound of the present invention in an amount sufficient to result in effective inhibition. Particularly, the compounds of the present invention can be administered to treat such diseases and disorders such as narcolepsy or sleep/wake disorders, feeding behavior, eating disorders, obesity, cognition, arousal,
20 memory, mood disorders, mood attention alteration, attention deficit hyperactivity disorder (ADHD), Alzheimer's disease/dementia, schizophrenia, pain, stress, migraine, motion sickness, depression, psychiatric disorders, epilepsy, gastrointestinal disorders, respiratory disorders (such as asthma), inflammation, and myocardial infarction. In certain embodiments, the compounds can be administered to treat narcolepsy or sleep/wake
25 disorders, obesity, cognition, attention deficit hyperactivity disorder (ADHD), and dementia. In other embodiments, the compounds can be administered to treat narcolepsy or sleep/wake disorders, or they can used to treat obesity, or they can used to treat cognition, or they can used to treat attention deficit hyperactivity disorder (ADHD), or they can used to treat dementia.

The inhibition of enzymatic activity by the compounds of the present invention can be determined using, for example, the following assays as set forth below. They are not intended, nor are they to be construed, as limiting the scope of the disclosure.

Rat H₃ Assays:

5 Cell line development and membrane preparation. The rat H₃ receptor cDNA was PCR amplified from reverse-transcribed RNA pooled from rat thalamus, hypothalamus, striatum and prefrontal cortex with a sequence corresponding to bp #338-1672 of Genbank file #NM_053506, encoding the entire 445-amino-acid rat histamine H₃ receptor. This was engineered into the pIRES-neo3 mammalian expression vector, which was stably
10 transfected into the CHO-A3 cell line (Euroscreen, Belgium), followed by clonal selection by limiting dilution. Cells were harvested and cell pellets were frozen (-80° C). Cell pellets were resuspended in 5 mM Tris-HCl, pH 7.5 with 5 nM EDTA and a cocktail of protease inhibitors (Complete Protease Inhibitor Tablets, Roche Diagnostics). Cells were disrupted using a polytron cell homogenizer and the suspension was centrifuged at 1000 x g
15 for 10 minutes at 4°C. The pellet was discarded and the supernatant centrifuged at 40,000 x g for 30 min at 4°C. This membrane pellet was washed in membrane buffer containing 50 mM Tris-HCl, pH 7.5 with 0.6 mM EDTA, 5 mM MgCl₂ and protease inhibitors, recentrifuged as above and the final pellet resuspended in membrane buffer plus 250 mM sucrose and frozen at -80°C.

20 Radioligand Binding. Membranes were resuspended in 50 mM Tris HCl (pH 7.4), 5 mM MgCl₂, 0.1% BSA. The membrane suspensions (10 µg protein per well) were incubated in a 96 well microtiter plate with [³H]-N-alpha-methylhistamine (approximately 1 nM final concentration), test compounds at various concentrations (0.01 nM – 30 µM) and scintillation proximity beads (Perkin Elmer, FlashBlueGPCR Scintillating Beads) in a final
25 volume of 80 µl for 4 hours at room temperature, protected from light. Non-specific binding was determined in the presence of 10 µM clobenpropit. Radioligand bound to receptor, and therefore in proximity to the scintillation beads, was measured using a MicroBeta scintillation counter.

30 GTPγS Binding. Membranes were resuspended in 20 mM HEPES pH 7.4 containing: 1 mM EDTA, 0.17 mg/ml dithiothreitol, 100 mM NaCl, 30 µg/ml saponin and 5 mM MgCl₂. For measurement of inverse agonist activity, increasing concentrations of test compounds were incubated in a 96 well microtiter plate with 10 µg/well membrane protein,

5 μ M GDP, scintillation proximity beads (Perkin Elmer, FlashBlueGPCR Scintillating Beads) and [35 S]-GTP γ S (0.1 nM final concentration). Following incubation for 45 minutes in the dark at room temperature, the microtiter plate was centrifuged at 1000 x g for 5 minutes and radioactivity bound to the membranes was counted using a MicroBeta scintillation counter. Non-specific binding was measured in the presence of 10 μ M GTP. A decrease in bound [35 S]-GTP γ S is indicative of H₃ receptor inverse agonist activity in this assay. Antagonist activity of test compounds was determined in a similar experiment under the following conditions. Membranes were resuspended in 20 mM HEPES pH 7.4 containing: 1 mM EDTA, 0.17 mg/ml dithiothreitol, 200 mM NaCl, 30 μ g/ml saponin and 10 20 mM MgCl₂. The membranes were incubated at 10 μ g/well membrane protein in a microtiter plate with increasing concentrations of test compounds, 20 μ M GDP, scintillation proximity beads and [35 S]-GTP γ S (0.1 nM final concentration) plus 30 nM R-alpha-methylhistamine. The microtiter plates were incubated and processed as described above. A decrease in R-alpha-methylhistamine stimulated [35 S]-GTP γ S binding is indicative of H₃ 15 receptor antagonist activity in this assay.

Human H₃ Assays:

Methods: CHO cells stably expressing the human H₃ receptor (GenBank : NM_007232) were harvested and cell pellets were frozen (-80° C). Cell pellets were resuspended in 5 mM Tris-HCl, pH 7.5 with 5 nM EDTA and a cocktail of protease 20 inhibitors (Complete Protease Inhibitor Tablets, Roche Diagnostics). Cells were disrupted using a polytron cell homogenizer and the suspension was centrifuged at 1000 x g for 10 minutes at 4°C. The pellet was discarded and the supernatant centrifuged at 40,000 x g for 30 min at 4°C. This membrane pellet was washed in membrane buffer containing 50 mM Tris-HCl, pH 7.5 with 0.6 mM EDTA, 5 mM MgCl₂ and protease inhibitors, recentrifuged 25 as above and the final pellet resuspended in membrane buffer plus 250 mM sucrose and frozen at -80°C.

Radioligand Binding. Membranes were resuspended in 50 mM Tris HCl (pH 7.4), 5 mM MgCl₂, 0.1% BSA. The membrane suspensions (10 μ g protein per well) were incubated in a 96 well microtiter plate with [3 H]-N-alpha-methylhistamine (approximately 1 30 nM final concentration), test compounds at various concentrations (0.01 nM – 30 μ M) and scintillation proximity beads (Perkin Elmer, FlashBlueGPCR Scintillating Beads) in a final volume of 80 μ l for 4 hours at room temperature, protected from light. Non-specific

binding was determined in the presence of 10 μ M clobenpropit. Radioligand bound to receptor, and therefore in proximity to the scintillation beads, was measured using a MicroBeta scintillation counter.

GTP γ S Binding. Membranes were resuspended in 20 mM HEPES pH 7.4

5 containing: 1 mM EDTA, 0.17 mg/ml dithiothreitol, 100 mM NaCl, 30 μ g/ml saponin and 5 mM MgCl₂. For measurement of inverse agonist activity, increasing concentrations of test compounds were incubated in a 96 well microtiter plate with 10 μ g/well membrane protein, 5 μ M GDP, scintillation proximity beads (Perkin Elmer, FlashBlueGPCR Scintillating Beads) and [³⁵S]-GTP γ S (0.1 nM final concentration). Following incubation for 45 minutes
10 in the dark at room temperature, the microtiter plate was centrifuged at 1000 x g for 5 minutes and radioactivity bound to the membranes was counted using a MicroBeta scintillation counter. Non-specific binding was measured in the presence of 10 μ M GTP. A decrease in bound [³⁵S]-GTP γ S is indicative of H₃ receptor inverse agonist activity in this assay. Antagonist activity of test compounds was determined in a similar experiment under
15 the following conditions. Membranes were resuspended in 20 mM HEPES pH 7.4 containing: 1 mM EDTA, 0.17 mg/ml dithiothreitol, 200 mM NaCl, 30 μ g/ml saponin and 20 mM MgCl₂. The membranes were incubated at 10 μ g/well membrane protein in a microtiter plate with increasing concentrations of test compounds, 20 μ M GDP, scintillation proximity beads and [³⁵S]-GTP γ S (0.1 nM final concentration) plus 30 nM R-alpha-methylhistamine. The microtiter plates were incubated and processed as described above.
20 A decrease in R-alpha-methylhistamine stimulated [³⁵S]-GTP γ S binding is indicative of H₃ receptor antagonist activity in this assay.

Other assays that may be used in connection with the present invention are set forth below. Examples of the present invention can be tested in the following in vivo models:

25 **Evaluation of Wake Promoting Activity in Rats**

The methodology utilized for evaluating wake promoting activity of test compounds is based on that described by Edgar and Seidel, *Journal of Pharmacology and Experimental Therapeutics*, 283:757-769, 1997, and incorporated herein in its entirety by reference. Compounds of the invention either have demonstrated or are expected to demonstrate utility
30 for wake promoting activity.

Dipsogenia Model: Inhibition of histamine agonist-induced water drinking in the rat. Histamine, and the H₃-selective agonist (*R*)- α -methylhistamine (RAMH) induce water drinking behavior in the rat when administered either peripherally or centrally (Kraly, F.S.,

June, K.R. 1982 *Physiol. Behav.* 28: 841.; Leibowitz, S.F. 1973 *Brain Res.* 63:440; Ligneau X., Lin, J-S., Vanni-Mercier G., Jouvet M., Muir J.L., Ganellin C.R., Stark H., Elz S., Schunack W., Schwartz, J-C. 1998 *J Pharmacol. Exp. Ther.* 287:658-66.; Clapham, J. and Kilpatrick G.J. 1993 *Eur. J. Pharmacol.* 232:99-103) an effect which is blocked by H₃ receptor antagonists thioperamide and ciproxifan. Compounds of the invention either have demonstrated or are expected to block RAMH induce water drinking behavior.

Novel object discrimination: Novel object discrimination (NOD; also referred to as novel object recognition) is an assay for short-term visual recognition memory that was first described by Ennaceur and Delacour (Ennaceur, A. and Delacour, J. (1988) *Behav Brain Res* 31: 47-59).

Social recognition: Social recognition (SR) is an assay for short-term social (olfactory) memory that was first described by Thor and Holloway (1982). Thor, D. and Holloway, W. (1982) *J Comp Physiol Psychol* 96: 1000-1006.

Table A lists the Human and H₃ binding data for Examples 1-78 and 81 of the present invention.

TABLE A

H₃ Pyridazinone Binding data

Example	Human H ₃ Ki nM	Rat H ₃ Ki nM
1	A	A
2	A	B
3	A	A
4	A	A
5	A	A
6	A	A
7	A	A
8	A	A
9	A	A
10	A	B
81	A	A
11	A	A
12	A	A
13	A	A
14	A	A
15	B	C
16	A	A
17	A	A
18	A	A
19	A	A
20	A	A
21	A	C

Example	Human H ₃ Ki nM	Rat H ₃ Ki nM
22	A	A
23	A	B
24	A	A
25	B	D
26	A	D
27	D	D
28	A	B
29	A	A
30	A	C
31	A	B
32	A	A
33	A	B
34	A	A
35	B	B
36	B	D
37	A	B
38	A	A
39	A	A
40	A	A
41	A	A
42	B	B
43	A	A
44	A	B
45	A	A
46	A	B
47	A	A
48	A	A
49	A	A
50	A	A
51	A	D
52	A	A
53	A	A
54	A	A
55	A	A
56	A	A
57	A	A
58	A	A
59	A	A
60	A	A
61	A	A
62	D	D
63	D	D
64	A	B
65	D	D
66	D	D
67	B	D

Example	Human H ₃ K _i nM	Rat H ₃ K _i nM
68	A	B
69	B	D
70	B	B
71	B	C
72	A	A
73	C	D
74	A	A
75	A	A
76	A	A
77	A	B
78	A	A
79		
80		

Binding constants (K_i) for Examples 1 to 78 and 81 in the Human H₃ and Rat H₃ methods described herein are expressed by letter descriptor to indicate the following ranges: A is 0.1-100 nM; B is 101-500 nM; C is 501-1000 nM; and D is >1000nM.

Table B lists the Human and Rat H₃ binding data for Examples 82-262 of the present invention. The Example numbers in the Table correspond to the Actual Example numbers in the Examples Section.

10 **TABLE B** **H3 Pyridazinone Binding data**

Example	human H3 K _i (nM)	rat H3 K _i (nM)
81	A	A
82	A	A
83	A	A
84	A	A
85	A	A
86	A	A
87	A	A
88	A	A

89	A	A
90	A	5
91	A	A
92	A	A
93	A	A
94	A	A
95	A	A
96	A	A
97	A	A
98	A	A
99	A	A
100	A	A
101	A	A
102	D	D
103	A	A
104	A	A
105	D	D
106	A	A
107	A	A
108	A	A
109	A	A
110	A	A

111	A	A
112	A	
113	D	D
114	A	A
115	A	A
116	A	A
117	A	A
118	A	A
119	A	A
120	A	B
121	A	A
122	A	A
123	A	A
124	A	A
125	B	C
126	B	C
127	C	C
128	A	A
129	A	B
130	B	B
131	A	A
132	A	A

133	A	A
134	A	A
135	B	B
136	A	B
137	A	A
138	A	A
139	A	A
140	B	C
141	A	A
142	A	B
143	A	C
143	A	A
144	A	A
145	A	A
146	A	A
147	A	B
148	A	A
149	A	A
150	A	A
151	A	A
152	A	A
153	A	A

154	A	A
155	A	A
156	A	A
157	A	A
158	A	A
159	D	D
160	B	B
161	D	D
162	C	D
163	A	A
164	A	A
165	D	D
166	A	A
167	A	A
168	A	A
169	A	A
170	A	A
171	A	A
172	A	A
173	A	A
174	A	A
175	A	A

176	A	A
177	A	A
178	A	A
179	A	A
180	A	A
181	A	B
182	A	A
183	A	A
184	A	A
185	A	A
186	A	A
187	A	A
188	A	A
189	A	A
190	A	A
191	A	A
192	4	A
193	A	A
194	A	A
195	A	A
196	A	A
197	A	A

198	A	A
199	A	A
200	A	A
201	A	B
202	A	A
203	A	A
204	A	A
205	B	B
206	D	D
207	A	A
208	A	A
209	A	A
210	A	A
211	A	A
212	A	A
213	B	B
214	A	A
215	A	A
216	A	A
217	A	A
218	A	A
219	A	A

220	A	A
221	A	A
222	A	A
223	A	A
224	A	A
225	A	A
226	A	A
227	A	A
228	A	B
229	A	C
230	A	A
231	A	A
232	A	A
233	A	B
234	A	A
235	A	A
236	A	A
237	A	A
238	D	D
239	A	A
240	A	A
241	B	B

242	A	B
243	A	A
244	A	A
245	A	A
246	A	A
247	A	A
248	A	A
249	A	A
250	A	A
251	A	A
252	A	A
253	A	A
254	A	A
255	B	B
256	A	B
257	A	A
258	A	A
259	B	B
260	A	A
261	A	A
262	A	B

Binding constants (K_i) for Examples 1 to 78 and 81 in the Human H_3 and Rat H_3 methods described herein are expressed by letter descriptor to indicate the

following ranges: A is 0.1-100 nM; B is 101-500 nM; C is 501-1000 nM; and D is >1000nM.

Compounds of the invention either have demonstrated or are expected to demonstrate inhibition of H₃ and thereby for utility for treatment of the indications described herein.

Publications cited throughout this disclosure are incorporated in their entirety herein by reference.

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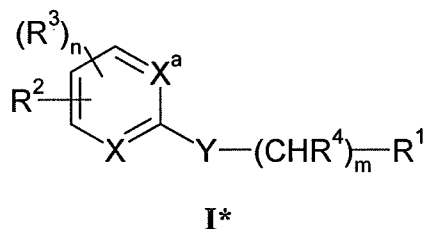
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Claims:

1. A compound according to formula I*:



or a stereoisomeric form, mixture of stereoisomeric forms, or a pharmaceutically acceptable salt thereof;

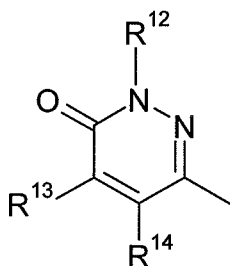
wherein:

X and X^a are each independently CH or N;

Y is O;

R¹ is a piperidine or pyrrolidine ring, optionally substituted with 1 to 3 R²⁰ groups;

R² is



wherein:

R² is para to the Y-(CHR⁴)_m-R¹ group;

each R³ is:

independently H, F, Cl, Br, I, OR²¹, NR²³R²⁴, NO₂, CN, CF₃, C₁-C₆alkyl, C(=O)R²¹, CO₂R²¹, or C(=O)NR²³R²⁴; or

when R³ is ortho to R² then R³ and R¹⁴ taken together may form -(CH₂)_s-, -CH₂Z-, -ZCH₂-, -ZCH₂CH₂- or CH₂CH₂Z-; wherein Z is O, S(O)_y, or NR²⁷;

each R⁴ is independently H, C₁-C₆alkyl, or OR²¹, wherein the alkyl group is optionally substituted with 1 to 3 R²⁰ groups;

R^{12} is H, C_1 - C_6 alkyl, cycloalkyl, aryl, arylalkyl, heteroaryl, heterocycloalkyl, $C(=O)R^{27}$, or CO_2R^{27} , wherein the alkyl, cycloalkyl, aryl, arylalkyl, heteroaryl, or heterocycloalkyl group is optionally substituted with 1 to 3 R^{20} groups;

R^{13} and R^{14} are each independently H, C_1 - C_6 alkyl, aryl, arylalkyl C_1 - C_6 alkoxy,

$S(=O)_y$ - C_1 - C_6 alkyl, cycloalkyl, heterocycloalkyl, or heteroaryl;

or R^{13} and R^{14} , taken together with the carbon atoms through which they are connected form a fused phenyl, thienyl, pyrrolyl, oxazolyl, pyridinyl, or C_3 - C_6 cycloalkyl ring; and wherein the fused phenyl, thienyl, pyrrolyl, oxazolyl, pyridinyl, or cycloalkyl ring is optionally substituted with 1 to 3 R^{20} groups;

R^{15} is H, C_1 - C_6 alkyl, $C(=O)R^{25}$, CO_2R^{25} ;

R^{20} at each occurrence is independently, H, F, Cl, Br, I, OR^{21} , OR^{22} , $NR^{23}R^{24}$, $NHOH$, NO_2 , CN , CF_3 , C_1 - C_6 alkyl optionally substituted with OR^{26} , C_2 - C_6 alkenyl, C_2 - C_6 alkynyl, C_3 - C_7 cycloalkyl C_0 - C_4 alkyl, 3- to 7-membered heterocycloalkyl C_0 - C_4 alkyl, phenyl, 5- or 6-membered heteroaryl C_0 - C_4 alkyl, arylalkyl, $(=O)$, $C(=O)R^{21}$, CO_2R^{21} , $OC(=O)R^{21}$, $C(=O)NR^{23}R^{24}$, $NR^{27}C(=O)R^{21}$, $NR^{27}C(=O)OR^{21}$, $OC(=O)NR^{23}R^{24}$, $NR^{27}C(=S)R^{21}$, or $S(O)_qR^{21}$;

each R^{21} is independently H, C_1 - C_6 alkyl, aryl, or arylalkyl;

each R^{22} is independently the residue of an amino acid after the hydroxyl group of the carboxyl group is removed;

each R^{23} and R^{24} is independently selected from H, C_1 - C_6 alkyl, and aryl, or R^{23} and R^{24} , together with the nitrogen atom to which they are attached, form a 3 to 7 membered heterocyclic ring optionally substituted with $=O$;

R^{25} is C_1 - C_6 alkyl, aryl, or alkylaryl;

R^{26} is H, C_1 - C_6 alkyl, aryl, or alkylaryl;

R^{27} is H or C_1 - C_6 alkyl;

m is 1, 2, 3, 4, or 5 when R^1 is attached via a nitrogen atom, and m is 0, 1, 2, 3, 4, or 5 when R^1 is attached via a carbon atom;

n is 1, 2, or 3;

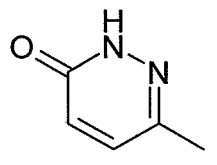
q is 0, 1, or 2;

s is 1, 2, or 3; and

y is 0, 1, or 2.

2. A compound according to claim 1, wherein at least one of X and X_a is CH.
3. A compound according to claim 1, wherein the optionally substituted piperidine or pyrrolidine ring is attached via a nitrogen atom.
4. A compound according to claim 3, wherein the piperidine or pyrrolidine ring is substituted with one or two alkyl groups.
5. A compound according to claim 1, wherein the piperidine ring is attached via a carbon atom.
6. A compound according to claim 5, wherein the piperidine ring is N-substituted with cycloalkyl.
7. A compound according to claim 1, wherein R¹³ and R¹⁴, taken together with the carbon atoms through which they are connected form a fused phenyl, thienyl, oxazolyl, pyridinyl, or C₃-C₆cycloalkyl ring; and wherein the fused phenyl, thienyl, pyrrolyl, oxazolyl, pyridinyl, or cycloalkyl ring is optionally substituted with 1 to 3 R²⁰ groups.

8. A compound according to claim 1, wherein R^{12} is H, C_1 - C_6 alkyl, cycloalkyl, aryl, arylalkyl, or heteroaryl.



9. A compound according to claim 1, wherein R^2 is:

10. A compound according to claim 1, wherein R^{13} and R^{14} are each independently H or C_1 - C_6 alkyl.

11. A compound according to claim 1, wherein R^{14} is heteroaryl.

12. A compound according to claim 1, wherein R^4 is H, alkyl or alkoxy.

13. A compound according to claim 1, wherein R^4 is H or C_1 alkyl.

14. A compound according to claim 5, wherein m is 0 or 1.

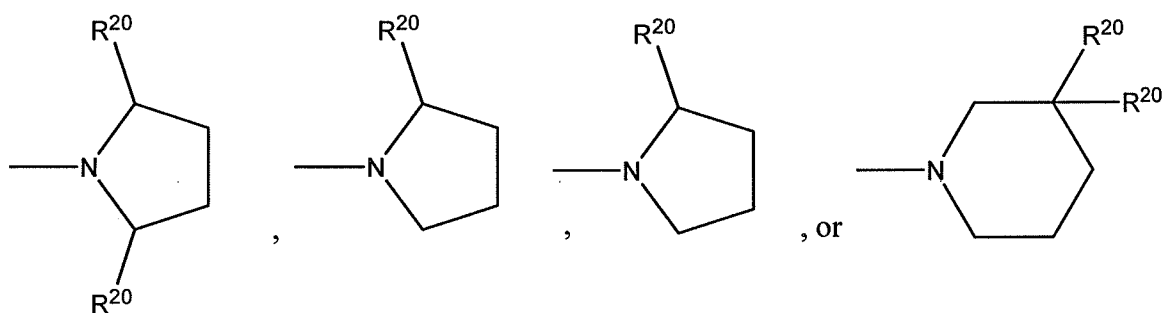
15. A compound according to claim 1, wherein m is 3 when R^1 is attached via a nitrogen atom.

16. A compound according to claim 4, wherein m is 3.

17. A compound according to claim 1, wherein s is 2.

18. A compound according to claim 1, wherein n is 0 or 1.

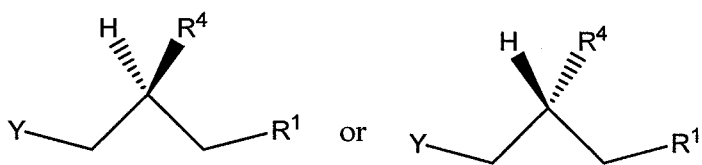
19. A compound according to claim 5, wherein R^1 is:



20. A compound according to claim 19, wherein R^{20} is F, Cl, CF_3 , $NR^{23}R^{24}$, or C_1 - C_6 alkyl optionally substituted with OR^{26} , cycloalkyl C_0 - C_4 alkyl, or heterocycloalkyl C_0 - C_4 alkyl.

21. A compound according to claim 1, wherein R^{23} and R^{24} are each independently C_1 - C_6 alkyl.

22. A compound according to claim 1, wherein $Y-(CHR^4)_m-R^1$ is:



23. A compound according to claim 1, wherein when R^4 is OR^{21} , R^{21} is H or C_1 - C_6 alkyl.

24. A compound according to claim 1, selected from the group consisting of:

2-methyl-6-{4-[(R)-2-methyl-3-((R)-2-methyl-pyrrolidin-1-yl)-propoxy]-phenyl}-2H-pyridazin-3-one;

6-[4-(1-cyclopentyl-piperidin-4-yloxy)-phenyl]-2-methyl-2H-pyridazin-3-one;

6-{3,5-difluoro-4-[3-((R)-2-methyl-pyrrolidin-1-yl)-propoxy]-phenyl}-2-methyl-2H-pyridazin-3-one;

6-{3-chloro-4-[3-((R)-2-methyl-pyrrolidin-1-yl)-propoxy]-phenyl}-2-methyl-2H-pyridazin-3-one;

6-{4-[3-((R)-2-methyl-pyrrolidin-1-yl)-propoxy]-phenyl}-5-pyridin-2-yl-2H-pyridazin-3-one;

6-[4-(1-cyclobutyl-piperidin-4-yloxy)-phenyl]-5-pyridin-2-yl-2H-pyridazin-3-one;

2-(2-fluoro-ethyl)-6-{4-[3-((R)-2-methyl-pyrrolidin-1-yl)-propoxy]-phenyl}-2H-pyridazin-3-one;

6-{3-fluoro-4-[3-((R)-2-methyl-pyrrolidin-1-yl)-propoxy]-phenyl}-2H-pyridazin-3-one;

6-[3-fluoro-4-(3-piperidin-1-yl-propoxy)-phenyl]-2H-pyridazin-3-one;

4-methyl-6-{4-[3-((R)-2-methyl-pyrrolidin-1-yl)-propoxy]-phenyl}-2H-pyridazin-3-one;

4-methyl-6-[4-(3-piperidin-1-yl-propoxy)-phenyl]-2H-pyridazin-3-one;

4-{4-[3-((S)-2-hydroxymethyl-pyrrolidin-1-yl)-propoxy]-phenyl}-2-methyl-5,6,7,8-tetrahydro-2H-phthalazin-1-one;

2-[3-((R)-2-methyl-pyrrolidin-1-yl)-propoxy]-5-(6-oxo-1,6-dihydro-pyridazin-3-yl)-benzonitrile;

2-[3-(piperidin-1-yl)-propoxy]-5-(6-oxo-1,6-dihydro-pyridazin-3-yl)-benzonitrile;

2-(2-hydroxyethyl)-6-{4-[3-((R)-2-methyl-pyrrolidin-1-yl)-propoxy]-phenyl}-2H-pyridazin-3-one;

6-{4-[(S)-2-methyl-3-((R)-2-methyl-pyrrolidin-1-yl)-propoxy]-phenyl}-2H-pyridazin-3-one;

4-[4-(3-piperidin-1-yl-propoxy)-phenyl]-2,5,6,7-tetrahydro-cyclopenta[d]pyridazin-1-one;

6-[4-(3-piperidin-1-yl-propoxy)-phenyl]-2H-pyridazin-3-one;

6-[3-methoxy-4-(3-piperidin-1-yl-propoxy)-phenyl]-2H-pyridazin-3-one;

6-{3-methoxy-4-[3-((R)-2-methyl-pyrrolidin-1-yl)-propoxy]-phenyl}-2H-pyridazin-3-one;

6-[2-methyl-4-(3-piperidin-1-yl-propoxy)-phenyl]-2H-pyridazin-3-one;

6-{4-[3-((R)-2-methyl-pyrrolidin-1-yl)-propoxy]-phenyl}-2-pyrimidin-2-yl-2H-pyridazin-3-one;

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6-[6-(1-cyclopentyl-piperidin-4-yloxy)-pyridin-3-yl]-2H-pyridazin-3-one;
6-[6-(1-isopropyl-piperidin-4-ylmethoxy)-pyridin-3-yl]-2H-pyridazin-3-one;
6-[6-(1-cyclobutyl-piperidin-4-yloxy)-pyridin-3-yl]-2H-pyridazin-3-one;
6-[6-(1-isopropyl-piperidin-4-yloxy)-pyridin-3-yl]-2H-pyridazin-3-one;
6-[6-(1-cyclopentyl-piperidin-4-yloxy)-pyridin-3-yl]-2-methyl-2H-pyridazin-3-one;
6-[6-(1-cyclobutyl-piperidin-4-yloxy)-pyridin-3-yl]-2-methyl-2H-pyridazin-3-one;
6-[6-(1-cyclobutyl-piperidin-4-yloxy)-pyridin-3-yl]-2-isopropyl-2H-pyridazin-3-one;
6-{6-[3-((R)-2-methyl-pyrrolidin-1-yl)-propoxy]-pyridin-3-yl}-2H-pyridazin-3-one;
6-[6-(3-piperidin-1-yl-propoxy)-pyridin-3-yl]-2H-pyridazin-3-one;
6-[6-(1-cyclobutyl-piperidin-4-yloxy)-pyridin-3-yl]-2-pyridin-2-yl-2H-pyridazin-3-one;
6-[4-(1-cyclopentyl-piperidin-4-yloxy)-phenyl]-2H-pyridazin-3-one;
6-[4-(1-cyclobutyl-piperidin-4-yloxy)-phenyl]-2H-pyridazin-3-one;
6-[4-(1-cyclobutyl-piperidin-4-yloxy)-3-fluoro-phenyl]-2H-pyridazin-3-one;
6-[4-(1-cyclobutyl-piperidin-4-yloxy)-phenyl]-2-pyridin-2-yl-2H-pyridazin-3-one;
6-[4-((R)-1-cyclohexyl-pyrrolidin-3-yloxy)-phenyl]-2H-pyridazin-3-one;
6-[4-((R)-1-cyclobutyl-pyrrolidin-3-yloxy)-phenyl]-2H-pyridazin-3-one;
6-{4-[3-((R)-2-methyl-pyrrolidin-1-yl)-propoxy]-phenyl}-2-(2,2,2-trifluoro-ethyl)-2H-pyridazin-3-one;
6-[4-(3-piperidin-1-yl-propoxy)-phenyl]-2-(2,2,2-trifluoro-ethyl)-2H-pyridazin-3-one;
4-[4-(1-cyclobutyl-piperidin-4-yloxy)-phenyl]-2,5,6,7-tetrahydro-cyclopenta[d]pyridazin-1-one;
6-{3,5-difluoro-4-[3-((R)-2-methyl-pyrrolidin-1-yl)-propoxy]-phenyl}-2H-pyridazin-3-one;
6-{3,5-dibromo-4-[3-((R)-2-methyl-pyrrolidin-1-yl)-propoxy]-phenyl}-2H-pyridazin-3-one;
6-[4-(1-cyclobutyl-piperidin-4-yloxy)-3,5-difluoro-phenyl]-2H-pyridazin-3-one;
5-methyl-6-{4-[3-((R)-2-methyl-pyrrolidin-1-yl)-propoxy]-phenyl}-2H-pyridazin-3-one;
5-ethyl-6-{4-[3-((R)-2-methyl-pyrrolidin-1-yl)-propoxy]-phenyl}-2H-pyridazin-3-one;
6-{2-methoxy-4-[3-((R)-2-methyl-pyrrolidin-1-yl)-propoxy]-phenyl}-2H-pyridazin-3-one;

6-{2-fluoro-4-[3-((R)-2-methyl-pyrrolidin-1-yl)-propoxy]-phenyl}-2H-pyridazin-3-one;
 6-{4-[3-((R)-2-methyl-pyrrolidin-1-yl)-propoxy]-phenyl}-2-pyridin-2-yl-2H-pyridazin-3-one;;
 6-{4-[3-((R)-2-methyl-pyrrolidin-1-yl)-propoxy]-phenyl}-4-pyridin-2-yl-2H-pyridazin-3-one;
 6-[4-(1-cyclobutyl-piperidin-4-yloxy)-2-fluoro-phenyl]-2H-pyridazin-3-one;
 6-[4-(1-cyclobutyl-piperidin-4-yloxy)-phenyl]-5-methyl-2H-pyridazin-3-one;
 6-[4-(3-morpholin-4-yl-propoxy)-phenyl]-2H-pyridazin-3-one;
 6-{4-[3-((S)-2-methyl-pyrrolidin-1-yl)-propoxy]-phenyl}-2H-pyridazin-3-one;
 6-[4-(3-pyrrolidin-1-yl-propoxy)-phenyl]-2H-pyridazin-3-one;
 6-[4-(2-hydroxy-3-piperidin-1-yl-propoxy)-phenyl]-2H-pyridazin-3-one;
 6-{4-[2-hydroxy-3-((R)-2-methyl-pyrrolidin-1-yl)-propoxy]-phenyl}-2H-pyridazin-3-one;
 6-{4-[(S)-2-hydroxy-3-((R)-2-methyl-pyrrolidin-1-yl)-propoxy]-phenyl}-2H-pyridazin-3-one;
 6-{4-[(R)-2-hydroxy-3-((R)-2-methyl-pyrrolidin-1-yl)-propoxy]-phenyl}-2H-pyridazin-3-one;
 6-[4-((R)-2-hydroxy-3-piperidin-1-yl-propoxy)-phenyl]-2H-pyridazin-3-one; and
 6-{4-[3-((R)-2-methyl-pyrrolidin-1-yl)-propoxy]-phenyl}-2H-pyridazin-3-one;
 or a stereoisomeric form, mixture of stereoisomeric forms, or a pharmaceutically acceptable salt thereof.

25. A compound according to claim 24, wherein the compound is selected from the group consisting of:

6-[4-(3-piperidin-1-yl-propoxy)-phenyl]-2H-pyridazin-3-one;
 6-{4-[(S)-2-Methyl-3-((R)-2-methyl-pyrrolidin-1-yl)-propoxy]-phenyl}-2H-pyridazin-3-one; and

6-{4-[3-((R)-2-methyl-pyrrolidin-1-yl)-propoxy]-phenyl}-2H-pyridazin-3-one;
or a stereoisomeric form, mixture of stereoisomeric forms, or a pharmaceutically acceptable salt thereof.

26. A compound according to claim 25, wherein the compound is selected from the group consisting of:

6-{4-[(S)-2-methyl-3-((R)-2-methyl-pyrrolidin-1-yl)-propoxy]-phenyl}-2H-pyridazin-3-one; and

6-{4-[3-((R)-2-methyl-pyrrolidin-1-yl)-propoxy]-phenyl}-2H-pyridazin-3-one;
or a stereoisomeric form, mixture of stereoisomeric forms, or a pharmaceutically acceptable salt thereof.

27. A compound according to claim 26, wherein the compound is 6-{4-[3-((R)-2-methyl-pyrrolidin-1-yl)-propoxy]-phenyl}-2H-pyridazin-3-one, or a stereoisomeric form, mixture of stereoisomeric forms, or a pharmaceutically acceptable salt thereof.

28. A pharmaceutical composition comprising a compound of Claim 1 or a stereoisomeric form, mixture of stereoisomeric forms, or a pharmaceutically acceptable salt thereof and one or more pharmaceutically acceptable excipients.

29. A compound according to formula I* as claimed in claim 1 or a stereoisomeric form, mixture of stereoisomeric forms, or a pharmaceutically acceptable salt thereof for use in the treatment of a disorder selected from the group consisting of narcolepsy or sleep/wake disorders, feeding behavior, eating disorders, obesity, cognition, arousal, memory, mood disorders, mood attention alteration, attention deficit hyperactivity disorder (ADHD), Alzheimer's disease/dementia, schizophrenia, pain, stress, migraine, motion sickness, depression, psychiatric disorders, epilepsy, gastrointestinal disorders, respiratory disorders, inflammation, and myocardial infarction.