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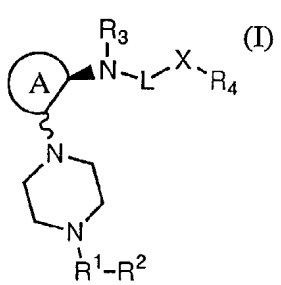
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(54) Title: PIPERAZINE DERIVATIVES FOR USE AS CCR-3 RECEPTOR ANTAGONISTS IN THE TREATMENT OF ASTHMA




(I)

(57) Abstract: The present invention relates to piperazine derivatives of Formula (I), wherein: $R^1$-$R^4$, A, L, and X are as defined in the specification. The compounds are useful as CCR-3 receptor antagonists, and therefore, may be used for the treatment of CCR-3 mediated diseases such as asthma.

# PIPERAZINE DERIVATIVES FOR USE AS CCR-3 RECEPTOR ANTAGONISTS IN THE TREATMENT OF ASTHMA

This invention relates to piperazine derivatives that are CCR-3 receptor antagonists, pharmaceutical compositions containing them, their use for treating CCR-3 mediated diseases such as asthma, and method for preparing these compounds.

Tissue eosinophilia is a feature of a number of pathological conditions such as asthma, rhinitis, eczema and parasitic infections (see Bousquet, J. et al., N. Eng. J. Med. 323: 1033-1039 (1990) and Kay, A. B. and Corrigan, C. J., Br. Med. Bull. 48:51-64 (1992)). In asthma, eosinophil accumulation and activation are associated with damage to bronchial epithelium and hyperresponsiveness to constrictor mediators. Chemokines such as RANTES, eotaxin and MCP-3 are known to activate eosinophils (see Baggiolini, M. and Dahinden, C. A., Immunol. Today. 15:127-133 (1994), Rot, A. M. et al., J. Exp. Med. 176, 1489-1495 (1992) and Ponath, P. D. et al., J. Clin. Invest., Vol. 97, #3, 604-612 (1996)). However, unlike RANTES and MCP-3 which also induce the migration of other leukocyte cell types, eotaxin is selectively chemotactic for eosinophils (see Griffith-Johnson, D. A. et al., Biochem. Biophy. Res. Commun. 197:1167 (1993) and Jose, P. J. et al., Biochem. Biophy. Res. Commun. 207, 788 (1994)). Specific eosinophil accumulation was observed at the site of administration of eotaxin whether by intradermal or intraperitoneal injection or aerosol inhalation (see Griffith-Johnson, D. A. et al., Biochem. Biophy. Res. Commun. 197:1167 (1993); Jose, P. J. et al., J. Exp. Med. 179, 881-887 (1994); Rothenberg, M. E. et al., J. Exp. Med. 181, 1211 (1995) and Ponath, P. D., J. Clin. Invest., Vol. 97, #3, 604-612 (1996)).

Glucocorticoids such as dexamethasone, methprednisolone and hydrocortisone have been used for treating many eosinophil-related disorders, including bronchial asthma (R. P. Schleimer et al., Am. Rev. Respir. Dis., 141, 559 (1990)). The glucocorticoids are believed to inhibit IL-5 and IL-3 mediated eosinophil survival in these diseases. However, prolonged use of glucocorticoids can lead to side effects such as glaucoma, osteoporosis and growth retardation in the patients (see Hanania, N. A. et al., J. Allergy and Clin. Immunol., Vol. 96,

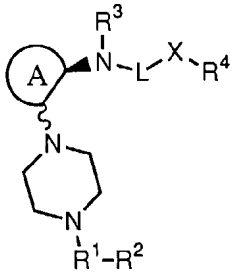
571-579 (1995) and Saha, M. T. et al., Acta Paediatrica, Vol. 86, #2, 138-142 (1997)). It is therefore desirable to have an alternative means of treating eosinophil related diseases without incurring these undesirable side effects.

Recently, the CCR-3 receptor was identified as a major chemokine receptor that eosinophils use for their response to eotaxin, RANTES and MCP-3. When transfected into a murine pre-beta. lymphoma line, CCR-3 bound eotaxin, RANTES and MCP-3 conferred chemotactic responses on these cells to eotaxin, RANTES and MCP-3 (see Ponath, P. D. et al., J. Exp. Med. 183, 2437-2448 (1996)). The CCR-3 receptor is expressed on the surface of eosinophils, T-cells (subtype Th-2), basophils and mast cells and is highly selective for eotaxin. Studies have shown that pretreatment of eosinophils with an anti-CCR-3 mAb completely inhibits eosinophil chemotaxis to eotaxin, RANTES and MCP-3 (see Heath, H. et al., J. Clin. Invest., Vol. 99, #2, 178-184 (1997)). Applicants' issued U.S. patents U.S. Patent Nos. 6,140,344 and 6,166,015 and published EP application EP903349, published March 24, 1999 disclose CCR-3 antagonists that inhibit eosinophilic recruitment by chemokine such as eotaxin.

Therefore, blocking the ability of the CCR-3 receptor to bind RANTES, MCP-3 and eotaxin and thereby preventing the recruitment of eosinophils should provide for the treatment of eosinophil-mediated inflammatory diseases.

The present invention concerns novel piperazine derivatives which are capable of inhibiting the binding of eotaxin to the CCR-3 receptor and thereby provide a means of combating eosinophil induced diseases, such as asthma.

In a first aspect, this invention provides a compound of Formula (I):



(I)

wherein:

$R^1$ is $(C_1$-$C_2)$alkylene;

$R^2$ is optionally substituted phenyl;

$R^3$ is hydrogen, alkyl, acyl, aryl, or arylalkyl;

ring A is a cycloalkyl, heterocyclyl, or optionally substituted phenyl;

L is -C(=O)-, -C(=S)-, $-SO_2$-, $-C(=O)N(R_a)$-, $-C(=S)\ N(R_a)$-, $-SO_2\ N(R_a)$-, -C(=O)O-, -C(=S)O-, $-S(=O)_2O$-;

where $R_a$ is hydrogen, alkyl, acyl, aryl, arylalkyl, alkoxycarbonyl, or benzyloxycarbonyl;

X is absent, -(CR'R")O-, -(CR'R")S-,$-(CR'R")NR_b$- or alkylene;

where R' and R" are independently hydrogen or alkyl, and $R_b$ is hydrogen or alkyl; and

$R^4$ is aryl or heteroaryl;

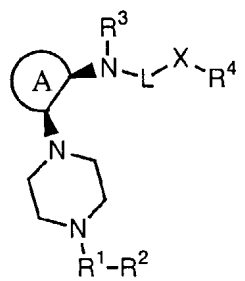
provided the compound of Formula I is not 1-{2-[4-(3,4-dichlorobenzyl)piperazin-1-yl]cyclohexyl}-3-(3-methoxyphenyl)urea; and

provided that when ring A is phenyl or cyclohexyl, then $R^2$ is substituted phenyl;

and prodrugs, individual isomers, racemic and non-racemic mixtures of isomers, and pharmaceutically acceptable salts thereof.

Also, within the compounds as defined above [they will be referred to in the following under (i)], preferred are the following compounds:

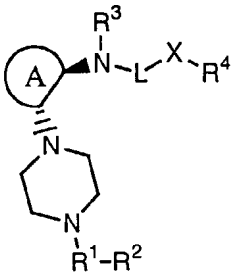
(ii) The compound of (i), which is a compound of Formula (II):




(II)

wherein $R^1$-$R^4$, A, L, and X are as defined in (i).

(iii) The compound of (i), which is a compound of Formula (III):



(III)

wherein $R^1$-$R^4$, A, L, and X are as defined in (i).

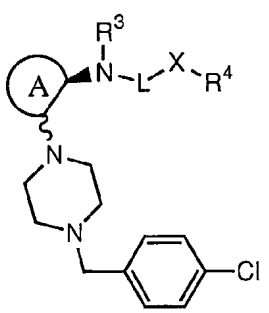
(iv) The compound of any one of (i) to (iii) wherein $R^1$ is methylene.

(v) The compound of any one of (i) to (iv) wherein $R^2$ is 4-chlorophenyl or 3,4-dichlorophenyl.

(vi) The compound of any one of (i) to (v) wherein $R^3$ is hydrogen.

(vii) The compound of any one of (i) to (vi) wherein L is -C(=O)-, -$SO_2$-, -C(=O)N($R_a$)-, -C(=S)N($R_a$)-, or -C(=O)O-.

(viii) The compound of (i) which is a compound of formula (IV):



(IV)

wherein $R^3$, $R^4$, A, L, and X are as defined in (i).

(ix) The compound of (vii) wherein X is absent, methylene, 1,2-ethanediyl, 1,3-propanediyl, or 1,4-butanediyl.

(x) The compound of (ix) wherein $R^4$ is 3,4-dichlorophenyl, 3,4,5-trimethoxyphenyl, 4-methanesulfonylphenyl, 3-methanesulfonylphenyl, 4-methoxynaphthalen-2-yl, 5-(3,4-dimethoxyphenyl)pyrimidin-2-yl, phenyl, 3-fluorophenyl, 4-ethylphenyl, 3-methoxyphenyl, 2,4-difluorophenyl, 3-trifluoromethylphenyl, 4-methylphenyl, 4-fluorophenyl, 2-fluorophenyl, 3-carbamoylphenyl, 4-carbamoylphenyl, 4-acetylphenyl, 4-nitrophenyl, 2-methylphenyl, 2-chloro-4-fluorophenyl, 3,4-dimethoxyphenyl, 2,5-dimethoxyphenyl, 2,3-dichlorophenyl, 2,4-dichlorophenyl, 4-bromophenyl, 4-chloro-3-nitrophenyl, 2-nitrophenyl, 2-nitro-4-trifluoromethylphenyl, 4-chlorophenyl, 3-chlorophenyl, 2-chlorophenyl, 3-methylphenyl, 2-trifluoromethylphenyl, 2-methoxyphenyl, 3-bromophenyl, 4-trifluoromethylphenyl, 3-trifluoromethylphenyl, 3,5-bis-trifluoromethylphenyl, 4-*tert*-butylphenyl, 4-ethoxyphenyl, 3-cyanophenyl, 4-cyanophenyl, 4-methoxyphenyl, 3-nitrophenyl, 3,5-dimethoxyphenyl, 4-iodophenyl, 4-isopropylphenyl, 3-methoxycarbonylphenyl, 3-acetylphenyl, 2-methylphenyl, indol-2-yl, 5-methoxyindol-2-yl, 5-chloroindol-2-yl, 2-methoxycarbonylphenyl, 3,5-dichlorophenyl, 1-naphthyl, 3-chloro-2-methylphenyl, 2,5-dimethylphenyl, 2-thienyl, 3-ethoxyphenyl, 3-isoquinolyl, 2-methylquinolin-6-yl, 3-methylaminophenyl, 3-quinolyl, 2-quinolyl, 5-hydroxynaphthalen-2-yl, 8-hydroxyquinolin-2-yl, 5,7-dimethyl-[1,8]naphthyridin-2-yl, 6-quinolyl, 3-(acetylamino)phenyl, or 2,3,4-trimethoxyphenyl.

(xi) The compound of (x) wherein $R^4$ is 3,4,5-trimethoxyphenyl, 4-acetyl-phenyl, 3-carbamoylphenyl, 4-carbamoylphenyl, 3-methanesulfonylphenyl or 4-methanesulfonyl-phenyl.

(xii) The compound of (i), which is *N*-{2-[4-(3,4-Dichloro-benzyl)-piperazin-1-yl]-phenyl}-2-thiophen-2-yl-acetamide;

*N*-{2-[4-(3,4-Dichloro-benzyl)-piperazin-1-yl]-phenyl}-3,4-difluoro-benzamide;

*N*-{2-[4-(3,4-Dichloro-benzyl)-piperazin-1-yl]-cyclohexyl}-4-methyl-benzamide;

1-{2-[4-(3,4-Dichloro-benzyl)-piperazin-1-yl]-phenyl}-3-(3-methoxy-phenyl)-urea;

4-Chloro-*N*-{2-[4-(3,4-dichloro-benzyl)-piperazin-1-yl]-phenyl}-benzamide;

*N*-{2-[4-(3,4-Dichloro-benzyl)-piperazin-1-yl]-phenyl}-4-methyl-benzenesulfonamide;

1-{4-[4-(4-Chloro-benzyl)-piperazin-1-yl]-tetrahydro-furan-3-yl}-3-(3,4,5-trimethoxy-phenyl)-urea;

*N*-{2-[4-(3,4-Dichloro-benzyl)-piperazin-1-yl]-phenyl}-4-methyl-benzamide;

or a salt thereof.

More preferably for the compound of Formula I, $R^4$ is not alkoxyphenyl when $R^1$ is methylene; $R^2$ is 3,4-dichlorophenyl, $R^3$ is hydrogen; ring A is cyclohexyl; L is $C(=O)N(R_a)$-; X is absent; and $R_a$ is hydrogen.

Even more preferably for the compound of Formula I, A is not cyclohexyl when L is $C(=O)N(R_a)$-; X is absent; and $R_a$ is hydrogen.

In a second aspect, this invention provides pharmaceutical compositions containing a therapeutically effective amount of a compound of Formula (I) or a pharmaceutically acceptable salt thereof, and a pharmaceutically acceptable excipient.

In a third aspect, this invention provides processes disclosed herein for preparing compounds of Formula (I).

In a forth aspect, this invention provides novel intermediates disclosed herein that are useful for preparing compounds of Formula (I).

In a fifth aspect, this invention provides a compound of Formula (I) or a pharmaceutically acceptable salt thereof for use in medical therapy or diagnosis, especially for use in the treatment of CCR-3 mediated diseases including respiratory diseases such as asthma.

In a sixth aspect, this invention provides the use of a compound of Formula (I) or a pharmaceutically acceptable salt thereof for the manufacture of a medicament useful for

treating a disease in a mammal treatable by administration of a CCR-3 receptor antagonist (e.g. asthma).

Unless otherwise stated, the following terms used in the specification and claims have the meanings given below.

"Acyl" means a radical –C(O)R, where R is hydrogen, alkyl, cycloalkyl, cycloalkylalkyl, phenyl or phenylalkyl wherein alkyl, cycloalkyl, cycloalkylalkyl, and phenylalkyl are as defined herein. Representative examples include, but are not limited to formyl, acetyl, cyclohexylcarbonyl, cyclohexylmethylcarbonyl, benzoyl, benzylcarbonyl.

"Acylalkyl" means a radical –alkylene-C(O)R where R is hydrogen, alkyl, haloalkyl, cycloalkyl, cycloalkyl-alkyl, optionally substituted phenyl, benzyl, hydroxy, alkoxy, amino, monoalkylamino or dialkylamino. Representative examples include methylcarbonyl-methyl, 2-(ethoxycarbonyl)ethyl, 2-(methoxycarbonyl)ethyl, 2-carboxyethyl.

"Acylamino" means a radical –NR'C(O)R, where R' is hydrogen or alkyl, and R is hydrogen, alkyl, cycloalkyl, cycloalkylalkyl, phenyl or phenylalkyl wherein alkyl, cycloalkyl, cycloalkylalkyl, and phenylalkyl are as defined herein. Representative examples include, but are not limited to formylamino, acetylamino, cylcohexylcarbonylamino, cyclohexylmethyl-carbonylamino, benzoylamino, benzylcarbonylamino.

"Alkoxy " means a radical -OR where R is an alkyl as defined herein e.g., methoxy, ethoxy, propoxy, butoxy.

"Alkoxycarbonyl" means a radical -C(O)-R where R is alkoxy as defined herein.

"Alkenyl" means a linear monovalent hydrocarbon radical of two to six carbon atoms or a branched monovalent hydrocarbon radical of three to six carbon atoms, containing at least one double bond, e.g., ethenyl, propenyl.

"Alkyl" means a linear saturated monovalent hydrocarbon radical of one to six carbon atoms or a branched saturated monovalent hydrocarbon radical of three to six carbon atoms, e.g., methyl, ethyl, propyl, 2-propyl, *n*-butyl, *iso*-butyl, *tert*-butyl, pentyl.

"Alkylamino" or "Monoalkylamino" means a radical -NHR where R represents an alkyl, cycloalkyl or cycloalkyl-alkyl group as defined herein. Representative examples include, but are not limited to methylamino, ethylamino, isopropylamino, cyclohexylamino.

"Alkylene" means a linear saturated divalent hydrocarbon radical of one to six carbon atoms or a branched saturated divalent hydrocarbon radical of three to six carbon atoms, e.g., methylene, ethylene, 2,2-dimethylethylene, propylene, 2-methylpropylene, butylene, pentylene.

"Alkynyl" means a linear monovalent hydrocarbon radical of two to six carbon atoms or a branched monovalent hydrocarbon radical of three to six carbon atoms, containing at least one triple bond, e.g., ethynyl, propynyl.

"Alkylsulfonyl" means a radical $-S(O)_2R$ where R is an alkyl, cycloalkyl or cycloalkyl-alkyl group as defined herein, e.g., methylsulfonyl, ethylsulfonyl, propylsulfonyl, butylsulfonyl, cyclohexylsulfonyl.

"Alkylsulfinyl" means a radical -S(O)R where R is an alkyl, cycloalkyl or cycloalkyl-alkyl group as defined herein e.g., methylsulfinyl, ethylsulfinyl, propylsulfinyl, butylsulfinyl, cyclohexylsulfinyl.

"Alkylthio" means a radical -SR where R is an alkyl as defined above e.g., methylthio, ethylthio, propylthio, butylthio.

"Aryl" means a monocyclic or bicyclic aromatic hydrocarbon radical of 6 to 10 ring atoms which is optionally substituted with one or more substituents, preferably one, two or three, substituents preferably selected from the group consisting of alkyl, haloalkyl, hydroxyalkyl, heteroalkyl, acyl, acylamino, amino, alkylamino, dialkylamino, alkylthio, alkylsulfinyl, alkylsulfonyl, $-SO_2NR'R''$ (where R' and R" are independently hydrogen or alkyl), alkoxy, haloalkoxy, alkoxycarbonyl, carbamoyl, hydroxy, halo, nitro, cyano, mercapto, methylenedioxy or ethylenedioxy. More specifically the term aryl includes, but is not limited to, phenyl, chlorophenyl, fluorophenyl, methoxyphenyl, 1-naphthyl, 2-naphthyl, and the derivatives thereof.

"Arylene" means a divalent aryl group as defined above.

"Arylalkyl" refers to an alkyl radical as defined herein in which one of the hydrogen atoms of the alkyl group is replaced with an aryl group. Typical arylalkyl groups include, but are not limited to, benzyl, 2-phenylethan-1-yl, naphthylmethyl, 2-naphthylethan-1-yl, naphthobenzyl, 2-naphthophenylethan-1-yl.

"Aryloxy" means a radical -O-R where R is an aryl group as defined herein.

"Carbamoyl" means the radical $-C(=O)NH_2$.

"Cycloalkyl" refers to a saturated monovalent cyclic hydrocarbon radical of three to seven ring carbons e.g., cyclopropyl, cyclobutyl, cyclohexyl, 4-methylcyclohexyl.

"Cycloalkyl-alkyl" means a radical $-R^xR^y$ where $R^x$ is an alkylene group and $R^y$ is cycloalkyl group as defined herein, *e.g.*, cyclohexylmethyl.

"Dialkylamino" means a radical -NRR' where R and R' independently represent an alkyl, cycloalkyl, or cycloalkylalkyl group as defined herein. Representative examples include, but are not limited to dimethylamino, methylethylamino, di(1-methylethyl)amino, (cyclohexyl)(methyl)amino, (cyclohexyl)(ethyl)amino, (cyclohexyl)(propyl)amino, (cyclohexylmethyl)(methyl)amino, (cyclohexylmethyl)(ethyl)amino.

"Halo" means fluoro, chloro, bromo, or iodo, preferably fluoro and chloro.

"Haloalkyl" means alkyl substituted with one or more same or different halo atoms, e.g., $-CH_2Cl$, $-CF_3$, $-CH_2CF_3$, $-CH_2CCl_3$.

"Heteroaryl" means a monocyclic or bicyclic radical of 5 to 12 ring atoms having at least one aromatic ring containing one, two, or three ring heteroatoms selected from N, O, or S, the remaining ring atoms being C, with the understanding that the attachment point of the heteroaryl radical will be on an aromatic ring. The heteroaryl ring is optionally substituted independently with one or more substituents, preferably one or two substituents, selected from alkyl, haloalkyl, hydroxyalkyl, heteroalkyl, acyl, acylamino, amino, alkylamino, dialkylamino, alkylthio, alkylsulfinyl, alkylsulfonyl, $-SO_2NR'R''$ (where R' and R" are independently hydrogen or alkyl), alkoxy, haloalkoxy, alkoxycarbonyl, carbamoyl, hydroxy, halo, nitro, cyano, mercapto, methylenedioxy, ethylenedioxy or optionally substituted phenyl. More specifically the term heteroaryl includes, but is not limited to, pyridyl, furanyl, thienyl, thiazolyl, isothiazolyl, triazolyl, imidazolyl, isoxazolyl, pyrrolyl, pyrazolyl, pyrimidinyl, 5-(3,4-dimethoxyphenyl)-pyrimidin-2-yl, 5-(4-

methoxyphenyl)-pyrimidin-2-yl, 5-(3,4-methylenedioxyphenyl)-pyrimidin-2-yl, benzofuranyl, tetrahydrobenzofuranyl, isobenzofuranyl, benzothiazolyl, benzoisothiazolyl, benzotriazolyl, indolyl, isoindolyl, benzoxazolyl, quinolyl, tetrahydroquinolinyl, isoquinolyl, benzimidazolyl, benzisoxazolyl or benzothienyl and derivatives thereof.

"Heteroarylene" means a divalent heteroaryl group as defined above.

"Heteroarylalkyl" means an alkyl radical as defined herein in which one of the hydrogen atoms of the alkyl group is replaced with a heteroaryl group.

"Heteroalkyl" means an alkyl radical as defined herein wherein one, two or three hydrogen atoms have been replaced with a substituent independently selected from the group consisting of $-OR^a$, $-NR^bR^c$, and $-S(O)_nR^d$ (where n is an integer from 0 to 2), with the understanding that the point of attachment of the heteroalkyl radical is through a carbon atom, wherein $R^a$ is hydrogen, acyl, alkyl, cycloalkyl, or cycloalkylalkyl; $R^b$ and $R^c$ are independently of each other hydrogen, acyl, alkyl, cycloalkyl, or cycloalkylalkyl; when n is 0, $R^d$ is hydrogen, alkyl, cycloalkyl, or cycloalkylalkyl, and when n is 1 or 2, $R^d$ is alkyl, cycloalkyl, cycloalkylalkyl, amino, acylamino, monoalkylamino, or dialkylamino;. Representative examples include, but are not limited to, 2-hydroxyethyl, 3-hydroxypropyl, 2-hydroxy-1-hydroxymethylethyl, 2,3-dihydroxypropyl, 1-hydroxymethylethyl, 3-hydroxybutyl, 2,3-dihydroxybutyl, 2-hydroxy-1-methylpropyl, 2-aminoethyl, 3-aminopropyl, 2-methylsulfonylethyl, aminosulfonylmethyl, aminosulfonylethyl, aminosulfonylpropyl, methylaminosulfonylmethyl, methylaminosulfonylethyl, methylaminosulfonylpropyl.

"Heterocyclyl" means a saturated or unsaturated non-aromatic cyclic radical of 3 to 8 ring atoms in which one or two ring atoms are heteroatoms selected from $NR^x$ {wherein each $R^x$ is independently hydrogen, alkyl, acyl, alkylsulfonyl, aminosulfonyl, (alkylamino)sulfonyl, (dialkylamino)sulfonyl, carbamoyl, (alkylamino)carbonyl, (dialkylamino)carbonyl, (carbamoyl)alkyl, (alkylamino)carbonylalkyl, or dialkylaminocarbonylalkyl}, O, or $S(O)_n$ (where n is an integer from 0 to 2), the remaining ring atoms being C. The heterocyclyl ring may be optionally substituted independently with one, two, or three substituents selected from alkyl, haloalkyl, heteroalkyl, halo, nitro, cyanoalkyl, hydroxy, alkoxy, amino, monoalkylamino, dialkylamino, aralkyl, $-(X)_n-C(O)R$

(where X is O or NR', n is 0 or 1, R is hydrogen, alkyl, haloalkyl, hydroxy, alkoxy, amino, monoalkylamino, dialkylamino or optionally substituted phenyl, and R' is hydrogen or alkyl), -alkylene-C(O)R (where R is hydrogen, alkyl, haloalkyl, hydroxy, alkoxy, amino, monoalkylamino, dialkylamino or optionally substituted phenyl) or $-S(O)_nR^d$ (where n is an integer from 0 to 2, and $R^d$ is hydrogen (provided that n is 0), alkyl, haloalkyl, cycloalkyl, cycloalkylalkyl, amino, monoalkylamino, dialkylamino, or hydroxyalkyl). More specifically the term heterocyclyl includes, but is not limited to, tetrahydropyranyl, piperidino, N-methylpiperidin-3-yl, piperazino, N-methylpyrrolidin-3-yl, 3-pyrrolidino, morpholino, thiomorpholino, thiomorpholino-1-oxide, thiomorpholino-1,1-dioxide, tetrahydrothiophenyl-S,S-dioxide, pyrrolinyl, imidazolinyl, and the derivatives thereof.

"Hydroxyalkyl" means an alkyl radical as defined herein, substituted with one or more, preferably one, two or three hydroxy groups, provided that the same carbon atom does not carry more than one hydroxy group. Representative examples include, but are not limited to, 2-hydroxyethyl, 2-hydroxypropyl, 3-hydroxypropyl, 1-(hydroxymethyl)-2-methylpropyl, 2-hydroxybutyl, 3-hydroxybutyl, 4-hydroxybutyl, 2,3-dihydroxypropyl, 2-hydroxy-1-hydroxymethylethyl, 2,3-dihydroxybutyl, 3,4-dihydroxybutyl and 2-(hydroxymethyl)-3-hydroxypropyl, preferably 2-hydroxyethyl, 2,3-dihydroxypropyl and 1-(hydroxymethyl)-2-hydroxyethyl. Accordingly, as used herein, the term "hydroxyalkyl" is used to define a subset of heteroalkyl groups.

"Leaving group" has the meaning conventionally associated with it in synthetic organic chemistry, i.e., an atom or a group capable of being displaced by a nucleophile and includes halo (such as chloro, bromo, and iodo), alkanesulfonyloxy, arenesulfonyloxy, alkylcarbonyloxy (e.g., acetoxy), arylcarbonyloxy, mesyloxy, tosyloxy, trifluoromethanesulfonyloxy, aryloxy (e.g., 2,4-dinitrophenoxy), methoxy, N,O-dimethylhydroxylamino.

"Optionally substituted phenyl" means a phenyl group which is optionally substituted with one or more substituents, preferably one, two or three substituents preferably selected from the group consisting of alkyl, haloalkyl, hydroxyalkyl, heteroalkyl, acyl, acylamino, amino, alkylamino, dialkylamino, alkylthio, alkylsulfinyl, alkylsulfonyl, $-SO_2NR'R''$ (where R' and R" are independently hydrogen or alkyl), alkoxy, haloalkoxy,

alkoxycarbonyl, carbamoyl, hydroxy, halo, nitro, cyano, mercapto, methylenedioxy or ethylenedioxy. More specifically the term includes, but is not limited to, phenyl, chlorophenyl, fluorophenyl, bromophenyl, methylphenyl, ethylphenyl, methoxyphenyl, cyanophenyl, 4-nitrophenyl, 4-trifluoromethylphenyl, 4-chlorophenyl, 3,4-difluorophenyl, 2,3-dichlorophenyl, 3-methyl-4-nitrophenyl, 3-chloro-4-methylphenyl, 3-chloro-4-fluorophenyl or 3,4-dichlorophenyl and the derivatives thereof.

"Optional" or "optionally" means that the subsequently described event or circumstance may but need not occur, and that the description includes instances where the event or circumstance occurs and instances in which it does not. For example, "aryl group optionally mono- or di-substituted with an alkyl group" means that the alkyl may but need not be present, and the description includes situations where the aryl group is mono- or disubstituted with an alkyl group and situations where the aryl group is not substituted with the alkyl group.

"Pharmaceutically acceptable excipient" means an excipient that is useful in preparing a pharmaceutical composition that is generally safe, non-toxic and neither biologically nor otherwise undesirable, and includes excipient that is acceptable for veterinary use as well as human pharmaceutical use. A "pharmaceutically acceptable excipient" as used in the specification and claims includes both one and more than one such excipient.

"Pharmaceutically acceptable salt" of a compound means a salt that is pharmaceutically acceptable and that possesses the desired pharmacological activity of the parent compound. Such salts include: (1) acid addition salts, formed with inorganic acids such as hydrochloric acid, hydrobromic acid, sulfuric acid, nitric acid, phosphoric acid, and the like; or formed with organic acids such as acetic acid, propionic acid, hexanoic acid, cyclopentanepropionic acid, glycolic acid, pyruvic acid, lactic acid, malonic acid, succinic acid, malic acid, maleic acid, fumaric acid, tartaric acid, citric acid, benzoic acid, 3-(4-hydroxybenzoyl)benzoic acid, cinnamic acid, mandelic acid, methanesulfonic acid, ethanesulfonic acid, 1,2-ethane-disulfonic acid, 2-hydroxyethanesulfonic acid, benzenesulfonic acid, 4-chlorobenzenesulfonic acid, 2-naphthalenesulfonic acid, 4-toluenesulfonic acid, camphorsulfonic acid, 4-methylbicyclo[2.2.2]-oct-2-ene-1-carboxylic

acid, glucoheptonic acid, 3-phenylpropionic acid, trimethylacetic acid, tertiary butylacetic acid, lauryl sulfuric acid, gluconic acid, glutamic acid, hydroxynaphthoic acid, salicylic acid, stearic acid, muconic acid; or (2) salts formed when an acidic proton present in the parent compound either is replaced by a metal ion, e.g., an alkali metal ion, an alkaline earth ion, or an aluminum ion; or coordinates with an organic base such as ethanolamine, diethanolamine, triethanolamine, tromethamine, N-methylglucamine.

"Phenylalkyl" refers to an alkyl radical as defined herein in which one of the hydrogen atoms of the alkyl radical has been replaced by an optionally substituted phenyl.

"Protecting group" refers to a grouping of atoms that when attached to a reactive group in a molecule masks, reduces or prevents that reactivity. Examples of protecting groups can be found in T.W. Green and P.G. Futs, Protective Groups in Organic Chemistry, (Wiley, 2nd ed. 1991) and Harrison and Harrison et al., Compendium of Synthetic Organic Methods, Vols. 1-8 (John Wiley and Sons, 1971-1996). Representative amino protecting groups include, formyl, acetyl, trifluoroacetyl, benzyl, benzyloxycarbonyl (CBZ), *tert*-butoxycarbonyl (Boc), trimethyl silyl (TMS), 2-trimethylsilyl-ethanesulfonyl (SES), trityl and substituted trityl groups, allyloxycarbonyl, 9-fluorenylmethyloxycarbonyl (FMOC), nitro-veratryloxycarbonyl (NVOC). Representative hydroxy protecting groups include those where the hydroxy group is either acylated or alkylated such as benzyl, and trityl ethers as well as alkyl ethers, tetrahydropyranyl ethers, trialkylsilyl ethers and allyl ethers.

"Treating" or "treatment" of a disease includes: (1) preventing the disease, i.e., causing the clinical symptoms of the disease not to develop in a mammal that may be exposed to or predisposed to the disease but does not yet experience or display symptoms of the disease; (2) inhibiting the disease, i.e., arresting or reducing the development of the disease or its clinical symptoms; or (3) relieving the disease, i.e., causing regression of the disease or its clinical symptoms.

"A therapeutically effective amount" means the amount of a compound that, when administered to a mammal for treating a disease, is sufficient to effect such treatment for the disease. The "therapeutically effective amount" will vary depending on the compound, the disease and its severity and the age, weight, etc., of the mammal to be treated.

"Prodrugs" means any compound which releases an active parent drug according to Formula I *in vivo* when such a prodrug is administered to a mammalian subject. Prodrugs of a compound of Formula I are prepared by modifying functional groups present in the compound of Formula I in such a way that the modifications may be cleaved *in vivo* to release the parent compound. Prodrugs include compounds of Formula I wherein a hydroxy, amino, or sulfhydryl group in a compound of Formula I is bonded to any group that may be cleaved *in vivo* to regenerate the free hydroxyl, amino, or sulfhydryl group, respectively. Examples of prodrugs include, but are not limited to esters (e.g., acetate, formate, and benzoate derivatives), carbamates (e.g., N,N-dimethylaminocarbonyl) of hydroxy functional groups in compounds of Formula I.

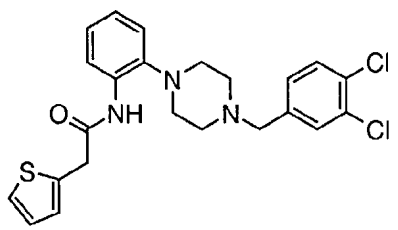
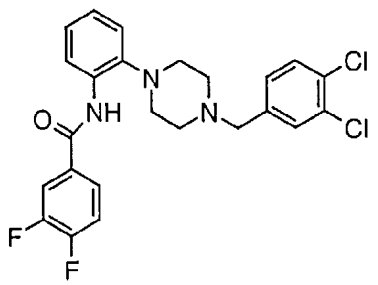
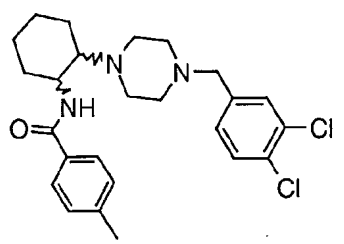
Compounds that have the same molecular Formula but differ in the nature or sequence of bonding of their atoms or the arrangement of their atoms in space are termed "isomers." Isomers that differ in the arrangement of their atoms in space are termed "stereoisomers". Stereoisomers that are not mirror images of one another are termed "diastereomers" and those that are non-superimposable mirror images of each other are termed "enantiomers". When a compound has an asymmetric center, for example, if a carbon atom is bonded to four different groups, a pair of enantiomers is possible. An enantiomer can be characterized by the absolute configuration of its asymmetric center and is described by the R- and S-sequencing rules of Cahn and Prelog, or by the manner in which the molecule rotates the plane of polarized light and designated as dextrorotatory or levorotatory (i.e., as (+) or (-)-isomers respectively). A chiral compound can exist as either individual enantiomer or as a mixture thereof. A mixture containing equal proportions of the enantiomers is called a "racemic mixture".

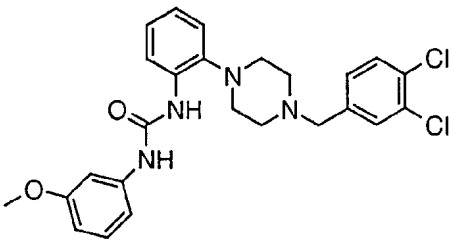
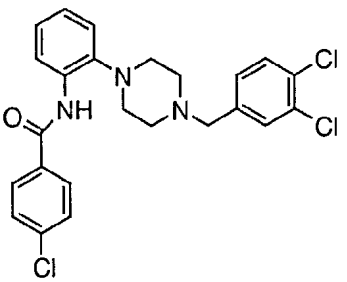
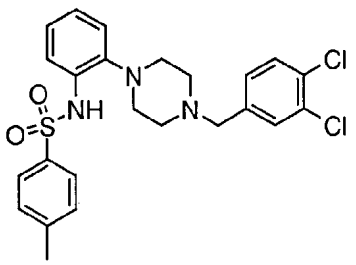
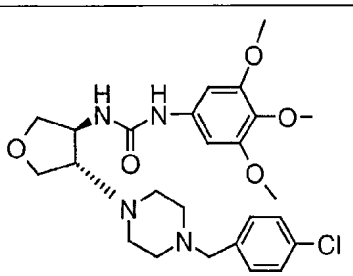
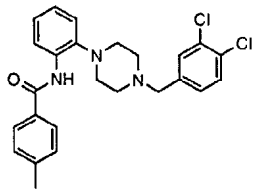
The compounds of this invention may possess one or more asymmetric centers; such compounds can therefore be produced as individual (R)- or (S)-stereoisomers or as mixtures thereof. Unless indicated otherwise, the description or naming of a particular compound in the specification and claims is intended to include both individual enantiomers and mixtures, racemic or otherwise, thereof. The methods for the determination of stereochemistry and the separation of stereoisomers are well-known in the

art (see discussion in Chapter 4 of "Advanced Organic Chemistry", 4th edition J. March, John Wiley and Sons, New York, 1992).

In general, the nomenclature used in this Application is based on AUTONOM™, a Beilstein Institute computerized system for the generation of IUPAC systematic nomenclature. For example, a compound of Formula (I) wherein $R_1$ is methylene; $R_2$ is 3,4-dichlorophenyl; L is C(=O); A is phenyl; $R_3$ is hydrogen; and $R_4$ is 3,4-difluorophenyl; and X is absent (Example 1), is named *N-{2-[4-((3E,5E)-4,5-Dichloro-2-methylene-hepta-3,5-dienyl)-piperazin-1-yl]-phenyl}-3,4-difluoro-benzamide.*

Representative compounds of Formula (I) are shown in the following table.

| Cpd. No. | Structure | M.P. (°C) | Example |
|---|---|---|---|
| 1 |  | | 5 |
| 2 |  | | 1 |
| 3 |  | | |

| Cpd. No. | Structure | M.P. (°C) | Example |
|---|---|---|---|
| 4 |  | | 4 |
| 5 |  | | 6 |
| 6 |  | | 3 |
| 7 |  2HCl | 190.8-204.3 | 2 |
| 8 |  | | 7 |

While the broadest definition of this invention is described before, certain compounds of Formula (I) are preferred.

A preferred compound of the invention is a compound of Formula (I) wherein $R^1$ is methylene.

Another preferred compound of the invention are compounds of Formula (I) wherein ring A is cyclopentyl. Compounds where ring A is cyclopentyl are bind unexpectedly potently to the CCR-3 receptor. Other preferred compounds of the invention are compounds of Formula (I) wherein ring A is heterocyclyl (particularly tetrahydropyranyl, S,S-dioxo-tetrahydothiophenyl, tetrahydrothiophenyl or pyrrolidinyl) or compounds of Formula (I) wherein ring A is phenyl.

A preferred compound of the invention is a compound of Formula (I) wherein $R^2$ is phenyl ring substituted with one, or two substituents selected from alkyl, alkoxy, haloalkyl, halo, cyano or nitro; preferably methyl, ethyl, methoxy, trifluoromethyl, chloro, fluoro or bromo; most preferably 4-nitrophenyl, 4-trifluoromethylphenyl, 4-chlorophenyl, 3,4-difluorophenyl, 2,3-dichlorophenyl, 3-methyl-4-nitrophenyl, 3-chloro-4-methylphenyl, 3-chloro-4-fluorophenyl or 3,4-dichlorophenyl. Particularly preferred are 4-chlorophenyl or 3,4-dichlorophenyl. Such substituted compounds show particularly good binding to the CCR-3 receptor compared to their unsubstituted phenyl analogues.

A preferred compound of the invention is a compound of Formula (I) wherein $R^3$ is hydrogen or methyl, preferably hydrogen.

A preferred compound of the invention is a compound of Formula (I) wherein L is -C(=O)-, $-SO_2-$, $-C(=O)N(R_a)-$, $-C(=S)N(R_a)-$, or -C(=O)O-. More preferred are compounds where L is -C(=O)-, $-C(=O)N(R_a)-$, most preferably $-C(=O)N(R_a)-$. In the preceding $R_a$ is preferably hydrogen or methyl, most preferably hydrogen.

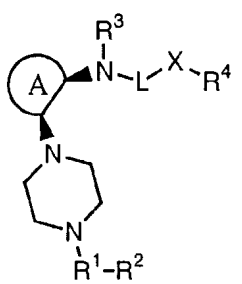
A preferred compound of the invention is a compound of Formula (I) wherein X is absent, methylene, 1,2-ethanediyl, 1,3-propanediyl, or 1,4-butanediyl.

A preferred compound of the invention is a compound of Formula (I) wherein $R^4$ is optionally substituted phenyl, optionally substituted heteroaryl wherein the heteroaryl ring is indolyl, thienyl, quinolinyl or 1,8-naphthyridinyl. Preferably $R^4$ is selected from 3,4-dichlorophenyl, 3,4,5-trimethoxyphenyl, 4-methanesulfonyl-phenyl, 3-methanesulfonylphenyl, 4-methoxynaphthalen-2-yl, 5-(3,4-dimethoxyphenyl)pyrimidin-2-yl, phenyl, 3-fluorophenyl, 4-ethylphenyl, 3-methoxyphenyl, 2,4-difluorophenyl,

3-trifluoromethylphenyl, 4-methylphenyl, 4-fluorophenyl, 2-fluorophenyl, 3-carbamoylphenyl, 4-carbamoylphenyl, 4-acetylphenyl, 4-nitrophenyl, 2-methylphenyl, 2-chloro-4-fluorophenyl, 3,4-dimethoxyphenyl, 2,5-dimethoxyphenyl, 2,3-dichlorophenyl, 2,4-dichlorophenyl, 4-bromophenyl, 4-chloro-3-nitrophenyl, 2-nitrophenyl, 2-nitro-4-trifluoromethylphenyl, 4-chlorophenyl, 3-chlorophenyl, 2-chlorophenyl, 3-methylphenyl, 2-trifluoromethylphenyl, 2-methoxyphenyl, 3-bromophenyl, 4-trifluoromethylphenyl, 3-trifluoromethylphenyl, 3,5-bis-trifluoromethylphenyl, 4-*tert*-butylphenyl, 4-ethoxyphenyl, 3-cyanophenyl, 4-cyanophenyl, 4-methoxyphenyl, 3-nitrophenyl, 3,5-dimethoxyphenyl, 4-iodophenyl, 4-isopropylphenyl, 3-methoxycarbonylphenyl 3-acetylphenyl, 2-methylphenyl, indol-2-yl, 5-methoxyindol-2-yl, 5-chloroindol-2-yl, 2-methoxycarbonylphenyl, 3,5-dichlorophenyl, 1-naphthyl, 3-chloro-2-methylphenyl, 2,5-dimethylphenyl, 2-thienyl, 3-ethoxyphenyl, 3-isoquinolyl, 2-methylquinolin-6-yl, 3-methylaminophenyl, 3-quinolyl, 2-quinolyl, 5-hydroxynaphthalen-2-yl, 8-hydroxyquinolin-2-yl, 5,7-dimethyl-[1,8]naphthyridin-2-yl, 6-quinolyl, 3-(acetylamino)phenyl or 2,3,4-trimethoxyphenyl.

Also preferred are compounds where X is $-CH_2S-$, $-CH_2O-$, $-CH_2CH_2-$ and $R^4$ is heteroaryl, preferably optionally substituted pyrimidinyl, pyrazolyl or thienyl. Particularly preferred are compounds where X is $-CH_2S-$ and $R^4$ is 5-(3,4-dimethoxyphenyl)-pyrimidin-2-yl, 5-(3,4-methylenedioxy)-pyrimidin-2-yl, 5-(4-methoxyphenyl)pyrimidin-2-yl.

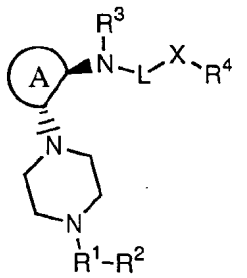
A specific compound of Formula (I) is a compound of Formula (II):



(II)

wherein $R^1$-$R^4$, A, L, and X have any of the values described herein.

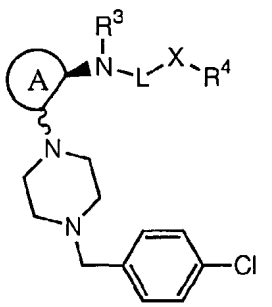
A specific compound of Formula (I) is a compound of Formula (III):



(III)

wherein $R^1$-$R^4$, A, L, and X have any of the values described herein.

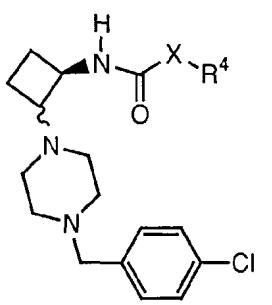
A specific compound of formula (I) is a compound of formula (IV):



(IV)

wherein $R^3$,$R^4$, A, L, and X have any of the values described herein.

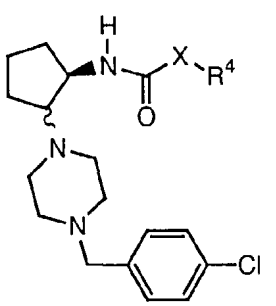
A specific compound of Formula (I) is a compound of formula (V):



(V)

wherein X and $R^4$ have any of the values defined herein.

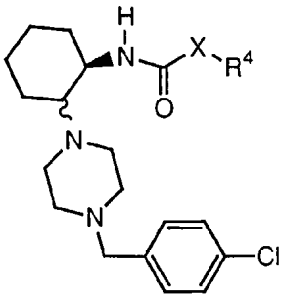
A specific compound of Formula (I) is a compound of formula (VI):



(VI)

wherein X and $R^4$ have any of the values defined herein.

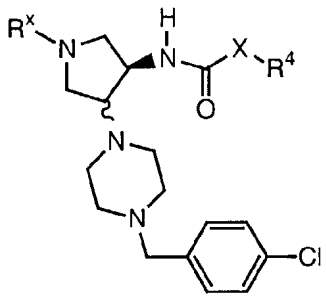
A specific compound of Formula (I) is a compound of formula (VII):



(VII)

wherein X and $R^4$ have any of the values defined herein.

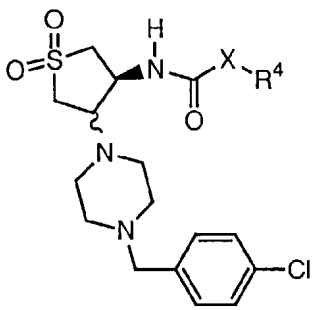
A specific compound of Formula (I) is a compound of formula (VIII):



(VIII)

wherein X and $R^4$ have any of the values defined herein; and $R^x$ is hydrogen, alkyl, acyl, alkylsulfonyl, aminosulfonyl, (alkylamino)sulfonyl, (dialkylamino)sulfonyl, carbamoyl, (alkylamino)carbonyl, (dialkylamino)carbonyl, (carbamoyl)alkyl, (alkylamino)carbonylalkyl, or dialkylaminocarbonylalkyl.

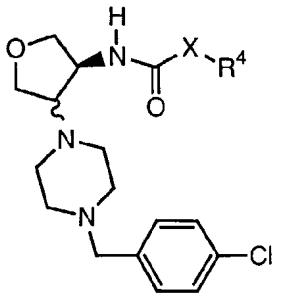
A specific compound of Formula (I) is a compound of formula (IX):



(IX)

wherein X and $R^4$ have any of the values defined herein.

A specific compound of Formula (I) is a compound of formula (X):



(X)

wherein X and $R^4$ have any of the values defined herein.

A particularly preferred compound of the invention is:

*N*-{2-[4-(3,4-Dichloro-benzyl)-piperazin-1-yl]-phenyl}-2-thiophen-2-yl-acetamide;

*N*-{2-[4-(3,4-Dichloro-benzyl)-piperazin-1-yl]-phenyl}-3,4-difluoro-benzamide;

*N*-{2-[4-(3,4-Dichloro-benzyl)-piperazin-1-yl]-cyclohexyl}-4-methyl-benzamide;

1-{2-[4-(3,4-Dichloro-benzyl)-piperazin-1-yl]-phenyl}-3-(3-methoxy-phenyl)-urea;

4-Chloro-*N*-{2-[4-(3,4-dichloro-benzyl)-piperazin-1-yl]-phenyl}-benzamide;

*N*-{2-[4-(3,4-Dichloro-benzyl)-piperazin-1-yl]-phenyl}-4-methyl-benzenesulfonamide;

1-{4-[4-(4-Chloro-benzyl)-piperazin-1-yl]-tetrahydro-furan-3-yl}-3-(3,4,5-trimethoxy-phenyl)-urea.

or a pharmaceutically acceptable salt thereof.

The compounds of the invention are CCR-3 receptor antagonists and inhibit eosinophil recruitment by CCR-3 chemokines such as RANTES, eotaxin, MCP-2, MCP-3 and MCP-4. Compounds of this invention and compositions containing them are useful in the treatment of eosiniphil-induced diseases such as inflammatory or allergic diseases and including respiratory allergic diseases such as asthma, allergic rhinitis, hypersensitivity lung diseases, hypersensitivity pneumonitis, eosinophilic pneumonias (e.g., chronic eosinophilic pneumonia); inflammatory bowel diseases (e.g., Crohn's disease and ulcerative colitis); and psoriasis and inflammatory dermatoses such as dermatitis and eczema.

The CCR-3 antagonistic activity of the compounds of this invention can be measured by *in vitro* assays such as ligand binding and chemotaxis assays as described in more detail in Examples 9, 10, and 11. *In vivo* activity can be assayed in the Ovalbumin induced Asthma in Balb/c Mice Model as described in more detail in Example 12.

In general, the compounds of this invention can be administered in a therapeutically effective amount by any of the accepted modes of administration for agents that serve similar utilities. The actual amount of the compound of this invention, i.e., the active ingredient, will depend upon numerous factors such as the severity of the disease to be treated, the age and relative health of the subject, the potency of the compound used, the route and form of administration, and other factors.

Therapeutically effective amounts of compounds of Formula (I) may range from approximately 0.01-20 mg per kilogram body weight of the recipient per day; preferably about 0.1-10 mg/kg/day. Thus, for administration to a 70 kg person, the dosage range would most preferably be about 7 mg to 0.7 g per day.

In general, compounds of this invention will be administered as pharmaceutical compositions by any one of the following routes: oral, transdermal, inhalation (e.g., intranasal or oral inhalation) or parenteral (e.g., intramuscular, intravenous or subcutaneous) administration. A preferred manner of administration is oral using a convenient daily dosage regimen which can be adjusted according to the degree of affliction. Compositions can take the form of tablets, pills, capsules, semisolids, powders, sustained release Formulations, solutions, suspensions, liposomes, elixirs, or any other appropriate compositions. Another preferred manner for administering compounds of this invention is inhalation. This is an effective means for delivering a therapeutic agent directly to the respiratory tract for the treatment of diseases such as asthma and other similar or related respiratory tract disorders (see U.S. Pat. No. 5,607,915).

The choice of formulation depends on various factors such as the mode of drug administration and the bioavailability of the drug substance. For delivery via inhalation the compound can be formulated as liquid solutions or suspensions, aerosol propellants or dry

powder and loaded into a suitable dispenser for administration. There are three types of pharmaceutical inhalation devices--nebulizer inhalers, metered-dose inhalers (MDI) and dry powder inhalers (DPI). Nebulizer devices produce a stream of high velocity air that causes the therapeutic agents (which has been formulated in a liquid form) to spray as a mist which is carried into the patient's respiratory tract. MDI's typically have the formulation packaged with a compressed gas. Upon actuation, the device discharges a measured amount of therapeutic agent by compressed gas, thus affording a reliable method of administering a set amount of agent. DPI's administer therapeutic agents in the form of a free flowing powder that can be dispersed in the patient's inspiratory air-stream during breathing by the device. In order to achieve a free flowing powder, the therapeutic agent is formulated with an excipient, such as lactose. A measured amount of the therapeutic is stored in a capsule form and is dispensed to the patient with each actuation. Recently, pharmaceutical formulations have been developed especially for drugs that show poor bioavailability based upon the principle that bioavailability can be increased by increasing the surface area i.e., decreasing particle size. For example, U.S. Pat. No. 4,107,288 describes a pharmaceutical formulation having particles in the size range from 10 to 1,000 nm in which the active material is supported on a crosslinked matrix of macromolecules. U.S. Pat. No. 5,145,684 describes the production of a pharmaceutical formulation in which the drug substance is pulverized to nanoparticles (average particle size of 400 nm) in the presence of a surface modifier and then dispersed in a liquid medium to give a pharmaceutical formulation that exhibits remarkably high bioavailability.

The compositions are comprised of in general, a compound of Formula (I) in combination with at least one pharmaceutically acceptable excipient. Acceptable excipients are non-toxic, aid administration, and do not adversely affect the therapeutic benefit of the compound of Formula (I). Such excipient may be any solid, liquid, semi-solid or, in the case of an aerosol composition, gaseous excipient that is generally available to one of skill in the art.

Solid pharmaceutical excipients include starch, cellulose, talc, glucose, lactose, sucrose, gelatin, malt, rice, flour, chalk, silica gel, magnesium stearate, sodium stearate, glycerol monostearate, sodium chloride, dried skim milk and the like. Liquid and

semisolid excipients may be selected from glycerol, propylene glycol, water, ethanol and various oils, including those of petroleum, animal, vegetable or synthetic origin, e.g., peanut oil, soybean oil, mineral oil, sesame oil, etc. Preferred liquid carriers, particularly for injectable solutions, include water, saline, aqueous dextrose, and glycols.

Compressed gases may be used to disperse a compound of this invention in aerosol form. Inert gases suitable for this purpose are nitrogen, carbon dioxide, etc.

For liposomal formulations of the drug for parenteral or oral delivery the drug and the lipids are dissolved in a suitable organic solvent e.g. tert-butanol, cyclohexane (1% ethanol). The solution is lyopholized and the lipid mixture is suspended in an aqueous buffer and allowed to form a liposome. If necessary, the liposome size can be reduced by sonification. (see, Frank Szoka, Jr. and Demetrios Papahadjopoulos, "Comparative Properties and Methods of Preparation of Lipid Vesicles (Liposomes)", Ann. Rev. Biophys. Bioeng., 9:467-508 (1980), and D. D. Lasic, "Novel Applications of Liposomes", Trends in Biotech., 16:467-608, (1998)).

Other suitable pharmaceutical excipients and their formulations are described in Remington's Pharmaceutical Sciences, edited by E. W. Martin (Mack Publishing Company, 18th ed., 1990).

The level of the compound in a formulation can vary within the full range employed by those skilled in the art. Typically, the formulation will contain, on a weight percent (wt %) basis, from about 0.01-99.99 wt % of a compound of Formula (I) based on the total formulation, with the balance being one or more suitable pharmaceutical excipients. Preferably, the compound is present at a level of about 1-80 wt %. Representative pharmaceutical formulations containing a compound of Formula (I) are described in Example 8.

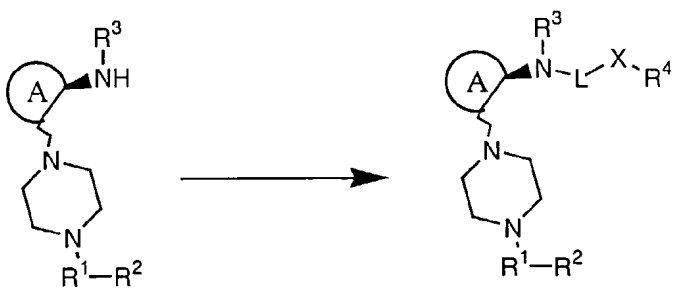
The compounds of the present invention can be prepared in a number of ways known to one skilled in the art. Preferred methods include, but are not limited to, the general synthetic procedures described below.

The starting materials and reagents used in preparing these compounds are either available from commercial suppliers such as Aldrich Chemical Co., (Milwaukee, Wis.,

USA), Bachem (Torrance, Calif., USA), Enika Chemie or Sigma (St. Louis, Mo., USA), Maybridge (Dist: Ryan Scientific, P.O. Box 6496, Columbia, S.C. 92960), Bionet Research Ltd., (Cornwall PL32 9QZ, UK), Menai Organics Ltd., (Gwynedd, N. Wales, UK), Butt Park Ltd., (Dist. Interchim, Montlucon Cedex, France) or are prepared by methods known to those skilled in the art following procedures set forth in references such as Fieser and Fieser's Reagents for Organic Synthesis, Volumes 1-17 (John Wiley and Sons, 1991); Rodd's Chemistry of Carbon Compounds, Volumes 1-5 and Supplementals (Elsevier Science Publishers, 1989), Organic Reactions, Volumes 1-40 (John Wiley and Sons, 1991), March's Advanced Organic Chemistry, (John Wiley and Sons, 1992), and Larock's Comprehensive Organic Transformations (VCH Publishers Inc., 1989). These schemes are merely illustrative of some methods by which the compounds of this invention can be synthesized, and various modifications to these schemes can be made and will be suggested to one skilled in the art having referred to this disclosure.

The starting materials and the intermediates of the reaction may be isolated and purified if desired using conventional techniques, including but not limited to filtration, distillation, crystallization, chromatography. Such materials may be characterized using conventional means, including physical constants and spectral data.

Compounds of Formula (I) are generally prepared from the precursor amine of Formula (Ia) as shown below.



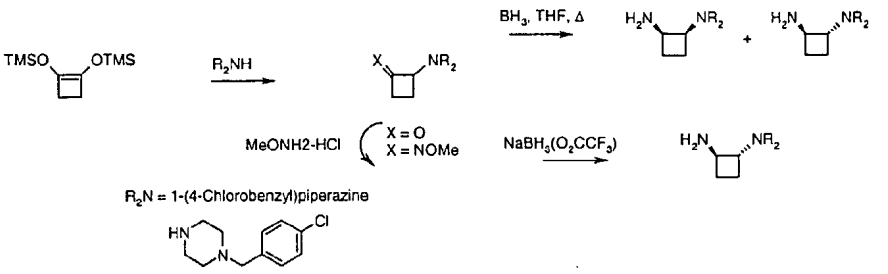

Ia I

Preparation of compounds of Formula (Ia) and their conversion to compounds of Formula I is illustrated in the following Schemes 1-8.

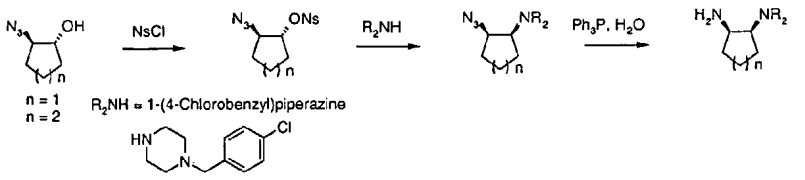
Schemes 1-5 show methods of preparing compounds of Formula Ia having different rings A. Specific exemplification is provided for $R^1$-$R^2$ being 4-chlorobenzyl in Preparations 1-6. Preparation of analogous compounds where $R^1$ and $R^2$ vary within the

full scope of this invention may be readily prepared by one of skill in the art in light of this specification and incorporated references.

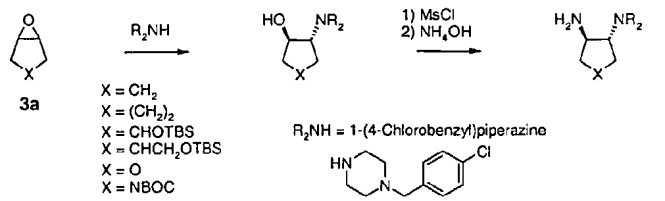
**Scheme 1. Synthesis of Cyclobutylamines – Ring A = Cyclobutyl.**




**Scheme 2. Synthesis of Cis Diamines – Ring A = Cyclopentyl and Cyclohexyl.**




**Scheme 3. Synthesis of Trans Diamines - Ring A = Cycloalkyl, Tetrahydrofuranyl, Pyrrolidinyl or Tetrahydrothiophenyl.**



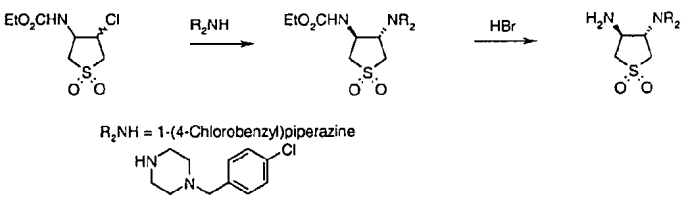

General Procedure A: (Amine Alkylation with Epoxides)

A 0.5-1.5 M solution of the amine, $R_2NH$ (1 equiv), and the specified epoxide, **3a** (1.1-10 equiv) in EtOH is stirred at 80-95 °C for 2-4.5 days, allowed to cool to room temperature, and concentrated. The crude amino alcohol is purified by chromatography or recrystallization.

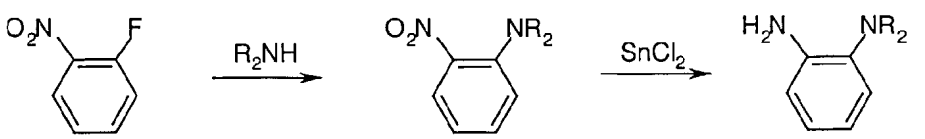
General Procedure B: (Amine Formation Using Methanesulfonyl Chloride and Ammonium Hydroxide)

A 0.2-0.3 M solution of the amino alcohol (1 equiv) in $CH_2Cl_2$ at 0 °C is treated successively with $Et_3N$ (2 equiv) and $MeSO_2Cl$ (2 equiv), stirred at 0 °C for 1-2 hours, and partitioned between $CH_2Cl_2$ and 10-15% $NH_4OH$. The aqueous phase is extracted with $CH_2Cl_2$ and the extracts are dried and concentrated. A 0.13M solution of the residue in 2.5:1 dioxane:28-30 wt % $NH_4OH$ is stirred at 70-80 °C 2.5-18 hours, allowed to cool to room temperature, and concentrated. The residue is partitioned between EtOAc and 1 N NaOH, the aqueous phase is extracted with EtOAc, and the extracts are washed with brine, dried and concentrated. The crude product is purified by chromatography or used without further purification.

**Scheme 4. Synthesis of Sulfone – Ring A = Sulfolane.**



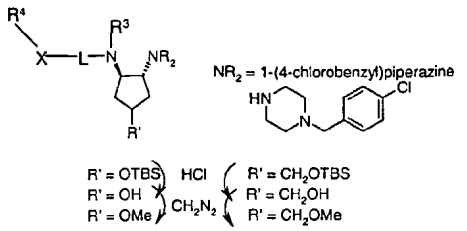

**Scheme 5. Synthesis of Aniline – Ring A = Phenyl.**



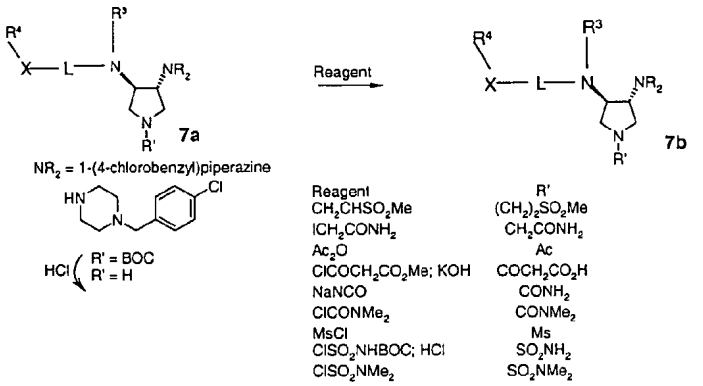

$R_2NH$ = 4-(4-Chlorobenzyl)piperazine

Schemes 6 and 7 show preparation of compounds of Formula Ia where ring A is substituted. Scheme 6 shows preparation of compounds of Formula Ia with a substituted cyclopentyl ring A. Scheme 7 shows preparation of compounds of Formula Ia with a substituted pyrrolidine ring A by treatment of the unsubstituted pyrrolidine **7a** (R=H) with the appropriate reagent to produce the substituted pyrrolidine **7b**.

**Scheme 6 Synthesis of Ureas.**



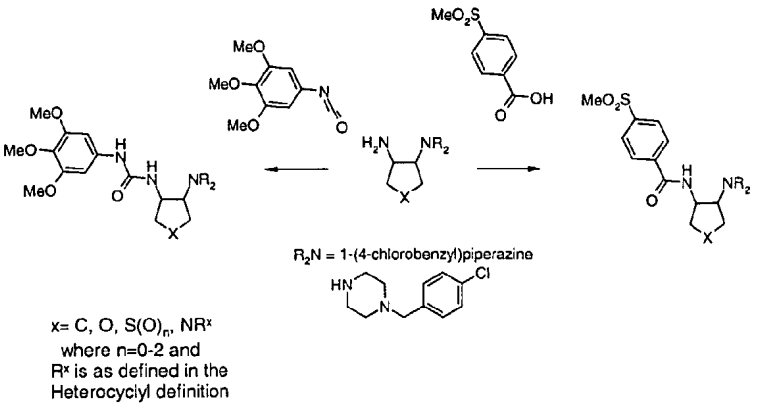

**Scheme 7. Synthesis of Pyrrolidine Derivatives.**




Schemes 8 and 9 show methods of converting compounds of Formula (Ia) to compounds of Formula (I) where L and A are varied.

**Scheme 8. Conversion of Primary Amines to Ureas and Benzamides.**

Compounds of Formula (I) where L is $-C(=O)NR_a$ and X is absent are made as shown below in Scheme 8 (exemplified with $R^4$ being 3,4,5-trimethoxyphenyl) and General Procedures C and D. Compounds of Formula (I) where L is –C(=O)- and X is absent are made as shown below in Scheme 8 (exemplified with $R^4$ being 3,4,5-trimethoxyphenyl) and General Procedures E and F.




General Procedure C: (Urea Formation Using Isocyanates)

A 0.1-0.6 M solution of the amine (1 equiv) in $CH_2Cl_2$ or $CH_2Cl_2$ and DMF at 0-20 °C is treated with the specified isocyanate (1.1-2 equiv), stirred for 0.5-1.5 hours, and partitioned between $CH_2Cl_2$ and saturated $NaHCO_3$. The aqueous phase is extracted with $CH_2Cl_2$ and the extracts are dried and concentrated. The crude urea is purified by column chromatography or preparative TLC or used in the next step without further purification.

General Procedure D: (Urea Formation Using Isocyanates)

A 0.1-0.6 M solution of the amine (1 equiv) in $CH_2Cl_2$ or $CH_2Cl_2$ and DMF at 0-20 °C is treated with the specified isocyanate (1.1-2 equiv), stirred for 0.5-1.5 hours, and partitioned between $CH_2Cl_2$ and saturated $NaHCO_3$. The aqueous phase is extracted with $CH_2Cl_2$ and the extracts are dried and concentrated. The crude urea is purified by column chromatography or preparative TLC or used in the next step without further purification. A solution of the free base in $CH_2Cl_2$ is treated with 1 N HCl in $Et_2O$ and concentrated to give the hydrochloride salt.

General Procedure E: (Amide Formation Using 1-Hydroxybenzotriazole and 1-(3-Dimethylaminopropyl)-3-ethylcarbodiimide Hydrochloride)

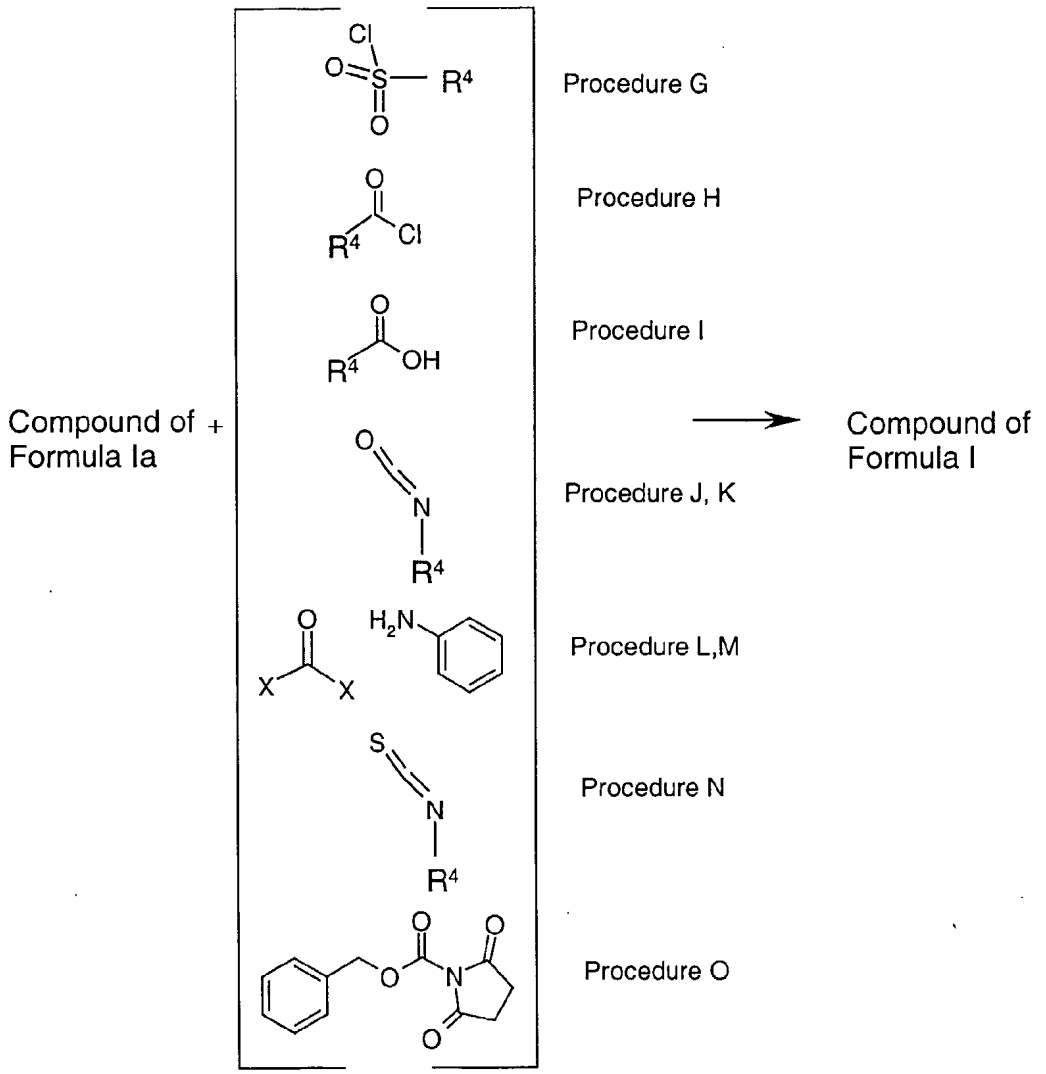
A 0.1-0.4 M solution of the amine (1 equiv) and the specified carboxylic acid (1.2-1.5 equiv) in $CH_2Cl_2$ at 0 °C is treated successively with 1-hydroxybenzotriazole hydrate (HOBt) (0.2-0.5 equiv) and 1-[3-(dimethylamino)propyl]-3-ethylcarbodiimide

hydrochloride (DEC) (1.3-2 equiv), stirred at 0-20 °C for 2-72 hours, and partitioned between $CH_2Cl_2$ and saturated $NaHCO_3$. The aqueous phase is extracted with $CH_2Cl_2$ and the extracts are dried and concentrated. The crude amide is purified by column chromatography and/or preparative TLC.

General Procedure F: (Amide Formation Using 1-Hydroxybenzotriazole and 1-(3-Dimethylaminopropyl)-3-ethylcarbodiimide Hydrochloride)

A 0.1-0.4 M solution of the amine (1 equiv) and the specified carboxylic acid (1.2-1.5 equiv) in $CH_2Cl_2$ at 0 °C is treated successively with 1-hydroxybenzotriazole hydrate (HOBt) (0.2-0.5 equiv) and 1-[3-(dimethylamino)propyl]-3-ethylcarbodiimide hydrochloride (DEC) (1.3-2 equiv), stirred at 0-20 °C for 2-72 hours, and partitioned between $CH_2Cl_2$ and saturated $NaHCO_3$. The aqueous phase is extracted with $CH_2Cl_2$ and the extracts are dried and concentrated. The crude amide is purified by column chromatography and/or preparative TLC. A solution of the free base in $CH_2Cl_2$ is treated with 1 N HCl in $Et_2O$ and concentrated to provide the hydrochloride salt.

Scheme 9 and following procedures G-O describe the various methods used to convert compounds of Formula Ia to compounds of Formula I where L is varied.




General Procedure G (Parallel Synthesis of Sulfonamides)

A mixture of **the requisite amine Ia** (1 equiv), the appropriate sulfonyl chloride (1.5 equiv), and Amberlite IRA67 (2 equiv) in $CH_2Cl_2$ (2 ml) was rotated overnight. The mixture was treated with PS-trisamine (1.2 equiv) (Argonaut Technologies Inc., San Carlos, CA, USA) and rotated overnight. The solid was collected by filtration and washed with $CH_2Cl_2$, MeOH, and $CH_2Cl_2$. The filtrate was concentrated to give the product.

General Procedure H (Parallel Synthesis of Amides from Acid Chlorides)

A mixture of **the requisite amine Ia** (1 equiv), the appropriate acid chloride (1.5 equiv), and Amberlite IRA67 (2 equiv) in $CH_2Cl_2$ (2 ml) was rotated overnight. The mixture was treated with PS-trisamine (1.2 equiv) and MP-carbonate (2 equiv) (Argonaut Technologies, San Carlos, CA) and rotated overnight. The solid was collected by filtration and washed with $CH_2Cl_2$, MeOH, and $CH_2Cl_2$. The filtrate was concentrated to give the product.

General Procedure I (Parallel Synthesis of Amides from Carboxylic Acids)

A mixture of **the requisite amine Ia** (1 equiv), the appropriate carboxylic acid (1.5 equiv), and PS-carobodiimide (2 equiv) (Argonaut Technologies Inc., San Carlos, CA, USA) in $CH_2Cl_2$ (2 ml) was rotated overnight. The mixture was treated with MP-carbonate (2 equiv) and rotated overnight. The solid was collected by filtration and washed with $CH_2Cl_2$, MeOH, and $CH_2Cl_2$. The filtrate was concentrated to give the product.

General Procedure J (Parallel Synthesis of Ureas from Isocyanates and Purification by Parallel Chromatography)

A mixture of **the requisite amine Ia** (1 equiv) and the appropriate isocyanate (1.2 equiv) in $CH_2Cl_2$ (2 ml) was stirred overnight. The mixture was concentrated to give the crude product, which was purified by parallel chromatography using a step gradient (2.5% MeOH/$CH_2Cl_2$, 10% MeOH/$CH_2Cl_2$).

General Procedure K (Parallel Synthesis of Ureas from Isocyanates and Purification by Catch and Release Scavenger)

A mixture of **the requisite amine Ia** (1 equiv) and the appropriate isocyanate (1.2 equiv) in $CH_2Cl_2$ (2 ml) was stirred overnight. The mixture was treated with MP-TsOH and rotated for 3 hours. The solid was collected by filtration and washed with $CH_2Cl_2$, MeOH, and $CH_2Cl_2$. The solid was rotated with 2 M $NH_3$ in MeOH for 2 hours. The solid was collected by filtration and washed with $CH_2Cl_2$, MeOH, and $CH_2Cl_2$. The filtrate was concentrated to give the purified product.

General Procedure L (Parallel Synthesis of Ureas from Anilines using Phoxime Resin)

A mixture of the appropriate aniline (3 equiv) and Phoxime resin (1 equiv) in $CH_2Cl_2$ (2 ml) was rotated for 3 hours. If the aniline had not dissolved, triethylamine (3.5 equiv) was added. The mixture was rotated overnight. The solid was collected by filtration and washed with $CH_2Cl_2$, MeOH, $CH_2Cl_2$, MeOH, and $CH_2Cl_2$. A mixture of the solid and **the requisite amine Ia** (1.1 equiv) in $CH_2Cl_2$ (0.5 ml) and toluene (1.5 ml) were heated at 80 °C with shaking overnight and allowed to cool to room temperature. The solid was collected by filtration and washed with $CH_2Cl_2$, MeOH, and $CH_2Cl_2$. The filtrate was concentrated to give the product.

General Procedure M (Parallel Synthesis of Ureas from Anilines using Triphosgene)

A mixture of the appropriate aniline (1.2 equiv), triphosgene (0.4 equiv), and triethylamine (1.4 equiv) in $CH_2Cl_2$ was heated at 35 °C for 1 hour. After cooling to room temperature, **the requisite amine Ia** (1 equiv) was added. The mixture was stirred overnight, washed with $H_2O$ and brine, passed through $Na_2SO_4$, and concentrated to give crude product which was purified by parallel chromatography.

General Procedure N (Parallel Synthesis of Thioureas from Thioisocyanates)

A mixture of **the requisite amine Ia** (1 equiv) and the appropriate thioisocyanate (1.2 equiv) in $CH_2Cl_2$ (2 ml) was stirred overnight. The mixture was treated with MP-TsOH and rotated for 3 hours. The solid was collected by filtration and washed with $CH_2Cl_2$, MeOH, and $CH_2Cl_2$. The solid was rotated with 2 M $NH_3$ in MeOH for 2 hours. The solid was collected by filtration and washed with $CH_2Cl_2$, MeOH, and $CH_2Cl_2$. The filtrate was concentrated to give the purified product.

General Procedure O (Parallel Synthesis of Carbamates)

A mixture of **the requisite amine Ia** (1 equiv) and the appropriate succinimide (1.5 equiv) in $CH_2Cl_2$ (2 ml) was stirred overnight. If the reaction was not complete, it was heated at 38 °C for 1 hour. The mixture was washed with $H_2O$ and brine, passed through $Na_2SO_4$ and concentrated to give the crude product which was purified via parallel purification (step gradient 5% MeOH/$CH_2Cl_2$, 10% MeOH/$CH_2Cl_2$).

# Examples

Unless otherwise noted, all non-aqueous reactions were run under a nitrogen atmosphere and $Na_2SO_4$ was used to dry all organic layers. Purifications were typically carried out by flash chromatography on silica gel (230-400 mesh) or preparative TLC on Uniplate Silica Gel GF PLC Plates (20 x 20 cm, 1000 microns) from Analtech, Inc., Newark, DE. Alumina used was basic with 6 wt % $H_2O$ (Brockmann III). Melting points taken in capillary tubes are uncorrected. IR spectra were determined in KBr. NMR spectra were run in CDCl3, unless otherwise indicated. $^1H$ NMR spectra were recorded on 300 MHz instruments and $^{13}C$ NMR spectra were recorded at 75.5 MHz. Mass spectral analyses were accomplished using electrospray ionization. Analytical reverse-phase HPLC was performed on Shimadzu system equipped with a diode array spectrometer (range 190-300 nm; Hewlett Packard). The stationary phase was a Zorbax SB-Phenyl Rapid Resolution column (4.6 mm x 50 mm; Hewlett Packard), mobile phase A was 0.1% trifluoroacetic acid, and mobile phase B was $CH_3CN$. A flow rate of 2.5 ml/min with a linear gradient of 20-55% B in 5 min and then 55-20% B in 5 min was employed. Other physical and analytical data were obtained by the physical and analytical chemistry group at Roche Bioscience. All parallel synthesis reactions were run in sealed tubes that were vented prior to being rotated overnight. Amberlite IRA67 (Aldrich Chemical Co., Milwaukee, Wis., USA) was washed consecutively with $CH_2Cl_2$, MeOH, $CH_2Cl_2$, MeOH, $CH_2Cl_2$ and then dried under vacuum prior to use. All products derived from parallel synthesis reactions were characterized via HPLC-MS.

The following General Procedures (A-O) are useful for preparing compounds of the invention. These General Procedures are referred to in the following Examples.

**Preparation 1**

1-(3,4-dichlorobenzyl)piperazine and 1-(4-chlorobenzyl)piperazine

Step 1

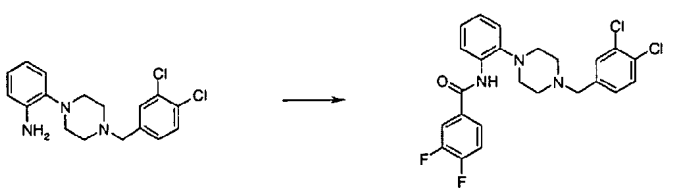
3,4-Dichlorobenzyl bromide (35.20 g, 150 mmol) was added to a solution of N-(*tert*-butoxycarbonyl)piperazine (24.84 g, 130 mmol) and triethylamine (20.91 ml, 150 mmol) in chloroform (100 ml) over 30 min. After 1 hour, the reaction mixture was diluted with ethyl acetate and the product was precipitated out as the hydrochloride salt by adding 1N aqueous hydrogen chloride solution. The solid product was filtered, washed with water and then resuspended in ethyl acetate. Two equivalents of 1N aqueous sodium hydroxide solution was added and the free amine was extracted into ethyl acetate. The organic layer was separated, dried over magnesium sulfate, filtered and concentrated to provide 1-(*tert*-butoxycarbonyl)-4-(3,4-dichlorobenzyl)piperazine (45 g).

Step 2

Trifluoroacetic acid (75 ml, 974 mmol) was added to a solution 1-(*tert*-butoxycarbonyl)-4-(3,4-dichlorobenzyl)piperazine (45 g, 130 mmol) in chloroform (75 ml). The reaction mixture was stirred for 1 hour at room temperature and then made basic with a sodium hydroxide solution. The product was extracted into ethyl acetate and the organic layer was washed with sodium bicarbonate solution, dried over magnesium sulfate and concentrated *in vacuo* to give 1-(3,4-dichlorobenzyl)piperazine (35.8 g) as a solid.

1-(4-chlorobenzyl)piperazine was obtained by replacing 3,4-dichlorobenzylbromide in Step 1 with 4-chlorobenzylbromide.

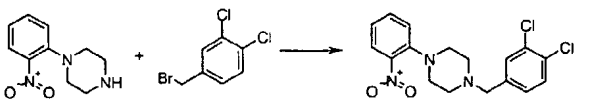
**Example 1: Preparation of *N*-{2-[4-(3,4-dichlorobenzyl)-piperazin-1-yl]-phenyl}-3,4-difluoro-benzamide**




2-[4-(3,4-Dichlorobenzyl)-piperazin-1-yl]-phenylamine (45 mg) was dissolved in a solution of triethylamine in dichloromethane (3 ml, 0.29 M in triethylamine). This solution was added to a test tube containing 3,4-difluorobenzoyl chloride (65 mg). After standing at ambient temperature for several days, the reaction was directly passed through a small pad

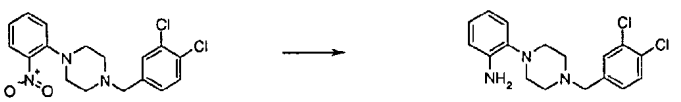
of silica and eluted with 10% ethyl acetate in hexanes, then with 50% ethyl acetate in hexanes. Solvent removal left 49.8 mg of the product: MS *m/z* 475 $(M)^+$. R0114-9313

Step A: Preparation of 1-(3,4-dichlorobenzyl)-4-(2-nitrophenyl)-piperazine



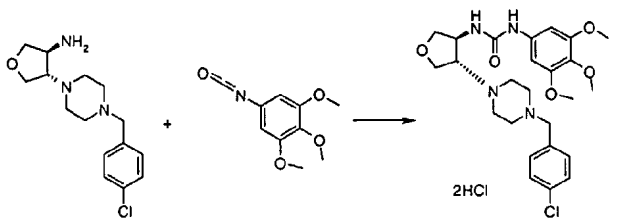
A mixture of 1-(2-nitro-phenyl)-piperazine (4.53 g) (commercially from Emkachem) and 3,4-dichlorobenzyl bromide (4.6 g) in 100 ml of dichloromethane was treated with triethylamine (3.4 ml). The reaction was stirred at ambient temperature under inert atmosphere overnight. After solvent removal, the crude reaction mixture was subjected directly to flash chromatography using silica. Elution with hexanes, then 20% ethyl acetate in hexanes, and finally 33% ethyl acetate in hexanes furnished the product as an oil (6.4 g), which was carried on as is.

Step B: Preparation of 2-[4-(3,4-dichlorobenzyl)-piperazin-1-yl]-phenylamine



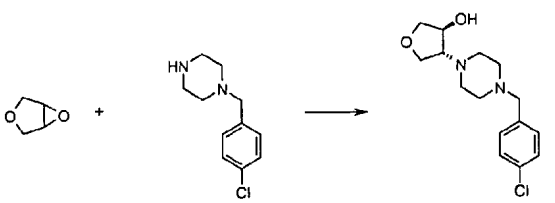
A solution of 1-(3,4-dichlorobenzyl)-4-(2-nitro-phenyl)-piperazine (1.19 g) in 50 ml of 4/1 ethyl acetate/methanol was treated with 5% palladium on carbon (55 mg) and placed under a hydrogen atmosphere. After stirring at ambient temperature overnight, the reaction was filtered using a pad of silica and the pad was washed with 17% ethyl acetate in hexanes, then 33% ethyl acetate in hexanes. Removal of solvent afforded 0.75 g of the product as a solid.

**Example 2: Preparation of (±)-*trans*-1-{4-[4-(4-chlorobenzyl)-piperazin-1-yl]-tetrahydrofuran-3-yl}-3-(3,4,5-trimethoxyphenyl)urea dihydrochloride**



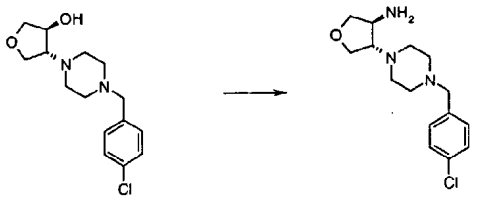

Following General Procedure D, (±)-*trans*-4-[4-(4-chlorobenzyl)piperazin-1-yl]-tetrahydrofuran-3-ylamine (120 mg, 0.41 mmol) and 5-isocyanato-1,2,3-trimethoxybenzene (102 mg, 0.50 mol) were coupled in $CH_2Cl_2$ (2 ml) at 0 °C for 1 hour. Purification of the crude product by preparative TLC with 100% EtOAc followed by a subsequent preparative TLC with 10:0.95:0.05 $CH_2Cl_2$:MeOH:$NH_4OH$ gave the free base (160 mg, 0.32 mmol) as a white solid. A solution of the free base in $CH_2Cl_2$ was treated with 1 N HCl in $Et_2O$ (0.8 ml, 0.8 mmol) and concentrated to give the product (180 mg, 77%) as a pale tan solid: mp 190.8-204.3 °C; MS *m/z* 505 $(M + H)^+$. R0331-0138

**Step A**: Preparation of (±)-*trans*-4-[4-(4-chlorobenzyl)-piperazin-1-yl]-tetrahydro-furan-3-ol




Following General Procedure A, 1-(4-chlorobenzyl)-piperazine (500 mg, 2.37 mmol) was alkylated with 3,6-dioxa-bicyclo[3.1.0]hexane (2.04 g, 23.7 mol) (Barili, P. L.; Berti, G.; Mastrorilli, E.; *Tetrahedron* **1993**, *49*, 6263) in EtOH (3 ml) at 90 °C for 2 days. Chromatography of the crude product with 100% $CH_2Cl_2$ followed by 40:0.95:0.05-10:0.95:0.05 $CH_2Cl_2$:MeOH:$NH_4OH$ gave the product (615 mg, 87%) as a yellow solid: MS *m/z* 297 $(M + H)^+$.

Step B: Preparation of (±)-*trans*-4-[4-(4-chlorobenzyl)-piperazin-1-yl]-tetrahydro-furan-3-ylamine



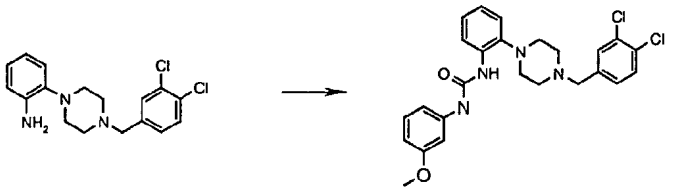
Following General Procedure B, (±)-*trans*-4-[4-(4-chlorobenzyl)-piperazin-1-yl]-tetrahydrofuran-3-ol (600 mg, 2.02 mmol) in $CH_2Cl_2$ (10 ml) was treated with $Et_3N$ (0.56 ml, 4.0 mmol) and $MeSO_2Cl$ (0.31 ml, 4.0 mol) for 2 hours and the resultant product was heated in dioxane (11.6 ml) and $NH_4OH$ (4.7 ml) for 6 hours. Chromatography of the crude product with 100% $CH_2Cl_2$ followed by 30:0.95:0.05-10:0.95:0.05 $CH_2Cl_2$:MeOH:$NH_4OH$ gave the product (330 mg, 55%) as a yellow oil: MS *m/z* 296 $(M + H)^+$.

**Example 3. Preparation of N-{2-[4-(3,4-dichloro-benzyl)-piperazin-1-yl]-phenyl}-4-methyl-benzenesulfonamide**



2-[4-(3,4-Dichlorobenzyl)-piperazin-1-yl]-phenylamine (45 mg) was dissolved in a solution of triethylamine in dichloromethane (3 ml, 0.29 M in triethylamine). This solution was added to a test tube containing p-toluenesulfonyl chloride (60 mg). After standing at ambient temperature for several days, the reaction was directly passed through a small pad of silica and eluted with 10% ethyl acetate in hexanes, then with 50% ethyl acetate in hexanes. Solvent removal left 57.5 mg of the product: MS *m/z* 489 $(M)^+$.

**Example 4. Preparation of 1-{2-[4-(3,4-dichloro-benzyl)-piperazin-1-yl]-phenyl}-3-(3-methoxy-phenyl)-urea**



2-[4-(3,4-Dichlorobenzyl)-piperazin-1-yl]-phenylamine (45 mg) was dissolved in a solution of triethylamine in dichloromethane (3 ml, 0.29 M in triethylamine). This solution was added to a test tube containing 3-methoxyphenyl isocyanate (45 mg). After standing at ambient temperature for several days, the reaction was directly passed through a small pad of silica and eluted with 10% ethyl acetate in hexanes, then with 50% ethyl acetate in hexanes. Solvent removal left 26.2 mg of the product, which was subsequently repurified by silica gel chromatography to afford 9.4 mg product: MS *m/z* 484 $(M)^+$.

**Example 5. Preparation of N-{2-[4-(3,4-dichloro-benzyl)-piperazin-1-yl]-phenyl}-2-thiophen-2-yl-acetamide**



2-[4-(3,4-Dichlorobenzyl)-piperazin-1-yl]-phenylamine (45 mg) was dissolved in a solution of triethylamine in dichloromethane (3 ml, 0.29 M in triethylamine). This solution was added to a test tube containing 2-thiopheneacetyl chloride (50 mg). After standing at ambient temperature for several days, the reaction was directly passed through a small pad of silica and eluted with 10% ethyl acetate in hexanes, then with 50% ethyl acetate in hexanes. Solvent removal left 48.6 mg of the product: MS *m/z* 459 $(M)^+$.

**Example 6. Preparation of 4-Chloro-N-{2-[4-(3,4-dichloro-benzyl)-piperazin-1-yl]-phenyl}-4-methyl-benzamide**



2-[4-(3,4-Dichlorobenzyl)-piperazin-1-yl]-phenylamine (45 mg) was dissolved in a solution of triethylamine in dichloromethane (3 ml, 0.29 M in triethylamine). This solution was added to a test tube containing 4-chlorobenzoyl chloride (60 mg). After standing at ambient temperature for several days, the reaction was directly passed through a small pad of silica and eluted with 10% ethyl acetate in hexanes, then with 50% ethyl acetate in hexanes. Solvent removal left 49.6 mg of the product, which was subsequently repurified by silica gel chromatography to afford 11.4 mg product: MS *m/z* 473 $(M)^+$.

**Example 7. Preparation of N-{2-[4-(3,4-dichloro-benzyl)-piperazin-1-yl]-phenyl}-4-methyl-benzamide**



2-[4-(3,4-Dichlorobenzyl)-piperazin-1-yl]-phenylamine (45 mg) was dissolved in a solution of triethylamine in dichloromethane (3 ml, 0.29 M in triethylamine). This solution was added to a test tube containing 4-methylbenzoyl chloride (55 mg). After standing at ambient temperature for several days, the reaction was directly passed through a small pad of silica and eluted with 10% ethyl acetate in hexanes, then with 50% ethyl acetate in hexanes. Solvent removal left 10.7 mg of the product: MS *m/z* 453 $(M)^+$.

**Example 8: Formulation Examples**

The following are representative pharmaceutical Formulations containing a compound of Formula (I).

**Tablet Formulation**

The following ingredients are mixed intimately and pressed into single scored tablets.

| Ingredient | Quantity per tablet, mg |
|---|---|
| compound of this invention | 400 |
| cornstarch | 50 |
| croscarmellose sodium | 25 |
| lactose | 120 |
| magnesium stearate | 5 |

**Capsule Formulation**

The following ingredients are mixed intimately and loaded into a hard-shell gelatin capsule.

| Ingredient | Quantity per capsule, mg |
|---|---|
| compound of this invention | 200 |
| lactose, spray-dried | 148 |
| magnesium stearate | 2 |

**Suspension Formulation**

The following ingredients are mixed to form a suspension for oral administration.

| Ingredient | Amount |
|---|---|
| compound of this invention | 1.0 g |
| fumaric acid | 0.5 g |
| sodium chloride | 2.0 g |
| methyl paraben | 0.15 g |
| propyl paraben | 0.05 g |
| granulated sugar | 25.5 g |
| sorbit (70% solution) | 12.85 g |
| Veegum K (Vanderbilt Co.) | 1.0 g |
| flavoring | 0.035 ml |
| colorings | 0.5 mg |
| distilled water | q.s. to 100 ml |

**Injectable Formulation**

The following ingredients are mixed to form an injectable Formulation.

| Ingredient | Amount |
|---|---|
| compound of this invention | 0.2 g |
| sodium acetate buffer solution, | 0.4M 2.0 ml |
| HCl (1N) or NaOH (1N) | q.s. to suitable pH |
| water (distilled, sterile) | q.s. to 20 ml |

**Liposomal Formulation**

The following ingredients are mixed to form a liposomal Formulation.

| Ingredient | Amount |
|---|---|
| compound of this invention | 10 mg |
| L-.alpha.-phosphatidylcholine | 150 mg |
| tert-butanol | 4 ml |

Freeze dry the sample and lyopholize overnight. Reconstitute the sample with 1 ml 0.9% saline solution. Liposome size can be reduced by sonication.

**Example 9 CCR-3 Receptor Binding Assay--In Vitro**

The CCR-3 antagonistic activity of the compounds of the invention was determined by their ability to inhibit the binding of $^{125}$I eotaxin to CCR-3 L1.2 transfectant cells (see Ponath, P. D. et al., J. Exp. Med., Vol. 183, 2437-2448, (1996)).

The assay was performed in Costar 96-well polypropylene round bottom plates. Test compounds were dissolved in DMSO and then diluted with binding buffer (50 mM HEPES, 1 mM CaCl.sub.2, 5 mM $MgCl_2$, 0.5% bovine serum albumin (BSA), 0.02% sodium azide, pH 7.24) such that the final DMSO concentration was 2%. 25 µl of the test solution or only buffer with DMSO (control samples) was added to each well, followed by the addition of 25 µl of $^{125}$I-eotaxin (100 pmol) (NEX314, New England Nuclear, Boston, Mass.) and 1.5 x $10^5$ of the CCR-3 L1.2 transfected cells in 25 µl binding buffer. The final reaction volume was 75 µl.

After incubating the reaction mixture for 1 hour at room temperature, the reaction was terminated by filtering the reaction mixture through polyethylenimine treated Packard Unifilter GF/C filter plate (Packard, Chicago, Ill.). The filters were washed four times with ice cold wash buffer containing 10 mm HEPES and 0.5M sodium chloride (pH 7.2) and dried at 65°C. for approximately 10 minutes. 25 µl/well of Microscint-20® scintillation fluid (Packard) was added and the radioactivity retained on the filters was determined by using the Packard TopCount®

Compounds of this invention were active in this assay. Representative values for some of the compounds listed in Table 1 are shown below.

| Cpd. No. | IC50 (μM) |
|---|---|
| 1 | 200 |
| 2 | 36 |
| 3 | 12.75 |
| 7 | 0.1099 |

**Example 10: Inhibition of Eotaxin Mediated Chemotaxis of CCR-3 L1.2 Transfectant Cells--In Vitro Assay**

The CCR-3 antagonistic activity of the compounds of this invention can be determined by measuring the inhibition of eotaxin mediated chemotaxis of the CCR-3 L1.2 transfectant cells, using a slight modification of the method described in Ponath, P. D. et al., J. Clin. Invest. 97: 604-612 (1996). The assay is performed in a 24-well chemotaxis plate (Costar Corp., Cambridge, Mass.). CCR-3 L1.2 transfectant cells are grown in culture medium containing RPMI 1640, 10% Hyclone® fetal calf serum, 55 mM 2-mercaptoethanol and Geneticin 418 (0.8 mg/ml). 18-24 hours before the assay, the transfected cells are treated with n-butyric acid at a final concentration of 5 mM/1x$10^6$ cells/ml, isolated and resuspended at 1x$10^7$ cells/ml in assay medium containing equal parts of RPMI 1640 and Medium 199 (M 199) with 0.5% bovine serum albumin.

Human eotaxin suspended in phosphate buffered saline at 1 mg/ml is added to bottom chamber in a final concentration of 100 nm. Transwell culture inserts (Costar Corp., Cambridge, Mass.) having 3 micron pore size are inserted into each well and L1.2 cells (1x$10^6$) are added to the top chamber in a final volume of 100 μl. Test compounds in DMSO are added both to the top and bottom chambers such that the final DMSO volume is 0.5%. The assay is performed against two sets of controls. The positive control contained cells with no test compound in the top chamber and only eotaxin in the lower chamber. The negative control contains cells with no test compound in the top chamber and neither eotaxin nor test compound in lower chamber. The plate is incubated at 37 °C. After 4 hours, the inserts are removed from the chambers and the cells that have migrated to the

bottom chamber are counted by pipetting out 500 µl of the cell suspension from the lower chamber to 1.2 ml Cluster tubes (Costar) and counting them on a FACS for 30 seconds.

**Example 11: Inhibition of Eotaxin Mediated Chemotaxis of Human Eosinophils--In Vitro Assay**

The ability of compounds of the invention to inhibit eotaxin mediated chemotaxis of human eosinophils can be assessed using a slight modification of procedure described in Carr, M. W. et al., Proc. Natl. Acad. Sci. USA, 91: 3652-3656 (1994). Experiments are performed using 24 well chemotaxis plates (Costar Corp., Cambridge, Mass.). Eosinophils are isolated from blood using the procedure described in PCT Application, Publication No. WO 96/22371. The endothelial cells used are the endothelial cell line ECV 304 obtained from European Collection of Animal Cell Cultures (Porton Down, Salisbury, U.K.). Endothelial cells are cultured on 6.5 mm diameter Biocoat.RTM. Transwell tissue culture inserts (Costar Corp., Cambridge, Mass.) with a 3.0 µM pore size. Culture media for ECV 304 cells consists of M199, 10% Fetal Calf Serum, L-glutamine and antibiotics. Assay media consists of equal parts RPMI 1640 and M199, with 0.5% BSA. 24 hours before the assay $2x10^5$ ECV 304 cells are plated on each insert of the 24-well chemotaxis plate and incubated at 37 °C. 20 nM of eotaxin diluted in assay medium is added to the bottom chamber. The final volume in bottom chamber is 600 µl. The endothelial coated tissue culture inserts are inserted into each well. $10^6$ eosinophil cells suspended in 100 µl assay buffer are added to the top chamber. Test compounds dissolved in DMSO are added to both top and bottom chambers such that the final DMSO volume in each well was 0.5%. T he assay is performed against two sets of controls. The positive control contains cells in the top chamber and eotaxin in the lower chamber. The negative control contains cells in the top chamber and only assay buffer in the lower chamber. The plates are incubated at 37 °C. in 5% $CO_2$ /95% air for 1-1.5 hours.

The cells that migrate to the bottom chamber are counted using flow cytometry. 500 µl of the cell suspension from the lower chamber are placed in a tube, and relative cell counts are obtained by acquiring events for a set time period of 30 seconds.

**Example 12: Inhibition of Eosinophil Influx Into the Lungs of Ovalbumin Sensitized Balb/c Mice by CCR-3 Antagonist--In Vivo Assay**

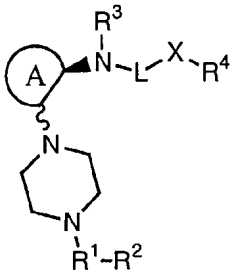
The ability of the compounds of the invention to inhibit leukocyte infiltration into the lungs can be determined by measuring the inhibition of eosinophil accumulation into the bronchioalveolar lavage (BAL) fluid of Ovalbumin (OA)-sensitized balb/c mice after antigen challenge by aerosol. Briefly, male balb/c mice weighing 20-25g are sensitized with OA (10 μg in 0.2 ml aluminum hydroxide solution) intraperitoneally on days 1 and 14. After a week, the mice are divided into ten groups. Test compound or only vehicle (control group) or anti-eotaxin antibody (positive control group) is administered either intraperitoneally, subcutaneously or orally. After 1 hour, the mice are placed in a Plexiglass box and exposed to OA aerosol generated by a PARISTAR.TM. nebulizer (PARI, Richmond, Va.) for 20 minutes. Mice which have not been sensitized or challenged are included as a negative control. After 24 or 72 hours, the mice are anesthetized (urethane, approx. 1 g/kg, i.p.), a tracheal cannula (PE 60 tubing) is inserted and the lungs are lavaged four times with 0.3 ml PBS. The BAL fluid is transferred into plastic tubes and kept on ice. Total leukocytes in a 20 μl aliquot of the BAL fluid is determined by Coulter Counter.TM. (Coulter, Miami, Fla.). Differential leukocyte counts are made on Cytospin.TM. preparations which have been stained with a modified Wright's stain (DiffQuick.TM.) by light microscopy using standard morphological criteria.

The foregoing invention has been described in some detail by way of illustration and example, for purposes of clarity and understanding. It will be obvious to one of skill in the art that changes and modifications may be practiced within the scope of the appended claims. Therefore, it is to be understood that the above description is intended to be illustrative and not restrictive. The scope of the invention should, therefore, be determined not with reference to the above description, but should instead be determined with reference to the following appended claims, along with the full scope of equivalents to which such claims are entitled.

All patents, patent applications and publications cited in this application are hereby incorporated by reference in their entirety for all purposes to the same extent as if each individual patent, patent application or publication were so individually denoted.

## Claims

1. A compound of Formula (I):



(I)

wherein:

$R^1$ is $(C_1$-$C_2)$alkylene;

$R^2$ is optionally substituted phenyl;

$R^3$ is hydrogen, $C_{1-6}$ alkyl, acyl, aryl, or aryl $C_{1-6}$ alkyl;

ring A is a $C_{3-7}$ cycloalkyl, heterocyclyl, or optionally substituted phenyl;

L is -C(=O)-, -C(=S)-, $-SO_2$-, -C(=O)N($R_a$)-, -C(=S) N($R_a$)-, $-SO_2$ N($R_a$)-, -C(=O)O-, -C(=S)O-, $-S(=O)_2O$-;

where $R_a$ is hydrogen, $C_{1-6}$ alkyl, acyl, aryl, aryl $C_{1-6}$ alkyl, $C_{1-6}$ alkoxycarbonyl, or benzyloxycarbonyl;

X is absent, -(CR'R")O-, -(CR'R")S-,-(CR'R")$NR_b$- or $C_{1-6}$ alkylene;

where R' and R" are independently hydrogen or $C_{1-6}$ alkyl, and $R_b$ is hydrogen or $C_{1-6}$ alkyl;

$R^4$ is aryl or heteroaryl;

provided the compound of Formula I is not 1-{2-[4-(3,4-dichlorobenzyl)piperazin-1-yl]cyclohexyl}-3-(3-methoxyphenyl)urea; and

provided that when ring A is phenyl or cyclohexyl, then $R^2$ is substituted phenyl;

and prodrugs, individual isomers, racemic and non-racemic mixtures of isomers, and pharmaceutically acceptable salts thereof;

wherein

the term "optionally substituted phenyl" refers to a phenyl group which is optionally substituted with one or more substituents selected from the group consisting of

$C_{1-6}$ alkyl, halo $C_{1-6}$ alkyl, hydroxy $C_{1-6}$ alkyl, heteroalkyl, acyl, acylamino, amino, $C_{1-6}$ alkylamino, di $C_{1-6}$ alkylamino, $C_{1-6}$ alkylthio, $C_{1-6}$ alkylsulfinyl, $C_{1-6}$ alkylsulfonyl, -$SO_2NR'R''$ (where R' and R'' are independently hydrogen or $C_{1-6}$ alkyl), $C_{1-6}$ alkoxy, halo $C_{1-6}$ alkoxy, $C_{1-6}$ alkoxycarbonyl, carbamoyl, hydroxy, halo, nitro, cyano, mercapto, methylenedioxy and ethylenedioxy;

the term "acyl" refers to a radical –C(O)R, where R is hydrogen, $C_{1-6}$ alkyl, $C_{3-7}$ cycloalkyl, $C_{3-7}$ cycloalkyl $C_{1-6}$ alkyl, phenyl or phenyl $C_{1-6}$ alkyl;

the term "acyl $C_{1-6}$ alkyl" refers to a radical – $C_{1-6}$ alkylene-C(O)R where R is hydrogen, $C_{1-6}$ alkyl, halo $C_{1-6}$ alkyl, $C_{3-7}$ cycloalkyl, $C_{3-7}$ cycloalkyl- $C_{1-6}$ alkyl, optionally substituted phenyl, benzyl, hydroxy, $C_{1-6}$ alkoxy, amino, mono $C_{1-6}$ alkylamino or di $C_{1-6}$ alkylamino;

the term "aryl" refers to a monocyclic or bicyclic aromatic hydrocarbon radical of 6 to 10 ring atoms which is optionally substituted with one or more substituents selected from the group consisting of $C_{1-6}$ alkyl, halo $C_{1-6}$ alkyl, hydroxy $C_{1-6}$ alkyl, heteroalkyl, acyl, acylamino, amino, $C_{1-6}$ alkylamino, di $C_{1-6}$ alkylamino, $C_{1-6}$ alkylthio, $C_{1-6}$ alkylsulfinyl, $C_{1-6}$ alkylsulfonyl, -$SO_2NR'R''$ (where R' and R'' are independently hydrogen or $C_{1-6}$ alkyl), $C_{1-6}$ alkoxy, halo $C_{1-6}$ alkoxy, $C_{1-6}$ alkoxycarbonyl, carbamoyl, hydroxy, halo, nitro, cyano, mercapto, methylenedioxy and ethylenedioxy;
the term "acyl" refers to a radical –C(O)R, where R is hydrogen, $C_{1-6}$ alkyl, $C_{3-7}$ cycloalkyl, $C_{3-7}$ cycloalkyl $C_{1-6}$ alkyl, phenyl or phenyl $C_{1-6}$ alkyl;

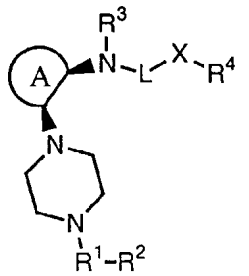
the term "Heterocyclyl" refers to a saturated or unsaturated non-aromatic cyclic radical of 3 to 8 ring atoms in which one or two ring atoms are heteroatoms selected from $NR^x$ {wherein each $R^x$ is independently hydrogen, $C_{1-6}$ alkyl, acyl, $C_{1-6}$ alkylsulfonyl, aminosulfonyl, ($C_{1-6}$ alkylamino)sulfonyl, (di $C_{1-6}$ alkylamino)sulfonyl, carbamoyl, ($C_{1-6}$ alkylamino)carbonyl, (di $C_{1-6}$ alkylamino)carbonyl, (carbamoyl) $C_{1-6}$ alkyl, ($C_{1-6}$ alkylamino)carbonyl $C_{1-6}$ alkyl, or di $C_{1-6}$ alkylaminocarbonyl $C_{1-6}$ alkyl}, O, or $S(O)_n$ (where n is an integer from 0 to 2), the remaining ring atoms being C and the heterocyclyl ring may be optionally substituted independently with one, two, or three substituents selected from $C_{1-6}$ alkyl, halo $C_{1-6}$ alkyl, heteroalkyl, halo, nitro, cyano $C_{1-6}$ alkyl, hydroxy, $C_{1-6}$ alkoxy, amino, mono $C_{1-6}$ alkylamino, di $C_{1-6}$ alkylamino, aryl $C_{1-6}$ alkyl, -$(X)_n$-C(O)R

(where X is O or NR', n is 0 or 1, R is hydrogen, $C_{1-6}$ alkyl, halo $C_{1-6}$ alkyl, hydroxy, $C_{1-6}$ alkoxy, amino, mono $C_{1-6}$ alkylamino, di $C_{1-6}$ alkylamino or optionally substituted phenyl, and R' is hydrogen or $C_{1-6}$ alkyl), - $C_{1-6}$ alkylene-C(O)R (where R is hydrogen, $C_{1-6}$ alkyl, halo $C_{1-6}$ alkyl, hydroxy, $C_{1-6}$ alkoxy, amino, mono $C_{1-6}$ alkylamino, di $C_{1-6}$ alkylamino or optionally substituted phenyl) or $-S(O)_nR^d$ (where n is an integer from 0 to 2, and $R^d$ is hydrogen (provided that n is 0), $C_{1-6}$ alkyl, halo $C_{1-6}$ alkyl, $C_{3-7}$ cycloalkyl, $C_{3-7}$ cycloalkyl $C_{1-6}$ alkyl, amino, mono $C_{1-6}$ alkylamino, di $C_{1-6}$ alkylamino, or hydroxy $C_{1-6}$ alkyl);

the term "heteroaryl" refers to a monocyclic or bicyclic radical of 5 to 12 ring atoms having at least one aromatic ring containing one, two, or three ring heteroatoms selected from N, O, or S, the remaining ring atoms being C, with the understanding that the attachment point of the heteroaryl radical will be on an aromatic ring, and the heteroaryl ring is optionally substituted independently with one or more substituents selected from $C_{1-6}$ alkyl, halo $C_{1-6}$ alkyl, hydroxy $C_{1-6}$ alkyl, heteroalkyl, acyl, acylamino, amino, $C_{1-6}$ alkylamino, di $C_{1-6}$ alkylamino, $C_{1-6}$ alkylthio, $C_{1-6}$ alkylsulfinyl, $C_{1-6}$ alkylsulfonyl, - $SO_2NR'R''$ (where R' and R'' are independently hydrogen or $C_{1-6}$ alkyl), $C_{1-6}$ alkoxy, halo $C_{1-6}$ alkoxy, $C_{1-6}$ alkoxycarbonyl, carbamoyl, hydroxy, halo, nitro, cyano, mercapto, methylenedioxy, ethylenedioxy and optionally substituted phenyl; and

the term "heteroalkyl" refers to a $C_{1-6}$ alkyl radical wherein one, two or three hydrogen atoms have been replaced with a substituent independently selected from the group consisting of $-OR^a$, $-NR^bR^c$, and $-S(O)_nR^d$ (where n is an integer from 0 to 2), with the understanding that the point of attachment of the heteroalkyl radical is through a carbon atom, wherein $R^a$ is hydrogen, acyl, $C_{1-6}$ alkyl, $C_{3-7}$ cycloalkyl, or $C_{3-7}$ cycloalkyl $C_{1-6}$ alkyl; $R^b$ and $R^c$ are independently of each other hydrogen, acyl, $C_{1-6}$ alkyl, $C_{3-7}$ cycloalkyl, or $C_{3-7}$ cycloalkyl $C_{1-6}$ alkyl; when n is 0, $R^d$ is hydrogen, $C_{1-6}$ alkyl, $C_{3-7}$ cycloalkyl, or $C_{3-7}$ cycloalkyl $C_{1-6}$ alkyl, and when n is 1 or 2, $R^d$ is $C_{1-6}$ alkyl, $C_{3-7}$ cycloalkyl, $C_{3-7}$ cycloalkyl $C_{1-6}$ alkyl, amino, acylamino, mono $C_{1-6}$ alkylamino, and di $C_{1-6}$ alkylamino.

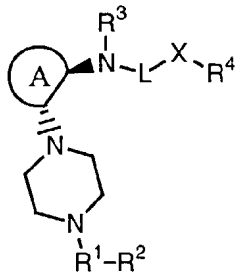
2. The compound according to claim 1, which is a compound of Formula (II):



(II)

wherein $R^1$-$R^4$, A, L, and X are as defined in claim 1.

3. The compound according to claim 1, which is a compound of Formula (III):



(III)

wherein $R^1$-$R^4$, A, L, and X are as defined in claim 1.

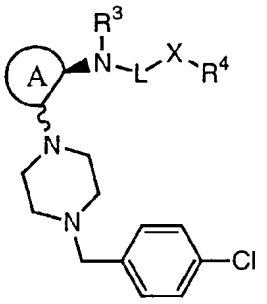
4. The compound according to any one of claims 1-3 wherein $R^1$ is methylene.

5. The compound according to any one of claims 1-4 wherein $R^2$ is 4-chlorophenyl or 3,4-dichlorophenyl.

6. The compound according to any one of claims 1-5 wherein $R^3$ is hydrogen.

7. The compound according to any one of claims 1-6 wherein L is -C(=O)-, -$SO_2$-, -C(=O)N($R_a$)-, -C(=S)N($R_a$)-, or -C(=O)O-.

8. The compound according to claim 1 which is a compound of formula (IV):



(IV)

wherein $R^3$, $R^4$, A, L, and X are as defined in claim 1.

9. The compound according to claim 7 wherein X is absent, methylene, 1,2-ethanediyl, 1,3-propanediyl, or 1,4-butanediyl.

10. The compound according to claim 9 wherein $R^4$ is 3,4-dichlorophenyl, 3,4,5-trimethoxyphenyl, 4-methanesulfonylphenyl, 3-methanesulfonylphenyl, 4-methoxynaphthalen-2-yl, 5-(3,4-dimethoxyphenyl)pyrimidin-2-yl, phenyl, 3-fluorophenyl, 4-ethylphenyl, 3-methoxyphenyl, 2,4-difluorophenyl, 3-trifluoromethylphenyl, 4-methylphenyl, 4-fluorophenyl, 2-fluorophenyl, 3-carbamoylphenyl, 4-carbamoylphenyl, 4-acetylphenyl, 4-nitrophenyl, 2-methylphenyl, 2-chloro-4-fluorophenyl, 3,4-dimethoxyphenyl, 2,5-dimethoxyphenyl, 2,3-dichlorophenyl, 2,4-dichlorophenyl, 4-bromophenyl, 4-chloro-3-nitrophenyl, 2-nitrophenyl, 2-nitro-4-trifluoromethylphenyl, 4-chlorophenyl, 3-chlorophenyl, 2-chlorophenyl, 3-methylphenyl, 2-trifluoromethylphenyl, 2-methoxyphenyl, 3-bromophenyl, 4-trifluoromethylphenyl, 3-trifluoromethylphenyl, 3,5-bis-trifluoromethylphenyl, 4-*tert*-butylphenyl, 4-ethoxyphenyl, 3-cyanophenyl, 4-cyanophenyl, 4-methoxyphenyl, 3-nitrophenyl, 3,5-dimethoxyphenyl, 4-iodophenyl, 4-isopropylphenyl, 3-methoxycarbonylphenyl, 3-acetylphenyl, 2-methylphenyl, indol-2-yl, 5-methoxyindol-2-yl, 5-chloroindol-2-yl, 2-methoxycarbonylphenyl, 3,5-dichlorophenyl, 1-naphthyl, 3-chloro-2-methylphenyl, 2,5-dimethylphenyl, 2-thienyl, 3-ethoxyphenyl, 3-isoquinolyl, 2-methylquinolin-6-yl, 3-methylaminophenyl, 3-quinolyl, 2-quinolyl, 5-hydroxynaphthalen-2-yl, 8-hydroxyquinolin-2-yl, 5,7-dimethyl-[1,8]naphthyridin-2-yl, 6-quinolyl, 3-(acetylamino)phenyl, or 2,3,4-trimethoxyphenyl.

11. The compound according to claim 10 wherein $R^4$ is 3,4,5-trimethoxyphenyl, 4-acetyl-phenyl, 3-carbamoylphenyl, 4-carbamoylphenyl, 3-methanesulfonylphenyl or 4-methanesulfonyl-phenyl.

12. The compound according to claim 1 which is *N*-{2-[4-(3,4-Dichloro-benzyl)-piperazin-1-yl]-phenyl}-2-thiophen-2-yl-acetamide;

*N*-{2-[4-(3,4-Dichloro-benzyl)-piperazin-1-yl]-phenyl}-3,4-difluoro-benzamide;

*N*-{2-[4-(3,4-Dichloro-benzyl)-piperazin-1-yl]-cyclohexyl}-4-methyl-benzamide;

1-{2-[4-(3,4-Dichloro-benzyl)-piperazin-1-yl]-phenyl}-3-(3-methoxy-phenyl)-urea;

4-Chloro-*N*-{2-[4-(3,4-dichloro-benzyl)-piperazin-1-yl]-phenyl}-benzamide;

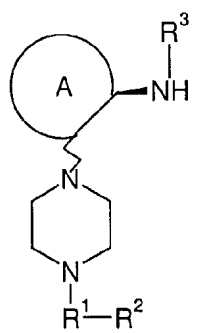
*N*-{2-[4-(3,4-Dichloro-benzyl)-piperazin-1-yl]-phenyl}-4-methyl-benzenesulfonamide;

1-{4-[4-(4-Chloro-benzyl)-piperazin-1-yl]-tetrahydro-furan-3-yl}-3-(3,4,5-trimethoxy-phenyl)-urea;

*N*-{2-[4-(3,4-Dichloro-benzyl)-piperazin-1-yl]-phenyl}-4-methyl-benzamide;

or a salt thereof.

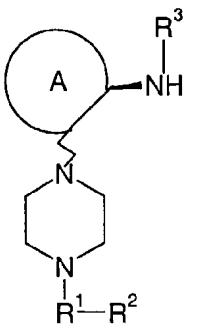
13. A method for preparing a compound of Formula (I) according to claim 1, wherein L is $-C(=O)NR_a-$, X is absent, $R_a$ is H, comprising reacting a compound of Formula (Ia)




(Ia)

with an isocyanate of Formula (XI), $R^4$-N=C=O.

14. A method for preparing a compound of Formula (I) according to claim 1, wherein L is -C(=O)-, X is absent, comprising reacting a compound of Formula (Ia)




(Ia)

with a compound of a formula, $R^4$-C(=O)OH.

15. A composition containing a therapeutically effective amount of a compound according to any one of claims 1-12, or a salt thereof; and an excipient.

16. A compound according to any one of claims 1-12, or a salt thereof for use as therapeutically active substances.

17. A use of a compound according to any one of claims 1-12, or a salt thereof; for the manufacture of a medicament comprising one or more compounds according to any one of claims 1-12 for the treatment of a disease treatable by a CCR-3 receptor antagonist.

18. The use according to claim 17, wherein the disease is asthma.

19. The invention as herein before described, particularly with reference to the new compounds, intermediates, medicaments, uses and processes.

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