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(54) Title: NOVEL COMPOUNDS AND COMPOSITIONS AS PROTEASE INHIBITORS

(57) Abstract

The present invention relates to novel N-cyanomethyl amides which are cysteine protease inhibitors, the pharmaceutically acceptable salts and N-oxides thereof, their uses as therapeutic agents and the methods of their making.
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NOVEL COMPOUNDS AND COMPOSITIONS AS PROTEASE INHIBITORS

THE INVENTION

This application relates to compounds and compositions for treating diseases associated with cysteine protease activity, particularly diseases associated with activity of cathepsins B, K, L or S.

DESCRIPTION OF THE FIELD

Cysteine proteases represent a class of peptidases characterized by the presence of a cysteine residue in the catalytic site of the enzyme. Cysteine proteases are associated with the normal degradation and processing of proteins. The aberrant activity of cysteine proteases, e.g., as a result of increase expression or enhanced activation, however, may have pathological consequences. In this regard, certain cysteine proteases are associated with a number of disease states, including arthritis, muscular dystrophy, inflammation, tumor invasion, glomerulonephritis, malaria, periodontal disease, metachromatic leukodystrophy and others.

For example, increased cathepsin B levels and redistribution of the enzyme are found in tumors; thus, suggesting a role for the enzyme in tumor invasion and metastasis. In addition, aberrant cathepsin B activity is implicated in such disease states as rheumatoid arthritis, osteo arthritis, pneumocystis carinii, acute pancreatitis, inflammatory airway disease and bone and joint disorders.

The prominent expression of cathepsin K in osteoclasts and osteoclast-related multinucleated cells and its high collagenolytic activity suggest that the enzyme is involved in ososteoclast-mediated bone resorption and, hence, in bone abnormalities such as occurs in osteoporosis. In addition, cathepsin K expression in the lung and its elastinolytic activity suggest that the enzyme plays a role in pulmonary disorders as well.

Cathepsin L is implicated in normal lysosomal proteolysis as well as several disease states, including, but not limited to, metastasis of melanomas. Cathepsin S is implicated in
Alzheimer's disease and certain autoimmune disorders, including, but not limited to juvenile onset diabetes, multiple sclerosis, pemphigus vulgaris, Graves' disease, myasthenia gravis, systemic lupus erythematosus, rheumatoid arthritis and Hashimoto's thyroiditis; allergic disorders, including, but not limited to asthma; and allogeneic immune responses, including, but not limited to, rejection of organ transplants or tissue grafts.

In view of the number of diseases wherein it is recognized that an increase in cysteine protease activity contributes to the pathology and/or symptomatology of the disease, molecules which are shown to inhibit the activity of this class of enzymes, in particular molecules which are inhibitors of cathepsins B, K, L and/or S, will be useful as therapeutic agents.

**SUMMARY OF THE INVENTION**

In one particular embodiment, the present invention relates to compounds of Formula (I):

![Chemical Structure](image)

(I)

in which:

R₁ is a group of Formula (a) or (b):

![Chemical Structures](image)

(a) (b)

wherein:

X¹ and X² independently are -C(O)- or -CH₂S(O)₂-;
R⁴ and R⁶ are hydrogen or (C₁₋₆)alkyl;
R⁷ and R⁸ are hydrogen or (C₁₋₆)alkyl or as defined below;
R⁰ and R¹⁰ independently are (i) (C₁₋₆)alkyl optionally substituted with cyano, halo or nitro or (ii) a group selected from -X³NR¹²R¹², -X³NR¹²C(O)OR¹²,
-X³NR¹²C(O)NR¹²R¹², -X³NR¹²C(NR¹²)NR¹²R¹², -X³OR¹², -X³SR¹²,
-X³C(O)OR¹², -X³C(O)NR¹²R¹², -X³S(O)₂NR¹²R¹², -X³P(O)(OR¹²)OR¹²,
-X³OP(O)(OR¹²)OR¹², -X³NR¹²C(O)R¹³, -X³S(O)R¹³, -X³S(O)₂R¹³, -X³C(O)R¹³,
-X³C(O)R¹⁴, -X³C(O)OR¹⁴, -X³OC(O)R¹⁴, -X³NR¹⁵C(O)R¹⁴, -X³NR¹⁵C(O)OR¹⁴,
-X³C(O)NR¹⁴R¹⁵, -X³S(O)₂NR¹⁴R¹⁵, -X³NR¹⁵C(O)NR¹⁴R¹⁵,
-X³NR¹⁵C(NR¹⁵)NR¹⁴R¹⁵, -X³SR¹⁴, -X³S(O)₂R¹⁴, -X³S(O)R¹⁴, -X³OR¹⁴, or
-X⁴NR¹⁴R¹⁵, wherein X³ is (C₁₋₆)alkylene, X⁴ is a bond or (C₁₋₆)alkylene, R¹² at each occurrence independently is hydrogen, (C₁₋₆)alkyl or halo-substituted (C₁₋₆)alkyl, R¹³ is (C₁₋₆)alkyl or halo-substituted (C₁₋₆)alkyl, R¹⁴ is (C₃₋₁₂)cycloalkyl(C₀₋₆)alkyl,
hetero(C₉₋₁₂)cycloalkyl(C₀₋₆)alkyl, (C₆₋₁₂)aryl(C₀₋₆)alkyl, hetero(C₅₋₁₂)aryl(C₀₋₆)alkyl,
(C₉₋₁₂)polycycloaryl(C₀₋₆)alkyl or hetero(C₉₋₁₂)polycycloaryl(C₀₋₆)alkyl and R¹⁵ is hydrogen or (C₁₋₆)alkyl, and wherein within R¹⁴ said cycloalkyl, heterocycloalkyl, aryl, heteroaryl, polycycloaryl or heteropolycycloaryl ring optionally is substituted by a group selected from -R¹⁶, -X⁴OR¹⁶, -X⁴SR¹⁶, -X⁴S(O)₂R¹⁶,
-X⁴C(O)R¹⁶, -X⁴C(O)OR¹⁶, -X⁴OC(O)R¹⁶, -X⁴NR¹⁶R¹⁷, -X⁴NR¹⁷C(O)R¹⁶,
-X⁴NR¹⁷C(O)OR¹⁶, -X⁴C(O)NR¹⁶R¹⁷, -X⁴S(O)₂NR¹⁶R¹⁷, -X⁴NR¹⁷C(O)NR¹⁶R¹⁷ or
-X⁴NR¹⁷C(NR¹⁷)NR¹⁶R¹⁷, wherein X⁴ is a bond or (C₁₋₆)alkylene, R¹⁶ is hydrogen or (C₁₋₆)alkyl and R¹⁷ is (C₃₋₁₂)cycloalkyl(C₀₋₆)alkyl, hetero(C₃₋₁₂)cycloalkyl(C₀₋₆)alkyl,
(C₆₋₁₂)aryl(C₀₋₆)alkyl, hetero(C₆₋₁₂)aryl(C₀₋₆)alkyl, (C₉₋₁₂)polycycloaryl(C₀₋₆)alkyl or
hetero(C₉₋₁₂)polycycloaryl(C₀₋₆)alkyl, or (iii) a group selected from
(C₃₋₁₂)cycloalkyl(C₀₋₆)alkyl, hetero(C₃₋₁₂)cycloalkyl(C₀₋₆)alkyl, (C₆₋₁₂)aryl(C₀₋₆)alkyl,
hetero(C₅₋₁₂)aryl(C₀₋₆)alkyl, (C₉₋₁₂)polycycloaryl(C₀₋₆)alkyl and
hetero(C₉₋₁₂)polycycloaryl(C₀₋₆)alkyl, wherein said cycloalkyl, heterocycloalkyl, aryl, heteroaryl, polycycloaryl or heteropolycycloaryl ring optionally is substituted by a group selected from -R¹⁶, -X⁴OR¹⁶, -X⁴SR¹⁶, -X⁴S(O)₂R¹⁶, -X⁴S(O)R¹⁶, -X⁴S(O)₂R¹⁶,
-X^4C(O)R^{16}, -X^4C(O)OR^{16}, -X^4OC(O)R^{16}, -X^4NR^{16}R^{17}, -X^4NR^{17}C(O)R^{16},
-X^4NR^{17}C(O)OR^{16}, -X^4C(O)NR^{16}R^{17}, -X^4S(O)_2NR^{16}R^{17}, -X^4NR^{17}C(O)NR^{16}R^{17} or
-X^4NR^{17}C(NR^{17})NR^{16}R^{17}, wherein X^4, R^{16} and R^{17} are as defined above; wherein
within R^9 and/or R^{10} any alicyclic or aromatic ring system present may be substituted
further by 1 to 5 radicals independently selected from (C_{1-4})alkyl, (C_{1-6})alkyldiene,
cyano, halo, halo-substituted (C_{1-4})alkyl, nitro, -X^4NR^{12}R^{12}, -X^4NR^{12}C(O)OR^{12},
-X^4NR^{12}C(O)NR^{12}R^{12}, -X^4NR^{12}C(NR^{12})NR^{12}R^{12}, -X^4OR^{12}, -X^4SR^{12},
-X^4C(O)OR^{12}, -X^4C(O)NR^{12}R^{12}, -X^4S(O)_2NR^{12}R^{12}, -X^4P(O)(OR)^4OR^{12},
-X^4OP(O)(OR)^4OR^{12}, -X^4OC(O)R^{13}, -X^4NR^{13}C(O)R^{13}, -X^4S(O)R^{13}, -X^4S(O)_2R^{13}
and -X^4C(O)R^{13}, wherein X^4, R^{12} and R^{13} are as defined above, or
R^9 taken together with R^7 and/or R^{10} taken together with R^8 form
trimethylene, tetramethylene or phenylene-1,2-dimethylene, optionally substituted with
hydroxy, oxo or methylene; and

R^{11} is -X^5X^6R^{18}, wherein X^5 is -C(O)-, -C(O)C(O)- or -S(O)_2-, X^6 is a
bond, -O- or -NR^{19}-, wherein R^{19} is hydrogen or (C_{1-6})alkyl, and R^{18} is
(i) (C_{1-10})alkyl optionally substituted by cyano, halo, nitro, -NR^{12}R^{12},
-NR^{12}C(O)OR^{12}, -NR^{12}C(O)NR^{12}R^{12}, -NR^{12}C(NR^{12})NR^{12}R^{12}, -OR^{12}, -SR^{12},
-C(O)OR^{12}, -C(O)NR^{12}R^{12}, -S(O)_2NR^{12}R^{12}, -P(O)(OR)^4OR^{12},
-OP(O)(OR)^4OR^{12}, -NR^{12}C(O)R^{13}, -S(O)R^{13}, -S(O)_2R^{13}, -C(O)R^{13}, -OR^{20}, -SR^{20},
-S(O)R^{20}, -S(O)_2R^{20}, -C(O)R^{20}, -C(O)OR^{20}, -C(O)NR^{20}R^{21}, -NR^{20}R^{21},
-NR^{21}C(O)R^{20}, -NR^{21}C(O)OR^{20}, -NR^{21}C(O)NR^{20}R^{21} or -NR^{21}C(NR^{21})NR^{20}R^{21},
wherein R^{12} and R^{13} are as defined above, R^{20} is (C_{3-12})cycloalkyl(C_{6-6})alkyl,
hetero(C_{3-12})cycloalkyl(C_{6-6})alkyl, (C_{6-12})arylcycloalkyl, hetero(C_{5-12})arylcycloalkyl,
(C_{9-12})bicycloalkyl(C_{6-6})alkyl or hetero(C_{8-12})bicycloalkyl(C_{6-6})alkyl and R^{21} at each
occurrence independently is hydrogen or (C_{1-6})alkyl, or
(ii) (C_{3-12})cycloalkyl(C_{6-6})alkyl, hetero(C_{3-12})cycloalkyl(C_{6-6})alkyl,
(C_{6-12})arylcycloalkyl(C_{6-6})alkyl, hetero(C_{5-12})arylcycloalkyl(C_{6-6})alkyl or
hetero(C_{8-12})bicycloalkyl(C_{6-6})alkyl or (iii) (C_{3-6})cycloalkyl(C_{6-6})alkyl,
hetero(C_{3-6})cycloalkyl(C_{6-6})alkyl, phenyl(C_{6-6})alkyl or hetero(C_{5-6})arylcycloalkyl(C_{6-6})alkyl,
wherein said cycloalkyl, heterocycloalkyl, phenyl or heteroaryl is substituted by 
-X^4OR^{22}, -X^4SR^{22}, -X^4S(O)R^{22}, -X^4S(O)_2R^{22}, -X^4C(O)R^{22}, -X^4C(O)OR^{22},
-X^4C(O)NR^{22}R^{23}, -X^4NR^{22}R^{23}, -X^4NR^{23}C(O)R^{12}, -X^4NR^{23}C(O)OR^{22},
-X^4NR^{23}C(O)NR^{22}R^{23} or -X^4NR^{23}C(NR^{23})NR^{22}R^{23}, wherein X^4 is as defined
above, R^{22} is (C_{3-6})cycloalkyl(C_{0-6})alkyl, hetero(C_{3-6})cycloalkyl(C_{0-6})alkyl,
phenyl(C_{0-6})alkyl or hetero(C_{5-6})aryl(C_{0-6})alkyl and R^{23} at each occurrence
independently is hydrogen or (C_{1-6})alkyl; wherein within R^{11} any alicyclic or aromatic
ring system present may be substituted further by 1 to 5 radicals independently
selected from (C_{1-6})alkyl, (C_{1-6})alkylidene, cyano, halo, halo-substituted (C_{1-4})alkyl,
nitro, -X^4NR^{12}R^{12}, -X^4NR^{12}C(O)OR^{12}, -X^4NR^{12}C(O)NR^{12}R^{12},
-X^4NR^{12}C(NR^{12})NR^{12}R^{12}, -X^4OR^{12}, -X^4SR^{12}, -X^4C(O)OR^{12}, -X^4C(O)NR^{12}R^{12},
-X^4S(O)NR^{12}R^{12}, -X^4P(O)(OR^3)OR^{12}, -X^4OP(O)(OR^3)OR^{12}, -X^4OC(O)R^{13},
-X^4NR^{12}C(O)R^{13}, -X^4S(O)R^{13}, -X^4S(O)NR^{12}R^{13} and -X^4C(O)R^{13}, wherein X^4, R^{12}
and R^{13} are as defined above;

R^2 is hydrogen or (C_{1-6})alkyl or as defined below;
R^3 is hydrogen, (C_{1-6})alkyl or as defined below; and
R^4 is (i) hydrogen or (C_{1-6})alkyl, wherein said alkyl is optionally substituted with
cyano, halo, nitro, -NR^{12}R^{12}, -NR^{12}C(O)OR^{12}, -NR^{12}C(O)NR^{12}R^{12},
-NR^{12}C(NR^{12})NR^{12}R^{12}, -OR^{12}, -SR^{12}, -(O)OR^{12}, -(O)NR^{12}R^{12}, -(O)NR^{12}R^{12},

-P(O)(OR^{12})OR^{12}, -OP(O)(OR^{12})OR^{12}, -NR^{12}C(O)R^{13}, -S(O)R^{13}, -S(O)NR^{12}R^{12},
-NR^{15}C(O)R^{14}, -NR^{15}C(O)OR^{14}, -(O)NR^{14}R^{15}, -(O)NR^{14}R^{15}, -(O)NR^{14}R^{15}, -(O)NR^{14}R^{15},
-NR^{15}C(NR^{15})NR^{14}R^{15}, wherein R^{12}, R^{13}, R^{14} and R^{15} are as defined above, or (ii) a group
selected from (C_{3-12})cycloalkyl(C_{0-6})alkyl, hetero(C_{3-12})cycloalkyl(C_{0-6})alkyl,

(C_{6-12})aryl(C_{0-6})alkyl, hetero(C_{5-12})aryl(C_{0-6})alkyl, (C_{9-12})polycycloaryl(C_{0-6})alkyl and
hetero(C_{8-12})polycycloaryl(C_{0-6})alkyl, wherein said cycloalkyl, heterocycloalkyl, aryl,
heteroaryl, polycycloaryl or heteropolycycloaryl ring optionally is substituted by a group
selected from -R^{16}, -X^4OR^{16}, -X^4SR^{16}, -X^4S(O)R^{16}, -X^4S(O)_2R^{16}, -X^4C(O)R^{16},
-X^4C(O)OR^{16}, -X^4OC(O)R^{16}, -X^4NR^{16}R^{17}, -X^4NR^{17}C(O)R^{16}, -X^4NR^{17}C(O)OR^{16},
-X^4C(O)NR^{16}R^{17}, -X^4S(O)_{2}NR^{16}R^{17}, -X^4NR^{17}C(O)NR^{16}R^{17} or -X^4NR^{17}C(NR^{17})NR^{16}R^{17},

wherein X^4, R^{16} and R^{17} are as defined above; wherein within R^9 and/or R^{10} any alicyclic or aromatic ring system present may be substituted further by 1 to 5 radicals independently selected from (C_{1-6})alkyl, (C_{1-6})alkyldiene, cyano, halo, halo-substituted (C_{1-4})alkyl, nitro,

-X^4NR^{12}R^{12}, -X^4NR^{12}C(O)OR^{12}, -X^4NR^{12}C(O)NR^{12}R^{12}, -X^4NR^{12}C(NR^{12})NR^{12}R^{12},

-X^4OR^{12}, -X^4SR^{12}, -X^4C(O)OR^{12}, -X^4C(O)NR^{12}R^{12}, -X^4S(O)_{2}NR^{12}R^{12},

-X^4P(O)(OR^{3})OR^{12}, -X^4P(O)(OR^{3})OR^{12}, -X^4OC(O)R^{13}, -X^4NR^{12}C(O)R^{13}, -X^4S(O)R^{13},

-X^4S(O)_{2}R^{13} and -X^4C(O)R^{13}, wherein X^4, R^{12} and R^{13} are as defined above, or

R^4 and R^2 taken together form trimethylene, tetramethylene or phenylene-1,2-dimethylene, optionally substituted with hydroxy, oxo or methylene, or

R^4 and R^3 together with the carbon atom to which both R^4 and R^3 are attached form (C_{3-8})cycloalkylene or (C_{3-8})heterocycloalkylene; and the N-oxide derivatives, prodrug derivatives, protected derivatives, individual isomers and mixtures of isomers; and the pharmaceutically acceptable salts thereof.

In another particular embodiment, this invention relates to compounds of Formula (II):

![Formula (II)](image)

wherein:

- R^2 is hydrogen or (C_{1-6})alkyl or as defined below;
- R^3 is hydrogen, (C_{1-6})alkyl or as defined below;
- R^4 is (i) hydrogen or (C_{1-6})alkyl, wherein said alkyl optionally is substituted with cyano, halo, nitro, -NR^{12}R^{12}, -NR^{12}C(O)OR^{12}, -NR^{12}C(O)NR^{12}R^{12},

-NR^{12}C(NR^{12})NR^{12}R^{12}, -OR^{12}, -SR^{12}, -C(O)OR^{12}, -C(O)NR^{12}R^{12}, -S(O)_{2}NR^{12}R^{12},

-P(O)(OR^{13})OR^{12}, -OP(O)(OR^{12})OR^{12}, -NR^{12}C(O)R^{13}, -S(O)R^{13}, -S(O)_{2}R^{13}, -C(O)R^{13},

-OR^{14}, -SR^{14}, -S(O)R^{14}, -S(O)_{2}R^{14}, -C(O)R^{14}, -C(O)OR^{14}, -OC(O)R^{14}, -NR^{14}R^{15},

-NR^{15}C(O)R^{14}, -NR^{15}C(O)OR^{14}, -C(O)NR^{14}R^{15}, -S(O)_{2}NR^{14}R^{15}, -NR^{15}C(O)NR^{14}R^{15} or
-NR_{15}C(NR_{15})NR_{14}R_{15}, wherein R_{12} at each occurrence independently is hydrogen,
(C_{1-6})alkyl or halo-substituted (C_{1-6})alkyl, R_{13} is (C_{1-6})alkyl or halo-substituted (C_{1-6})alkyl, R_{14} is (C_{3-12})cycloalkyl(C_{6-6})alkyl, hetero(C_{3-12})cycloalkyl(C_{6-6})alkyl, (C_{6-12})aryl(C_{6-6})alkyl, hetero(C_{5-12})aryl(C_{6-6})alkyl, (C_{9-12})polycycloaryl(C_{6-6})alkyl or
hetero(C_{8-12})polycycloaryl(C_{6-6})alkyl and R_{15} is hydrogen or (C_{1-6})alkyl, and wherein within R_{14} said cycloalkyl, heterocycloalkyl, aryl, heteroaryl, polycycloaryl or heteropolycycloaryl ring optionally is substituted by a group selected from -R_{16}, -X^4 OR_{16}, -X^4 SR_{16}, -X^4 S(O)R_{16}, -X^4 S(O)R_{16}, -X^4 C(O)R_{16}, -X^4 C(O)OR_{16}, -X^4 OC(O)R_{16}, -X^4 NR_{16}R_{17}, -X^4 NR_{17}C(O)R_{16}, -X^4 NR_{17}C(O)OR_{16}, -X^4 C(O)NR_{16}R_{17}, -X^4 S(O)_{2}NR_{16}R_{17}, -X^4 NR_{17}C(O)NR_{16}R_{17} or
-X^4 NR_{17}C(O)NR_{16}R_{17}, wherein X^4 is a bond or (C_{1-6})alkylene, R_{16} is hydrogen or (C_{1-6})alkyl and R_{17} is (C_{3-12})cycloalkyl(C_{6-6})alkyl, hetero(C_{3-12})cycloalkyl(C_{6-6})alkyl, (C_{6-12})aryl(C_{6-6})alkyl, hetero(C_{5-12})aryl(C_{6-6})alkyl, (C_{9-12})polycycloaryl(C_{6-6})alkyl or hetero(C_{8-12})polycycloaryl(C_{6-6})alkyl, or (ii) a group selected from (C_{3-12})cycloalkyl(C_{6-6})alkyl, hetero(C_{3-12})cycloalkyl(C_{6-6})alkyl, (C_{6-12})aryl(C_{6-6})alkyl, hetero(C_{5-12})aryl(C_{6-6})alkyl, (C_{9-12})polycycloaryl(C_{6-6})alkyl and
hetero(C_{8-12})polycycloaryl(C_{6-6})alkyl, wherein said cycloalkyl, heterocycloalkyl, aryl, heteroaryl, polycycloaryl or heteropolycycloaryl ring optionally is substituted by a group selected from -R_{16}, -X^4 OR_{16}, -X^4 SR_{16}, -X^4 S(O)R_{16}, -X^4 S(O)_{2}R_{16}, -X^4 C(O)R_{16}, -X^4 C(O)OR_{16}, -X^4 OC(O)R_{16}, -X^4 NR_{16}R_{17}, -X^4 NR_{17}C(O)R_{16}, -X^4 NR_{17}C(O)OR_{16}, -X^4 C(O)NR_{16}R_{17}, -X^4 S(O)_{2}NR_{16}R_{17}, -X^4 NR_{17}C(O)NR_{16}R_{17} or -X^4 NR_{17}C(O)NR_{16}R_{17}, wherein X^4, R_{16} and R_{17} are as defined above; wherein within R^4 any alicyclic or aromatic ring system present may be substituted further by 1 to 5 radicals independently selected from (C_{1-6})alkyl, (C_{1-6})alkylidene, cyano, halo, halo-substituted (C_{1-6})alkyl, nitro, -X^4 NR_{12}R_{12}, -X^4 NR_{12}C(O)OR_{12}, -X^4 NR_{12}C(O)NR_{12}R_{12}, -X^4 NR_{12}C(NR_{12})NR_{12}R_{12}, -X^4 OR_{12}, -X^4 SR_{12}, -X^4 C(O)OR_{12}, -X^4 C(O)NR_{12}R_{12}, -X^4 S(O)_{2}NR_{12}R_{12}, -X^4 P(O)(OR)_{3} OR_{12}, -X^4 OP(O)(OR)_{3} OR_{12}, -X^4 OC(O)R_{13}, -X^4 NR_{12}C(O)R_{13}, -X^4 S(O)R_{13}, -X^4 S(O)_{2}R_{13} and
-X^4 C(O)R_{13}, wherein X^4, R_{12} and R_{13} are as defined above, or
R^4 and R^2 taken together form trimethylene, tetramethylene or phenylene-1,2-dimethylene, optionally substituted with hydroxy, oxo or methylene, or
R^4 and R^3 together with the carbon atom to which both R^4 and R^3 are attached form (C_{3,4})cycloalkylene or (C_{3,4})heterocycloalkylene;
R^5 is hydrogen or (C_{1,6})alkyl;
R^7 is hydrogen or (C_{1,6})alkyl;
R^9 is (C_{6,12})aryl(C_{1,6})alkyl, hetero(C_{5,12})aryl(C_{1,6})alkyl, -X^4OR^{14}, -X^4SR^{14},
-X^4S(O)R^{14}, -X^4S(O)_2R^{14} or -X^4NR^{14}R^{15}, wherein X^4, R^{14} and R^{15} are as defined above and wherein R^9 said aryl or heteroaryl ring optionally is substituted by 1 to 5 radicals independently selected from (C_{1,6})alkyl, cyano, halo, halo-substituted (C_{1,4})alkyl, nitro,
-X^4NR^{12}R^{12}, -X^4NR^{12}C(O)OR^{12}, -X^4NR^{12}C(O)NR^{12}R^{12}, -X^4NR^{12}C(NR^{12})NR^{12}R^{12},
-X^4OR^{12}, -X^4SR^{12}, -X^4C(O)R^{12}, -X^4C(O)OR^{12}, -X^4C(O)NR^{12}R^{12}, -X^4S(O)_2NR^{12}R^{12},
-X^4P(O)(OR^{3})OR^{12}, -X^4OP(O)(OR^{3})OR^{12}, -X^4OC(O)R^{13}, -X^4NR^{12}C(O)R^{13}, -X^4S(O)R^{13},
-X^4S(O)_2R^{13}, wherein X^4, R^{12} and R^{13} are as defined above; and
R^{11} is -X^4X^6R^{18}, wherein X^4 is -C(O)-, -C(O)C(O)- or -S(O)_{2}-, X^6 is a bond, -O- or -NR^{19}-, wherein R^{19} is hydrogen or (C_{1,6})alkyl, and R^{18} is (i) (C_{1,6})alkyl optionally substituted by cyano, halo, nitro, -NR^{12}R^{12}, -NR^{12}C(O)OR^{12}, -NR^{12}C(O)NR^{12}R^{12},
-NR^{12}C(NR^{12})NR^{12}R^{12}, -OR^{12}, -SR^{12}, -C(O)OR^{12}, -C(O)NR^{12}R^{12}, -S(O)_2NR^{12}R^{12},
-P(O)(OR^{12})OR^{12}, -OP(O)(OR^{12})OR^{12}, -NR^{12}C(O)R^{13}, -S(O)R^{13}, -S(O)_2R^{13}, -C(O)R^{13},
-NR^{21}C(O)R^{20}, -NR^{21}C(O)OR^{20}, -NR^{21}C(O)NR^{20}R^{21} or -NR^{21}C(NR^{21})NR^{20}R^{21}, wherein
R^{12} and R^{13} are as defined above, R^{20} is (C_{3,12})cycloalkyl(C_{6,6})alkyl,
hetero(C_{3,12})cycloalkyl(C_{6,6})alkyl, (C_{6,12})aryl(C_{6,6})alkyl, hetero(C_{5,12})aryl(C_{6,6})alkyl,
(C_{9,12})bicycloaryl(C_{6,6})alkyl or hetero(C_{8,12})bicycloaryl(C_{6,6})alkyl and R^{21} at each occurrence independently is hydrogen or (C_{1,6})alkyl, or (ii) (C_{3,12})cycloalkyl(C_{6,6})alkyl,
hetero(C_{3,12})cycloalkyl(C_{6,6})alkyl, (C_{6,12})aryl(C_{6,6})alkyl, hetero(C_{5,12})aryl(C_{6,6})alkyl,
hetero(C_{9,12})bicycloaryl(C_{6,6})alkyl or hetero(C_{8,12})bicycloaryl(C_{6,6})alkyl or
(iii) (C_{3,4})cycloalkyl(C_{6,6})alkyl, hetero(C_{3,6})cycloalkyl(C_{6,6})alkyl, phenyl(C_{6,6})alkyl or hetero(C_{5,6})aryl(C_{6,6})alkyl, wherein said cycloalkyl, heterocycloalkyl, phenyl or heteroaryl is
substituted by -X^4OR^{22}, -X^4SR^{22}, -X^4S(O)R^{22}, -X^4S(O)_2R^{22}, -X^4C(O)R^{22}, -X^4C(O)OR^{22},
-X^4C(O)NR^{22}R^{23}, -X^4NR^{22}R^{23}, -X^4NR^{23}C(O)R^{22}, -X^4NR^{23}C(O)OR^{22},

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-X^4NR^{22}C(O)NR^{22}R^{23} or -X^4NR^{23}C(NR^{23})NR^{22}R^{23}, wherein X^4 is as defined above, R^{22} is (C_{3,6})cycloalkyl(C_{0,6})alkyl, hetero(C_{3,6})cycloalkyl(C_{0,6})alkyl, phenyl(C_{0,6})alkyl or hetero(C_{3,6})aryl(C_{0,6})alkyl and R^{23} at each occurrence independently is hydrogen or (C_{1,6})alkyl; wherein within R^{11} any alicyclic or aromatic ring system present may be substituted further by 1 to 5 radicals independently selected from (C_{1,6})alkyl, (C_{1,6})alkyldene, cyano, halo, halo-substituted (C_{1,6})alkyl, nitro, -X^4NR^{12}R^{12}, -X^4NR^{12}C(O)OR^{12}, 
-X^4NR^{12}C(O)NR^{12}R^{12}, -X^4NR^{12}C(NR^{12})NR^{12}R^{12}, -X^4OR^{12}, -X^4SR^{12}, -X^4C(O)OR^{12}, 
-X^4C(O)NR^{12}R^{12}, -X^4S(O)NR^{12}R^{12}, -X^4P(O)(OR^3)OR^{12}, -X^4P(O)(OR^3)OR^{12}, 
-X^4OC(O)R^{13}, -X^4NR^{12}C(O)R^{13}, -X^4S(O)R^{13}, -X^4S(O)R^{13} and -X^4C(O)R^{13}, wherein X^4, 
R^{12} and R^{13} are as defined above; and the N-oxide derivatives, prodrug derivatives, protected derivatives, individual isomers and mixtures of isomers; and the pharmaceutically acceptable salts thereof.

In another particular embodiment, the present invention relates to a pharmaceutical composition which contains a compound of Formula I or a N-oxide derivative, prodrug derivative, individual isomer or mixture of isomers or a pharmaceutically acceptable salt thereof in admixture with one or more suitable excipients.

In another particular embodiment, the present invention relates to a method of treating a disease in an animal in which inhibition of a cysteine protease can prevent, inhibit or ameliorate the pathology and/or symptomatology of the disease, which method comprises administering to the animal a therapeutically effective amount of compound of Formula I or a N-oxide derivative, prodrug derivative, individual isomer or mixture of isomers or a pharmaceutically acceptable salt thereof.

In another particular embodiment, the present invention relates processes for preparing compounds of Formula I and the N-oxide derivatives, prodrug derivative, protected derivatives, individual isomers and mixtures of isomers, and the pharmaceutically acceptable salts thereof as set forth in "Detailed Description of the Invention".

In another particular embodiment, the present invention relates a compound of Formula (III):
in which:

- $R^1$ is a group of Formula (a) or (b):

\[
\begin{align*}
  & R^6 \quad N \quad X^2 \quad X^1 \quad \{ \text{a} \} \\
  & R^5 \\
  \end{align*}
\]

\[
\begin{align*}
  & R^7 \quad N \quad X^4 \quad X^3 \quad X^2 \quad X^1 \quad \{ \text{b} \} \\
  & R^5 \\
  \end{align*}
\]

wherein:

- $X^1$ and $X^3$ independently are -C(O)- or -S(O)$_2$-,
- $X^2$ is -CR$_8$R$_9^-$, -CH$_2$CR$_8$R$_9^-$ or -CR$_8$R$_9^-$CH$_2^-$ and $X^4$ is -CHR$_{10}^-$,
- -CH$_2$CHR$_{10}^-$ or -CHR$_{10}^-$CH$_2^-$, wherein:

\[
R^8 \text{ is hydrogen or (C$_{1-6}$)alkyl,}
\]

$R^9$ is (i) (C$_{1-6}$)alkyl or halo-substituted(C$_{1-6}$)alkyl optionally substituted with -OR$_{11}^-$, -SR$_{11}^-$, -S(O)R$_{11}^-$, -S(O)$_2$R$_{11}^-$, -C(O)R$_{11}^-$, -C(O)OR$_{11}^-$, -NR$_{11}^-$R$_{12}^-$,
- -NR$_{12}^-$C(O)OR$_{11}^-$, -C(O)NR$_{11}^-$R$_{12}^-$, -S(O)$_2$NR$_{11}^-$R$_{12}^-$, -NR$_{12}^-$C(O)NR$_{11}^-$R$_{12}^-$ or
- -NR$_{12}^-$C(NR$_{12}^-$)NR$_{11}^-$R$_{12}^-$, wherein $R^1$ is hydrogen, (C$_{1-6}$)alkyl,
(C$_{3-12}$)cycloalkyl(C$_{0-3}$)alkyl, hetero(C$_{3-12}$)cycloalkyl(C$_{0-3}$)alkyl,
(C$_{6-12}$)aryl(C$_{0-3}$)alkyl or hetero(C$_{5-12}$)aryl(C$_{0-3}$)alkyl and $R^2$ is hydrogen or
(C$_{1-6}$)alkyl, or (ii) (C$_{3-12}$)cycloalkyl(C$_{0-3}$)alkyl,

hetero(C$_{3-12}$)cycloalkyl(C$_{0-3}$)alkyl, (C$_{6-12}$)aryl(C$_{0-3}$)alkyl,

hetero(C$_{5-12}$)aryl(C$_{0-3}$)alkyl, (C$_{9-12}$)polycycloaryl(C$_{0-3}$)alkyl or

hetero(C$_{8-12}$)polycycloaryl(C$_{0-3}$)alkyl optionally substituted with -R$_{13}^-$,

\[
\begin{align*}
  & -X^3\text{OR}_{13}^-, -X^3\text{SR}_{13}^-, -S(O)R_{13}^-, -S(O)_2R_{13}^-, -C(O)R_{13}^-, -C(O)OR_{13}^-, \\
  & -X^3\text{NR}_{13}^3\text{R}_{14}^-, -X^5\text{NR}_{14}^3C(O)\text{OR}_{13}^-, -C(O)\text{NR}_{13}^3\text{R}_{14}^-, -S(O)_2\text{NR}_{13}^3\text{R}_{14}^-, \\
  & -\text{NR}_{14}^3C(O)\text{NR}_{13}^3\text{R}_{14}^- \text{ or } -\text{NR}_{14}^3C(NR_{14}^3)\text{NR}_{13}^3\text{R}_{14}^-, \text{ wherein } X^5 \text{ is a bond or}
\end{align*}
\]
methylene, \( R^{13} \) is (C\(_{3-12}\))cycloalkyl\((C_{0-3})\)alkyl,
hetero(C\(_{3-12}\))cycloalkyl\((C_{0-3})\)alkyl, (C\(_{6-12}\))arylm\((C_{0-3})\)alkyl,
hetero(C\(_{5-12}\))aryl\((C_{0-3})\)alkyl, (C\(_{9-12}\))polycycloaryl\((C_{0-3})\)alkyl or
hetero(C\(_{8-12}\))polycycloaryl\((C_{0-3})\)alkyl and \( R^{14} \) is hydrogen or \((C_{1-6})\)alkyl, or
(iii) together with \( R^{5} \) when \( X^{2} \) is -CHR\(^{2}\)- forms trimethylene, tetramethylene or
phenylene-1,2-dimethylene, optionally substituted with 1 to 2 of hydroxy,
oxo, \((C_{1-4})\)alkyl or methylene; wherein any 1 to 3 annular atoms of any
aromatic ring with available valences comprising \( R^{5} \) are optionally
independently substituted with halo, nitro, cyano, \((C_{1-6})\)alkyl,
halo-substituted\((C_{1-6})\)alkyl, -OR\(^{15}\), -C(O)R\(^{15}\), -C(O)OR\(^{15}\), -C(O)NR\(^{15}\)R\(^{15}\),
-S(O)\(_{2}\)NR\(^{15}\)R\(^{15}\), -X\(^{5}\)NR\(^{15}\)R\(^{15}\), -X\(^{5}\)NR\(^{15}\)C(O)OR\(^{15}\), -X\(^{5}\)NR\(^{15}\)C(O)NR\(^{15}\)R\(^{15}\) or
-X\(^{5}\)NR\(^{15}\)C(NR\(^{15}\)NR\(^{15}\)R\(^{15}\), wherein \( X^{5} \) is as defined above and each \( R^{15} \)
independently is hydrogen or \((C_{1-6})\)alkyl, and
\( R^{10} \) is hydrogen or \((C_{1-6})\)alkyl;

\( R^{5} \) and \( R^{7} \) are independently hydrogen, \((C_{1-6})\)alkyl or as defined above; and \( R^{6} \) is -X\(^{6}\)X\(^{16}\)R\(^{16}\), wherein \( X^{6} \) is -C(O)- or -S(O)\(_{2}\)-, \( X^{7} \) is a bond, -O- or
-NR\(^{17}\)-, wherein \( R^{17} \) is hydrogen or \((C_{1-6})\)alkyl, and \( R^{16} \) is (i) \((C_{1-6})\)alkyl or
halo-substituted\((C_{1-6})\)alkyl optionally substituted with -OR\(^{11}\), -SR\(^{11}\), -S(O)R\(^{11}\),
-S(O)\(_{2}\)R\(^{11}\), -C(O)R\(^{11}\), -C(O)OR\(^{11}\), -NR\(^{11}\)R\(^{12}\), -NR\(^{12}\)C(O)OR\(^{11}\), -C(O)NR\(^{11}\)R\(^{12}\),
-NR\(^{12}\)C(O)NR\(^{11}\)R\(^{12}\) or -NR\(^{12}\)C(NR\(^{12}\))NR\(^{11}\)R\(^{12}\), wherein \( R^{11} \) and \( R^{12} \) are as defined
above, or (ii) \((C_{3-6})\)cycloalkyl\((C_{0-3})\)alkyl, hetero\((C_{3-6})\)cycloalkyl\((C_{0-3})\)alkyl,
(C\(_{6-12}\))aryl\((C_{0-3})\)alkyl, hetero(C\(_{5-12}\))aryl\((C_{0-3})\)alkyl, (C\(_{9-12}\))polycycloaryl\((C_{0-3})\)alkyl or
hetero(C\(_{8-12}\))polycycloaryl\((C_{0-3})\)alkyl optionally substituted with 1 to 2 of -R\(^{13}\),
-X\(^{5}\)OR\(^{13}\), -X\(^{5}\)SR\(^{13}\), -S(O)R\(^{13}\), -S(O)\(_{2}\)R\(^{13}\), -C(O)OR\(^{13}\), -X\(^{5}\)NR\(^{13}\)R\(^{14}\),
-X\(^{5}\)NR\(^{14}\)C(O)OR\(^{13}\), -C(O)NR\(^{13}\)R\(^{14}\), -NR\(^{14}\)C(O)NR\(^{13}\)R\(^{14}\) or
-NR\(^{14}\)C(NR\(^{14}\))NR\(^{13}\)R\(^{14}\), wherein \( X^{5}, R^{13} \) and \( R^{14} \) are as defined above; wherein any
1 to 3 annular atoms of any aromatic ring with available valences comprising \( R^{16} \)
optionally independently are substituted with halo, nitro, cyano, \((C_{1-6})\)alkyl,
halo-substituted\((C_{1-6})\)alkyl, -OR\(^{15}\), -C(O)R\(^{15}\), -C(O)OR\(^{15}\), -C(O)NR\(^{15}\)R\(^{15}\),
-S(O)₂NR¹⁵R¹⁵, -X⁵NR¹⁵R¹⁵, -X⁵NR¹⁵C(O)OR¹⁵, -X⁵NR¹⁵C(O)NR¹⁵R¹⁵ or
-X⁵NR¹⁵C(NR¹⁵)NR¹⁵R¹⁵, wherein X⁵ and R¹⁵ are as defined above;
R² is hydrogen or (C₁₋₆)alkyl or as defined below;
R³ is hydrogen, (C₁₋₆)alkyl or as defined below; and
R⁴ is (i) hydrogen, (ii) (C₁₋₆)alkyl or halo-substituted(C₁₋₆)alkyl optionally substituted
with -OR¹¹, -SR¹¹, -S(O)R¹¹, -S(O)₂R¹¹, -C(O)R¹¹, -C(O)OR¹¹, -NR¹¹R¹²,
-NR¹²C(O)OR¹¹, -C(O)NR¹¹R¹², -NR¹²C(O)NR¹¹R¹² or -NR¹²C(NR¹²)NR¹¹R¹², wherein
R¹¹ and R¹² are as defined above, or (iii) (C₃₋₁₂)cycloalkyl(C₀₋₃)alkyl,
hetero(C₃₋₁₂)cycloalkyl(C₀₋₃)alkyl, (C₆₋₁₂)aryl(C₀₋₃)alkyl, hetero(C₅₋₁₂)aryl(C₀₋₃)alkyl,
(C₉₋₁₂)polycycloaryl(C₀₋₃)alkyl or hetero(C₈₋₁₂)polycycloaryl(C₀₋₃)alkyl optionally substituted
with -R¹³, -X⁶OR¹³, -X⁶SR¹³, -S(O)R¹³, -S(O)₂R¹³, -C(O)OR¹³, -X⁶NR¹³R¹⁴,
-X⁶NR¹⁴C(O)OR¹³, -C(O)NR¹³R¹⁴, -NR¹⁴C(O)NR¹³R¹⁴ or -NR¹⁴C(NR¹⁴)NR¹³R¹⁴,
wherein X⁶, R¹³ and R¹⁴ are as defined above or (iv) together with R² forms trimethylene,
tetramethylene or phenylene-1,2-dimethylene, optionally substituted with hydroxy, oxo, (C₁.
₄)alkyl or methylene or (v) together with R³ forms ethylene, trimethylene or tetramethylene;
wherein any 1 to 3 annular atoms of any aromatic ring with available valences comprising R⁴
optionally independently are substituted with halo, nitro, cyano, (C₁₋₆)alkyl,
halo-substituted(C₁₋₆)alkyl, -OR¹⁵, -C(O)R¹⁵, -C(O)OR¹⁵, -C(O)NR¹⁵R¹⁵,
-S(O)₂NR¹⁵R¹⁵, -X⁷NR¹⁵R¹⁵, -X⁷NR¹⁵C(O)OR¹⁵, -X⁷NR¹⁵C(O)NR¹⁵R¹⁵ or
-X⁷NR¹⁵C(NR¹⁵)NR¹⁵R¹⁵, wherein X⁷ and R¹⁵ are as defined above; and the N-oxide
derivatives, prodrug derivatives, protected derivatives, individual isomers and mixtures of
isomers; and the pharmaceutically acceptable salts thereof.

In another particular embodiment, the present invention relates to a method of treating
a disease in an animal in which cathepsin S activity contributes to the pathology and/or
symptomatology of the disease, which method comprising administering to the animal a
therapeutically effective amount of a compound of Formula (I):

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in which:

R¹ is a group of Formula (a) or (b):

(a) \[
\begin{align*}
R^1 & \quad R^5 & \quad R^9 \\
R^7 & \quad X^1 & \quad R^{11}
\end{align*}
\]

(b) \[
\begin{align*}
R^1 & \quad R^5 & \quad R^9 \\
R^6 & \quad X^2 & \quad R^{10}
\end{align*}
\]

wherein:

X¹ and X² independently are -C(O)- or -CH₂S(O)₂-;

R⁵ and R⁶ are hydrogen or (C₁₋₆)alkyl;

R⁷ and R⁸ are hydrogen or (C₁₋₆)alkyl or as defined below;

R⁹ and R¹₀ independently are (i) (C₁₋₆)alkyl optionally substituted with cyano,

halo or nitro or (ii) a group selected from -X³NR¹²R¹², -X³NR¹²C(O)OR¹²,

-X³NR¹₂C(O)NR¹²R¹², -X³NR¹₂C(NR¹²)NR¹²R¹², -X³OR¹², -X³SR¹²,

-X³C(O)OR¹², -X³C(O)NR¹²R¹², -X³S(O)₂NR¹²R¹², -X³P(O)(OR¹²)OR¹²,

-X³OP(O)(OR¹²)OR¹², -X³NR¹₂C(O)R¹³, -X³S(O)R¹³, -X³S(O)₂R¹³, -X³C(O)R¹³,

-X³C(O)R¹⁴, -X³C(O)OR¹⁴, -X³OC(O)R¹⁴, -X³NR¹⁵C(O)R¹⁴, -X³NR¹⁵C(O)OR¹⁴,

-X³C(O)NR¹⁴R¹⁵, -X³S(O)₂NR¹⁴R¹⁵, -X³NR¹⁵C(O)NR¹⁴R¹⁵,

-X³NR¹⁵C(O)NR¹⁴R¹⁵, -X⁴S(O)R¹⁴, -X⁴S(O)₂R¹⁴, -X⁴OR¹⁴, or

-X⁴NR¹⁴R¹⁵, wherein X³ is (C₁₋₆)alkylene, X⁴ is a bond or (C₁₋₆)alkylene, R¹² at each occurrence independently is hydrogen, (C₁₋₆)alkyl or halo-substituted (C₁₋₆)alkyl, R¹³ is (C₁₋₆)alkyl or halo-substituted (C₁₋₆)alkyl, R¹⁴ is (C₃₋₁₂)cycloalkyl(C₆₋₆)alkyl,

hetero(C₃₋₁₂)cycloalkyl(C₆₋₆)alkyl, (C₆₋₁₂)aryl(C₆₋₆)alkyl, hetero(C₅₋₁₂)aryl(C₆₋₆)alkyl,

(C₉₋₁₂)polycycloary(C₆₋₆)alkyl or hetero(C₈₋₁₂)polycycloary(C₆₋₆)alkyl and R¹⁵ is
hydrogen or (C₁₆₆)alkyl, and wherein within R¹⁴ said cycloalkyl, heterocycloalkyl, aryl, heteroaryl, polycycloaryl or heteropolycycloaryl ring optionally is substituted by a group selected from -R¹⁶, -X⁴OR¹⁶, -X⁴SR¹⁶, -X⁴S(O)R¹⁶, -X⁴S(O)₂R¹⁶, -X⁴C(O)R¹⁶, -X⁴C(O)OR¹⁶, -X⁴OC(O)R¹⁶, -X⁴NR¹⁶R¹⁷, -X⁴NR¹⁷C(O)R¹⁶, -X⁴NR¹⁷C(O)OR¹⁶, -X⁴C(O)NR¹⁶R¹⁷, -X⁴S(O)₂NR¹⁶R¹⁷, -X⁴NR¹⁷C(O)NR¹⁶R¹⁷ or -X⁴NR¹⁷C(NR¹⁷)₂NR¹⁶R¹⁷, wherein X⁴ is a bond or (C₁₆₆)alkyne, R¹⁶ is hydrogen or (C₁₆₆)alkyl and R¹⁷ is (C₃₋₁₂)cycloalkyl(C₀₋₆)alkyl, hetero(C₃₋₁₂)cycloalkyl(C₀₋₆)alkyl, (C₆₋₁₂)aryl(C₀₋₆)alkyl, hetero(C₅₋₁₂)aryl(C₀₋₆)alkyl, (C₉₋₁₂)polycycloaryl(C₀₋₆)alkyl or hetero(C₈₋₁₂)polycycloaryl(C₀₋₆)alkyl, or (iii) a group selected from (C₃₋₁₂)cycloalkyl(C₀₋₆)alkyl, hetero(C₃₋₁₂)cycloalkyl(C₀₋₆)alkyl, (C₆₋₁₂)aryl(C₀₋₆)alkyl, hetero(C₅₋₁₂)aryl(C₀₋₆)alkyl, (C₉₋₁₂)polycycloaryl(C₀₋₆)alkyl and hetero(C₈₋₁₂)polycycloaryl(C₀₋₆)alkyl, wherein said cycloalkyl, heterocycloalkyl, aryl, heteroaryl, polycycloaryl or heteropolycycloaryl ring optionally is substituted by a group selected from -R¹⁶, -X⁴OR¹⁶, -X⁴SR¹⁶, -X⁴S(O)R¹⁶, -X⁴S(O)₂R¹⁶, -X⁴C(O)R¹⁶, -X⁴C(O)OR¹⁶, -X⁴OC(O)R¹⁶, -X⁴NR¹⁶R¹⁷, -X⁴NR¹⁷C(O)R¹⁶, -X⁴NR¹⁷C(O)OR¹⁶, -X⁴C(O)NR¹⁶R¹⁷, -X⁴S(O)₂NR¹⁶R¹⁷, -X⁴NR¹⁷C(O)NR¹⁶R¹⁷ or -X⁴NR¹⁷C(NR¹⁷)₂NR¹⁶R¹⁷, wherein X⁴, R¹⁶ and R¹⁷ are as defined above; wherein within R⁹ and/or R¹⁰ any alicyclic or aromatic ring system present may be substituted further by 1 to 5 radicals independently selected from (C₁₆₆)alkyl, (C₁₆₆)alkyliedene, cyano, halo, halo-substituted (C₁₆₆)alkyl, nitro, -X⁴NR¹⁴R¹²(R¹², -X⁴NR¹⁴C(O)OR¹², -X⁴NR¹⁴C(O)NR¹⁴R¹², -X⁴NR¹⁴C(NR¹⁴)₂NR¹⁴R¹², -X⁴OR¹², -X⁴SR¹², -X⁴C(O)OR¹², -X⁴C(O)NR¹⁴R¹², -X⁴S(O)₂NR¹⁴R¹², -X⁴S(O)₂OR¹²(R¹², -X⁴OP(O)(OR¹²)₂OR¹², -X⁴OC(O)R¹³, -X⁴NR¹⁴C(O)R¹³, -X⁴S(O)₂R¹³, -X⁴S(O)₂R¹³ and -X⁴C(O)R¹³, wherein X⁴, R¹² and R¹³ are as defined above, or

R⁹ taken together with R² and/or R¹⁰ taken together with R⁸ form trimethylene, tetramethylene or phenylene-1,2-dimethylene, optionally substituted with hydroxy, oxo or methylene; and

R¹¹ is -X⁵X⁶R¹⁸, wherein X⁵ is -C(O) -, -C(O)C(O) - or -S(O)₂-, X⁶ is a bond, -O- or -NR¹⁹-, wherein R¹⁹ is hydrogen or (C₁₆₆)alkyl, and R¹⁸ is
(i) (C_{1-10}) alkyl optionally substituted by cyano, halo, nitro, -NR^{12}R^{12},
-NR^{12}C(O)OR^{12}, -NR^{12}C(O)NR^{12}R^{12}, -NR^{12}C(NR^{12})NR^{12}R^{12}, -OR^{12}, -SR^{12},
-C(O)OR^{12}, -C(O)NR^{12}R^{12}, -S(O)_{2}NR^{12}R^{12}, -P(O)(OR^{12})OR^{12},
-OP(O)(OR^{12})OR^{12}, -NR^{12}C(O)R^{13}, -S(O)R^{13}, -S(O)_{2}R^{13}, -C(O)R^{13}, -OR^{20}, -SR^{20},
-S(O)R^{20}, -S(O)_{2}R^{20}, -C(O)R^{20}, -C(O)OR^{20}, -C(O)NR^{20}R^{21}, -NR^{20}R^{21},
-NR^{21}C(O)R^{20}, -NR^{21}C(O)OR^{20}, -NR^{21}C(O)NR^{20}R^{21} or -NR^{21}C(NR^{21})NR^{20}R^{21},
wherein R^{12} and R^{13} are as defined above, R^{20} is (C_{3-12})cycloalkyl(C_{0-6})alkyl,
hetero(C_{3-12})cycloalkyl(C_{0-6})alkyl, (C_{6-12})aryl(C_{0-6})alkyl, hetero(C_{5-12})aryl(C_{0-6})alkyl,
(C_{9-12})bicycloaryl(C_{0-6})alkyl or hetero(C_{9-12})bicycloaryl(C_{0-6})alkyl and R^{21} at each occurrence
independently is hydrogen or (C_{1-6})alkyl, or
(ii) (C_{3-12})cycloalkyl(C_{0-6})alkyl, hetero(C_{3-12})cycloalkyl(C_{0-6})alkyl,
(C_{6-12})aryl(C_{0-6})alkyl, hetero(C_{5-12})aryl(C_{0-6})alkyl, (C_{9-12})bicycloaryl(C_{0-6})alkyl
or hetero(C_{9-12})bicycloaryl(C_{0-6})alkyl or (iii) (C_{3-6})cycloalkyl(C_{0-6})alkyl,
hetero(C_{3-6})cycloalkyl(C_{0-6})alkyl, phenyl(C_{0-6})alkyl or hetero(C_{5-6})aryl(C_{0-6})alkyl,
wherein said cycloalkyl, heterocycloalkyl, phenyl or heteroaryl is substituted by
-X^{4}OR^{22}, -X^{4}SR^{22}, -X^{4}S(O)R^{22}, -X^{4}S(O)_{2}R^{22}, -X^{4}C(O)R^{22}, -X^{4}C(O)OR^{22},
-X^{4}C(O)NR^{23}R^{23}, -X^{4}NR^{22}R^{23}, -X^{4}NR^{23}C(O)R^{22}, -X^{4}NR^{23}C(O)OR^{22},
-X^{4}NR^{23}C(O)NR^{23}R^{23} or -X^{4}NR^{23}C(NR^{23})NR^{22}R^{23}, wherein X^{4} is as defined
above, R^{22} is (C_{3-6})cycloalkyl(C_{0-6})alkyl, hetero(C_{3-6})cycloalkyl(C_{0-6})alkyl,
phenyl(C_{0-6})alkyl or hetero(C_{5-6})aryl(C_{0-6})alkyl and R^{23} at each occurrence
independently is hydrogen or (C_{1-6})alkyl; wherein within R^{13} any alicyclic or aromatic
ring system present may be substituted further by 1 to 5 radicals independently
selected from (C_{1-6})alkyl, (C_{1-6})alkylidene, cyano, halo, halo-substituted (C_{1-4})alkyl,
nitro, -X^{4}NR^{12}R^{12}, -X^{4}NR^{12}C(O)OR^{12}, -X^{4}NR^{12}C(O)NR^{12}R^{12},
-X^{4}NR^{12}C(NR^{12})NR^{12}R^{12}, -X^{4}OR^{12}, -X^{4}SR^{12}, -X^{4}C(O)OR^{12}, -X^{4}C(O)NR^{12}R^{12},
-X^{4}S(O)_{2}NR^{12}R^{12}, -X^{4}P(O)(OR^{3})OR^{12}, -X^{4}OP(O)(OR^{3})OR^{12}, -X^{4}OC(O)R^{13},
-X^{4}NR^{12}C(O)R^{13}, -X^{4}S(O)R^{13}, -X^{4}S(O)_{2}R^{13} and -X^{4}C(O)R^{12}, wherein X^{4}, R^{12} and
R^{13} are as defined above;
R^{2} is hydrogen or (C_{1-6})alkyl or as defined below;
$R^3$ is hydrogen, (C$_{1,8}$)alkyl or as defined below; and

$R^4$ is (i) hydrogen or (C$_{1,8}$)alkyl, wherein said alkyl is optionally substituted with
cyano, halo, nitro, -NR$_2$R$^{12}$, -NR$_2$C(O)OR$^{12}$, -NR$_2$C(O)NR$_2$R$^{12}$,
-NR$_2$C(NR$_2$)NR$_2$R$_{12}$, -OR$^{12}$, -SR$^{12}$, -C(O)OR$^{12}$, -C(O)NR$_2$R$^{12}$, -S(O)$_2$NR$_2$R$^{12}$,
-P(O)(OR$_{12}$)OR$^{12}$, -OP(O)(OR$_{12}$)OR$^{12}$, -NR$_2$C(O)R$^{13}$, -S(O)R$^{13}$, -S(O)$_2$R$^{13}$, -C(O)R$^{13}$,
-OR$^{14}$, -SR$^{14}$, -S(O)R$^{14}$, -S(O)$_2$R$^{14}$, -C(O)R$^{14}$, -C(O)OR$^{14}$, -OC(O)R$^{14}$, -NR$_2$R$^{15}$,
-NR$_2$C(O)R$^{14}$, -NR$_2$C(O)OR$^{14}$, -C(O)NR$_2$R$^{14}$, -S(O)$_2$NR$_2$R$^{14}$, -NR$_2$C(O)NR$_2$R$^{14}$
or
-NR$_2$C(NR$_2$)NR$_2$R$^{14}$, wherein R$^{12}$, R$^{13}$, R$^{14}$ and R$^{15}$ are as defined above, or (ii) a group
selected from (C$_{5,12}$)cycloalkyl(C$_{0,6}$)alkyl, hetero(C$_{5,12}$)cycloalkyl(C$_{0,6}$)alkyl,
(C$_{6,12}$)aryl(C$_{0,6}$)alkyl, hetero(C$_{8,12}$)aryl(C$_{0,6}$)alkyl, (C$_{9,12}$)polycycloaryl(C$_{0,6}$)alkyl and
hetero(C$_{8,12}$)polycycloaryl(C$_{0,6}$)alkyl, wherein said cycloalkyl, heterocycloalkyl, aryl,
heteroaryl, polycycloaryl or heteropolycycloaryl ring optionally is substituted by a group
selected from -R$^{16}$, -X$^4$OR$^{16}$, -X$^4$SR$^{16}$, -X$^4$S(O)R$^{16}$, -X$^4$S(O)$_2$R$^{16}$, -X$^4$C(O)R$^{16}$,
-X$^4$C(O)OR$^{16}$, -X$^4$OC(O)R$^{16}$, -X$^4$NR$_2$R$^{17}$, -X$^4$NR$^{17}$C(O)R$^{16}$, -X$^4$NR$^{17}$C(O)OR$^{16}$,
-X$^4$C(O)NR$_2$R$^{17}$, -X$^4$S(O)$_2$NR$_2$R$^{17}$, -X$^4$NR$_2$C(O)NR$_2$R$_{16}$ or -X$^4$NR$^{17}$C(NR$_2$)NR$_2$R$^{16}$,
wherein X$^4$, R$^{16}$ and R$^{17}$ are as defined above; wherein within R$^{9}$ and/or R$^{10}$ any alicyclic or
aromatic ring system present may be substituted further by 1 to 5 radicals independently
selected from (C$_{1,8}$)alkyl, (C$_{4,9}$)alkylenyl, cyano, halo, halo-substituted (C$_{1,4}$)alkyl, nitro,
-X$^4$NR$_2$R$^{12}$, -X$^4$NR$_2$C(O)OR$^{12}$, -X$^4$NR$_2$C(O)NR$_2$R$^{12}$, -X$^4$NR$_2$C(NR$_2$)NR$_2$R$^{12}$,
-X$^4$OR$^{12}$, -X$^4$SR$^{12}$, -X$^4$C(O)OR$^{12}$, -X$^4$C(O)NR$_2$R$^{12}$, -X$^4$S(O)$_2$NR$_2$R$^{12}$,
-X$^4$P(O)(OR$_3$)OR$^{12}$, -X$^4$OP(O)(OR$_3$)OR$^{12}$, -X$^4$OC(O)R$^{13}$, -X$^4$NR$_2$C(O)R$^{13}$, -X$^4$S(O)R$^{13}$,
-X$^4$S(O)$_2$R$^{13}$ and -X$^4$C(O)R$^{13}$, wherein X$^4$, R$^{12}$ and R$^{13}$ are as defined above, or

R$^4$ and R$^3$ taken together form trimethylene, tetramethylene or
phenylene-1,2-dimethylene, optionally substituted with hydroxy, oxo or methylene, or

R$^4$ and R$^3$ together with the carbon atom to which both R$^4$ and R$^3$ are attached form
(C$_{3,8}$)cycloalkylene or (C$_{3,8}$)heterocycloalkylene; or an N-oxide derivative, prodrug
derivative, individual isomer and mixtures of isomers; or a pharmaceutically acceptable salt
thereof, but excluding compounds of the formula
in which $R^3$ and $R^4$ are each hydrogen or $(C_{1-6})$alkyl, or together with the carbon atom to which they are both attached form $(C_{3-5})$cycloalkylene; $R^5$ is hydrogen or $(C_{1-6})$alkyl; $R^9$ is $(C_{6-12})$aryl$(C_{1-6})$alkyl, hetero$(C_{5-12})$aryl$(C_{1-6})$alkyl, $(C_{4-5})$alkyl or cyclohexylmethyl; and $R^{11}$ is C$(O)R^{18}$ wherein $R^{18}$ is hetero$(C_{3-12})$cycloalkyl, $(C_{6-12})$aryl$(C_{0-6})$alkyl or hetero$(C_{5-12})$aryl$(C_{0-6})$alkyl.

In another particular embodiment, the present invention relates to the use of a compound of Formula (I):

$$\begin{array}{c}
\begin{array}{c}
\text{R}^1 \\
\text{R}^2 \\
\text{N} \\
\text{C} & \equiv & \text{N} \\
\text{R}^3 \\
\text{R}^4
\end{array}
\end{array}$$

(I)

in which:

$R^1$ is a group of Formula (a) or (b):

$$\begin{array}{c}
\begin{array}{c}
\text{R}^{11} \\
\text{R}^5 \\
\text{N} \\
\text{X}^1 \\
\text{R}^7
\end{array}
\end{array} \quad \begin{array}{c}
\begin{array}{c}
\text{R}^{11} \\
\text{R}^8 \\
\text{N} \\
\text{X}^2 \\
\text{R}^7
\end{array}
\end{array}$$

(a) \quad (b)

wherein:

$X^1$ and $X^2$ independently are $-C(O)$- or $-CH_2S(O)_2$-;

$R^5$ and $R^6$ are hydrogen or $(C_{1-6})$alkyl;

$R^7$ and $R^8$ are hydrogen or $(C_{1-6})$alkyl or as defined below;
R² and R¹⁰ independently are (i) (C₁₋₆)alkyl optionally substituted with cyano, halo or nitro or (ii) a group selected from -X³NR¹²R¹², -X³NR¹²C(O)OR¹², -X³NR¹²C(O)NR¹²R¹², -X³NR¹²C(NR¹²)NR¹²R¹², -X³OR¹², -X³SR¹², -X³C(O)OR¹², -X³C(O)NR¹²R¹², -X³S(O)₂NR¹²R¹², -X³P(O)(OR¹²)OR¹², -X³OP(O)(OR¹²)OR¹², -X³NR¹²C(O)R¹³, -X³S(O)R¹³, -X³S(O)₂R¹³, -X³C(O)R¹³, -X³C(O)R¹⁴, -X³C(O)OR¹⁴, -X³OC(O)R¹⁴, -X³NR¹⁵C(O)R¹⁴, -X³NR¹⁵C(O)OR¹⁴, -X³C(O)NR¹⁴R¹⁵, -X³S(O)₂NR¹⁴R¹⁵, -X³NR¹⁵C(O)NR¹⁴R¹⁵, -X³NR¹⁵C(NR¹⁵)NR¹⁴R¹⁵, -X³S(O)R¹⁴, -X³S(O)₂R¹⁴, -X³OR¹⁴, or -X³NR¹⁴R¹⁵, wherein X³ is (C₁₋₆)alkylene, X⁴ is a bond or (C₁₋₆)alkylene, R¹² at each occurrence independently is hydrogen, (C₁₋₆)alkyl or halo-substituted (C₁₋₆)alkyl, R¹³ is (C₁₋₆)alkyl or halo-substituted (C₁₋₆)alkyl, R¹⁴ is (C₃₋₁₂)cycloalkyl(C₀₋₆)alkyl, hetero(C₃₋₁₂)cycloalkyl(C₀₋₆)alkyl, (C₆₋₁₂)aryl(C₀₋₆)alkyl, hetero(C₅₋₁₂)aryl(C₀₋₆)alkyl, (C₉₋₁₂)polycycloaryl(C₀₋₆)alkyl or hetero(C₈₋₁₂)polycycloaryl(C₀₋₆)alkyl and R¹⁵ is hydrogen or (C₁₋₆)alkyl, and wherein within R¹⁴ said cycloalkyl, heterocycloalkyl, aryl, heteroaryl, polycycloaryl or heteropolycycloaryl ring optionally is substituted by a group selected from -R¹⁶, -X⁴OR¹⁶, -X⁴SR¹⁶, -X⁴S(O)R¹⁶, -X⁴S(O)₂R¹⁶, -X⁴C(O)R¹⁶, -X⁴C(O)OR¹⁶, -X⁴OC(O)R¹⁶, -X⁴NR¹⁶R¹⁷, -X⁴NR¹⁷C(O)R¹⁶, -X⁴NR¹⁷C(O)OR¹⁶, -X⁴C(O)NR¹⁶R¹⁷, -X⁴S(O)₂NR¹⁶R¹⁷, -X⁴NR¹⁷C(O)NR¹⁶R¹⁷ or -X⁴NR¹⁷C(NR¹⁷)NR¹⁶R¹⁷, wherein X⁴ is a bond or (C₁₋₆)alkylene, R¹⁶ is hydrogen or (C₁₋₆)alkyl and R¹⁷ is (C₃₋₁₂)cycloalkyl(C₀₋₆)alkyl, hetero(C₃₋₁₂)cycloalkyl(C₀₋₆)alkyl, (C₆₋₁₂)aryl(C₀₋₆)alkyl, hetero(C₅₋₁₂)aryl(C₀₋₆)alkyl, (C₉₋₁₂)polycycloaryl(C₀₋₆)alkyl or hetero(C₈₋₁₂)polycycloaryl(C₀₋₆)alkyl, or (iii) a group selected from (C₃₋₁₂)cycloalkyl(C₀₋₆)alkyl, hetero(C₃₋₁₂)cycloalkyl(C₀₋₆)alkyl, (C₆₋₁₂)aryl(C₀₋₆)alkyl, hetero(C₅₋₁₂)aryl(C₀₋₆)alkyl, (C₉₋₁₂)polycycloaryl(C₀₋₆)alkyl and hetero(C₈₋₁₂)polycycloaryl(C₀₋₆)alkyl, wherein said cycloalkyl, heterocycloalkyl, aryl, heteroaryl, polycycloaryl or heteropolycycloaryl ring optionally is substituted by a group selected from -R¹⁶, -X⁴OR¹⁶, -X⁴SR¹⁶, -X⁴S(O)R¹⁶, -X⁴S(O)₂R¹⁶, -X⁴C(O)R¹⁶, -X⁴C(O)OR¹⁶, -X⁴OC(O)R¹⁶, -X⁴NR¹⁶R¹⁷, -X⁴NR¹⁷C(O)R¹⁶, -X⁴NR¹⁷C(O)OR¹⁶, -X⁴S(O)₂NR¹⁶R¹⁷, -X⁴NR¹⁷C(O)NR¹⁶R¹⁷ or -X⁴NR¹⁷C(NR¹⁷)NR¹⁶R¹⁷.
-X^4NR^{17}C(NR^{17})NR^{16}R^{17}$, wherein X^4, R^{16} and R^{17} are as defined above; wherein within R^9 and/or R^{10} any alicyclic or aromatic ring system present may be substituted further by 1 to 5 radicals independently selected from (C_{1-6})alkyl, (C_{1-6})alkyldiene, cyano, halo, halo-substituted (C_{1-6})alkyl, nitro, -X^4NR^{12}R^{12}, -X^4NR^{12}C(O)OR^{12}, -X^4NR^{12}C(O)NR^{12}R^{12}, -X^4OR^{12}, -X^4SR^{12}, -X^4C(O)OR^{12}, -X^4C(O)NR^{12}R^{12}, -X^4S(O)_{2}NR^{12}R^{12}, -X^4PR(O)(OR)^{6}OR^{12}, -X^4OP(O)(OR)^{12}OR^{12}, -X^4OC(O)R^{13}, -X^4NR^{12}C(O)R^{13}, -X^4S(O)R^{13}, -X^4S(O)_{2}R^{13}

and -X^4C(O)R^{13}, wherein X^4, R^{12} and R^{13} are as defined above, or

R^9 taken together with R^7 and/or R^{10} taken together with R^8 form

trimethylene, tetramethylene or phenylene-1,2-dimethylene, optionally substituted with hydroxy, oxo or methylene; and

R^{11} is -X^5X^6R^{18}, wherein X^5 is -C(O)-, -C(O)C(O)- or -S(O)_{2}-, X^6 is a bond, -O- or -NR^{19}, wherein R^{19} is hydrogen or (C_{1-6})alkyl, and R^{18} is (i) (C_{1-10})alkyl optionally substituted by cyano, halo, nitro, -NR^{12}R^{12}, -NR^{12}C(O)OR^{12}, -NR^{12}C(O)NR^{12}R^{12}, -NR^{12}C(NR^{12})NR^{12}R^{12}, -OR^{12}, -SR^{12}, -C(O)OR^{12}, -C(O)NR^{12}R^{12}, -S(O)_{2}NR^{12}R^{12}, -P(O)(OR)^{12}OR^{12}, -OP(O)(OR)^{12}OR^{12}, -NR^{12}C(O)R^{13}, -S(O)R^{13}, -S(O)_{2}R^{13}, -C(O)R^{13}, -OR^{20}, -SR^{20}, -S(O)R^{20}, -S(O)_{2}R^{20}, -C(O)R^{20}, -C(O)OR^{20}, -C(O)NR^{20}R^{21}, -NR^{20}R^{21}, -NR^{21}C(O)R^{20}, -NR^{21}C(O)NR^{20}R^{21} or -NR^{21}C(NR^{21})NR^{20}R^{21},

wherein R^{12} and R^{13} are as defined above, R^{20} is (C_{3-11})cycloalkyl(C_{0-6})alkyl, hetero(C_{3-12})cycloalkyl(C_{0-6})alkyl, (C_{6-12})aryl(C_{0-6})alkyl, hetero(C_{5-12})arylcycloalkyl(C_{0-6})alkyl, (C_{9-12})bicycloalkyl(C_{0-6})alkyl or hetero(C_{8-12})bicycloalkyl(C_{0-6})alkyl and R^{21} at each occurrence independently is hydrogen or (C_{1-6})alkyl, or

(ii) (C_{3-12})cycloalkyl(C_{0-6})alkyl, hetero(C_{3-12})cycloalkyl(C_{0-6})alkyl,

(C_{6-12})aryl(C_{0-6})alkyl, hetero(C_{5-12})arylcycloalkyl(C_{0-6})alkyl or hetero(C_{8-12})bicycloalkyl(C_{0-6})alkyl or (iii) (C_{3-6})cycloalkyl(C_{0-6})alkyl, hetero(C_{3-6})cycloalkyl(C_{0-6})alkyl, phenyl(C_{0-6})alkyl or hetero(C_{5-6})arylcycloalkyl(C_{0-6})alkyl, wherein said cycloalkyl, heterocycloalkyl, phenyl or heteroaryl is substituted by

-X^4OR^{22}, -X^4SR^{22}, -X^4S(O)R^{22}, -X^4S(O)_{2}R^{22}, -X^4C(O)R^{22}, -X^4C(O)OR^{22},

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-X^4C(O)NR^{22}R^{23}, -X^4NR^{22}R^{23}, -X^4NR^{23}C(O)R^{22}, -X^4NR^{23}C(O)OR^{22},
-X^4NR^{23}C(O)NR^{22}R^{23} or -X^4NR^{23}C(NR^{23})NR^{22}R^{23}, wherein X^4 is as defined
above, R^{22} is (C_{3,6})cycloalkyl(C_{0,6})alkyl, hetero(C_{3,6})cycloalkyl(C_{0,6})alkyl,
phenyl(C_{0,6})alkyl or hetero(C_{3,6})aryl(C_{0,6})alkyl and R^{23} at each occurrence
independently is hydrogen or (C_{1-6})alkyl; wherein within R^{11} any alicyclic or aromatic
ring system present may be substituted further by 1 to 5 radicals independently
selected from (C_{1-6})alkyl, (C_{1-6})alkylidene, cyano, halo, halo-substituted (C_{1-6})alkyl,
nitro, -X^4NR^{12}R^{12}, -X^4NR^{12}C(O)OR^{12}, -X^4NR^{12}C(O)NR^{12}R^{12},
-X^4NR^{12}C(NR^{12})NR^{12}R^{12}, -X^4OR^{12}, -X^4SR^{12}, -X^4S(O)OR^{12}, -X^4C(O)OR^{12}, -X^4C(O)NR^{12}R^{12},
-X^4S(O)_{2}NR^{12}R^{12}, -X^4P(O)(OR^{3})OR^{12}, -X^4OP(O)(OR^{3})OR^{12}, -X^4OC(O)R^{13},
-X^4NR^{12}C(O)R^{13}, -X^4S(O)R^{13}, -X^4S(O)_{2}R^{13} and -X^4C(O)R^{13}, wherein X^4, R^{12} and
R^{13} are as defined above;
R^{2} is hydrogen or (C_{1-6})alkyl or as defined below;
R^{3} is hydrogen, (C_{1-6})alkyl or as defined below; and
R^{4} is (i) hydrogen or (C_{1-6})alkyl, wherein said alkyl is optionally substituted with
cyano, halo, nitro, -NR^{12}R^{12}, -NR^{12}C(O)OR^{12}, -NR^{12}C(O)NR^{12}R^{12},
-NR^{12}C(NR^{12})NR^{12}R^{12}, -OR^{12}, -SR^{12}, -C(O)OR^{12}, -C(O)NR^{12}R^{12}, -S(O)_{2}NR^{12}R^{12},
P(O)(OR^{12})OR^{12}, -OP(O)(OR^{12})OR^{12}, -NR^{12}C(O)R^{13}, -S(O)OR^{13}, -S(O)_{2}R^{13}, -C(O)R^{13},
-OR^{14}, -SR^{14}, -S(O)R^{14}, -S(O)_{2}R^{14}, -C(O)OR^{14}, -OC(O)R^{14}, -NR^{14}R^{15},
-NR^{15}C(NR^{15})NR^{14}R^{15}, wherein R^{12}, R^{13}, R^{14} and R^{15} are as defined above, or (ii) a group
selected from (C_{3,12})cycloalkyl(C_{0,6})alkyl, hetero(C_{3,12})cycloalkyl(C_{0,6})alkyl,
(C_{6,12})aryl(C_{0,6})alkyl, hetero(C_{5,12})aryl(C_{0,6})alkyl, (C_{9,12})polycycloaryl(C_{0,6})alkyl and
hetero(C_{8,12})polycycloaryl(C_{0,6})alkyl, wherein said cycloalkyl, heterocycloalkyl, aryl,
heteroaryl, polycycloaryl or heteropolycycloaryl ring optionally is substituted by a group
selected from -R^{16}, -X^4OR^{16}, -X^4SR^{16}, -X^4S(O)R^{16}, -X^4S(O)_{2}R^{16}, -X^4C(O)R^{16},
-X^4C(O)OR^{16}, -X^4OC(O)R^{16}, -X^4NR^{16}R^{17}, -X^4NR^{17}C(O)R^{16}, -X^4NR^{17}C(O)OR^{16},
-X^4C(O)NR^{16}R^{17}, -X^4S(O)_{2}NR^{16}R^{17}, -X^4NR^{17}C(O)NR^{16}R^{17} or -X^4NR^{17}C(NR^{17})NR^{16}R^{17},
wherein X^4, R^{16} and R^{17} are as defined above; wherein within R^{9} and/or R^{10} any alicyclic or
aromatic ring system present may be substituted further by 1 to 5 radicals independently selected from (C_{1-6})alkyl, (C_{1-6})alkyldene, cyano, halo, halo-substituted (C_{1-4})alkyl, nitro, 
-X^4NR^{12}R^{12}, -X^4NR^{12}C(O)OR^{12}, -X^4NR^{12}C(O)NR^{12}R^{12}, -X^4NR^{12}C(NR^{12})NR^{12}R^{12},
-X^4OR^{12}, -X^4SR^{12}, -X^4C(O)OR^{12}, -X^4C(O)NR^{12}R^{12}, -X^4S(OR)^2NR^{12}R^{12},
-X^4P(O)(OR)^3OR^{12}, -X^4OP(O)(OR)^3OR^{12}, -X^4OC(O)R^{13}, -X^4NR^{12}C(O)R^{13}, -X^4S(O)R^{13},
-X^4S(O)_2R^{13} and -X^4C(O)R^{13}, wherein X^4, R^{12} and R^{13} are as defined above, or
R^4 and R^2 taken together form trimethylene, tetramethylene or phenylene-1,2-dimethylene, optionally substituted with hydroxy, oxo or methylene, or
R^4 and R^3 together with the carbon atom to which both R^4 and R^3 are attached form
(C_{3,8})cycloalkylene or (C_{3,8})heterocycloalkylene; or an N-oxide derivative, prodrug derivative, individual isomer and mixtures of isomers; or a pharmaceutically acceptable salt thereof, but excluding compounds of the formula

![Chemical Structure]

in which R^3 and R^4 are each hydrogen or (C_{1-6})alkyl, or together with the carbon atom to which they are both attached form (C_{3,8})cycloalkylene; R^5 is hydrogen or (C_{1-6})alkyl; R^9 is (C_{6-12})aryl(C_{1-6})alkyl, hetero(C_{5-12})aryl(C_{1-6})alkyl, (C_{4-5})alkyl or cyclohexylmethyl; and R^{11} is C(O)R^{18} wherein R^{18} is hetero(C_{3-12})cycloalkyl, (C_{6-12})aryl(C_{6-6})alkyl or hetero(C_{5-12})aryl(C_{6-6})alkyl, in the manufacture of a medicament for treating a disease in an animal in which cathepsin S activity contributes to the pathology and/or symptomatology of the disease.

In another particular embodiment, the present invention relates to a method of treating a disease in an animal in which cathepsin S activity contributes to the pathology and/or symptomatology of the disease, which method comprising administering to the animal a therapeutically effective amount of a compound of Formula (III):
in which:

R\(^1\) is a group of Formula (a) or (b):

\[
\begin{align*}
\text{(a)} \quad & R_6^6 N^X^N^X^2^X^1^R^5 \\
\text{(b)} \quad & R_7^6 N^X^N^X^3^X^2^X^1^R^5
\end{align*}
\]

wherein:

X\(^1\) and X\(^3\) independently are -C(O) or -S(O)\(^2\),

-CH\(_2\)CR\(^R\(^8\)\) or -CR\(^R\(^8\)\)CH\(_2\) and X\(^4\) is -CHR\(^10\),

-CH\(_2\)CHR\(^10\) or -CHR\(^10\)CH\(_2\), wherein:

R\(^8\) is hydrogen or (C\(_1\)-6)alkyl,

R\(^9\) is (i) (C\(_1\)-6)alkyl or halo-substituted(C\(_1\)-6)alkyl optionally substituted

with -OR\(^11\), -SR\(^11\), -S(O)R\(^11\), -S(O)\(^2\)R\(^11\), -C(O)R\(^11\), -C(O)OR\(^11\), -NR\(^11\)R\(^12\),

-NR\(^12\)C(O)OR\(^11\), -C(O)NR\(^11\)R\(^12\), -S(O)\(^2\)NR\(^11\)R\(^12\), -NR\(^12\)C(O)NR\(^11\)R\(^12\) or

-NR\(^12\)C(NR\(^13\))NR\(^11\)R\(^12\), wherein R\(^11\) is hydrogen, (C\(_1\)-6)alkyl,

(C\(_3\)-12)cycloalkyl(C\(_0\)-3)alkyl, hetero(C\(_3\)-12)cycloalkyl(C\(_0\)-3)alkyl,

(C\(_6\)-12)aryl(C\(_0\)-3)alkyl or hetero(C\(_5\)-12)aryl(C\(_0\)-3)alkyl and R\(^12\) is hydrogen or

(C\(_1\)-6)alkyl, or (ii) (C\(_3\)-12)cycloalkyl(C\(_0\)-3)alkyl,

hetero(C\(_3\)-12)cycloalkyl(C\(_0\)-3)alkyl, (C\(_6\)-12)aryl(C\(_0\)-3)alkyl,

hetero(C\(_5\)-12)aryl(C\(_0\)-3)alkyl, (C\(_9\)-12)polycycloaryl(C\(_0\)-3)alkyl or

hetero(C\(_8\)-12)polycycloaryl(C\(_0\)-3)alkyl optionally substituted with -R\(^13\),

-X\(^2\)OR\(^13\), -X\(^2\)SR\(^13\), -S(O)R\(^13\), -S(O)\(^2\)R\(^13\), -C(O)R\(^13\), -C(O)OR\(^13\),

-X\(^2\)NR\(^13\)R\(^14\), -X\(^5\)NR\(^14\)C(O)OR\(^13\), -C(O)NR\(^13\)R\(^14\), -S(O)\(^2\)NR\(^13\)R\(^14\),

-NR\(^14\)C(O)NR\(^13\)R\(^14\) or -NR\(^14\)C(NR\(^14\))NR\(^13\)R\(^14\), wherein X\(^2\) is a bond or
methylene, R^{13} is (C_{3,12})cycloalkyl(C_{0,3})alkyl, hetero(C_{3,12})cycloalkyl(C_{0,3})alkyl, (C_{6,12})aryl(C_{0,3})alkyl, hetero(C_{4,12})aryl(C_{0,3})alkyl, (C_{9,12})polycycloaryl(C_{0,3})alkyl or hetero(C_{4,12})polycycloaryl(C_{0,3})alkyl and R^{14} is hydrogen or (C_{1,6})alkyl, or (iii) together with R^{5} when X^{2} is -CHR^{9}- forms trimethylene, tetramethylene or phenylene-1,2-dimethylene, optionally substituted with 1 to 2 of hydroxy, oxo, (C_{1,4})alkyl or methylene; wherein any 1 to 3 annular atoms of any aromatic ring with available valences comprising R^{9} are optionally independently substituted with halo, nitro, cyano, (C_{1,6})alkyl, halo-substituted(C_{1,6})alkyl, -OR^{15}, -C(O)R^{15}, -C(O)OR^{15}, -C(O)NR^{15}R^{15}, -S(O)_{2}NR^{15}R^{15}, -X^{5}NR^{15}R^{15}, -X^{5}NR^{15}C(O)OR^{15}, -X^{5}NR^{15}C(O)NR^{15}R^{15} or -X^{5}NR^{15}C(NR^{15})NR^{15}R^{15}, wherein X^{5} is as defined above and each R^{15} independently is hydrogen or (C_{1,6})alkyl, and R^{10} is hydrogen or (C_{1,4})alkyl;

\[ R^{5} \text{ and } R^{7} \text{ are independently hydrogen, (C}_{1,6}\text{)alkyl or as defined above; and } R^{6} = -X^{6}X^{7}R^{16}, \text{ wherein } X^{6} = -C(O)- \text{ or } -S(O)_{2}-, \text{ and } X^{7} \text{ is a bond, } -O- \text{ or } -NR^{17}-, \text{ wherein } R^{17} \text{ is hydrogen or (C}_{1,6}\text{)alkyl, and } R^{16} \text{ is (i) (C}_{1,6}\text{)alkyl or halo-substituted(C}_{1,6}\text{)alkyl optionally substituted with -OR}^{11}, -SR^{11}, -S(O)R^{11}, -S(O)_{2}R^{11}, -C(O)R^{11}, -C(O)OR^{11}, -NR^{11}R^{12}, -NR^{12}C(O)OR^{11}, -C(O)NR^{11}R^{12}, -NR^{12}C(O)NR^{11}R^{12} \text{ or } -NR^{12}C(NR^{12})NR^{11}R^{12}, \text{ wherein } R^{11} \text{ and } R^{12} \text{ are as defined above, or (ii) (C}_{3,6}\text{)cycloalkyl(C}_{0,3}\text{)alkyl, hetero(C}_{3,6}\text{)cycloalkyl(C}_{0,3}\text{)alkyl, (C}_{6,12}\text{)aryl(C}_{0,3}\text{)alkyl, hetero(C}_{6,12}\text{)aryl(C}_{0,3}\text{)alkyl, (C}_{9,12}\text{)polycycloaryl(C}_{0,3}\text{)alkyl or hetero(C}_{9,12}\text{)polycycloaryl(C}_{0,3}\text{)alkyl optionally substituted with 1 to 2 of } -R^{13}, -X^{5}OR^{13}, -X^{5}SR^{13}, -S(O)R^{13}, -S(O)_{2}R^{13}, -C(O)OR^{13}, -X^{5}NR^{13}R^{14}, -X^{5}NR^{14}C(O)OR^{13}, -C(O)NR^{13}R^{14}, -NR^{14}C(O)NR^{13}R^{14} \text{ or } -NR^{14}C(NR^{14})NR^{13}R^{14}, \text{ wherein } X^{5}, R^{13} \text{ and } R^{14} \text{ are as defined above; wherein any 1 to 3 annular atoms of any aromatic ring with available valences comprising } R^{16} \text{ optionally independently are substituted with halo, nitro, cyano, (C}_{1,6}\text{)alkyl, halo-substituted(C}_{1,6}\text{)alkyl, -OR}^{15}, -C(O)R^{15}, -C(O)OR^{15}, -C(O)NR^{15}R^{15}, -23- \]
-S(O)\textsubscript{2}NR\textsubscript{15}R\textsubscript{15}, -X\textsuperscript{5}NR\textsubscript{15}R\textsubscript{15}, -X\textsuperscript{5}NR\textsubscript{15}C(O)OR\textsubscript{15}, -X\textsuperscript{5}NR\textsubscript{15}C(O)NR\textsubscript{15}R\textsubscript{15} or

-X\textsuperscript{5}NR\textsubscript{15}C(NR\textsubscript{15})NR\textsubscript{15}R\textsubscript{15}, wherein X\textsuperscript{5} and R\textsubscript{15} are as defined above;

R\textsuperscript{2} is hydrogen or (C\textsubscript{1,6})alkyl or as defined below;

R\textsuperscript{3} is hydrogen, (C\textsubscript{1,6})alkyl or as defined below; and

R\textsuperscript{4} is (i) hydrogen, (ii) (C\textsubscript{1,6})alkyl or halo-substituted(C\textsubscript{1,6})alkyl optionally substituted with -OR\textsubscript{11}, -SR\textsubscript{11}, -S(O)R\textsubscript{11}, -S(O)\textsubscript{2}R\textsubscript{11}, -C(O)R\textsubscript{11}, -C(O)OR\textsubscript{11}, -NR\textsubscript{11}R\textsubscript{12},

-NR\textsubscript{12}C(O)OR\textsubscript{11}, -C(O)NR\textsubscript{11}R\textsubscript{12}, -NR\textsubscript{12}C(O)NR\textsubscript{11}R\textsubscript{12} or -NR\textsubscript{12}C(NR\textsubscript{12})NR\textsubscript{11}R\textsubscript{12}, wherein

R\textsubscript{11} and R\textsubscript{12} are as defined above, or (iii) (C\textsubscript{3,12})cycloalkyl(C\textsubscript{0,3})alkyl,

hetero(C\textsubscript{3,12})cycloalkyl(C\textsubscript{0,3})alkyl, (C\textsubscript{6,12})ary(C\textsubscript{0,3})alkyl, hetero(C\textsubscript{5,12})ary(C\textsubscript{0,3})alkyl,

(C\textsubscript{9,12})polycycloaryl(C\textsubscript{0,3})alkyl or hetero(C\textsubscript{9,12})polycycloaryl(C\textsubscript{0,3})alkyl optionally substituted with -R\textsubscript{13}, -X\textsuperscript{5}OR\textsubscript{13}, -X\textsuperscript{5}SR\textsubscript{13}, -S(O)R\textsubscript{13}, -S(O)\textsubscript{2}R\textsubscript{13}, -C(O)OR\textsubscript{13}, -X\textsuperscript{5}NR\textsubscript{13}R\textsubscript{14},

-X\textsuperscript{5}NR\textsubscript{14}C(O)OR\textsubscript{13}, -C(O)NR\textsubscript{13}R\textsubscript{14}, -NR\textsubscript{14}C(O)NR\textsubscript{13}R\textsubscript{14} or -NR\textsubscript{14}C(NR\textsubscript{14})NR\textsubscript{13}R\textsubscript{14},

wherein X\textsuperscript{5}, R\textsubscript{13} and R\textsubscript{14} are as defined above or (iv) together with R\textsuperscript{2} forms trimethylene, tetramethylene or phenylene-1,2-dimethylene, optionally substituted with hydroxy, oxo, (C\textsubscript{1,4})alkyl or methylene or (v) together with R\textsuperscript{3} forms ethylene, trimethylene or tetramethylene;

wherein any 1 to 3 annular atoms of any aromatic ring with available valences comprising R\textsuperscript{4} optionally independently are substituted with halo, nitro, cyano, (C\textsubscript{1,6})alkyl,

halo-substituted(C\textsubscript{1,6})alkyl, -OR\textsubscript{15}, -C(O)R\textsubscript{15}, -C(O)OR\textsubscript{15}, -C(O)NR\textsubscript{15}R\textsubscript{15},

-S(O)\textsubscript{2}NR\textsubscript{15}R\textsubscript{15}, -X\textsuperscript{5}NR\textsubscript{15}R\textsubscript{15}, -X\textsuperscript{5}NR\textsubscript{15}C(O)OR\textsubscript{15}, -X\textsuperscript{5}NR\textsubscript{15}C(O)NR\textsubscript{15}R\textsubscript{15} or

-X\textsuperscript{5}NR\textsubscript{15}C(NR\textsubscript{15})NR\textsubscript{15}R\textsubscript{15}, wherein X\textsuperscript{5} and R\textsubscript{15} are as defined above; or an N-oxide derivative, prodrug derivative, individual isomer and mixtures of isomers; or a pharmaceutically acceptable salt thereof, but excluding compounds of the formula

\[
\begin{array}{c}
\text{R}^{11} \\
\text{N} \\
\text{O} \\
\text{R}^{5} \\
\text{R}^{9} \\
\text{R}^{3} \\
\text{R}^{4}
\end{array}
\]

in which R\textsuperscript{3} and R\textsuperscript{4} are each hydrogen or (C\textsubscript{1,6})alkyl, or together with the carbon atom to which they are both attached form (C\textsubscript{3,5})cycloalkylene; R\textsuperscript{5} is hydrogen or (C\textsubscript{1,6})alkyl; R\textsuperscript{5} is (C\textsubscript{6,12})ary(C\textsubscript{1,6})alkyl, hetero(C\textsubscript{5,12})ary(C\textsubscript{1,6})alkyl, (C\textsubscript{4,5})alkyl or cyclohexylmethyl; and R\textsuperscript{11} is
C(O)R^{18} wherein R^{18} is hetero(C_{3-12})cycloalkyl, (C_{6-12})aryl(C_{0-6})alkyl or hetero(C_{5-12})aryl(C_{0-6})alkyl.

In another particular embodiment, the present invention relates to the use of a compound of Formula (III):

\[
R^2 \quad \begin{array}{c}
N \\
\cdot \\
N
\end{array}
\]

(III)

in which:

- R^1 is a group of Formula (a) or (b):

\[
\begin{array}{c}
R^6 \\
\cdot \\
N \\
X^1 \quad \begin{array}{c}
N \\
X^2 \\
R^5
\end{array}
\end{array}
\]

(a)

\[
\begin{array}{c}
R^6 \\
\cdot \\
N \\
X^3 \quad \begin{array}{c}
N \\
X^4 \\
R^5
\end{array}
\end{array}
\]

(b)

wherein:

- X^1 and X^3 independently are -C(O)- or -S(O)_2-,
- X^2 is -CR^8R^9, -CH_2CR^8R^9 or -CR^8R^9CH_2- and X^4 is -CHR^{10}-, -CH_2CHR^{10}- or -CHR^{10}CH_2-, wherein:

- R^8 is hydrogen or (C_{1-6})alkyl,
- R^9 is (i) (C_{1-6})alkyl or halo-substituted(C_{1-6})alkyl optionally substituted

- OR^{11}, -SR^{11}, -S(O)R^{11}, -S(O)_2R^{11}, -C(O)R^{11}, -C(O)OR^{11}, -NR^{11}R^{12}, -NR^{12}C(O)OR^{11}, -C(O)NR^{11}R^{12}, -S(O)NR^{11}R^{12}, -NR^{12}C(O)NR^{11}R^{12} or -NR^{12}C(NR^{13})NR^{11}R^{12}, wherein R^{11} is hydrogen, (C_{1-6})alkyl, (C_{3-12})cycloalkyl(C_{0-3})alkyl, hetero(C_{3-12})cycloalkyl(C_{0-3})alkyl, (C_{6-12})aryl(C_{0-3})alkyl or hetero(C_{5-12})aryl(C_{0-3})alkyl and R^{12} is hydrogen or
- (C_{1-6})alkyl, or (ii) (C_{3-12})cycloalkyl(C_{0-3})alkyl, hetero(C_{2-12})cycloalkyl(C_{0-3})alkyl, (C_{6-12})aryl(C_{0-3})alkyl,
hetero(C₅₋₁₂)aryl(C₉₋₁₂)alkyl, (C₉₋₁₂)polycyloaryl(C₉₋₁₂)alkyl or
decarboxyl(C₉₋₁₂)polycyloaryl(C₉₋₁₂)alkyl optionally substituted with -R¹³,
-X²OR¹³, -X²SR¹³, -S(O)R¹³, -S(Ο₂)R¹³, -C(O)R¹³, -C(O)OR¹³,
-X²NR¹³R¹⁴, -X⁵NR¹⁴C(O)OR¹⁵, -C(O)NR¹³R¹⁴, -S(O)₂NR¹³R¹⁴,
-NR¹⁴C(O)NR¹³R¹⁴ or -NR¹⁴C(NR¹⁴)NR¹³R¹⁴, wherein X² is a bond or
methylene, R¹³ is (C₃₋₁₃)cycloalkyl(C₉₋₁₂)alkyl,
hetero(C₃₋₁₃)cycloalkyl(C₉₋₁₂)alkyl, (C₆₋₁₂)aryl(C₉₋₁₂)alkyl,
hetero(C₃₋₁₃)aryl(C₉₋₁₂)alkyl, (C₉₋₁₂)polycyloaryl(C₉₋₁₂)alkyl or
hetero(C₆₋₁₂)polycyloaryl(C₉₋₁₂)alkyl and R¹⁴ is hydrogen or (C₁₋₆)alkyl, or
(iii) together with R² when X² is -CHR²- forms trimethylene, tetramethylene or
phenylene-1,2-dimethylene, optionally substituted with 1 to 2 of hydroxy,
oxo, (C₁₋₆)alkyl or methylene; wherein any 1 to 3 annular atoms of any
aromatic ring with available valences comprising R⁵ are optionally
independently substituted with halo, nitro, cyano, (C₁₋₆)alkyl,
halo-substituted(C₁₋₆)alkyl, -OR¹⁵, -C(O)R¹⁵, -C(O)OR¹⁵, -C(O)NR¹³R¹⁵,
-S(O)₂NR¹⁵R¹⁵, -X⁵NR¹⁵R¹⁵, -X⁵NR¹⁵C(O)OR¹⁵, -X⁵NR¹⁵C(O)NR¹³R¹⁵ or
-X⁵NR¹⁵C(NR¹⁴)NR¹³R¹⁵, wherein X² is as defined above and each R¹⁵
independently is hydrogen or (C₁₋₆)alkyl, and
R¹⁰ is hydrogen or (C₁₋₆)alkyl;
R⁵ and R⁷ are independently hydrogen, (C₁₋₆)alkyl or as defined above; and
R⁶ is -X⁶X⁷R¹⁶, wherein X⁶ is -C(O)- or -S(O)²-, X⁷ is a bond, -O- or
-NR¹⁷²-, wherein R¹⁷ is hydrogen or (C₁₋₆)alkyl, and R¹⁶ is (i) (C₁₋₆)alkyl or
halo-substituted(C₁₋₆)alkyl optionally substituted with -OR¹¹, -SR¹¹, -S(O)R¹¹,
-S(Ο₂)R¹¹, -C(O)R¹¹, -C(O)OR¹¹, -NR¹¹R¹², -NR¹¹C(O)OR¹¹, -C(O)NR¹¹R¹²,
-NR¹²C(O)NR¹³R¹² or -NR¹²C(NR¹³)NR¹¹R¹², wherein R¹¹ and R¹² are as defined
above, or (ii) (C₃₋₆)cycloalkyl(C₉₋₁₂)alkyl, hetero(C₃₋₆)cycloalkyl(C₉₋₁₂)alkyl,
(C₆₋₁₂)aryl(C₉₋₁₂)alkyl, hetero(C₅₋₁₂)aryl(C₉₋₁₂)alkyl, (C₉₋₁₂)polycyloaryl(C₉₋₁₂)alkyl or
hetero(C₆₋₁₂)polycyloaryl(C₉₋₁₂)alkyl optionally substituted with 1 to 2 of -R¹³,
-X⁸OR¹³, -X⁸SR¹³, -S(O)R¹³, -S(Ο₂)R¹³, -C(O)OR¹³, -X⁵NR¹³R¹⁴,
-X^2NR^14C(O)OR^13, -C(O)NR^13R^14, -NR^14C(O)NR^13R^14 or
-NR^14C(NR^15)NR^15R^14, wherein X^2, R^13 and R^14 are as defined above; wherein any
1 to 3 annular atoms of any aromatic ring with available valences comprising R^16
optionally independently are substituted with halo, nitro, cyano, (C_1-6)alkyl,
halo-substituted(C_1-6)alkyl, -OR^15, -C(O)R^15, -C(O)OR^15, -C(O)NR^13R^15,
-S(O)_2NR^15R^15, -X^5NR^15R^15, -X^5NR^15C(O)OR^15, -X^5NR^15C(O)NR^15R^15 or
-X^5NR^15C(NR^15)NR^15R^15, wherein X^5 and R^15 are as defined above;
R^2 is hydrogen or (C_1-6)alkyl or as defined below;
R^3 is hydrogen, (C_1-6)alkyl or as defined below; and
10 R^4 is (i) hydrogen, (ii) (C_1-6)alkyl or halo-substituted(C_1-6)alkyl optionally substituted
with -OR^11, -SR^11, -S(O)R^11, -S(O)_2R^11, -C(O)R^11, -C(O)OR^11, -NR^11R^12,
-NR^12C(O)OR^12, -C(O)NR^11R^12, -NR^12C(NR^12)NR^11R^12 or -NR^12C(NR^12)NR^11R^12, wherein
R^11 and R^12 are as defined above, or (iii) (C_3-12)cycloalkyl(C_0-3)alkyl,
hetero(C_3-12)cycloalkyl(C_0-3)alkyl, (C_6-12)aryl(C_0-3)alkyl, hetero(C_5-12)aryl(C_0-3)alkyl,
(C_9-12)polycycloaryl(C_0-3)alkyl or heterocyclopolycycloaryl(C_0-3)alkyl optionally substituted
with -R^13, -X^6OR^13, -X^6SR^13, -S(O)R^13, -S(O)_2R^13, -C(O)OR^13, -X^5NR^13R^14,
-X^5NR^14C(O)OR^13, -C(O)NR^13R^14, -NR^14C(O)NR^13R^14 or -NR^14C(NR^14)NR^13R^14,
wherein X^5, R^13 and R^14 are as defined above or (iv) together with R^2 forms trimethylene,
tetramethylene or phenylene-1,2-dimethylene, optionally substituted with hydroxy, oxo, (C_1,
4)alkyl or methylene or (v) together with R^3 forms ethylene, trimethylene or tetramethylene;
wherein any 1 to 3 annular atoms of any aromatic ring with available valences comprising R^4
optionally independently are substituted with halo, nitro, cyano, (C_1-6)alkyl,
halo-substituted(C_1-6)alkyl, -OR^15, -C(O)R^15, -C(O)OR^15, -C(O)NR^15R^15,
-S(O)_2NR^15R^15, -X^5NR^15R^15, -X^5NR^15C(O)OR^15, -X^5NR^15C(O)NR^15R^15 or
25 -X^5NR^15C(NR^15)NR^15R^15, wherein X^5 and R^15 are as defined above; or an N-oxide
derivative, prodrug derivative, individual isomer and mixtures of isomers; or a
pharmaceutically acceptable salt thereof, but excluding compounds of the formula
in which $R^3$ and $R^4$ are each hydrogen or $(C_{1-6})$alkyl, or together with the carbon atom to which they are both attached form $(C_{3-8})$cycloalkylene; $R^5$ is hydrogen or $(C_{1-6})$alkyl; $R^9$ is $(C_{6-12})$aryl$(C_{1-6})$alkyl, hetero$(C_{5-12})$aryl$(C_{1-6})$alkyl, $(C_{4-5})$alkyl or cyclohexylmethyl; and $R^{11}$ is $C\text{(O)}R^{18}$ wherein $R^{18}$ is hetero$(C_{3-12})$cycloalkyl, $(C_{6-12})$aryl$(C_{0-6})$alkyl or hetero$(C_{5-12})$aryl$(C_{0-6})$alkyl, in the manufacture of a medicament for treating a disease in an animal in which cathepsin S activity contributes to the pathology and/or symptomatology of the disease.

DETAILED DESCRIPTION OF THE INVENTION

Definitions:

Unless otherwise stated, the following terms used in the specification and claims are defined for the purposes of this Application and have the meanings given this Section:

"Alicyclic" means a moiety characterized by arrangement of the carbon atoms in closed non-aromatic ring structures having properties resembling those of aliphatics and may be saturated or partially unsaturated with two or more double or triple bonds.

"Aliphatic" means a moiety characterized by straight or branched chain arrangement of the constituent carbon atoms and may be saturated or partially unsaturated with two or more double or triple bonds.

"Alkyl" indicated alone means a straight or branched, saturated or unsaturated aliphatic radical having the number of carbon atoms indicated (e.g., $(C_{1-6})$alkyl includes methyl, ethyl, propyl, isopropyl, butyl, sec-butyl, isobutyl, tert-butyl, vinyl, allyl, 1-propenyl, isopropenyl, 1-but enyl, 2-butenyl, 3-butenyl, 2-methylallyl, ethynyl, 1-propynyl, 2-propynyl, and the like). Alkyl indicated as part of a larger radical (e.g., as in arylalkyl) means a straight or branched, saturated or unsaturated aliphatic divalent radical having the number of atoms indicated or when 0 atoms are indicated means a bond (e.g., $(C_{0-3})$alkyl of
(C_{3,12})_{\text{cycloalkyl}}(C_{0,2})_{\text{alkyl}} \text{ means a bond, methylene, ethylene, trimethylene,}
1-\text{methylene, or the like).}

"Alkylene", unless indicated otherwise, means a straight or branched, saturated or
unsaturated, aliphatic, divalent radical having the number of carbon atoms indicated (e.g.
(C_{1,6})_{\text{alkylene}} \text{ includes methylene }(-\text{CH}_2-), \text{ ethylene }(-\text{CH}_2\text{CH}_2-), \text{ trimethylene}
(-\text{CH}_2\text{CH}_2\text{CH}_2-), \text{ 2-methyltrimethylene }(-\text{CH}_3\text{CH}(\text{CH}_3)\text{CH}_2-), \text{ tetramethylene}
(-\text{CH}_2\text{CH}_2\text{CH}_2\text{CH}_2-), \text{ 2-butenylene }(-\text{CH}_2\text{CH}=\text{CHCH}_2-), \text{ 2-methyltetramethylene}
(-\text{CH}_3\text{CH}(\text{CH}_3)\text{CH}_2\text{CH}_2-), \text{ pentamethylene }(-\text{CH}_2\text{CH}_2\text{CH}_2\text{CH}_2\text{CH}_2- \text{ and the like).} \text{ For example, the instance wherein } R^5 \text{ is hydrogen and } R^9 \text{ taken together with } R^7 \text{ forms optionally
substituted trimethylene is illustrated by the following:}

![Diagram](image)
in which } R \text{ is an optional hydroxy or oxo group and } X^1 \text{ and } R^{11} \text{ are as defined in the Summary of the Invention.

"Alkylidene" means a straight or branched saturated or unsaturated, aliphatic, divalent
radical having the number of carbon atoms indicated (e.g. (C_{1,6})_{\text{alkylidene}} \text{ includes methylene}
(\text{CH}_2), \text{ ethylidene } (\text{CHCH}_3), \text{ isopropylidene } (\text{C(\text{CH}_3})_2), \text{ propylidene } (\text{CHCH}_2\text{CH}_3),
allylidene } (\text{CHCHCH}_2), \text{ and the like).

"Amino" means the radical -NH}_2. \text{ Unless indicated otherwise, the compounds of the}
invention containing amino moieties include protected derivatives thereof. Suitable protecting
groups for amino moieties include acetyl, \text{ tert-butoxycarbonyl, benzyloxycarbonyl, and the}
like.

"Animal" includes humans, non-human mammals (e.g., dogs, cats, rabbits, cattle,
horses, sheep, goats, swine, deer, etc.) and non-mammals (e.g., birds, etc.).
“Aryl” means a monocyclic or bicyclic ring assembly (fused or linked by a single bond) containing the total number of ring carbon atoms indicated, wherein each ring is comprised of 6 ring carbon atoms and is aromatic or when fused with a second ring forms an aromatic ring assembly. For example, (C₆₋₁₂)aryl includes phenyl, naphthyl and biphenyl.

“Aromatic” means a moiety wherein the constituent atoms make up an unsaturated ring system, all atoms in the ring system are sp² hybridized and the total number of pi electrons is equal to 4n + 2.

“Carbamoyl” means the radical -C(O)NH₂. Unless indicated otherwise, the compounds of the invention containing carbamoyl moieties include protected derivatives thereof. Suitable protecting groups for carbamoyl moieties include acetyl, tert-butoxycarbonyl, benzyloxycarbonyl, and the like and both the unprotected and protected derivatives fall within the scope of the invention.

“Carboxy” means the radical -C(O)OH. Unless indicated otherwise, the compounds of the invention containing carboxy moieties include protected derivatives thereof. Suitable protecting groups for carboxy moieties include benzyl, tert-butyl, and the like.

“Cycloalkyl” means a saturated or partially unsaturated, monocyclic ring, bicyclic ring assembly (directly linked by a single bond or fused) or bridged polycyclic ring assembly containing the number of annular carbon atoms indicated, and any carbocyclic ketone, thioketone or iminoketone derivative thereof (e.g., (C₃₋₁₂)cycloalkyl includes cyclopropyl, cyclobutyl, cyclopentyl, cyclohexyl, cyclohexenyl, 2,5-cyclohexadienyl, bicyclohexyl, cyclopentylcyclohexyl, bicyclo[2.2.2]octyl, adamantyl-1-yl, decahydropaphthalenyl, oxocyclohexyl, dioxycyclohexyl, thiocyclohexyl, 2-oxobicyclo[2.2.1]hept-1-yl, etc.).

“Cycloalkylene” means a saturated or partially unsaturated, monocyclic ring or bridged polycyclic ring assembly containing the number of annular carbon atoms indicated, and any carbocyclic ketone, thioketone or iminoketone derivative thereof. For example, the instance wherein R² and R² together with the carbon atom to which both R⁹ and R⁵ are attached form (C₃₋₈)cycloalkylene” includes, but is not limited to, the following:
in which X¹ and R⁷ are as defined in the Summary of the Invention.

“Disease” specifically includes any unhealthy condition of an animal or part thereof and includes an unhealthy condition which may be caused by, or incident to, medical or veterinary therapy applied to that animal, i.e., the "side effects" of such therapy.

“Guanidino” means the radical -NHC(NH)NH₂. Unless indicated otherwise, the compounds of the invention containing guanidino moieties include protected derivatives thereof. Suitable protecting groups for amino moieties include acetyl, tert-butoxycarbonyl, benzyloxy carbonyl, and the like.

“Halo” means fluoro, chloro, bromo or iodo.

“Halo-substituted alkyl”, as a group or part of a group, means “alkyl” substituted by one or more “halo” atoms, as such terms are defined in this Application. Halo-substituted alkyl includes haloalkyl, dihaloalkyl, trihaloalkyl, perhaloalkyl and the like (e.g. halo-substituted (C₁₋₃)alkyl includes chloromethyl, dichloromethyl, difluoromethyl, trifluoromethyl, 2,2,2-trifluoroethyl, perfluoroethyl, 2,2,2-trifluoro-1,1-dichloroethyle, and the like).

“Heteroaryl” means aryl, as defined in this Application, provided that one or more of the ring member carbon atoms indicated, is replaced by heteroatom moiety selected from -N, -NR-, -O- or -S-, wherein R is hydrogen, (C₁₋₆)alkyl or a protecting group, and each ring contained therein is comprised of 5 to 6 ring member atoms. For example, hetero(C₅₋₁₂)aryl as used in this Application includes benzofuryl, benzooxazolyl, benzothiazolyl, [2,4']bipyridinyl, carbazolyl, carbolinyl, chromenyl, cinnolinyl, furazanyl, furyl, imidazolyl, indazolyl, indolyl, indoliziny, isobenzofuryl, isochromenyl, isooxazolyl, isoquinolyl, isothiazolyl, naphthyridinyl, oxazolyl, perimidinyl, 2-phenylpyridyl, phthalazinyl, pteridinyl, purinyl, pyrazinyl, pyradazinyl, pyrazolyl, pyridyl, pyrimidinyl, pyrrolizinyl, pyrroloidinyl, pyrrolyl, pyranyl, quinazolinyl, quinolizinyl, quinolyl, quinoxaliny, tetrazolyl, thiazolyl,
4-thiazol-4-ylphenyl, thienyl, xanthyl, and the like. Suitable protecting groups include tert-butoxycarbonyl, benzylloxycarbonyl, benzyl, 4-methoxybenzyl, 2-nitrobenzyl, and the like.

"Heterocycloalkyl" means cycloalkyl, as defined herein, provided that one or more of the ring member carbon atoms indicated is replaced by heteroatom moiety selected from -N, -NR-, -O-, -S- or -S(O)_2-, wherein R is hydrogen, (C_1_6)alkyl or a protecting group, and any carbocyclic ketone, thio ketone or iminoketone derivative thereof (e.g. the term hetero(C_5_1_2)cy cloalkyl includes [1,4']bipiperidinyl, dihydrooxazolyl, morpholinyl, 1-morpholin-4-ylpiperidinyl, piperazinyl, piperidyl, pirazolidinyl, pirazolinyl, pyrrolinyl, pyrrolidinyl, quinuclidinyl, and the like). Suitable protecting groups include tert-butoxycarbonyl, benzylloxycarbonyl, benzyl, 4-methoxybenzyl, 2-nitrobenzyl, and the like. For example, a compound of Formula I wherein R^1 is piperidin-4-ylcarbonyl may exist as either the unprotected or a protected derivative, e.g. wherein R^1 is 1-tert-butoxycarbonylpiperidin-4-ylcarbonyl, and both the unprotected and protected derivatives fall within the scope of the invention.

"Heterocycloalkylene" means cycloalkylene, as defined in this Application, provided that one or more of the ring member carbon atoms indicated is replaced by heteroatom moiety selected from -N, -NR-, -O-, -S- or -S(O)_2-, wherein R is hydrogen or (C_1_6)alkyl. For example, the instance wherein R^3 and R^4 together with the carbon atom to which both R^3 and R^4 are attached form hetero(C_3_1_2)cy cloalkylene" includes, but is not limited to, the following:

in which R is hydrogen, (C_1_6)alkyl or a protecting group and R^2 is as defined in the Summary of the Invention.
“Heteropolycycloaryl” means polycycloaryl, as defined herein, except one or more of the annular carbon atoms indicated are replaced by a heteroatom moiety selected from -N, -NR-, -O-, -S- or -S(O)_{2}-, wherein R is hydrogen, (C_{1-6})alkyl or a protecting group, and any carbocyclic ketone, thiokeitone or iminoketone derivative thereof (e.g., hetero(C_{8,12})polycycloaryl includes 3,4-dihydro-2H-quinoliny1, 5,6,7,8-tetrahydroquinolinolyl, 3,4-dihydro-2H-[1,8]naphthyridinyl, morpholinylpyridyl, piperidinylphenyl, 1,2,3,4,5,6-hexahydr0-[2,2']bipyridinyl, 2,4-dioxo-3,4-dihydro-2H-quinoxalinyl, 3-oxo-2,3-dihydrobenzo[1,4]oxazinyl, etc.).

“Heteroatom moiety” includes -N, -NR-, -O-, -S- or -S(O)_{2}-, wherein R is hydrogen, (C_{1-6})alkyl or a protecting group.

“Hydroxy” means the radical -OH. Unless indicated otherwise, the compounds of the invention containing hydroxy radicals include protected derivatives thereof. Suitable protecting groups for hydroxy moieties include benzyl and the like. For example, a compound of Formula I wherein the R^{3} contains a hydroxy moiety exist as either the unprotected or a protected derivative, e.g., wherein R^{3} is benzyl benzyl, and both the unprotected and protected derivatives fall within the scope of the invention.

“Iminoketone derivative” means a derivative containing the moiety -C(NR)-, wherein R is hydrogen or (C_{1-6})alkyl.

“Isomers” mean compounds of Formula I having identical molecular formulae but differ in the nature or sequence of bonding of their atoms or in the arrangement of their atoms in space. Isomers that differ in the arrangement of their atoms in space are termed “stereo isomers”. Stereo isomers that are not mirror images of one another are termed “diastereomers” and stereo isomers that are nonsuperimposable mirror images are termed “enantiomers” or sometimes “optical isomers”. A carbon atom bonded to four nonidentical substituents is termed a “chiral center”. A compound with one chiral center has two enantiomeric forms of opposite chirality is termed a “racemic mixture”. A compound that has more than one chiral center has 2^{n-1} enantiomeric pairs, where n is the number of chiral centers. Compounds with more than one chiral center may exist as ether an individual diastereomer or as a mixture of diastereomers, termed a “diastereomeric mixture”. When one
chiral center is present a stereoisomer may be characterized by the absolute configuration of that chiral center. Absolute configuration refers to the arrangement in space of the substituents attached to the chiral center. Enantiomers are characterized by the absolute configuration of their chiral centers and described by the R- and S-sequencing rules of Cahn, Ingold and Prelog. Conventions for stereochemical nomenclature, methods for the determination of stereochemistry and the separation of stereo isomers are well known in the art (e.g., see “Advanced Organic Chemistry”, 3rd edition, March, Jerry, John Wiley & Sons, New York, 1985). It is understood that the names and illustration used in this Application to describe compounds of Formula I are meant to be encompassed all possible stereo isomers. Thus, for example, the name 1-((1-cyano-1-methylethylcarbamoyl)-3-methylbutylcarbamate is meant to include 1S-((1-cyano-1-methylethylcarbamoyl)-3-methylbutylcarbamate and 1R-((1-cyano-1-methylethylcarbamoyl)-3-methylbutylcarbamate and any mixture, racemic or otherwise, thereof.

“Ketone derivative” means a derivative containing the moiety -C(O)-.

“Methylene” means the divalent radical -CH₂- or CH₃, wherein its free valances can be attached to different atoms or the same atom. For example, the instance wherein R⁹ together with R⁷ forms trimethylene substituted methylene includes the following:

![Chemical structures](attachment:chemical_structures.png)

in which X¹ and R¹¹ are as defined in the Summary of the invention, and may be referred to as 2,2-methylene and 1,2-methylene, respectively.

“Nitro” means the radical -NO₂.

“Optional” or “optionally” means that the subsequently described event or circumstance may or may not occur, and that the description includes instances where the event or circumstance occurs and instances in which it does not. For example, the phrase "any 1 to 3 annular atoms of any aromatic ring with available valences comprising R⁶ optionally independently is substituted" means that the aromatic ring referred to may or may
not be substituted in order to fall within the scope of the invention.

“N-oxide derivatives” means a derivatives of compound of Formula I in which nitrogens are in an oxidized state (i.e., O−N) and which possess the desired pharmacological activity.

“Oxo” means the radical O.

“Pathology” of a disease means the essential nature, causes and development of the disease as well as the structural and functional changes that result from the disease processes.

“Pharmaceutically acceptable” means that which is useful in preparing a pharmaceutical composition that is generally safe, non-toxic and neither biologically nor otherwise undesirable and includes that which is acceptable for veterinary use as well as human pharmaceutical use.

“Pharmaceutically acceptable salts” means salts of compounds of Formula I which are pharmaceutically acceptable, as defined above, and which possess the desired pharmacological activity. Such salts include acid addition salts formed with inorganic acids such as hydrochloric acid, hydrobromic acid, sulfuric acid, nitric acid, phosphoric acid, and the like; or with organic acids such as acetic acid, propionic acid, hexanoic acid, heptanoic 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, o-(4-hydroxybenzoyl)benzoic acid, cinnamic acid, madelic acid, methanesulfonic acid, ethanesulfonic acid, 1,2-ethanedisulfonic acid, 2-hydroxyethanesulfonic acid, benzenesulfonic acid, p-chlorobenzenesulfonic acid, 2-naphthalenesulfonic acid, p-toluenesulfonic acid, camphorsulfonic acid, 4-methylbicyclo[2.2.2]oct-2-ene-1-carboxylic acid, glucoheptonic acid, 4,4′-methylenebis(3-hydroxy-2-ene-1-carboxylic acid), 3-phenylpropionic acid, trimethylacetic acid, tertiary butylacetic acid, lauryl sulfuric acid, gluconic acid, glutamic acid, hydroxynaphthoic acid, salicylic acid, stearic acid, muconic acid and the like.

Pharmaceutically acceptable salts also include base addition salts which may be formed when acidic protons present are capable of reacting with inorganic or organic bases. Acceptable inorganic bases include sodium hydroxide, sodium carbonate, potassium hydroxide, ammonium hydroxide, aluminum hydroxide and calcium hydroxide. Acceptable
organic bases include ethanolamine, diethanolamine, triethanolamine,  
N-methylglucamine and the like.

"Phenylene-1,2-dimethylene" means the divalent radical -CH₂C₆H₄CH₂-, wherein the  
methylene moieties are attached at the 1- and 2-positions of the phenylene moiety. For  
example, a group of Formula (a), wherein R⁹ together with R⁷ form optionally substituted  
phenylene-1,2-dimethylene is illustrated by the following formula:

\[ \text{Diagram of chemical structure} \]

in which R is an optional hydroxy or (C₁₋₄)alkyl group and X¹ and R¹¹ are as defined in the  
Summary of the Invention.

"Polycycloaryl" means a bicyclic ring assembly (directly linked by a single bond or  
fused) containing the number of ring member carbon atoms indicated, wherein at least one,  
but not all, of the fused rings comprising the radical is aromatic, and any carbocyclic ketone,  
thioketone or iminoketone derivative thereof (e.g., (C₉₋₁₂)polycycloaryl includes indanyl,  
indenyl, 1,2,3,4-tetrahydronaphthalenyl, 1,2-dihydronaphthalenyl, cyclohexylphenyl,  
phenylcyclohexyl, 2,4-dioxo-1,2,3,4-tetrahydronaphthalenyl, and the like).

"Prodrug" means a compound which is convertible in vivo by metabolic means (e.g.  
by hydrolysis) to a compound of Formula (I). For example an ester of a compound of  
Formula (I) containing a hydroxy group may be convertible by hydrolysis in vivo to the parent  
molecule. Alternatively an ester of a compound of Formula (I) containing a carboxy group  
may be convertible by  
hydrolysis in vivo to the parent molecule. Suitable esters of compounds of Formula (I)  
containing a hydroxy group, are for example acetates, citrates, lactates, tartrates, malonates,  
oxalates, salicylates, propionates, succinates, fumarates, maleates,  
methylene-bis-b-hydroxynaphthoates, gentisates, isethionates, di-p-toluoyltartrates,
methanesulphonates, ethanesulphonates, benzenesulphonates, p-toluenesulphonates, cyclohexylsulhamates and quinates. Suitable esters of compounds of Formula (I) containing a carboxy group, are for example those described by F.J. Leinweber, Drug Metab. Res., 1987, 18, page 379. An especially useful class of esters of compounds of Formula (I) containing a hydroxy group, may be formed from acid moieties selected from those described by Bundgaard et al., J. Med. Chem., 1989, 32, page 2503-2507, and include substituted (aminomethyl)-benzoates, for example, dialkylamino-methylbenzoates in which the two alkyl groups may be joined together and/or interrupted by an oxygen atom or by an optionally substituted nitrogen atom, e.g. an alkylated nitrogen atom, more especially (morpholino-methyl)benzoates, e.g. 3- or 4-(morpholinomethyl)benzoates, and (4-alkylpiperazin-1-yl)benzoates, e.g. 3- or 4-(4-alkylpiperazin-1-yl)benzoates.

“Protected derivatives” means derivatives of compounds of Formula I in which a reactive site or sites are blocked with protecting groups. Protected derivatives of compounds of Formula I are useful in the preparation of compounds of Formula I or in themselves may be active cysteine protease inhibitors. A comprehensive list of suitable protecting groups can be found in T.W. Greene, Protecting Groups in Organic Synthesis, John Wiley & Sons, Inc. 1981.

“Therapeutically effective amount” means that amount which, when administered to an animal for treating a disease, is sufficient to effect such treatment for the disease.

“Thioketone derivative” means a derivative containing the moiety -C(S)-.

“Treatment” or “treating” means any administration of a compound of the present invention and includes:

(1) preventing the disease from occurring in an animal which may be predisposed to the disease but does not yet experience or display the pathology or symptomatology of the disease,

(2) inhibiting the disease in an animal that is experiencing or displaying the pathology or symptomatology of the diseased (i.e., arresting further development of the pathology and/or symptomatology), or

(3) ameliorating the disease in an animal that is experiencing or displaying the pathology or
symptomatology of the diseased (i.e., reversing the pathology and/or symptomatology).

“Ureido” means the radical -NHC(O)NH₂. Unless indicated otherwise, the compounds of the invention containing ureido moieties include protected derivatives thereof. Suitable protecting groups for ureido moieties include acetyl, tert-butoxycarbonyl, benzylxycarbonyl, and the like. For example, a compound of Formula I wherein the R⁹ contains an ureido moiety may exist as either the unprotected or a protected derivative and the like, and both the unprotected and protected derivatives fall within the scope of the invention.

Presently Preferred Embodiments:

While the broadest definition of the invention is set forth in the Summary of the Invention, certain aspects of the invention are preferred. Preferred are compounds of Formula I in which:

R¹ represents a group of Formula (a) wherein within Formula (a):

X¹ is -C(O)-;

R⁵ represents hydrogen or (C₁₋₄)alkyl, preferably hydrogen;

R⁷ represents hydrogen or methyl, preferably hydrogen,

R⁹ represents (i) (C₁₋₄)alkyl optionally substituted with -OR¹⁴, -SR¹⁴,

-S(O)R¹⁴, -S(O)₂R¹⁴, -C(O)R¹⁴, -C(O)OR¹⁴, -OC(O)R¹⁴, -NR¹⁴R¹⁵,

-NR¹⁵C(O)R¹⁴, -NR¹⁵C(O)OR¹⁴, -C(O)NR¹⁴R¹⁵, -S(O)₂NR¹⁴R¹⁵,

-NR¹⁵C(O)NR¹⁴R¹⁵ or -NR¹⁵C(NR¹⁵)NR¹⁴R¹⁵, wherein R¹⁴ is (C₃₋₁₀)cycloalkyl(C₀₋₆)alkyl, hetero(C₃₋₁₀)cycloalkyl(C₀₋₆)alkyl, (C₆₋₁₀)aryl(C₀₋₆)alkyl, hetero(C₅₋₁₀)aryl(C₀₋₆)alkyl, (C₉₋₁₀)polycycloaryl(C₀₋₆)alkyl or hetero(C₈₋₁₀)polycycloaryl(C₀₋₆)alkyl and R¹⁵ is hydrogen or (C₁₋₆)alkyl, and wherein within R¹⁴ said cycloalkyl, heterocycloalkyl, aryl, heteroaryl, polycycloaryl or heteropolycycloaryl ring optionally is substituted by a group selected from -R¹⁶,

-X¹OR¹⁶, -X¹SR¹⁶, -X¹S(O)R¹⁶, -X¹S(O)₂R¹⁶, -X¹C(O)R¹⁶, -X¹C(O)OR¹⁶,

-X¹OC(O)R¹⁶, -X¹NR¹⁶R¹⁷, -X¹NR¹⁶C(O)R¹⁶, -X¹NR¹⁶C(O)OR¹⁶,

-X¹C(O)NR¹⁶R¹⁷, -X¹S(O)₂NR¹⁶R¹⁷, -X¹NR¹⁶C(O)NR¹⁶R¹⁷ or
-X^3NR^17C(NR^{17})NR^{16}R^{17}, wherein X^3 is a bond or (C_{1-6})alkylene, R^{16} is hydrogen or (C_{1-6})alkyl and R^{17} is (C_{3-10})cycloalkyl(C_{0-6})alkyl, hetero(C_{3-10})cycloalkyl(C_{0-6})alkyl, (C_{5-10})aryl(C_{0-6})alkyl, hetero(C_{5-10})aryl(C_{0-6})alkyl, (C_{9-10})polycycloaryl(C_{0-6})alkyl or hetero(C_{8-10})polycycloaryl(C_{0-6})alkyl, or (ii) a group selected from
(C_{3-10})cycloalkyl(C_{0-6})alkyl, hetero(C_{3-10})cycloalkyl(C_{0-6})alkyl, (C_{6-10})aryl(C_{0-6})alkyl, hetero(C_{5-10})aryl(C_{0-6})alkyl, (C_{9-10})polycycloaryl(C_{0-6})alkyl and hetero(C_{8-10})polycycloaryl(C_{0-6})alkyl, wherein said cycloalkyl, heterocycloalkyl, aryl, heteroaryl, polycycloaryl or heteropolycycloaryl ring optionally is substituted by a group selected from -R^{16}, -X^3OR^{16}, -X^3SR^{16}, -X^3S(O)R^{16}, -X^3S(O)_2R^{16},
-X^3C(O)R^{16}, -X^3C(O)OR^{16}, -X^3OC(O)R^{16}, -X^3NR^{16}R^{17}, -X^3NR^{17}C(O)R^{16},
-X^3NR^{17}C(O)OR^{16}, -X^3C(NR^{17})NR^{16}R^{17}, -X^3S(O)_2NR^{16}R^{17}, -X^3NR^{17}C(O)NR^{16}R^{17} or
-X^3NR^{17}C(NR^{17})NR^{16}R^{17}, wherein X^3, R^{16} and R^{17} are as defined above; wherein within R^9 any alicyclic or aromatic ring system present may be substituted further by 1 to 5 radicals independently selected from (C_{1-6})alkyl, (C_{1-6})alkyldiene, cyano, halo, halo-substituted (C_{1-6})alkyl, nitro, -X^3NR^{12}R^{12}, -X^3NR^{17}C(O)OR^{12},
-X^3NR^{17}C(O)NR^{15}R^{12}, -X^3NR^{17}C(NR^{17})NR^{12}R^{15}, -X^3OR^{12}, -X^3SR^{12},
-X^3C(O)OR^{12}, -X^3C(O)NR^{15}R^{12}, -X^3S(O)_2NR^{15}R^{12}, -X^3P(O)(OR^3)OR^{12},
-X^3OP(O)(OR^3)OR^{12}, -X^3OC(O)R^{13}, -X^3NR^{12}C(O)R^{13}, -X^3S(O)_2R^{13},
and -X^3C(O)R^{13}, wherein X^3 is as defined above, R^{12} at each occurrence independently is hydrogen, (C_{1-6})alkyl or halo-substituted (C_{1-6})alkyl and R^{13} is (C_{1-6})alkyl or halo-substituted (C_{1-6})alkyl; and
R^{11} represents -X^4X^5R^{18}, wherein X^4 is -C(O)- or -S(O)_2-, X^5 is a bond, -O- or -NR^{19}-, wherein R^{19} is hydrogen or (C_{1-6})alkyl, and R^{18} is (i) (C_{1-10})alkyl or (ii) (C_{1-12})cycloalkyl(C_{0-6})alkyl, hetero(C_{3-12})cycloalkyl(C_{0-6})alkyl,
(C_{6-12})aryl(C_{0-6})alkyl or hetero(C_{5-12})aryl(C_{0-6})alkyl or (iii) (C_{3-4})cycloalkyl(C_{0-6})alkyl, hetero(C_{3-4})cycloalkyl(C_{0-6})alkyl, phenyl(C_{0-6})alkyl or hetero(C_{5-4})aryl(C_{0-6})alkyl, wherein said cycloalkyl, heterocycloalkyl, phenyl or heteroaryl is substituted by
-X^9OR^{24}, -X^9C(O)R^{24}, -X^9C(O)OR^{24}, -X^9C(O)NR^{24}R^{25}, -X^9NR^{24}R^{25},
-X^9NR^{25}C(O)R^{24}, -X^9NR^{25}C(O)OR^{24}, -X^9NR^{25}C(O)NR^{24}R^{25} or
-X^9NR^{25}C(NR^{25})NR^{24}R^{25}$, wherein X^9 is a bond or (C_{1,6})alkylene, R^{24} is (C_{3,6})cycloalkyl(C_{0,6})alkyl, hetero(C_{3,6})cycloalkyl(C_{0,6})alkyl, phenyl(C_{0,6})alkyl or hetero(C_{5,6})aryl(C_{0,6})alkyl and R^{25} is hydrogen or (C_{1,6})alkyl, wherein within R^{11} any alicyclic or aromatic ring system present may be substituted further by 1 to 5 substituents independently selected from (C_{1,6})alkyl, halo, halo-substituted (C_{1,6})alkyl, -OR^{12}, -X^3SR^{12}, -C(O)OR^{12} and -X^3NR^{12}C(O)OR^{12}, wherein X^3 is a bond or (C_{1,6})alkylene and R^{14} is hydrogen or (C_{1,6})alkyl.

Within Formula (a), R^{11} particularly represents -X^4X^5R^{18}, wherein X^4 is -C(O)-, X^5 is a bond and R^{18} is (i) (C_{3,12})cycloalkyl(C_{0,6})alkyl, hetero(C_{3,12})cycloalkyl(C_{0,6})alkyl, (C_{6,12})aryl(C_{0,6})alkyl or hetero(C_{5,12})aryl(C_{0,6})alkyl or (ii) phenyl(C_{0,6})alkyl or hetero(C_{5,6})aryl(C_{0,6})alkyl, wherein said phenyl or heteroaryl is substituted by -X^6OR^{24}, -X^6C(O)R^{24}, -X^6C(O)OR^{24}, -X^6C(O)NR^{24}R^{25}, -X^9NR^{24}R^{25}, -X^9NR^{25}C(O)R^{24}, -X^9NR^{25}C(O)OR^{24}, -X^9NR^{25}C(O)NR^{24}R^{25} or -X^9NR^{25}C(NR^{25})NR^{24}R^{25}, wherein X^9 is a bond or (C_{1,6})alkylene, R^{24} is phenyl(C_{0,6})alkyl or hetero(C_{5,6})aryl(C_{0,6})alkyl and R^{25} is hydrogen or (C_{1,6})alkyl, wherein within R^{11} any aromatic ring system present may be substituted further by 1 to 5 substituents independently selected from (C_{1,6})alkyl, halo, halo-substituted (C_{1,6})alkyl, -OR^{12}, -X^3SR^{12}, -C(O)OR^{12} and -X^3NR^{12}C(O)OR^{12} wherein X^3 is a bond or (C_{1,6})alkylene and R^{12} is hydrogen or (C_{1,6})alkyl.

Within Formula (a), R^{11} more particularly represents benzoyl, furylcarbonyl, phenoxycarbonyl, pyridylthienylcarbonyl, benzoylbenzoyl, benzyolbenzoyl, thiencarbonyl, morpholinylcarbonyl, phenylureidobenzoyl, cyclohexenylcarbonyl or piperazinylcarbonyl, wherein within R^{11} any aromatic ring system present may be substituted further by 1 to 2 substituents independently selected from (C_{1,6})alkyl, tert-butoxycarbonylamino, tert-butoxycarbonylaminomethyl, bromo, chloro, ethoxy, fluoro, hydroxy, methoxy and methylsulfanyl.

Within Formula (a), R^9 particularly represents (i) (C_{1,6})alkyl optionally substituted with -OR^{14} or -SR^{14}, wherein R^{14} is (C_{3,6})cycloalkyl(C_{0,6})alkyl, phenyl(C_{0,6})alkyl, biphenyl(C_{0,6})alkyl or hetero(C_{5,6})aryl(C_{0,6})alkyl, or (ii) a group selected from (C_{3,6})cycloalkyl(C_{0,6})alkyl, phenyl(C_{0,6})alkyl, biphenyl(C_{0,6})alkyl or
hetero(C_{5,10})aryl(C_{0,4})alkyl; wherein within R^9 any alicyclic or aromatic ring system present may be substituted further by 1 to 5 radicals independently selected from (C_{1,6})alkyl, (C_{1,6})alkyldene, cyano, halo, halo-substituted (C_{1,4})alkyl, nitro, -X^3NR^{12}R^{12}, -X^3NR^{12}C(O)OR^{12}, -X^3NR^{12}C(O)NR^{12}R^{12}, -X^3NR^{12}C(NR^{12})NR^{12}R^{12}, -X^3OR^{12}, -X^3SR^{12}, -X^3C(O)OR^{12}, -X^3S(O)_{2}NR^{12}R^{12}, -X^3Si(O)(OR^3)OR^{12}, -X^3Si(OR^3)OR^{12}, -X^3OC(O)R^{13}, -X^3OC(O)OR^{13}, -X^3NR^{12}C(O)R^{13}, -X^3S(O)R^{13}, -X^3S(O)_{2}R^{13} and -X^3C(O)R^{13}, wherein X^3 is a bond or (C_{1,6})alkylene, R^{12} at each occurrence independently is hydrogen, (C_{1,3})alkyl or halo-substituted (C_{1,3})alkyl and R^{13} is (C_{1,3})alkyl or halo-substituted (C_{1,3})alkyl.

Within Formula (a), R^9 more particularly represents cyclohexylmethyl, wherein said cyclohexyl may be substituted by 1 to 5 radicals independently selected from (C_{1,6})alkyl, (C_{1,6})alkyldene or -X^3OC(O)R^{13}, or phenylmethylsulfanyl methyl or phenylsulfanylethyl, wherein said phenyl may be substituted by 1 to 5 radicals independently selected from (C_{1,4})alkyl, cyano, halo, halo-substituted (C_{1,4})alkyl, nitro, -OR^{12}, -SR^{12} and -C(O)OR^{12}, wherein R^{12} is hydrogen, (C_{1,3})alkyl or halo-substituted (C_{1,3})alkyl and R^{13} is (C_{1,6})alkyl or halo-substituted (C_{1,3})alkyl.

Within Formula (a), R^9 more particularly presents a group having the following formula:

![formula diagram]

in which q is 0 to 5 and R^{26} at each occurrence is independently selected from (C_{1,4})alkyl, cyano, halo, halo-substituted (C_{1,4})alkyl, nitro, -OR^{12}, -SR^{12} and -C(O)OR^{12}, wherein R^{12} is hydrogen, (C_{1,3})alkyl or halo-substituted (C_{1,3})alkyl and R^{13} is (C_{1,6})alkyl or halo-substituted
(C<sub>1-3</sub>)alkyl.

Within Formula (a), R<sup>3</sup> preferably represents benzylsulfanyl methyl, 2-bromobenzylsulfanyl methyl, 2-chlorobenzylsulfanyl, 2-(2-chlorophenylsulfanyl)ethyl, cyclohexyl, 4-ethyldene cyclohexyl, 2-iodobenzylsulfanyl methyl, 2-methylbenzylsulfanyl methyl, 3-methyl-3-trifluorocarbonyloxy cyclohexyl methyl, 4-methylenecyclohexyl methyl or 2-nitrobenzylsul finyl methyl.

R<sup>2</sup> preferably represents hydrogen;

R<sup>3</sup> preferably is hydrogen or (C<sub>1-4</sub>)alkyl, typically hydrogen, or taken with R<sup>4</sup> together with the carbon atom to which both R<sup>3</sup> and R<sup>4</sup> are attached form (C<sub>3-8</sub>)cycloalkylene (e.g. cyclopropylene or cyclohexylene).

R<sup>4</sup> preferably is hydrogen or taken with R<sup>3</sup> together with the carbon atom to which both R<sup>3</sup> and R<sup>4</sup> are attached form (C<sub>3-8</sub>)cycloalkylene (e.g. cyclopropylene or cyclohexylene).

Compounds of Formula II specifically include those in which R<sup>3</sup> represents (C<sub>6-12</sub>)aryl(C<sub>0-6</sub>)alkyl, hetero(C<sub>5-12</sub>)aryl(C<sub>0-6</sub>)alkyl, -X<sup>4</sup>OR<sup>14</sup>, -X<sup>4</sup>SR<sup>14</sup>, -X<sup>4</sup>S(O)R<sup>14</sup> or -X<sup>4</sup>NR<sup>14</sup>R<sup>15</sup>, wherein X<sup>4</sup> is a bond or (C<sub>1-6</sub>)alkylene, R<sup>14</sup> is (C<sub>6-12</sub>)aryl(C<sub>0-6</sub>)alkyl or hetero(C<sub>5-12</sub>)aryl(C<sub>0-6</sub>)alkyl and R<sup>15</sup> is hydrogen or (C<sub>1-6</sub>)alkyl, and wherein within R<sup>3</sup> said aryl or heteroaryl ring optionally is substituted by 1 to 5 radicals independently selected from (C<sub>1-6</sub>)alkyl, cyano, halo, halo-substituted (C<sub>1-6</sub>)alkyl, nitro, -X<sup>4</sup>NR<sup>12</sup>R<sup>12</sup>, -X<sup>4</sup>OR<sup>12</sup>, -X<sup>4</sup>C(O)R<sup>12</sup>, -X<sup>4</sup>SR<sup>12</sup>, wherein X<sup>4</sup> is a bond or (C<sub>1-6</sub>)alkylene, R<sup>12</sup> at each occurrence independently is hydrogen, (C<sub>1-6</sub>)alkyl or halo-substituted (C<sub>1-3</sub>)alkyl.

Compounds of Formula II particularly include those in which R<sup>3</sup> represents benzyl, benzoxymethyl, benzylsulfanyl ethyl, benzylsulfanyl methyl, benzylsulfanyl methyl, indolyl methyl, naphthylmethyl, phenethyl, phenoxyethyl, phenylamino, pyridylmethyl, pyridylsulfanyl ethyl, phenylsulfanyl ethyl, thiazolyl or thienyl, wherein within R<sup>3</sup> the aromatic ring may be substituted further by 1 to 5 radicals independently selected from (C<sub>1-6</sub>)alkyl, cyano, halo, halo-substituted (C<sub>1-6</sub>)alkyl, nitro, -X<sup>4</sup>NR<sup>12</sup>R<sup>12</sup>, -X<sup>4</sup>OR<sup>12</sup>, -X<sup>4</sup>C(O)R<sup>12</sup>, -X<sup>4</sup>SR<sup>12</sup>, wherein X<sup>4</sup> is a bond or (C<sub>1-6</sub>)alkylene, R<sup>12</sup> at each occurrence independently is hydrogen, (C<sub>1-6</sub>)alkyl or halo-substituted (C<sub>1-3</sub>)alkyl, and R<sup>13</sup> is (C<sub>1-6</sub>)alkyl or halo-substituted (C<sub>1-3</sub>)alkyl.
Compounds of Formula II more particularly include those in which R⁹ represents 4-aminobenzyl, benzyl, benzyloxymethyl, 2-benzylsulfanyethyl, benzylsulfanylmethyl, 2-bromobenzylsulfanylmethyl, 4-tert-butylbenzylsulfanylmethyl, 2-chlorobenzyl, 4-chlorobenzyl, 2-chlorobenzylsulfanylmethyl, 4-chlorobenzylsulfanylmethyl, 2-(2-chlorophenylsulfanyl)ethyl, 4-cyanobenzyl, 3,4-dichlorobenzylsulfanylmethyl, 1,6-dichlorobenzyl, 3,5-dimethylbenzylsulfanylmethyl, 2-fluorobenzyl, 4-fluorobenzyl, 2-fluorobenzylsulfanylmethyl, 1-formylindol-3-ylmethyl, indol-3-ylmethyl, 2-iodobenzylsulfanylmethyl, 2-methylbenzylsulfanylmethyl, 3-methylbenzylsulfanylmethyl, 4-methylbenzylsulfanylmethyl, 2-(2-methylphenylsulfanyl)ethyl, 4-methoxybenzyl, 4-methoxybenzylsulfanylmethyl, 4-methoxybenzylsulfinylmethyl, naphth-2-ylmethyl, naphth-2-ylmethylsulfanylmethyl, 3-nitrobenzyl, 1-nitrobenzylsulfanylmethyl, 2-nitrobenzylsulfanylmethyl, 3-nitrobenzylsulfanylmethyl, 4-nitrobenzylsulfanylmethyl, 4-nitrobenzyl, pentafluorobenzylsulfanylmethyl, phenylamino, phenethyl, phenethyl oxy, 2-phenoyethyl, 2-phenoxethyl 2-phenylsulfanylyethyl, pyrid-4-ylmethyl, pyrid-2-ylmethylsulfanylmethyl, pyrid-3-ylmethylsulfanylmethyl, pyrid-4-ylmethylsulfanylmethyl, 2-pyril-2-ysulfanylyethyl, 2-pyril-4-ysulfanylyethyl, thiazol-5-yl, thien-2-ylmethyl, 4-trifluoromethylbenzylsulfanylmethyl, 3-trifluoromethylbenzylsulfanylmethyl, 3-trifluoromethoxybenzylsulfanylmethyl, 4-trifluoromethoxybenzylsulfanylmethyl or 4-trifluororsulfanylbzylsulfanylmethyl,

Reference to the preferred embodiments set forth above is meant to include all combinations of particular and preferred groups.

Further preferred are compounds of Formula I selected from a group consisting of: N-(2-benzylsulfanyl-1R-cyanomethylcarbamoyl-ethyl)-4-hydroxybenzamide; N-[2-(2-bromobenzylsulfanyl)-1R-cyanomethylcarbamoyl-ethyl]benzamide; N-[1R-cyanomethylcarbamoyl-2-(2-iodobenzylsulfanyl)ethyl]benzamide; N-[1R-cyanomethylcarbamoyl-2-(2-cyanobenzylsulfanyl)ethyl]morpholine-4-carboxamide;
N-[3-(2-chlorophenylsulfanyl)-1R-cyanomethylcarbamoyl-propyl]benzamide; N-[1R-cyanomethylcarbamoyl-2-(2-nitrobenzylsulfanyl)ethyl]morpholine-
4-carboxamide

\[ N-[1R\text{-cyanomethylcarbamoyl}-2-(2\text{-methylbenzylsulfanyl})\text{ethyl}]\text{morpholine} - 4\text{-carboxamide}; \text{ and} \]

\[ N-[1R\text{-cyanomethylcarbamoyl}-2-(2\text{-methylbenzylsulfanyl})\text{ethyl}]\text{benzamide}. \]

5 Pharmacology and Utility:

The compounds of the invention are cysteine protease inhibitors, in particular the compounds of the invention inhibit the activity of cathepsins B, L, K and/or S and, as such, are useful for treating diseases in which cathepsin B, L, K and/or S activity contributes to the pathology and/or symptomatology of the disease. For example, the compounds of the invention are useful in treating tumor invasion and metastasis, in particular as anti-angiogenic agents, rheumatoid arthritis, osteo arthritis, pneumocystis carinii, acute pancreatitis, inflammatory airway disease and bone and joint disorders. Furthermore, the compounds of the invention are useful in treating bone resorption disorders, e.g., osteoporosis. The compounds of the invention also are useful in treating autoimmune disorders, including, but not limited to juvenile onset diabetes, multiple sclerosis, pemphigus vulgaris, Graves’ disease, myasthenia gravis, systemic lupus erythematosus, rheumatoid arthritis and Hashimoto’s thyroiditis, allergic disorders, including, but not limited to asthma, and allogeneic immune responses, including, but not limited to, organ transplants or tissue grafts.

The cysteine protease inhibitory activities of the compounds of the invention can be determined by methods known to those of ordinary skill in the art. Suitable \textit{in vitro} assays for measuring protease activity and the inhibition thereof by test compounds are known. Typically, the assay measures protease induced hydrolysis of a peptide based substrate. Details of assays for measuring protease inhibitory activity are set forth in Examples 10, 11, 12 and 13, infra.

25 Nomenclature:

The compounds of Formula I and the intermediates and starting materials used in their preparation are named in accordance with IUPAC rules of nomenclature in which the
characteristic groups have decreasing priority for citation as the principle group as follows: acids, esters, amides and amidines. For example, a compound of Formula I in which \( R^1 \) is a group of Formula (a), wherein \( X^1 \) is carbonyl, \( R^5 \) and \( R^7 \) are each hydrogen, \( R^9 \) is benzyl and \( R^{11} \) is tert-butoxycarbonyl and \( R^2, R^3 \) and \( R^4 \) are each hydrogen; that is, a compound having the following structure:

![Chemical Structure](image)

is named tert-butyl 1S-cyanomethy carbamoyl-2-phenylethyl carbamate and a compound of Formula I in which \( R^1 \) is a group of Formula (a), wherein \( X^1 \) is carbonyl, \( R^5 \) and \( R^7 \) are each hydrogen, \( R^9 \) is cyclohexylmethyl and \( R^{11} \) is morpholin-4-ylcarbonyl and \( R^2, R^3 \) and \( R^4 \) are each hydrogen; that is, a compound having the following structure:

![Chemical Structure](image)

is named \( N-(1S\text{-Cyanomethyl} \text{carbamoyl}-2\text{-cyclohexylethyl}) \text{morpholine-4-carboxamide} \).

Administration and Pharmaceutical Compositions:

In general, compounds of Formula I will be administered in therapeutically effective amounts via any of the usual and acceptable modes known in the art, either singly or in combination with another therapeutic agent. A therapeutically effective amount may vary
widely depending on the severity of the disease, the age and relative health of the subject, the potency of the compound used and other factors. For example, therapeutically effective amounts of a compound of Formula I may range from 0.1 micrograms per kilogram body weight ($\mu g$/kg) per day to 10 milligram per kilogram body weight (mg/kg) per day, typically $1 \mu g$/kg/day to 1 mg/kg/day. Therefore, a therapeutically effective amount for a 80 kg human patient may range from 10 $\mu g$/day to 100 mg/day, typically 0.1 mg/day to 10 mg/day. In general, one of ordinary skill in the art, acting in reliance upon personal knowledge and the disclosure of this Application, will be able to ascertain a therapeutically effective amount of a compound of Formula I for treating a given disease.

The compounds of Formula I can be administered as pharmaceutical compositions by one of the following routes: oral, systemic (e.g., transdermal, intranasal or by suppository) or parenteral (e.g., intramuscular, intravenous or subcutaneous). Compositions can take the form of tablets, pills, capsules, semisolids, powders, sustained release formulations, solutions, suspensions, elixirs, aerosols, or any other appropriate composition and 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 active ingredient. Such excipient may be any solid, liquid, semisolid 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 water, ethanol, glycerol, propylene glycol 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.

The amount of a compound of Formula I in the composition may vary widely depending upon the type of formulation, size of a unit dosage, kind of excipients and other factors known to those of skill in the art of pharmaceutical sciences. In general, a composition
of a compound of Formula I for treating a given disease will comprise from 0.01\% w to
10\% w, preferably 0.3\% w to 1\% w, of active ingredient with the remainder being the excipient
or excipients. Preferably the pharmaceutical composition is administered in a single unit
dosage form for continuous treatment or in a single unit dosage form ad libitum when relief of
symptoms is specifically required. Representative pharmaceutical formulations containing a
compound of Formula I are described in Example 15.

Chemistry:

Processes for Making Compounds of Formula I:

Compounds of Formula I can be prepared by proceeding as in the following
Scheme 1:

\[
\begin{align*}
\text{Scheme 1} \\
\text{1. } & R^1\text{OY} \\
\text{2. optionally deprotecting} \\
\end{align*}
\]

in which Y is hydrogen or an activating group (e.g., 2,5-dioxopyrrolidin-1-yl (NBS), and the
like) and each \( R^1 \), \( R^2 \), \( R^3 \) and \( R^4 \) are as defined in the Summary of the Invention.

Compounds of Formula I can be prepared by reacting a compound of Formula 2, or
a protected derivative thereof, with a compound of the formula $R'\text{OY}$, or a protected
derivative thereof, and then optionally deprotecting. The reaction is carried out in the
presence of a suitable acylation catalyst (e.g., triethylamine) and in a suitable solvent (e.g.,
acetonitrile, $N,N$-dimethylformamide (DMF), methylene chloride, or any suitable combination
thereof) at 10 to 30°C, preferably at about 25°C, and requires 24 to 30 hours to complete.

When Y is hydrogen the reaction can be effected in the presence of a suitable coupling agent
(e.g., benzotriazole-1-yloxytrispyrrolidinophosphonium hexafluorophosphate (PyBOP®),
1-(3-dimethylaminopropyl)-3-ethylcarbodiimide hydrochloride (EDC), O-benzotriazol-1-yl-
$N,N,N',N'$-tetramethyluronium hexafluorophosphate (HBTU), 1,3-dicyclohexylcarbodiimide
(DCC), or the like) and base (e.g., $N,N$-diisopropylethylamine, triethylamine, or the like) and
requires 2 to 15 hours to complete. Alternatively, when Y is hydrogen the reaction can be
carried out by treating the compound of formula $R'\text{OH}$ with $N$-methylmorpholine and isobutyl
chloroformate in a suitable solvent (e.g., THF, or the like) at between 0 and 5°C for
30 minutes to an hour and then introducing the compound of Formula 2 to the reaction
mixture and allowing the reaction to proceed for 12 to 15 hours.

Deprotection can be effected by any means which removes the protecting group and
gives the desired product in reasonable yield. A detailed description of the techniques
applicable to the creation of protecting groups and their removal can be found in T.W.
detailed description of the preparation of a compound of Formula I according to Scheme 1 is
set forth in Examples 4, 5, 6 and 8, infra.

Alternatively, compounds of Formula I can be prepared by reacting a compound of
Formula 2 with a compound of the formula $R'^1\text{-SS}$, wherein SS is a suitable solid support
(e.g., thiophenol resin, or the like). The reaction can be carried out in the presence of a
suitable acylation catalyst (e.g., 4-dimethylaminopyridine, or the like) and in a suitable solvent
(e.g., dry pyrimidine, or the like) and requires 60 to 70 hours to complete.
Compounds of Formula I can be prepared by proceeding as in the following reaction

Scheme 2:

\[
\begin{align*}
R^1 & \quad N \quad R^2 \\
\text{3} & \quad \downarrow \\
1. \text{NH}_3 & \quad 2. (\text{CF}_3\text{CO})_2\text{O}, \text{base} & \quad 3. \text{optionally deprotecting} \\
R^3 & \quad C=\text{N} \\
R^4 & \\
\end{align*}
\]

in which each R\text{1}, R\text{2}, R\text{3} and R\text{4} are as defined in the Summary of the Invention.

Compounds of Formula I can be prepared by treating a compound of Formula 3, or a protected derivative thereof, with ammonia to provide a corresponding amide, then reacting the amide with a suitable dehydrating agent (e.g., trifluoroacetic anhydride, cyanuric chloride, thionyl chloride, phosphonyl chloride, and the like) and optionally deprotecting. The reaction with the ammonia is carried out in a suitable solvent (e.g., methanol) at between 0 and 5°C and requires 6 to 10 days to complete. The reaction with the dehydrating agent is carried out in the presence of a suitable base (e.g., triethylamine) and in a suitable solvent (e.g., tetrahydrofuran (THF), and the like) at between 0 and 50°C and requires 1 to 2 hours to complete. A detailed description of the preparation of a compound of Formula I according to Scheme 2 is set forth in Examples 7 and 8, infra.
Additional Processes for Preparing Compounds of Formula I:

A compound of Formula I can be prepared as a pharmaceutically acceptable acid addition salt by reacting the free base form of the compound with a pharmaceutically acceptable inorganic or organic acid. Alternatively, a pharmaceutically acceptable base addition salt of a compound of Formula I can be prepared by reacting the free acid form of the compound with a pharmaceutically acceptable inorganic or organic base. Inorganic and organic acids and bases suitable for the preparation of the pharmaceutically acceptable salts of compounds of Formula I are set forth in the definitions section of this application. Alternatively, the salt forms of the compounds of Formula I can be prepared using salts of the starting materials or intermediates.

The free acid or free base forms of the compounds of Formula I can be prepared from the corresponding base addition salt or acid addition salt form. For example, a compound of Formula I in an acid addition salt form can be converted to the corresponding free base by treating with a suitable base (e.g., ammonium hydroxide solution, sodium hydroxide, etc.). A compound of Formula I in a base addition salt form can be converted to the corresponding free acid by treating with a suitable acid (e.g., hydrochloric acid, etc).

The N-oxides of compounds of Formula I can be prepared by methods known to those of ordinary skill in the art. For example, N-oxides can be prepared by treating an unoxidized form of the compound of Formula I with an oxidizing agent (e.g., trifluoroperacetic acid, permaleic acid, perbenzoic acid, peracetic acid, meta-chloroperoxybenzoic acid, etc.) in a suitable inert organic solvent (e.g., a halogenated hydrocarbon such as methylene chloride) at approximately 0°C. Alternatively, the N-oxides of the compounds of Formula I can be prepared from the N-oxide of an appropriate starting material.

Compounds of Formula I in unoxidized form can be prepared from N-oxides of compounds of Formula I by treating with a reducing agent (e.g., sulfur, sulfur dioxide, triphenyl phosphine, lithium borohydride, sodium borohydride, phosphorus trichloride, tribromide, etc.) in an suitable inert organic solvent (e.g., acetonitrile, ethanol, aqueous dioxane, etc.) at 0 to 80°C.

Prodrug derivatives of the compounds of Formula I can be prepared by methods
known to those of ordinary skill in the art (e.g., for further details see Saulnier et al. (1994), *Bioorganic and Medicinal Chemistry Letters*. 4:1985). For example, appropriate prodrugs can be prepared by reacting a non-derivatized compound of Formula I with a suitable carbamylyating agent (e.g., 1,1-acyloxyalkylcarbonochloridate, para-nitrophenyl carbonate, etc.).

Protected derivatives of the compounds of Formula I can be made by means known to those of ordinary skill in the art. A detailed description of the techniques applicable to the creation of protecting groups and their removal can be found in T.W. Greene, *Protecting Groups in Organic Synthesis*, John Wiley & Sons, Inc. 1981.

Compounds of Formula I can be prepared as their individual stereo isomers by reacting a racemic mixture of the compound with an optically active resolving agent to form a pair of diastereoisomeric compounds, separating the diastereomers and recovering the optically pure enantiomer. While resolution of enantiomers can be carried out using covalent diastereomeric derivatives of compounds of Formula I, dissociable complexes are preferred (e.g., crystalline diastereoisomeric salts). Diastereomers have distinct physical properties (e.g., melting points, boiling points, solubilities, reactivity, etc.) and can be readily separated by taking advantage of these dissimilarities. The diastereomers can be separated by chromatography or, preferably, by separation/resolution techniques based upon differences in solubility. The optically pure enantiomer is then recovered, along with the resolving agent, by any practical means that would not result in racemization. A more detailed description of the techniques applicable to the resolution of stereo isomers of compounds from their racemic mixture can be found in Jean Jacques Andre Collet, Samuel H. Wilen, Enantiomers, Racemates and Resolutions, Honh Wiley & Sons, Inc. (1981).
In summary, an aspect of the invention is a process for preparing a compound of Formula I, which process comprises:

(A) reacting a compound of Formula 2:

\[
\begin{array}{c}
\text{N} \\
\text{H} \\
\text{C} \\
\text{N} \\
\text{R}^2 \\
\text{R}^3 \\
\text{R}^4 \\
\end{array}
\]

or a protected derivative thereof with a compound of the formula \( R^1 O Y \), or a protected derivative thereof, in which \( Y \) is hydrogen or an activating group and each \( R^1, R^2, R^3 \) and \( R^4 \) are as defined in the Summary of the Invention; or

(B) reacting a compound of Formula 3:

\[
\begin{array}{c}
\text{N} \\
\text{R}^2 \\
\text{R}^1 \\
\text{O} \\
\text{O} \\
\text{R}^3 \\
\text{R}^4 \\
\end{array}
\]

with ammonia to provide a corresponding amide and then reacting the amide with trifluoroacetic anhydride, in which each \( R^1, R^2, R^3 \) and \( R^4 \) are as defined in the Summary of the Invention

(C) optionally deprotecting a protected derivative of a compound of Formula I to provide a corresponding unprotected derivative;

(D) optionally converting a compound of Formula I into a pharmaceutically acceptable salt;

(E) optionally converting a salt form of a compound of Formula I to non-salt form;

(F) optionally converting an unoxidized form of a compound of Formula I into a pharmaceutically acceptable \( N \)-oxide;

(G) optionally converting an \( N \)-oxide form of a compound of Formula I its unoxidized
form;

(H) optionally converting a non-derivatized compound of Formula I into a pharmaceutically prodrug derivative; and

(I) optionally converting a prodrug derivative of a compound of Formula I to its non-derivatized form.

Processes for Preparing Intermediates:

Compounds of Formula 2 can be prepared by reacting a compound of Formula 4:

```
\[ \text{R}^{19} \text{N} - \text{R}^{2} - \text{O} - \text{R}^{3} \text{R}^{4} \text{NH}_{2} \]
```

in which \( R^{19} \) is an amino protecting group and each \( R^{2}, R^{3} \) and \( R^{4} \) are as defined in the Summary of the Invention, with thionyl chloride and then deprotecting. The reaction with the thionyl chloride is carried out in the presence of a suitable base (e.g., triethylamine) and in a suitable solvent (e.g., DMF) at between 0 and 5°C and requires 30 minutes to an hour to complete. Alternatively, compounds of Formula 2 can be prepared by reacting a compound of Formula 4 with trifluoroacetic anhydride. The deprotection can be effected by any means which removes the protecting group and gives the desired product in reasonable yield. A detailed description of the preparation of a compound of Formula 2 according to above-described procedure is set forth in Example 1, infra.

Compounds of Formula 4 can be prepared by treating a corresponding alkanoyl halide with ammonia. The treatment is carried out in a suitable solvent (e.g., dichloromethane, 5% aqueous sodium carbonate, and the like, or any suitable combination thereof) at 10 to 30°C and requires 30 minutes to an hour to complete. The alkanoyl halide intermediates can be prepared from the corresponding alkanoyic acid by treating with thionyl chloride in a suitable solvent (e.g., dichloromethane) under nitrogen for 30 minutes to an hour. A detailed description of the preparation of a compound of Formula 2 according to the above-described
procedures is set forth in Example 1, infra.

Compounds of the formula R\(^1\)-SS can be prepared by reacting a compound of Formula 5(a) or 5(b):

![Chemical Structures]

5 in which R\(^{19}\) is an amino protecting group (e.g., tert-butoxycarbonyl, fluoren-9-ylmethoxycarbonyl, or the like) and each X\(^1\), X\(^2\), X\(^3\), R\(^5\) and R\(^7\) are as defined for Formula I in the Summary of the Invention, with a suitable solid support resin (e.g., Wang (4-benzoyloxybenzyl alcohol) resin, thiophenol resin, or the like), deprotecting to provide, respectively, a compound of Formula 6(a) or 6(b):

![Chemical Structures]

in which SS is a solid support and then reacting the compound of Formula 6(a) or 6(b) with a compound of the formula R\(^6\)OH (e.g., benzoic acid, indole-5-carboxylic acid, methanesulfonic acid, or the like).

The reaction between the compound of Formula 5(a) or 5(b) and the resin is carried out in the presence of a suitable coupling agent (e.g., benzotriazole-1-yloxytrispyrrolidinophosphonium hexafluorophosphate (e.g., diisopropylcarbodiimide (DIC), PyBOP®, EDC, HBTU, DCC, or the like) and acylation catalyst (e.g., N,N-diisopropylethylamine, triethylamine, 4-dimethylaminopyridine, 1-hydroxybenzotriazole hydrate, or the like) in a suitable solvent (e.g., methylene chloride,
DMF, or the like) and requires approximately 3 to 20 hours to complete. Deprotection can be effected by any means which removes the protecting group and gives the desired product in reasonable yield. The reaction between the compound of Formula 6(a) or 6(b) is carried out with a suitable coupling agent and acylation catalyst. A detailed description of the preparation of a compound of the formula R$^1$-SS according to the above-described procedures is set forth in Examples 2(A-C) and 4(A-C), infra.

Compounds of the formula R$^1$OH can be prepared by treating a compound of formula R$^1$-SS with a suitable acid (e.g., trifluoroacetic acid, or the like) in a suitable solvent (e.g., methylene chloride, or the like). Alternatively, compounds of the formula R$^1$OH in which X$^1$ is -C(O)- and X$^2$ is -CHR$^9$- can be prepared by alkylating an organometallic compound of Formula 7(a) or 7(b):

\[
\begin{align*}
\text{7(a)} & \quad \text{7(b)} \\
\begin{array}{c}
\text{R}^6 \quad \text{Li} \\
\text{N}^5 \\
\text{R}^5 \\
\end{array} & \quad \begin{array}{c}
\text{R}^6 \\
\text{N}^5 \\
\text{R}^7 \\
\text{X}^4 \quad \text{X}^2 \\
\text{R}^5 \\
\end{array} \\
\text{O} & \quad \text{O} \\
\end{align*}
\]

with a compound of the formula R$^9$L, in which L is a leaving group and each X$^3$, X$^4$, R$^5$, R$^6$, R$^7$ and R$^9$ are as defined for Formula I in the Summary of the Invention, and then converting the resulting ethyl ester to the corresponding acid. The alkylation is carried out in a suitable solvent (e.g., THF) at -78°C to 0°C and requires 1 to 2 hours to complete. Conversion the acid can be effected by treating the ester with lithium hydroxide for approximately 15 hours. The organometallic compound is generated by treating a corresponding organo compound with an appropriate base (e.g., N,N-diisopropylethylamine, triethylamine, and the like) and n-butyllithium or tert-butyllithium at -80 to -70°C, preferably at about -78°C, for approximately 30 minutes to an hour. A detailed description of the preparation of a compound of the formula R$^1$OH according to the above-described procedures is set forth in Example 3, infra.

Examples:
REFERENCE 1

Lithium 2S-amino-3-cyclohexylpropionate

A solution of methyl 2S-amino-3-cyclohexylpropionate hydrochloride (8.03 mmol, 1 eq) in dichloromethane (80 mL) and saturated NaHCO₃ solution (80 mL) was cooled to 0°C and then the organic layer was treated with a solution of 1.93 M phosgene in toluene (8.3 mL, 2 eq). The mixture was stirred for 10 minutes and then the aqueous was separated and extracted with dichloromethane (3x 27 mL). The combined organic layers were dried over sodium sulfate, filtered and concentrated. A portion of the residue (767 μM, 1.0 eq) was stirred under nitrogen together with morpholine (767 μM, 1.0 eq) in dry THF (1 mL) for 12 hours. The mixture was concentrated in vacuo and the residue dissolved in ethyl acetate (1 mL). The solution was washed with water (3 x 1 mL), dried over sodium sulfate and concentrated. The residue was dissolved in methanol (2 mL) and water (37 μL) and the solution was treated with lithium hydroxide monohydrate (19 mg, 0.105 eq) and then stirred for 12 hours. The solution was adjusted to pH 11 with additional lithium hydroxide monohydrate, heated at 60°C for 4 hours and then the concentrated in vacuo to provide lithium 2S-morpholin-4-ylcarbonylamino-3-cyclohexylpropionate.

Proceeding as in Reference 1 provided the following compounds:

- **lithium 2S-piperidin-1-ylcarbonylamino-3-cyclohexylpropionate**;
- **lithium**
- **2S-(4-tert-butoxycarbonylpiperazin-1-ylcarbonylamino)-3-cyclohexylpropionate**;
- **lithium 2S-(4-benzylpiperazin-1-ylcarbonylamino)-3-cyclohexylpropionate**;
- **lithium 2S-(4-ethoxycarbonylpiperazin-1-ylcarbonylamino)-3-cyclohexylpropionate**;
- **lithium 2S-(4-fur-2-ylcarbonylpiperazin-1-ylcarbonylamino)-3-cyclohexylpropionate**;
REFERENCE 2

3-Cyclohexyl-2S-(3-methoxybenzylloxycarbonylamino)propionic acid

A mixture of 2S-amino-3-cyclohexylpropionic acid (2.95 mmol, 1.0 eq) and sodium hydroxide (5.9 mmol, 2 eq) in a 1:1 mixture of THF/water (14 mL) was treated with

3-methoxybenzylformyld chloride (2.95 mmol, 1.0 eq), stirred for 3 hours and then treated with N,N-diethyl ethylenediamine (2.95 mmol, 1.0 eq). The mixture was stirred for approximately 12 hours, adjusted to pH 2 with 1M hydrochloric acid solution (13 mL) and then extracted with ethyl acetate (2 x 9 mL). The extract was washed with 1M hydrochloric acid solution (6 mL), dried over sodium sulfate and concentrated to provide

3-cyclohexyl-2S-(3-methoxybenzylloxycarbonylamino)propionic acid as a yellow oil.

EXAMPLE 1

tert-Butyl 1S-cyanomethylcarbamoyl-2-phenylethylcarbamate

(Compound 1)

A mixture comprised of 2S-tert-butoxycarbonylamino-3-phenylpropionic acid (28.9 g, 0.109 mol), aminoacetonitrile hydrochloride (10.1 g, 0.109 mol), triethylamine (61 mL, 0.436 mol), DMF (40 mL) and acetonitrile (360 mL) was stirred at room temperature for 27 hours. The mixture was filtered, concentrated to a volume of 100 mL and poured into ice water (1000 mL). The mixture was stirred until a precipitate had formed. The precipitate was collected, washed with water and dried. The dry product was recrystallized from 55% ethanol/water (80 mL). The crystals were collected and recrystallized from 65%
ethanol/water (70 mL). The crystals were collected and dried to provide tert-butyl 1S-cyanomethylcarbamoyl-2-phenylethylcarbamate (20.3 g, 0.067 mol) as white needles; H NMR: δ 1.39 (s, 9H), δ 3.06 (d, 2H, J = 7 Hz), δ 4.08 (m, 2H), δ 4.34 (dd, 1H, J = 13, 7 Hz), δ 4.97 (d, 1H, J = 8 Hz), δ 6.59 (m, 1H), δ 7.23 (m, 5H); ES-MS m/z 304 (MH+).

Proceeding as in Example 1 provided the following compounds of Formula I:

benzyl 5S-tert-butoxycarbonylamo-5-cyanomethylcarbamoylpentylethylcarbamate (Compound 2); H NMR: δ 1.37 (m, 15 H), δ 1.63 (m, 1H), δ 1.78 (m, 1H), δ 3.14 (dd, 2H, J = 13, 6 Hz), δ 4.07 (m, 2H), δ 5.06 (s, 2H), δ 5.42 (br s, 1H), δ 7.32 (m, 5H), δ 7.48 (br s, 1H); ES-MS m/z 419 (MH+);
cyclohexyl 5S-tert-butoxycarbonylamo-5-cyanomethylsuccinamate (Compound 3); H NMR: δ 1.35 (m, 17 H), δ 1.72 (m, 1H), δ 1.83 (m, 1H), δ 2.66 (dd, 1H, J = 18, 7 Hz), δ 2.96 (dd, 1H, J = 18, 5 Hz), δ 4.15 (dd, 2H, J = 6, 2 Hz), δ 4.50 (m, 1H), δ 4.77 (m, 1H), δ 5.64 (br s, 1H), δ 7.11 (br s, 1H); ES-MS m/z 354 (MH+);
tert-butyl 1S-cyanomethylcarbamoyl-2-(1-formyl-1H-indol-3-yl)ethylcarbamate (Compound 4); H NMR: δ 1.44 (s, 9H), δ 3.23 (m, 2H), δ 4.08 (m, 2H), δ 4.46 (m, 1H), δ 4.95 (br s, 1H), δ 7.38 (m, 4H), δ 7.62 (br s, 1H); ES-MS m/z 371 (MH+);
tert-butyl 2-(3-benzyloxyethyl-3H-imidazol-4-yl)-1S-cyanomethylcarbamoylethylcarbamate (Compound 5); H NMR: δ 1.39 (s, 9H), δ 3.09 (d, 2H, J = 7 Hz), δ 4.00 (d, 2H, J = 6 Hz), δ 4.42 (m, 1H), δ 4.45 (s, 2H), δ 5.29 (m, 2H), δ 5.58 (br d, 1H, J = 8 Hz), δ 6.79 (s, 1H), δ 7.29 (m, 1H), δ 7.49 (s, 1H), δ 7.93 (br s); ES-MS m/z 414 (MH+);
tert-butyl 2-(4-benzyloxyphenyl)-1S-cyanomethylcarbamoylethylcarbamate (Compound 6); H NMR: δ 1.40 (s, 9H), δ 3.01 (t, 2H, J = 6 Hz), δ 4.07 (t, 2H, J = 6 Hz), δ 4.29 (m, 1H), δ 4.90 (br s, 1H), δ 5.02 (s, 2H), δ 6.40 (br s, 1H), δ 6.92 (d, 2H, J = 8 Hz), δ 7.09 (d, 2H, J = 8 Hz), δ 7.37 (m, 5H); ES-MS m/z 410 (MH+); and tert-butyl 1S-cyanomethylcarbamoyl-2-cyclohexylethylcarbamate (Compound 7); H NMR: δ 0.94 (m, 2H), δ 1.20 (m, 3H), δ 1.44 (m, 11H), δ 1.71 (m, 6H), δ 4.15 (m, 2H),
δ 4.30 (m, 1H), δ 4.87 (br s, 1H), δ 7.04 (br s); ES-MS m/z 210 (M-BuCO₂).

EXAMPLE 2

N-(2-benzylsulfanyl-1R-cyanomethylcarbamoyethyl)benzamide

(Compound 8)

A mixture comprised of 2R-benzyloamino-3-benzylsulfanylpropionic acid (0.508 g, 1.61 mmol), aminoacetonitrile hydrochloride (0.149 g, 1.61 mmol), PyBOP® (0.838 g, 1.61 mmol), N,N-diisopropylethylamine (0.84 mL, 4.83 mmol) and DMF (10 mL) was stirred at room temperature for 2.5 hours. The mixture was concentrated and the residue was taken up into dichloromethane. The dichloromethane mixture was washed with 1N hydrochloric acid, water and aqueous sodium bicarbonate, dried (MgSO₄), filtered and concentrated. Product was purified from the residue by silica gel chromatography using 5% methanol in dichloromethane to provide N-(2-benzylsulfanyl-1R-cyanomethylcarbamoyl)ethyl)benzamide (541 mg, 1.53 mmol) as an oil. MS: m/e 353.8 (theory 353.1); Proton NMR Spectrum (DMSO-d₆): δ 8.85 (t, 1H), δ 8.75 (d, 1H), δ 7.99 (d, 2H), 7.5 (m, 3H), δ 7.3 (m, 5H), δ 4.7 (m, 1H), δ 4.15 (d, 2H), δ 3.75 (s, 2H), δ 2.8 (m, 2H) ppm.

Proceeding as in Example 2 provided the following compounds of Formula I:

N-[1R-cyanomethylcarbamoyl-2-(4-methylbenzylthioethyl)]benzamide
(Compound 9); MS: m/e 367.9 (theory 367.1); NMR Spectrum (DMSO-d$_6$): δ 8.82 (t, 1H), δ 8.69 (d, 1H), δ 7.88 (d, 2H), δ 7.5 (m, 3H), δ 7.16 (d, 2H), δ 7.08 (d, 2H), δ 4.7 (m, 1H), δ 4.2 (d, 2H), δ 3.7 (s, 2H), δ 2.75 (m, 2H), δ 2.1 (s, 3H) ppm;

_N-[1R-cyanomethylcarbamoyl]-2-(4-methoxybenzylthioethyl)benzamide_

(Compound 10); MS: m/e 383.9 (theory 383.1); NMR Spectrum (DMSO-d$_6$): δ 8.8 (t, 1H) δ 8.65 (d, 1H) δ 7.9 (d, 2H), δ 7.5 (m, 3H), δ 7.25 (d, 2H), δ 6.8 (d, 2H), δ 4.7 (m, 1H) δ 4.2 (d, 2H), δ 3.7 (s, 3H), δ 3.3 (s, 2H), δ 2.8 (m, 2H) ppm;

_N-[2-benzylxoy-1S-cyanomethylcarbamoylethyl]benzamide_ (Compound 11); MS: m/e 337.8 (theory 337.1); NMR Spectrum (DMSO-d$_6$): δ 8.82 (t, 1H) δ 8.67 (d, J = 7.8 Hz, 1H) δ 7.91 (d, J = 7 Hz, 2H), δ 7.5 (m, 3H), δ 7.3 (m, 5H), δ 4.8 (m, 1H) δ 4.54 (s, 2H), δ 4.17 (d, 2H), δ 3.7 (m, 2H) ppm;

_benzyl 1-cyanomethylcarbamoyl-3-methylthiopropylcarbamate_ (Compound 12); MS: m/e 321.8 (theory 321.1); NMR Spectrum (DMSO-d$_6$): δ 8.7 (t, 1H) δ 7.6 (d, 1H) δ 7.3 (m, 5H), δ 5.0 (q, 2H), δ 4.1 (m, 3H), δ 3.3 (d, 2H), δ 2.4 (m, 2H), δ 1.9 (s, 3H) ppm;

_N-[1S-cyanomethylcarbamoyl]-3-methylthiopropylbenzamide_ (Compound 13); MS: m/e 291.7 (theory 291.1); NMR Spectrum (DMSO-d$_6$): δ 8.7 (t, J = 5.6 Hz, 1H), δ 8.6 (d, J = 7.7 Hz, 1H), δ 7.9 (m, 2H), δ 7.5 (m, 3H), δ 4.5 (m, 1H), δ 4.11 (d, J = 5.6 Hz, 2H), δ 2.5 (m, 2H), δ 2.03 (s, 3H), δ 2.0 (m, 2H) ppm;

_benzyl 2-benzylthio-1R-cyanomethylcarbamoylethylcarbamate_ (Compound 14); MS: m/e 383.8 (theory 383.1); NMR Spectrum (DMSO-d$_6$): δ 8.8 (t, 1H), δ 7.8 (d, 1H), δ 7.4 (m, 10H), δ 5.1 (q, 2H), δ 4.1 (m, 1H), δ 4.2 (s, 2H), δ 3.8 (s, 2H), δ 2.8 (m, 1H), δ 2.6 (m, 1H) ppm;

_methyl 4-benzoxy carbonylamino-4S-cyanomethylcarbamoylbutyrate_ (Compound 15); MS: m/e 333.6 (theory 333.1); NMR Spectrum (DMSO-d$_6$): δ 8.7 (t, 1H), δ 7.7 (d, 1H), δ 7.4 (m, 5H), δ 5.0 (q, 2H), δ 4.0 (m, 1H), δ 3.55 (s, 3H), δ 3.3 (d, 2H), δ 2.3 (t, 2H), δ 1.8 (m, 2H) ppm;

_tert-butyl 2-benzoxy-1S-cyanomethylcarbamoylethylcarbamate_ (Compound 16); MS: m/e + Na 355.7 (theory 355.1); NMR Spectrum (DMSO-d$_6$): δ 8.7 (t, 1H), δ 7.0 (d, 1H), δ 7.3 (m, 5H), δ 4.45 (s, 2H), δ 4.2 (m, 1H), δ 4.1 (d, 2H), δ 3.55 (m, 2H), δ 1.4 (s, -60-
9H) ppm;

benzyl 2-benzyloxy-1S-cyanomethylcarbamoylthethylcarbamate (Compound 17);
NMR Spectrum (DMSO-d$_6$): δ 8.8 (t, 1H), δ 7.7 (d, 1H), δ 7.4 (m, 10H), δ 5.0 (q, 2H),
δ 4.5 (s, 2H), δ 4.3 (m, 1H), δ 4.1 (s, 2H), δ 3.6 (m, 2H) ppm;

$\text{N-}(1\text{-cyanomethylcarbamoylpent-3-ynyl})\text{benzamide}$ (Compound 18); MS: m/e 269.7
(theory 269.1); NMR Spectrum (DMSO-d$_6$): δ 8.8 (t, 1H), δ 8.65 (d, 1H), δ 7.9 (d, 2H),
δ 7.5 (m, 3H), δ 4.5 (m, 1H), δ 4.1 (d, 2H), δ 2.5 (m, 2H), δ 1.7 (s, 3H) ppm;

$\text{N-}(1\text{S-cyanomethylcarbamoyl-2-naphthalen-1-ylethyl})\text{benzamide}$ (Compound 19);
1H NMR: δ 3.45 (dd, 1H, J = 14, 9 Hz), δ 3.73 (dd, 1H, J = 17, 6 Hz), δ 3.90 (dd, 1H,
J = 19, 6 Hz), δ 4.04 (dd, 1H, J = 14, 6 Hz), δ 4.98 (m, 1H), δ 6.67 (m, 1H), δ 6.93 (m,
1H), δ 7.46 (m, 9H), δ 7.74 (m, 2H), δ 8.23 (d, 1H, J = 8 Hz); ES-MS m/z 358 (MH+);

$\text{N-}[2\text{-}(4\text{-chlorophenyl})\text{-1S-cyanomethylcarbamoylethyl}]\text{benzamide}$ (Compound 20);
1H NMR: δ 3.19 (m, 2H), δ 3.96 (dd, 1H, J = 19, 4 Hz), δ 4.10 (dd, 1H, J = 20, 6 Hz),
δ 4.98 (m, 1H), δ 6.79 (d, 1H, J = 7 Hz), δ 7.07 (m, 2H), δ 7.22 (m, 2H), δ 7.43 (m, 4H),
δ 7.69 (m, 1H), δ 8.08 (d, 1H, J = 8 Hz); ES-MS m/z 342 (MH+);

$\text{N-}(1\text{S-cyanomethylcarbamoyl-2-naphthalen-2-ylethyl})\text{benzamide}$ (Compound 21);
1H NMR: δ 3.29 (d, 2H, J = 7 Hz), δ 3.81 (dd, 2H, J = 18, 6 Hz), δ 3.98 (dd, 1H, J = 18, 6
Hz), δ 5.09 (dd, 1H, J = 15, 7 Hz), δ 6.74 (br d, 1H, J = 7 Hz), δ 7.37 (m, 6H), δ 7.68 (m,
6H); ES-MS m/z 358 (MH+);

$\text{N-}[1\text{-cyanomethylcarbamoyl-2-(4-cyanophenyl)ethyl}]\text{benzamide}$ (Compound 22); 1H
NMR: δ 3.18 (dd, 1H, J = 14, 7 Hz), δ 3.30 (dd, 1H, J = 15, 7 Hz), δ 4.03 (dd, 1H, J = 17,
6 Hz), δ 4.15 (dd, 1H, J = 19, 6 Hz), δ 4.93 (dd, 1H, J = 15, 8 Hz), δ 6.81 (d, 1H, J = 10
Hz), δ 7.30 (m, 2H), δ 7.43 (m, 3H), δ 7.55 (m, 2H), δ 7.67 (d, 2H, J = 8 Hz); ES-MS m/z
333 (MH+);

$\text{N-[1S-cyanomethylcarbamoyl-2-[4-(2\text{-dichlorobenzyloxy})phenyl]ethyl}]\text{benzamide}$
(Compound 23); 1H NMR: δ 3.15 (m, 2H), δ 4.08 (t, 2H, J = 6 Hz), δ 4.84 (dd, 1H, J = 16,
7 Hz), δ 5.24 (m, 3H), δ 6.87 (d, 1H, J = 8 Hz), δ 6.98 (m, 4H), δ 7.18 (d, 2H, J = 9 Hz),
δ 7.32 (m, 4H), δ 7.78 (d, 2H, J = 8 Hz); ES-MS m/z 482 (MH+);
cyclohexyl 4-benzoylamino-4S-cyanomethylcarbamoylbutyrate (Compound 24); 1H

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NMR: δ 1.37 (m, 5H), δ 1.53 (m, 2H), δ 1.68 (m, 2H), δ 1.83 (m, 1H), δ 2.17 (m, 2H), δ 2.42 (m, 1H), δ 2.66 (m, 1H), δ 4.15 (m, 2H), δ 4.68 (m, 2H), δ 7.47 (m, 3H), δ 7.79 (m, 2H); ES-MS m/z 372 (MH+);

\[ \text{N-[2-(4-benzoylphenyl)-1S-cyanomethylcarbamoyl-ethyl]benzamide (Compound 25)} \]

\[ \text{^1H NMR: δ 3.27 (m, 2H), δ 4.00 (dd, 1H, J = 15, 6 Hz), δ 4.13 (m, 1H, J = 17, 6 Hz), δ 4.23 (d, 1H, J = 6 Hz), δ 4.97 (dd, 1H, J = 15, 8 Hz), δ 6.96 (d, 1H, J = 9 Hz), δ 7.46 (m, 9H), δ 7.71 (m, 5H); ES-MS m/z 412 (MH+)} \]

\[ \text{N-(1S-cyanomethylcarbamoyl-2-phenylethyl)benzamide (Compound 26); ^1H NMR: δ 3.15 (dd, 1H, J = 12, 6 Hz), δ 3.25 (dd, 1H, J = 15, 6 Hz), δ 4.08 (t, 2H, J = 6 Hz), δ 4.84 (dd, 1H, J = 15, 6 Hz), δ 6.68 (br s, 1H), δ 6.77 (br s, 1H), δ 7.29 (m, 5H), δ 7.41 (m, 2H), δ 7.53 (m, 1H), δ 7.67 (d, 2H, J = 9 Hz); ES-MS m/z 308 (MH+)} \]

\[ \text{N-[1S-cyanomethylcarbamoyl-2-(1H-indol-3-yl)ethyl]benzamide (Compound 27); ^1H NMR: δ 3.25 (dd, 1H, J = 16, 8 Hz), δ 3.52 (dd, 1H, J = 16, 6 Hz), δ 3.95 (dd, 1H, J = 18, 4 Hz), δ 4.07 (dd, 1H, J = 18, 6 Hz), δ 4.93 (m, 1H), δ 6.44 (br s, 1H), δ 6.85 (d, 1H, J = 5 Hz), δ 7.22 (m, 3H), δ 7.38 (m, 3H), δ 7.50 (m, 1H), δ 7.67 (m, 2H, J = 8 Hz), δ 7.74 (d, 1H, J = 8 Hz), δ 8.18 (br s, 1H); ES-MS m/z 347 (MH+)} \]

\[ \text{N-[1S-cyanomethylcarbamoyl-2-(4-fluorophenylethyl)benzamide (Compound 28); ^1H NMR: δ 3.15 (m, 2H), δ 3.97 (dd, 1H, J = 18, 6 Hz), δ 4.11 (dd, 1H, J = 18, 6 Hz), δ 4.90 (dd, 1H, J = 15, 8 Hz), δ 6.95 (m, 3H), δ 7.20 (m, 2H), δ 7.46 (m, 3H), δ 7.68 d, 2H, J = 8 Hz); ES-MS m/z 326 (MH+)} \]

\[ \text{N-[2-(2-chlorophenyl)-1S-cyanomethylcarbamoyl-ethyl]benzamide (Compound 29); ^1H NMR: δ 3.34 (m, 2H), δ 4.04 (dd, 1H, J = 16, 6 Hz), δ 4.17 (dd, 1H, J = 16, 6 Hz), δ 4.93 (dd, 1H, J = 16, 6 Hz), δ 6.85 (m, 1H), δ 7.24 (m, 4H), δ 7.44 (m, 3H), δ 7.72 (m, 2H); ES-MS m/z 342 (MH+)} \]

\[ \text{N-[1S-cyanomethylcarbamoyl-2-(4-methoxyphenylethyl)benzamide (Compound 30); ^1H NMR: δ 3.13 (m, 2H), δ 3.76 (m, 4H), δ 4.06 (dd, 1H, J = 11, 6 Hz), δ 4.80 (m, 1H), δ 6.83 (m, 4H), δ 7.16 (d, 1H, J = 9 Hz), δ 7.46 (m, 2H), δ 7.66 (m, 2H); ES-MS m/z 338 (MH+)} \]

\[ \text{N-[2-(4-benzyl-oxyphenyl)-1-cyanomethylcarbamoyl-ethyl]benzamide} \]
(Compound 31); \( ^1H \text{NMR: } \delta 3.07 (m, 2H), \delta 3.90 (m, 1H), \delta 4.02 (m, 1H), \delta 4.94 (s, 2H), \delta 4.95 (m, 1H), \delta 6.70 (m, 1H), \delta 6.85 (m, 2H), \delta 7.09 (m, 2H), \delta 7.38 (m, 7H), \delta 7.72 (m, 3H); ES-MS m/z 414 (MH\(+\));

benzyl \( N-(1\text{-cyanomethylcarbamoyl-2-cyclohexylethyl}) \text{isophthalamate} \)

(Compound 32); \( ^1H \text{NMR: } \delta 0.86 (m, 2H), \delta 1.09 (m, 2H), \delta 1.39 (m, 5H), \delta 1.67 (m, 4H), \delta 3.04 (m, 1H), \delta 3.63 (m, 1H), \delta 4.11 (m, 1H), \delta 4.60 (m, 1H), \delta 4.77 (m, 1H), \delta 5.33 (s, 2H), \delta 7.38 (m, 5H), \delta 8.01 (d, 1H, J = 9 Hz), \delta 8.14 (m, 2H), \delta 8.45 (d, 1H, J = 12 Hz); ES-MS m/z 448 (MH\(+\));

benzyl \( N-(1\text{-cyanomethylcarbamoyl-2-cyclohexylethyl}) \text{terephthalamate} \)

(Compound 33); \( ^1H \text{NMR: } \delta 0.89 (m, 2H), \delta 1.13 (m, 3H), \delta 1.38 (m, 4H), \delta 1.66 (m, 4H), \delta 3.10 (m, 1H), \delta 3.64 (m, 1H), \delta 4.10 (m, 1H), \delta 4.80 (dd, 1H, J = 15, 8 Hz), \delta 5.34 (d, 2H, J = 2 Hz), \delta 7.37 (m, 5H), \delta 7.84 (d, 2H, J = 7 Hz), \delta 8.03 (m, 2H); ES-MS m/z 448 (MH\(+\));

\( N-(1\text{-cyanomethylcarbamoyl-2-(2-fluorophenyl)} \text{ethyl}) \text{benzamide} \) (Compound 34); \( ^1H \text{NMR: } \delta 3.23 (m, 2H), \delta 4.06 (dd, 1H, J = 18, 6 Hz), \delta 4.15 (dd, 1H, J = 18, 6 Hz), \delta 4.91 (dd, 1H, J = 15, 8 Hz), \delta 7.01 (m, 2H), \delta 7.23 (m, 1H), \delta 7.41 (m, 2H), \delta 7.52 (m, 2H), \delta 7.68 (d, 2H, J = 8 Hz); ES-MS m/z 326 (MH\(+\));

\( N-(2\text{-benzylicthio-1R-cyanomethylcarbamoylethyl}) \text{-2-(3,5-dimethoxyphenyl)thiazole-4-carboxamide} \) (Compound 35); MS: Calcd. 496; Found M + 1 = 497;

\( N-(1\text{-cyanomethylcarbamoyl}-2\text{-cyclohexylethyl}) \text{-2-(3,5-dimethoxyphenyl)thiazole-4-carboxamide} \) (Compound 36); MS: Calcd. 456; Found M + 1 = 457;

\( N-(1\text{-cyanomethylcarbamoylpent-3-eny}) \text{benzamide} \) (Compound 37); MS: m/e 271.8 (theory 271.1); NMR Spectrum (DMSO-d<sub>6</sub>): \( \delta 8.7 (t, 1H), \delta 8.657 (d, 1H), \delta 7.9 (d, 2H), \delta 7.5 (m, 3H), \delta 5.4 (m, 2H), \delta 4.5 (m, 1H), \delta 4.1 (d, 2H), \delta 2.5 (m, 2H), \delta 2.6 (d, 3H)

4-\text{tert-butyl-}N-(1\text{-cyanomethylcarbamoyl-2-cyclohexylethyl}) \text{benzamide}

(Compound 38); \( ^1H \text{NMR (CDCl}_3\text{): } \delta 8.02 (br s, 1H), \delta 7.73 (d, 2H, J = 8.7 Hz), \delta 7.43 (d, 2H, J = 8.5 Hz), \delta 7.05 (br d, 1H, J = 8.5 Hz), \delta 4.79 (dd, 1H, J = 15.1, 8.7 Hz), \delta 4.10 (dd, 2H, J = 19.9 Hz, 5.6 Hz), \delta 1.51 - 1.82 (m, 5H), \delta 1.30 (s, 9H), \delta 0.83 - 1.72 (m, 8H);
EI MS (M* = 369.9);  

\textit{N}-(1S-cyanomethylcarbamoyl-2-cyclohexylethyl)pyrimidine-5-carboxamide  
(Compound 39); \textit{\textsuperscript{1}}H NMR (CDCl\textsubscript{3}); \(\delta\) 9.33 (s, 1H), \(\delta\) 8.77 (s, 1H), \(\delta\) 8.56 (s, 1H), \(\delta\) 8.14 (br d, 1H, J = 8.7 Hz), \(\delta\) 7.30 (br s, 1H), \(\delta\) 4.69 (dd, 1H, J = 14.9, 9.2 Hz), \(\delta\) 4.15 (t, 2H, J = 3.9 Hz), \(\delta\) 0.76-2.30 (m, 13H); EI MS (M* = 315.9);  

\textit{N}-(1-cyanomethylcarbamoyl-2-cyclohexylethyl)naphthalene-1-carboxamide  
(Compound 40); \textit{\textsuperscript{1}}H NMR (CDCl\textsubscript{3}); \(\delta\) 8.19 (br d, 1H, J = 10.0 Hz), \(\delta\) 7.81 - 7.96 (m, 3H), \(\delta\) 7.47 - 7.62 (m, 3H), \(\delta\) 7.35 - 7.44 (m, 1H), \(\delta\) 6.69 (d, 1H, J = 8.7 Hz), \(\delta\) 4.90 (dd, 1H, J = 15.4, 9.0), \(\delta\) 4.03 (d, 2H, J = 4.9 Hz), \(\delta\) 0.79 - 1.89 (m, 13H); EI MS (M+ = 364.0);  

\textit{N}-(1S-cyanomethylcarbamoyl-2-cyclohexylethyl)-4-fluorobenzamide  
(Compound 41); \textit{\textsuperscript{1}}H NMR (CDCl\textsubscript{3}); \(\delta\) 7.70 - 7.83 (m, 2H), \(\delta\) 7.43 (br s, 1H), \(\delta\) 7.11 (t, 2H, J = 8.5 Hz), \(\delta\) 6.66 (br d, 1H, J = 8.4 Hz), \(\delta\) 4.69 (dd, 1H, J = 15.5, 9.4 Hz), \(\delta\) 4.14 (dd, 2H, J = 19.6, 8.4 Hz), \(\delta\) 0.67 - 1.88 (m, 13H); EI MS (M* = 331.6);  

\textit{N}-(1S-cyanomethylcarbamoyl-2-cyclohexylethyl)-4-hydroxybenzamide  
(Compound 42); \textit{\textsuperscript{1}}H NMR (CDCl\textsubscript{3}); \(\delta\) 7.64 (d, 2H, J = 9.0 Hz), \(\delta\) 7.39 (br s, 1H), \(\delta\) 6.83 (d, 2H, J = 9.5 Hz), \(\delta\) 6.43 (br d, 1H, J = 11.2 Hz), \(\delta\) 4.64 (dd, 1H, J = 16.8, 5.6 Hz), \(\delta\) 4.14 - 4.09 (m, 2H), \(\delta\) 0.81 - 1.89 (m, 13H); EI MS (M+ = 329.8);  

\textit{N}-(1S-cyanomethylcarbamoyl-2-cyclohexylethyl)napthalene-2-carboxamide  
(Compound 43); \textit{\textsuperscript{1}}H NMR (CDCl\textsubscript{3}); \(\delta\) 8.29 (s, 1H), \(\delta\) 7.76 - 7.94 (m, 5H), \(\delta\) 7.51 - 7.61 (m, 2H), \(\delta\) 6.57 (br d, 1H, J = 19.6 Hz), \(\delta\) 4.73 (dd, 1H, J = 19.6, 11.2 Hz), \(\delta\) 4.17 (dd, 2H, J = 13.3, 8.4 Hz), \(\delta\) 0.80 - 2.03 (m, 13H); EI MS (M+ = 363.9);  

\textit{N}-(1S-cyanomethylcarbamoyl-2-cyclohexylethyl)-4-trifluoromethylbenzamide  
(Compound 44); \textit{\textsuperscript{1}}H NMR (CDCl\textsubscript{3}); \(\delta\) 7.86 - 7.91 (m, 2H), \(\delta\) 7.70 - 7.75 (m, 2H), \(\delta\) 6.85 (br s, 1H), \(\delta\) 6.48 (br d, 1H, J = 8.4 Hz), \(\delta\) 4.65 (dd, 1H, J = 19.6, 11.2 Hz), \(\delta\) 4.09 - 4.20 (m, 2H), \(\delta\) 0.86 - 1.74 (m, 13H); EI MS (M+ = 381.9);  

\textit{N}-(1S-cyanomethylcarbamoyl-2-cyclohexylethyl)-4-methoxybenzamide  
(Compound 45); \textit{\textsuperscript{1}}H NMR (CDCl\textsubscript{3}); \(\delta\) 7.70 - 7.73 (m, 3H), \(\delta\) 6.94 (d, 2H, J = 8.5 Hz), \(\delta\) 6.29 (br s, 1H), \(\delta\) 4.57 - 4.69 (m, 1H), \(\delta\) 4.08 - 4.17 (m, 2H), \(\delta\) 3.85 (s, 3H), \(\delta\) 0.78 - 1.73 (m, 13H); EI MS (M+ = 343.9);
**N-cyanomethyl-3-cyclohexyl-2S-methylsulfonylaminopropionamide** (Compound 46);  
^1^H NMR (CDCl$_3$): δ 7.05 (br s, 1H), δ 5.29 (br d, 1H, J = 8.7 Hz), δ 4.12 - 4.20 (m, 1H), δ 3.44 (d, 2H, J = 9.7 Hz), δ 3.01 (s, 3H), δ 0.81 - 1.92 (m, 13H);  

**N-(1S-cyanomethylcarbamoyl-2-cyclohexylethyl)acetamide** (Compound 47); ^1^H NMR (CDCl$_3$): δ 7.51 (br s, 1H), δ 6.15 (br d, 1H, J = 8.0 Hz), δ 4.49 (dd, 1H, J = 17.8, 11.4 Hz), δ 4.11 (t, 2H, J = 18.6 Hz), δ 2.02 (s, 3H), δ 0.72 - 1.80 (m, 13H); EI MS (M+ = 251.6);  

**N-(1-cyanomethylcarbamoyl-2-cyclohexylethyl)-3-fluorobenzamide** (Compound 48);  
^1^H NMR (CDCl$_3$): δ 7.19 - 7.55 (m, 5 H), δ 6.72 (br s, 1 H, J = 8.7 Hz), δ 4.69 (dd, 1 H, J = 10.8, 3.8 Hz), δ 4.14 (dd, 2 H, J = 2.8, 15.7 Hz), δ 0.86 - 1.86 (m, 13 H); EI MS (M+ = 331.9);  

**4-chloro-N-(1-cyanomethylcarbamoyl-2-cyclohexylethyl)benzamide** (Compound 49); ^1^H NMR (CDCl$_3$): δ 8.78 (br s, 1H), δ 8.58 (br d, 1H, J = 8.0 Hz), δ 7.85 (d, 2H, J = 9.0Hz), δ 7.48 (d, 2H, J = 9.2 Hz), δ 4.64 (dd, 1H, J = 7.4, 14.1 Hz), δ 4.16 (dd, 2H, J = 3.1, 6.1 Hz), δ 0.87 - 1.85 (m, 13 H); EI MS (M+ = 347.9);  

**N-(1-cyanomethylcarbamoyl-2-cyclohexylethyl)-2-trifluoromethylbenzamide** (Compound 50); ^1^H NMR (CDCl$_3$): δ 7.42 - 7.78 (m, 5 H), δ 6.56 (br d, 1 H, J = 9.0 Hz), δ 4.81 (dd, 1 H, J = 15.4, 9.2 Hz), δ 4.10 (t, 2 H, J = 5.7 Hz), δ 0.80 - 1.79 (m, 13 H); EI MS (M+ = 382.0);  

**N-(1-cyanomethylcarbamoyl-2-cyclohexylethyl)-2-fluorobenzamide** (Compound 51);  
^1^H NMR (CDCl$_3$): δ 8.00 (t, 1 H, J = 8.4 Hz), δ 7.64 (br s, 1H), δ 7.50 (dd, 1H, J = 8.1, 2.5 Hz), δ 7.24 - 7.30 (m, 1 H), δ 7.07 - 7.18 (m, 2 H), δ 4.76 (dd, 1H, J = 17.2, 8.2 Hz), δ 4.16 (dd, 2H, J = 18.0, 6.2 Hz), δ 0.81 - 1.89 (m, 13 H); EI MS (M+ = 331.9);  

**N-(1-cyanomethylcarbamoyl-2-cyclohexylethyl)-4-trifluoromethoxybenzamide** (Compound 52); ^1^H NMR (CDCl$_3$): δ 7.01 - 8.02 (m, 6 H), δ 4.75 (br d, 1H, J = 14.6 Hz), δ 4.14 (dd, 2H, J = 6.0, 18.2 Hz), δ 0.78 - 1.90 (m, 13 H); EI MS (M+ = 398.0);  

**N-(1-cyanomethylcarbamoyl-2-cyclohexylethyl)-2,6-difluorobenzamide** (Compound 53); ^1^H NMR (CDCl$_3$): δ 7.66 (br s, 1H), δ 7.39 (t, 1H, J = 8.7 Hz), δ 6.95 (t, 2 H, J = 8.7 Hz), δ 6.74 (br d, 1 H, J = 8.5 Hz), δ 4.85 (dd, 1H, J = 14.9, 9.2 Hz),
δ 0.86 - 1.87 (m, 13 H); EI MS (M+ = 349.9);

N-(1-cyanomethylcarbamoyl-2-cyclohexyl ethyl)-2,3-difluorobenzamide

(Compound 54); 1H NMR (CDCl₃): δ 8.04 (dd, 1H, J = 15.3, 8.7 Hz), δ 7.55 (br s, 1H),
δ 6.84 - 7.07 (m, 3H), δ 4.74 (dd, 1H, J = 16.6, 7.9 Hz), δ 4.16 (dd, 2H, J = 18.0, 5.9 Hz),
δ 0.82 - 1.89 (m, 13H); EI MS (M+ = 349.9);

N-(1-cyanomethylcarbamoyl-2-cyclohexyl ethyl)-2,5-difluorobenzamide

(Compound 55); 1H NMR (CDCl₃): δ 7.69 (m, 1H), δ 7.37 (br s, 1H), δ 7.08 - 7.27 (m, 3H), δ 4.71 (dd, 1H, J = 15.1, 6.1 Hz), δ 4.16 (dd, 2H, J = 18.0, 6.2 Hz), δ 0.84 - 1.90 (m, 13 H); EI MS (M+ = 350.1);

N-(1-cyanomethylcarbamoyl-2-cyclohexyl ethyl)-2,4-difluorobenzamide

(Compound 56); 1H NMR (CDCl₃): δ 7.80 (br s, 1H), δ 7.65 (t, 1H), δ 7.14 - 7.36 (m, 3H), δ 4.79 (dd, 1H, J = 14.9, 7.2 Hz), δ 4.15 (dd, 2H, J = 18.2, 5.9 Hz), δ 0.80 - 1.81 (m, 13 H); EI MS (M+ = 349.9);

N-(1-cyanomethylcarbamoyl-2-cyclohexyl ethyl)-3,4-dimethoxybenzamide

(Compound 57); 1H NMR (CDCl₃): δ 7.66 (br s, 1H), δ 7.28 - 7.41 (m, 2 H), δ 6.86 (d, 1H, J = 8.4 Hz), δ 6.73 (br d, 1H, J = 7.9 Hz), δ 4.71 (dd, 1H, J = 14.1, 8.4 Hz), δ 4.14 (dd, 2H, J = 17.3, 5.9 Hz), δ 3.91 (s, 6 H), δ 0.81 - 1.88 (m, 13 H); EI MS (M+ = 374);

N-(1-cyanomethylcarbamoyl-2-cyclohexyl ethyl)-3,5-dimethoxybenzamide

(Compound 58); 1H NMR (CDCl₃): δ 7.41 (br s, 1H), δ 6.88 (d, 2H, J = 2.4 Hz), δ 6.59 (t, 2H, J = 2.2 Hz), δ 4.67 (dd, 1H, J = 16.8, 3.0 Hz), δ 4.12 (dd, 2 H, J = 17.3, 5.7 Hz), δ 3.81 (s, 6H), δ 0.82 - 1.88 (m, 13H); EI MS (M+ = 374);

N-(1-cyanomethylcarbamoyl-2-thiazol-5-yethyl)benzamide (Compound 59); 1H NMR (CDCl₃): δ 8.30 (d, 2H, J = 8.7 Hz), δ 7.72 (br s, 1H), δ 7.38 - 7.67 (m, 4H), δ 7.13 (t, 2H, J = 8.0 Hz), δ 4.96 (dd, 1H, J = 12.3, 5.9 Hz), δ 4.02 (t, 2H, J = 10.5 Hz), δ 3.48 (dd, 2H, J = 15.7, 5.4 Hz);

N-(1-cyanomethylcarbamoyl-2-thien-2-yethyl)benzamide (Compound 60); 1H NMR (CDCl₃): δ 7.71 (d, 2H, J = 8.5 Hz), δ 7.39 - 7.55 (m, 4H), δ 7.14 (d, 1H, J = 11.2 Hz), δ 6.85 - 6.96 (m, 3H), δ 4.94 (dd, 1H, J = 14.6, 6.9 Hz), δ 4.09 (m, 2H), δ 3.41 (t, 2H, J = 6.2 Hz); EI MS (M+ = 313.8);
\[ N-(1S\text{-cyanomethylcarbamoyl}-2\text{-cyclohexylethyl})benzamide \] (Compound 61); Proton NMR (300 MHz, CDCl3): \( \delta \) 7.79 (d, J = 7 Hz, 2H), \( \delta \) 7.67 (bt, 1H), \( \delta \) 7.44 (m, 3H), \( \delta \) 6.75 (bd, 1H), \( \delta \) 4.74 (m, 1H), \( \delta \) 4.10 (m, 2H), \( \delta \) 1.50 - 1.88 (m, 8H), \( \delta \) 0.83 - 1.44 (m, 5H). MS (electrospray): \( m/\text{z} \) 313.9 (100%); and

\[ N\text{-cyanomethyl}-3\text{-cyclohexyl}-2S\text{-trifluoromethylsulfonylaminopropionamide} \]
(Compound 62).

**EXAMPLE 3**

*tert*-Butyl 5-amino-1S-cyanomethylcarbamoylpentylcarbamate

(Compound 63)

![Chemical Structure](image)

A solution comprised of benzyl 5S-tert-butoxycarbonylamino-5-cyanomethylcarbamoylpentylcarbamate (77 mg, 184 mmol), prepared as in Example 1, in ethanol (2 mL) was treated with ammonium formate (116 mg, 1.84 mmol) and 10% wt palladium on carbon (77 mg). The mixture was stirred for 15 hours and then filtered through Celite. The filter cake washed with ethanol and the combined filtrates were concentrated on a rotary evaporator to provide *tert*-butyl 5-amino-1S-cyanomethylcarbamoylpentylcarbamate (61 mg, 184 mmol) as a white solid. \(^1\text{H} \) NMR (DMSO-\( d_6 \)): \( \delta \) 1.42 (m, 17 H), \( \delta \) 2.63 (m, 2H), \( \delta \) 3.09 (m, 2H); ES-MS m/z 323 (MK+).
EXAMPLE 4

\[ N-(1S-Cyanomethylcarbamoyl-2-cyclohexylethyl)-isophthalamic acid \]

(Compound 64)

\[
\begin{align*}
\text{HO} & \text{O} \\
& \text{O} \\
\text{N} & \text{NH} \\
\text{N} & \text{N} \\
\end{align*}
\]

A solution comprised of benzyl \(N-(1S\text{-cyanomethylcarbamoyl}-2\text{-cyclohexylethyl})\text{-isophthalamate} \) (82.4 mg, 184 \( \mu \)mol, 1.0 eq), prepared as in Example 2, in ethanol (2 mL) was treated with ammonium formate (116 mg, 1.84 mmol, 10.0 eq) and 10\% wt palladium on carbon (82.4 mg). The mixture was stirred for 15 hours and filtered through Celite. The filter cake was washed with ethanol and the combined filtrates were concentrated on a rotary evaporator to provide \(N-(1S\text{-cyanomethylcarbamoyl}-2\text{-cyclohexylethyl})\text{-terephthalamic acid} \) (61 mg, 170.7 \( \mu \)mol) as a white solid. \(^1\)H NMR

\(\text{MeOH-d}_4\): \(\delta\) 0.96 (m, 2H), \(\delta\) 1.26 (m, 2H), \(\delta\) 1.38 (m, 4H), \(\delta\) 1.76 (m, 5H), \(\delta\) 3.23 (d, 1H, \(J = 8\) Hz), \(\delta\) 3.72 (t, 1H, \(J = 7\) Hz), \(\delta\) 4.50 (m, 1H), \(\delta\) 7.50 (m, 1H), \(\delta\) 7.97 (m, 1H), \(\delta\) 8.13 (m, 1H), \(\delta\) 8.46 (m, 1H); ES-MS m/z 359 (MD+).

Proceeding as in Example 4 provided the following compounds of Formula I:

\(N-(1\text{-cyanomethylcarbamoyl}-2\text{-cyclohexylethyl})\text{-terephthalamic acid} \) (Compound 65); \(^1\)H NMR \(\text{MeOH-d}_4\): \(\delta\) 0.96 (m, 2H), \(\delta\) 1.32 (m, 5H), \(\delta\) 1.81 (m, 6H), \(\delta\) 3.12 (m, 2H), \(\delta\) 4.92 (m, 1H), \(\delta\) 7.87 (m, 2H), \(\delta\) 8.02 (m, 2H); ES-MS m/z 359 (MD+);

\(N-(1\text{-cyanomethylcarbamoyl}-2\text{(2.6-dichlorophenyl)ethyl}benzamide} \) (Compound 66); \(^1\)H NMR: \(\delta\) 3.45 (m, 1H), \(\delta\) 3.56 (m, 1H), \(\delta\) 4.13 (m, 2H), \(\delta\) 5.03 (m, 1H), \(\delta\) 7.30 (m, 5H), \(\delta\) 7.63 (m, 3H); ES-MS m/z 376 (MH+); and

\(N-(1\text{-cyanomethylcarbamoyl}-2\text{-cyclohexylethyl})\text{phthalamic acid} \) (Compound 67); \(^1\)H

-68-
NMR (MeOH-d₄): δ 0.94 (d, 2H, J = 7 Hz), δ 0.97 (d, 2H, J = 7 Hz), δ 1.28 (d, 2H, J = 7 Hz), δ 1.47 (m, 1H), δ 1.73 (m, 6H), δ 3.09 (t, 1H; J = 6 Hz), δ 3.29 (m, 1H), δ 4.45 (dd, 1H, J = 11, 5 Hz), δ 7.36 (m, 1H), δ 7.58 (m, 2H), δ 7.72 (m, 1H); ES-MS m/z 359 (MD+).

EXAMPLE 5

N-(1S-Cyanomethylcarbamoyl-2-cyclohexylethyl)morpholine-4-carboxamide
(Compound 68)

A mixture of lithium 2S-amino-3-cyclohexylpropionate (260 μmol, 1.0 eq), provided as in Reference 1, EDC (286 μmol, 1.1 eq), HOBr (312 μmol, 1.2 eq) and triethylamine (911 μmol, 3.5 eq) in dry dichloromethane (1 mL) was stirred under a nitrogen atmosphere for 5 minutes and then treated with aminoacetonitrile hydrochloride (520 μmol, 2.0 eq). The mixture was stirred 15 hours and then diluted with ethyl acetate (1 mL). The dilution was washed with 1 M hydrochloric acid (2x 1 mL), saturated NaHCO₃ (1 mL) and saturated NaCl (1 mL), dried over Na₂SO₄, filtered and concentrated on a rotary evaporator to provide N-(1S-cyanomethylcarbamoyl-2-cyclohexylethyl)morpholine-4-carboxamide. 1H NMR (CDCl₃) 0.95 (m, 2H); 1.23 (m, 4H); 1.62 (m, 7H); 3.35 (m, 4H); 3.68 (m, 4H); 4.05 (dd, 2H, J= 16, 6 Hz); 4.17 (dd, 2H, J=18, 6 Hz ); 4.27 (m, 1H); 5.01 (d, 1H, J= 8 Hz); 7.93 (t, 1H, J= 6 Hz); ES-MS m/z 323 (MH+).
Proceeding as in Example 5 provided the following compounds of Formula I:

\[ N-(1S\text{-cyanomethyl}carbamoyl\text{-}2\text{-cyclohexylethyl})piperidine\text{-}1\text{-carboxamide} \]

(Compound 69); 1H NMR 0.95 (CDCl\text{3}) (m, 2H); 1.24 (m, 6H); 1.60 (m, 11H); 3.54 (m, 4H); 4.11 (m, 2H); 4.33 (m, 1H); 4.75 (d, 1H, J= 8 Hz); 7.88 (t, 1H, J= 6 Hz); ES-MS m/z 321 (MH+);

\textit{tert-}butyl 4-(1S\text{-cyanomethyl}carbamoyl\text{-}2\text{-cyclohexylethyl}carbamoyl)piperazine\text{-}1\text{-carboxylate} (Compound 70); 1H NMR (CDCl\text{3}) 0.89 (m, 2H); 1.23 (m, 4H); 1.44 (s, 9H); 1.66 (m, 7H); 3.36 (s, 4H); 3.40 (s, 4H); 4.03 (dd, 1H, J= 18, 5 Hz); 4.14 (dd, 1H, J= 18, 6 Hz); 4.38 (dd, 1H, J=15, 8 Hz); 5.32 (d, 1H, J= 8 Hz); 8.21 (t, 1H, J= 6 Hz); ES-MS m/z 422 (MH+);

\[ N-(1S\text{-cyanomethyl}carbamoyl\text{-}2\text{-cyclohexylethyl})\text{-}4\text{-benzylpiperazine\text{-}1\text{-carboxamide} (Compound 71); 1H NMR (CDCl\text{3}) 0.96 (m, 2H); 1.24 (m, 4H); 1.70 (m, 7H); 2.44 (t, 4H, J= 5 Hz); 3.37 (t, 4H, J= 5 Hz); 3.52 (s, 2H); 4.06 (dd, 1H, J= 18, 6 Hz); 4.15 (dd, 1H, J= 18, 6 Hz); 4.32 (m, 1H); 7.30 (m, 5H); 7.72 (t, 1H, J= 6 Hz); ES-MS m/z 412 (MH+); \]

3\text{-methoxybenzyl 1S\text{-cyanomethyl}carbamoyl\text{-}2\text{-cyclohexylethylcarbamate} (Compound 72); 1H NMR 0.96 (m, 2H); 1.24 (m, 4H); 1.70 (m, 7H); 3.78 (s, 3H); 4.12 (m, 2H); 4.21 (m, 1H); 5.11 (m, 2H); 6.89 (m, 3H); 7.32 (m, 1H); ES-MS m/z 374 (MH+);

\textit{ethyl 4-(1S\text{-cyanomethyl}carbamoyl\text{-}2\text{-cyclohexylethyl}carbamoyl)piperazine\text{-}1\text{-carboxylate} (Compound 73); and \}

\[ N-(1S\text{-cyanomethyl}carbamoyl\text{-}2\text{-cyclohexylethyl})\text{-}4\text{-fur\text{-}2\text{-ylcarbonylpiperazine\text{-}1\text{-carboxamide} (Compound 74). \]
EXAMPLE 6

\( N\)-Cyanomethyl-3-cyclohexyl-2S-(3-phenethylureido)propionamide

(Compound 75)

A solution of tert-butyl 1S-cyanomethylcarbamoyl-2-cyclohexylethylcarbamate (103 mmol, 1 eq), provided as in Example 1, in diethyl ether (323 mL) was treated with toluenesulfonic acid monohydrate (206 mmol, 2.0 eq, azeotroped on a rotary evaporator with 2-propanol 3 times, until a white solid had formed) for 12 hours. The supernatant was decanted and the solid was washed extensively with diethyl ether until a powder had formed.

A portion of the resulting acid salt (789 \( \mu \)mol, 1 eq) was suspended in dry acetonitrile (1 mL) and then treated with phenethylisocyanate (789 \( \mu \)mol, 1.0 eq) and 4-methylmorpholine (789 \( \mu \)mol, 1 eq) for 12 hours. The mixture was concentrated \textit{in vacuo} and the residue dissolved in methylene chloride. The solution was stirred with 100 mg Argonaut PS-trisamine resin (345 \( \mu \)mol, 0.4 eq) for 2 hours. The mixture was filtered, diluted with ethyl acetate (1 mL), washed with 1M hydrochloric acid (1 mL), saturated sodium bicarbonate solution and saturated NaCl solution, dried over sodium sulfate, filtered and concentrated to provide \( N\)-cyanomethyl-3-cyclohexyl-2S-(3-phenethylureido)propionamide.

Proceeding as in Example 6 provided \( N\)-cyanomethyl-3-cyclohexyl-2S-(3-isopropylureido)propionamide (Compound 76).
Proceeding in a fashion analogous to the procedures exemplified above provided the following compounds of Formula I:

\(N\)-[1S-cyanomethylcarbamoyl-3-phenylpropyl]benzamide (Compound 77);
\(N\)-[1S-cyanomethylcarbamoyl-2-(4-hydroxyphenylethyl)]benzamide (Compound 78);
\(N\)-(1-cyanomethylcarbamoyl-2-cyclohexylethyl)-3-hydroxybenzamide (Compound 79); NMR 300mHz (DMSO-\(d_6\)), 8.39 (d, J=8.5H\(_3\), 1H), 7.26 (m, 3H), 6.96 (m, 1H), 4.64 (m, 1H), 4.14 (dd, J=4.2 and 17.3H\(_3\), 2H), 3.30 (m, 2H), 1.71 (m, 7H), 1.68-0.80 (m, 6H); MS=329.85 M+=329.40;

1-benzyl-5-benzyloxy-N-(1-cyanomethylcarbamoyl-2-phenylethyl)-2-methyl-1H-indole-3-carboxamide (Compound 80); MS: (m/z [M+]) 557.0;
\(N\)-(1-cyanomethylcarbamoyl-2-phenylethyl)-1-furan-2-yilmethyl-5-methoxy-2-methyl-1H-indole-3-carboxamide (Compound 81); MS: (m/z [M+]) 470.6;
\(N\)-(1-cyanomethylcarbamoyl-2-methylpropyl)-5-ethoxy-1-furan-2-yilmethyl-2-methyl-1H-indole-3-carboxamide (Compound 82); MS: (m/z [M+]) 436.9;
1-benzo[1,3]dioxol-4-yilmethyl-N-(2-benzylsulfanyl-1-cyanomethylcarbamoylthethyl)-5-methoxy-2-methyl-1H-indole-3-carboxamide (Compound 83); MS: (m/z [M+]) 570.8;
benzyl 5-(1-benzo[1,3]dioxol-4-yilmethyl-5-benzyloxy-2-methyl-1H-indol-3-ylcarbonylamino)-5-cyanomethylcarbamoylpentylcarbamate (Compound 84);
MS: (m/z [M+]) 716.0;
benzyl 5-(1-benzyl-5-benzyloxy-2-methyl-1H-indol-3-ylcarbonylamino)-5-cyanomethylcarbamoylpentylcarbamate (Compound 85); MS: (m/z [M+]) 672.4;
benzyl 5-cyanomethylcarbamoyl-5-(1-furan-2-yilmethyl-5-methoxy-2-methyl-1H-indol-3-ylcarbonylamino)pentylcarbamate (Compound 86); MS: (m/z [M+]) 586.8;
\(N\)-(1-cyanomethylcarbamoylpent-3-ethyl)benzamide (Compound 87); NMR 300mHz (DMSO-\(d_6\)), 8.67 (t, J=6H\(_3\), 1H), 8.53 (d, J=8.5H\(_3\), 1H), 7.86 (m, 2H), 7.50 (m, 3H), 5.3-5.7 (m, 2H), 4.40 (m, 1H), 4.12 (d, J=6H\(_3\), 2H), 2.3-2.6 (m, 2H), 1.57 (d, J=6.9H\(_3\), 3H); MS=271.8 M+=271.32;
\[ N-(1\text{-cyanomethylcarbamoyl}penta-4-enyl)benzamide \] (Compound 88); NMR 300mHz (DMSO-d\textsubscript{6}), 8.66 (m, 1H), 8.57 (d, J=8.2Hz, 1H), 7.89 (m, 2H), 7.47 (m, 3H), 5.80 (m, 1H), 4.9-5.05 (m, 2H), 4.4 (m, 1H), 4.11 (d, J=2.5Hz, 2H), 2.1 (m, 2H), 1.83 (m, 2H); MS=271.8 M+=271.32;

\[ N-(1\text{-cyanomethylcarbamoyl}butyl)benzamide \] (Compound 89); NMR 300mHz (DMSO-d\textsubscript{6}), 8.66 (t, J=5.8Hz, 1H), 8.53 (d, J=8.8Hz, 1H), 7.90 (m, 2H), 7.46 (m, 3H), 4.41 (m, 1H), 4.12 (m, 2H), 1.70 (m, 2H), 0.87 (t, J=8Hz, 3H); MS=259.8 M+=259.31;

\[ N-(1\text{-cyanomethylcarbamoyl}pent-4-ynyl)benzamide \] (Compound 90); NMR 300mHz (DMSO-d\textsubscript{6}), 8.67 (t, 1H), 8.61 (d, J=8.5Hz, 1H), 7.91 (m, 2H), 7.50 (m, 3H), 4.5 (m, 1H), 4.12 (m, 2H), 2.83 (t, J=2.5Hz, 1H), 2.25 (m, 2H), 1.97 (m, 2H); MS=269.8 M+=269.30;

\[ 2\text{-chloro-N-(1S-cyanomethylcarbamoyl}-2\text{-cyclohexylethyl)benzamide} \] (Compound 91);

\[ \text{1H NMR (CDCl}3\text{): 7.68 (t, J=6Hz, 1H), 7.34 (m, 4H), 6.41 (d, J=8Hz, 1H), 4.78 (m, 1H), 4.13 (d, J=12Hz, 2H), 2.0-0.8 (m, 13H); MS m/e 439.9;} \]

\[ 2\text{-bromo-N-(1S-cyanomethylcarbamoyl}-2\text{-cyclohexylethyl)benzamide} \] (Compound 93); \text{1H NMR (CDCl}3\text{): 7.68 (t, J=5.7Hz, 1H), 7.58 (dd, J=3.12Hz, 1H), 7.44 (dd, J=2.1,12Hz, 1H), 7.34 (m, 2H), 7.57 (d, J=8Hz, 1H), 4.79 (m, 1H), 4.13 (d, J=5.7Hz, 2H), 2.0-0.8 (m, 13H); MS m/e 393.7;}

\[ \text{N-(1S-cyanomethylcarbamoylhexyl)benzamide} \] (Compound 94); \text{1H NMR (DMSO): 8.65 (t, J=3Hz, 1H), 8.54 (d, J=8Hz, 1H), 7.91 (d, J=7Hz, 2H), 7.5 (m, 3H), 4.4 (m, 1H), 4.13 (d, J=5Hz, 2H), 1.74 (m, 2H), 1.3 (m, 6H), 0.85 (t, J=7Hz, 3H); MS: m/e = 287.8;}

\[ \text{N-(1S-cyanomethylcarbamoyl-4-phenylbutyl)benzamide} \] (Compound 95); \text{1H NMR (DMSO): 8.67 (t, J=7Hz, 1H), 8.56 (d, J=9Hz, 1H), 7.88 (d, J=9Hz, 2H), 7.4 (m, 3H), 7.2 (m, 5H), 4.45 (m, 1H), 4.11 (d, J=5Hz, 2H), 2.58 (t, J=8Hz, 2H), 1.7 (m, 4H); MS: m/e = 335.9;}

\[ \text{N-(1S-cyanomethylcarbamoyl-2-cyclohexylethyl)2-methoxybenzamide} \] (Compound 96);

\[ \text{N-(1S-cyanomethylcarbamoyl-2-cyclohexylethyl)-3,4,5-trimethoxybenzamide} \]
(Compound 97);
benzyl 1S-cyanomethylcarbamoyl-2-cyclohexylethylcarbamate (Compound 98);
isobutyl 1S-cyanomethylcarbamoyl-2-cyclohexylethylcarbamate (Compound 99);
cyclohexylmethyl 1S-cyanomethylcarbamoyl-2-cyclohexylethylcarbamic

5 (Compound 100);
N-(1S-cyanomethylcarbamoyl-3-cyclohexylpropyl)benzamide (Compound 101); ^1 H
NMR (DMSO): 8.66 (m, 1H), 8.52 (d,J = 8Hz, 1H), 7.88 (d,J = 8Hz, 2H), 7.45 (m, 3H),
4.37 (m, 1H), 4.12 (m, 2H), 1.9 – 0.08 (m, 15H); MS: m/e = 328.3;
N-(1S-cyanomethylcarbamoyl-2-cyclohexylethyl)-2-trifluoromethoxybenzamide

10 (Compound 102); ^1 H NMR (CDCl$_3$): 7.90 (dd, J=3, 10Hz, 1H), 7.79 (m, 1H), 7.535 (m,
1H), 7.395 (m, 1H), 7.31 (m, 1H), 6.92 (d,J=8Hz, 1H), 4.74 (m, 1H), 4.2 (dd,J=6.17Hz,
1H), 4.1 (dd,J=6.17Hz, 1H), 0.8-1.8 (m, 13H); MS:m/e =397.9;
N-(1S-cyanomethylcarbamoyl-2-cyclohexylethyl)-3-trifluoromethoxybenzamide

(Compound 103); ^1 H NMR (CDCl$_3$): 7.68 (m, 2H), 7.44 (m, 3H), 7.03 (t,J=6.6Hz, 1H),
4.73 (m, 1H), 4.38 (m, 1H), 4.11 (m, 2H), 0.8-1.8 (m, 11H); MS:m/e =397.9;
N-(1S-cyanomethylcarbamoyl-2-cyclohexylethyl)-3-iodobenzamide

(Compound 104); ^1 H NMR (CDCl$_3$): 8.1 (t, J=2.8Hz, 1H), 7.87 (d,J=6.9Hz, 1H), 7.70
(d,J=7.7Hz, 1H), 7.19 (t, J=17.5Hz, 1H), 6.9 (m, 1H), 6.44 (d,J=12Hz, 1H), 4.63 (m, 1H),
4.21 (dd,J=9.6, 6.6Hz, 1H), 4.1 (dd,J=9.6, 6.6Hz, 1H) 0.8-2.0 (m, 13H); MS:m/e =440.0;

20 3-chloro-N-(1S-cyanomethylcarbamoyl-2-cyclohexylethyl)benzamide

(Compound 105); ^1 H NMR (CDCl$_3$): 7.5 (t, J=5.2Hz, 1H), 7.65 (d, J=7.63Hz, 1H), 7.51
d,J=6Hz, 1H), 7.39 (t, J=8.8Hz, 1H), 6.59 (d, J=9.9Hz, 1H), 2.0-0.8 (m, 13H); MS:m/e
=348.0;

2-methoxyethyl 1S-cyanomethylcarbamoyl-2-cyclohexylethylcarbamate

25 (Compound 106);
N-(1S-cyanomethylcarbamoyl-2-cyclohexylethyl)cyclohexanecarboxamide

(Compound 107);
N-cyanomethyl-3-cyclohexyl-2S-[2-(4-methoxyphenyl)acetylamino]propionamide
(Compound 108); ^1 H NMR (CDCl$_3$): 7.83 (t, J=6Hz, 1H), 7.13 (d,J=9Hz, 2H), 6.86
\( \text{N-(1R-cyanomethylcarbamoyl-2-cyclohexylethyl)-2-methylsulfanylbenzamide} \)

(Compound 109); \(^1\)H NMR: \((\text{CDCl}_3)\) 8.11 (t, \(J=5.5\)Hz, 1H), 7.50 (d, \(J=7.5\)Hz, 1H), 7.40 (t, \(J=7.5\)Hz, 1H), 7.30 (d, \(J=1\)Hz, \(J=7.9\)Hz, 1H), 7.17 (t, \(J=7.7\)Hz, 1H), 6.94 (d, \(J=8.4\)Hz, 1H), 4.88 (m, 1H), 4.16 (dd, \(J=5.7\)Hz, \(J=17.3\)Hz, 1H), 4.08 (dd, \(J=5.7\)Hz, \(J=17.3\)Hz, 1H), 2.46 (s, 3H), 1.85-0.80 (m, 13H); MS: (M\(^{+}\)1) 360;

\( \text{N-(1S-cyanomethylcarbamoyl-2-cyclohexylethyl)-3,4-difluoro-benzamide} \)

(Compound 110); \(^1\)H NMR \((\text{CDCl}_3)\): 7.5 (t, \(J=5.1\)Hz, 1H), 5.88 (d, \(J=7.7\)Hz, 1H), 4.49 (m, 1H), 4.18 d, \(J=6\)Hz, 1H), 4.11 (d, \(J=6\)Hz, 1H), 2.12-0.8 (m, 24H); MS: m/e = 320.0;

\( \text{N-(1S-cyanomethylcarbamoyl-2-cyclohexylethyl)-3-methoxybenzamide} \)

(Compound 111); \(^1\)H NMR: \((\text{CDCl}_3)\) 7.63 (m, 1H), 7.37-7.28 (m, 3H), 7.06 (m, 1H), 6.76 (d, \(J=7.7\)Hz, 1H), 4.73 (m, 1H), 4.20 (dd, \(J=5.9\)Hz, \(J=17.3\)Hz, 1H), 4.07 (dd, \(J=5.7\)Hz, \(J=17.3\)Hz, 1H), 3.83 (s, 3H), 1.85-0.82 (m, 13H); MS: (M\(^{+}\)1) 344;

\( \text{4-bromo-N-(1S-cyanomethylcarbamoyl-2-cyclohexylethyl)benzamide} \)

(Compound 112); \(^1\)H NMR: \((\text{CDCl}_3)\) 7.65-7.57 (m, 4H), 7.10 (m, 1H), 6.48 (d, \(J=7.7\)Hz, 1H), 4.67 (m, 1H), 4.21 (dd, \(J=5.9\)Hz, \(J=17.3\)Hz, 1H), 4.12 (dd, \(J=5.7\)Hz, \(J=17.3\)Hz, 1H), 1.85-0.82 (m, 13H); MS: (M\(^{+}\)1) 392/394;

\( \text{N-(1S-cyanomethylcarbamoyl-2-cyclohexylethyl)piperazine-1-carboxamide} \)

(Compound 113);

\( \text{benzyl 4-(2-benzoylamino-2S-cyanomethylcarbamoylethyl)piperidine-1-carboxylate} \)

(Compound 114);

\( \text{3-bromo-N-(1S-cyanomethylcarbamoyl-2-cyclohexylethyl)benzamide} \)

(Compound 115); \(^1\)H NMR: \((\text{CD}_2\text{OD})\) 8.05 (s, 1H), 7.83 (d, \(J=7.7\)Hz, 1H), 7.71 (d, J=7.5Hz, 1H), 7.40 (t, \(J=7.9\)Hz, 1H), 4.67 (dd, \(J=6.9\)Hz, \(J=8.7\)Hz, 1H), 4.19 (d, \(J=17.5\)Hz, 1H), 4.11 (d, \(J=17.3\)Hz, 1H), 1.85-0.82 (m, 13H); MS: (M\(^{+}\)1) 392/394;

\( \text{N-(1S-cyanomethylcarbamoyl-2-cyclohexylethyl)-3-methylbenzamide} \)

(Compound 116); \(^1\)H NMR \((\text{DMSO})\): 7.64 (t, 1H), 7.25 (m, 4H), 6.43 (d, \(J=12\)Hz, 1H), 4.67 (m, 1H), 4.13 (m, 2H), 2.4 (s, 3H), 2.0-0.7 (m, 13H); MS m/e 327.8;
N-(1S-cyanomethylcarbamoyl-2-cyclohexylethyl)pentanamide (Compound 117); ¹H NMR (CDCl₃): 8.11 (t, 1H), 6.53 (d, J=8Hz, 1H), 4.59 (m, 1H), 4.10 (m, 2H), 2.21 (t, J=4.5Hz, 2H), 1.8-0.8 (m, 20H); MS m/e 293.8;

N-(1S-cyanomethylcarbamoyl-2-cyclohexylethyl)-2-methylbenzamide (Compound 118); ¹H NMR (CDCl₃): 7.91 (d, J=5.7Hz, 1H), 7.23 (m, 4H), 6.50 (t, J=3Hz, 1H), 4.76 (m, 1H), 4.05 (s, J=18Hz, 1H), 2.38 (d, 3H), 2.0-0.8 (m, 13H); MS m/e 328;

N-(1S-cyanomethylcarbamoyl-2-cyclohexylethyl)thiophene-3-carboxamide (Compound 119); ¹H NMR (CDCl₃): 8.1 (m, 2H), 7.32 (m, t, 2H), 7.08 (d, J=7.9Hz, 1H), 4.73 (m, 1H), 4.05 (dd, J=6.17Hz, 2H), 2.0-0.8 (m, 13H); MS m/e 319.80;

2S-[2-(4-benzylxoyphenyl)acetylamino]-N-cyanomethyl-3-cyclohexylpropionamide (Compound 120); ¹H NMR (CDCl₃): 7.8 (t, 1H), 7.5-6.9 (m, 9H), 6.10 (d, J=8Hz, 1H), 5.0 (s, 2H), 4.5 (m, 1H), 3.95 (m, 2H), 3.5 (s, 2H), 1.9-1.0 (m, 13H); MS m/e 434.97;

N-cyanomethyl-3-cyclohexyl-2S-[2-(2-methoxyphenyl)acetylamino]propionamide (Compound 121); ¹H NMR (CDCl₃): 7.58 (t, J=7.8Hz, 1H), 7.23 (m, 2H), 6.91 (m, 2H), 6.21 (d, J=7.2Hz, 1H), 4.44 (m, 1H), 3.94 (d, J=5.7Hz, 2H), 3.84 (s, 3H), 3.60 (d, J=8Hz, 1H), 3.49 (d, J=8Hz, 1H), 1.8-0.5 (m, 13H); MS m/e 357.89;

N-cyanomethyl-3-cyclohexyl-2-[2-(4-phenoxyphenyl)acetylamino]propionamide (Compound 122); ¹H NMR (CDCl₃): 7.55 (t, J=3Hz, 1H), 7.4-6.9 (m, 9H), 6.04 (d, J=8.8Hz, 1H), 4.47 (m, 1H), 4.02 (d, J=6Hz, 2H), 3.54 (s, 2H), 2.0-0.6 (m, 13H); MS m/e 419.94;

N-(1S-cyanomethylcarbamoyl-2-cyclohexylethyl)isonicotinamide (Compound 123); ¹H NMR (DMSO): 8.68 (d, J=4.5Hz, 2H), 8.2 (t, J=6.3Hz, 1H), 7.85 (d, J=7.9Hz, 1H), 7.66 (d, J=4.7Hz, 2H), 4.80 (m, 1H), 4.12 (d, J=6Hz, 2H), 2.0-0.7 (m, 13H); MS m/e 314.8;

N-(1S-cyanomethylcarbamoyl-2-cyclohexylethyl)thiophene-2-carboxamide (Compound 124); ¹H NMR: (CDCl₃) 8.55 (t, J=5.5Hz, 1H), 7.75 (d, J=7.7Hz, 1H), 7.64 (dd, J=1Hz, J=4Hz, 1H), 7.48 (dd, J=1Hz, J=5Hz, 1H), 7.04 (dd, J=5Hz, J=4Hz, 1H), 4.82 (q, J=7.5Hz, 1H), 4.13 (dd, J=5.9Hz, J=17Hz, 1H), 3.93 (dd, J=5.7Hz, J=17Hz, 1H), 1.80-0.84 (m, 13H); MS: (M⁺+1) 319.8;
**N**-(1S-cyanomethylcarbamoyl-2-piperidin-4-ylethyl)benzamide (Compound 125); 

**N**-(1S-cyanomethylcarbamoyl-2-(1-formyl-1H-indol-3-yl)ethyl)benzamide (Compound 126); 

**N**-(1S-cyanomethylcarbamoyl-2-(1-formyl-1H-indol-3-yl)ethyl)-4-fluorobenzamide (Compound 127); 

**N**-(1S-cyanomethylcarbamoyl-2-cyclohexylethyl)nicotinamide (Compound 128); 

$^1$H NMR (CDCl$_3$): 9.01 (d, J=4Hz, 1H), 8.72 (m, 1H), 8.11 (m, 1H), 7.83 (t, J=3Hz, 1H), 7.39 (m, 2H), 4.77 (m, 1H), 7.14 (m, 2H), 2.0-0.6 (m, 13H); MS m/e 314.88; 

**tert-butyl 3-(1S-cyanomethylcarbamoyl-2-cyclohexylethyl)phenylcarbamate** (Compound 129); 

**N**-[1S-cyanomethylcarbamoyl-2-(1-formyl-1H-indol-3-yl)ethyl]-4-hydroxybenzamide (Compound 130); 

**N**-(1S-cyanomethylcarbamoyl-2-cyclohexylethyl)-1H-indole-5-carboxamide (Compound 131); 

$^1$H NMR (CDCl$_3$): 11.32 (s, 1H), 8.64 (t, J=6Hz, 1H), 8.35 (d, J=9Hz, 1H), 8.22 (s, 1H), 7.68 (dd, J=3,10Hz, 1H), 7.42 (m, 1H), 6.54 (m, 1H), 4.54 (m, 1H), 4.12 (d, J=5.7Hz, 2H), 2.0-0.7 (m, 13H); MS m/e 352.86; 

**N**-(1R-cyanomethylcarbamoyl-2-cyclohexylethyl)-4-methylsulfanylbenzamide (Compound 132); 

**N**-(2-benzylsulfonyl-1R-cyanomethylcarbamoylethyl)-3-fluorobenzamide (Compound 133); 

$^1$H NMR (CDCl$_3$): 7.18-7.79 (m, 1H), 4.70 (dd,J=13.3, 7.2Hz, 1H), 4.28 (d,J=7.7Hz, 1H), 4.22 (d,J=7.4Hz, 1H), 3.78 (m, 2H), 3.03 (dd,J=14.1, 6.2Hz, 1H), 2.84 (J=14.1, 7.2Hz, 1H); MS: m/e=371.88; 

**N**-(2-benzylsulfonyl-1R-cyanomethylcarbamoylethyl)-4-fluorobenzamide (Compound 134); 

$^1$H NMR (CDCl$_3$): 7.74 (m, 2H), 7.47 (t,J=5.9Hz, 1H), 7.29 (m, 4H), 7.09 (m, 4H), 4.72 (dd,J=13.6, 6.9Hz, 1H), 4.11 (m, 2H), 3.77 (s, 5H), 3.02 (dd,J=13.8, 6.2Hz, 1H), 2.83 (dd,J=13.8, 7.2Hz, 1H); MS: m/e=371.79; 

**N**-(1S-cyanomethylcarbamoyl-2-(4-methoxybenzylsulfinyl)ethyl)benzamide (Compound 135); 

$^1$H NMR (DMSO): 8.94 (d,J = 8Hz, 1H), 8.87 (d,J = 6Hz, 1H), 7.87 (d,J = 7Hz, 2H), 7.5 (m, 3H), 7.24 (d,J = 10Hz, 2H), 6.93 (d,J = 10Hz, 2H), 4.80 (dd,J =
4.12Hz, 1H), 4.14 (d, J = 14Hz, 1H), 4.13 (s, 2H), 3.99 (d, J = 14Hz, 1H), 3.74 (s, 3H), 3.16 (d, J = 12.14Hz, 1H), 3.07 (dd, J = 14.4Hz, 1H); MS: m/e = 400.00;

N-(1S-cyanomethylcarbamoyl-2-cyclohexylethyl)-4-methylbenzamide

(Compound 136); 1H NMR (DMSO): 7.7 (t, 1H), 7.65 (d, 2H), 7.25 (d, 2H), 6.65 (d, 1H), 4.75 (m, 1H), 4.2 (dd, 1H), 4.03 (dd, 1H), 2.4 (5, 3H), 2.0-0.8 (m, 13H); MS: m/e 328.8;

N-(1S-cyanomethylcarbamoyl-2-cyclohexylethyl)-3-phenoxybenzamide

(Compound 137); 1H NMR (CDCl3): 8.49 (t, J=5.5Hz, 1H), 7.75 (dd, J=10.8.5Hz, 1H), 7.6-6.9 (m, 9H), 4.84 (m, 1H), 3.95 (m, 2H), 2.0-0.8 (m, 13H); MS:m/e =405.93;

3-benzoyl-N-(1S-cyanomethylcarbamoyl-2-cyclohexylethyl)benzamide

(Compound 138); 1H NMR (CDCl3): 8.19 (t, J=3Hz, 1H), 8.0 (m, 1H), 7.89 (d,J=8.8Hz, 1H), 7.76-7.4 (m, 5H), 6.88 (m, 1H), 4.74 (m, 1H),4.19 (dd,J=6,6.3Hz, 1H), 4.08 (dd,J=6,6.3Hz, 1H), 2.0-0.8 (m, 13H); MS:m/e =417.95;

N-(2-benzylsulfanyl-1R-cyanomethylcarbamoylthiophene-3-carboxamide

(Compound 139);

3-acetyl-N-(1R-cyanomethylcarbamoyl-2-cyclohexylethyl)benzamide

(Compound 140); 1H NMR: (CDCl3) 8.33 (t, J=1.5Hz, 1H), 8.08 (dt, J=1.7Hz, J=7.7Hz, 1H), 7.99 (dt, J=1.7Hz, J=7.9Hz, 1H), 7.55 (t, J=7.7Hz, 1H), 7.45 (t, J=6.7Hz, 1H), 6.92 (d, J=7.9Hz, 1H), 4.74 (m, 1H), 4.23-4.05 (m, 2H), 2.63 (s, 3H), 1.90-0.84 (m, 13H); MS: (M'+1) 355.8;

N-(2-benzylsulfanyl-1R-cyanomethylcarbamoylthiophene-3-carboxamide

(Compound 141); 1H NMR (CDCl3): 7.81 (t, J=5.7Hz,1H), 7.70 (dt,J=8.9, 2.2Hz, 2H), 7.20-7.32 (m,J=5H), 7.04 (d,J=7.7Hz, 1H), 6.89 (dt,J=8.9, 2.0Hz, 2H), 4.82 (dd,J=14.1, 6.7Hz, 1H), 4.08 (d,J=5.7Hz, 2H), 3.83 (s, 3H), 3.74 (s, 2H), 3.00 (dd,J=13.9, 6.7Hz, 1H), 2.86 (dd,J=13.9, 6.7Hz, 1H); MS: m/e=383.80;

N-(2-benzylsulfanyl-1R-cyanomethylcarbamoylthiophene-3-carboxamide

(Compound 142); 1H NMR (CDCl3): 7.49 (m, 1H), 7.24-7.39 (m, 5H), 7.14 (m, 1H), 7.04 (m,J= 2H), 6.53 (dd,J 3.7, 1.7Hz, 1H), 4.64 (m, 1H), 4.13 (dd,J=5.9, 1.2Hz, 2H), 3.79 (dd,J=16.1, 13.6Hz, 2H), 3.03 (ddJ=14.1, 5.9Hz, 1H), 2.80 (dd,J=14.3 6.9Hz, 1H); MS:m/e=343.84;
N-(2-benzylsulfanyl-1R-cyanomethylcarbamoyethyl)furan-3-carboxamide
(Compound 143); ^1^H NMR: 8.33 (t, J = 5.45 Hz, 1H), 7.16 – 7.28 (m, 5H), 5.41 (d, J = 7.2 Hz, 1H), 4.52 (dd, J = 13.9, 6.7 Hz, 1H), 4.06 (d, J = 5.7 Hz, 2H), 3.68 (s, 2H), 3.10 (s, 3H), 3.05 (m, 1H), 3.00 (s, 3H), 2.80 (m = 1H); MS (320.74);

N-(2-benzylsulfanyl-1R-cyanomethylcarbamoyethyl)-2-methoxybenzamide
(Compound 144); ^1^H NMR (CDCl₃): 8.75 (d, J = 6.9 Hz, 1H), 8.14 (dd, J = 2.0, 7.9 Hz, 1H), 7.50 (m, 1H), 7.20-7.35 (m, 6H), 7.12 (m, 1H), 4.78 (dd, J = 12.6, 6.2 Hz, 1H), 4.19 (dd, J = 12.6, 6.2 Hz, 1H), 4.07 (dd, J = 13.5, 5.4 Hz, 1H), 3.97 (s, 3H), 3.80 (d, J = 3.2 Hz, 2H), 3.08 (dd, J = 14.0, 3.7 Hz, 1H), 2.86 (dd, J = 14.1, 6.7 Hz, 1H); MS: m/e = 383.93;

N-(2-benzylsulfanyl-1R-cyanomethylcarbamoyethyl)-3-methoxybenzamide
(Compound 145); ^1^H NMR (CDCl₃): 7.96 (t, J = 5.7 Hz, 1H), 7.16-7.36 (m, 8H), 7.05 (m, 1H), 4.80 (m, 1H), 4.08 (d, J = 5.7 Hz, 1H), 3.80 (s, 3H), 3.77 (s, 2H), 2.98 (dd, J = 13.9, 6.4 Hz, 1H), 2.86 (dd, J = 6.9, 3.9 Hz, 1H); MS: m/e = 383.77;

N-(2-benzylsulfanyl-1R-cyanomethylcarbamoyethyl)morpholine-4-carboxamide
(Compound 146); ^1^H NMR (CDCl₃): 7.45 (m, 1H), 7.23 (m, 5H), 5.28 (m, 1H), 4.39 (m, 1H), 4.16 (dd, J = 17.6, 5.9 Hz, 1H), 4.06 (dd, J = 11.1, 5.5 Hz, 1H), 3.74 (s, 2H), 3.67 (t, J = 4.9 Hz, 4H), 3.31 (m, 4H), 3.00 (dd, J = 14.1, 6.4 Hz, 1H), 2.77 (dd, J = 13.8, 6.7 Hz, 1H); MS: 362.86;

6-amino-N-(2-benzylsulfanyl-1R-cyanomethylcarbamoyethyl)nicotinamide
(Compound 147); ^1^H NMR (CDCl₃): 8.42 (d, J = 2.5 Hz, 1H), 7.80 (dd, J = 8.7, 2.5 Hz, 1H), 7.18-7.30 (m, 5H), 6.46 (dd, J = 9.4, 0.7 Hz, 1H), 4.64 (t, J = 6.9 Hz, 1H), 4.08 (s, 2H), 3.70 (s, 2H), 2.80 (m, 2H); MS: m/e = 369.4474;

N-(2-benzylsulfanyl-1R-cyanomethylcarbamoyethyl)-3-pyrid-3-ylacrylamide
(Compound 148); ^1^H NMR (CDCl₃): 8.72 (d, J = 2.2 Hz, 1H), 8.54 (t, J = 4.7, 1.5 Hz, 1H), 7.82 (dtt, J = 7.9, 2.2 Hz, 1H), 7.57 (d, J = 15.6 Hz, 1H), 7.18-7.38 (m, 6H), 6.48 (d, J = 15.8 Hz, 1H), 4.61 (m, 4H), 4.10 (s, 2H), 3.73 (s, 2H), 2.80 (m, 2H); MS: m/e = 380.4706;

N-(2-benzylsulfanyl-1R-cyanomethylcarbamoyethyl)naphthalene-2-carboxamide
(Compound 149); ^1^H NMR (CDCl₃): 8.28 (m, 1H), 7.90 (m, 3H), 7.78 (dd, J = 8.4, 1.8 Hz, 1H), 7.57 (m, 2H), 7.17-7.38 (m, 6H), 7.13 (J = 7.2 Hz, 1H), 4.77 (m, 1H), 4.14 (d, J =
5.9Hz, 2H), 3.81 (s, 2H), 3.12 (dd, J = 14.1, 5.9Hz, 1H), 2.88 (dd, J = 14.1, 7.2Hz, 1H); MS (403.92);

N-(2-benzylsulfanyl-1R-cyanomethylcarbamoylethyl)benzofuran-2-carboxamide (Compound 150); \(^1^H\) NMR (DMSO): 7.66 (dt, J = 7.9, 1.2Hz, 1H), 7.16 – 7.54 (m, 9H), 4.74 (m, 1H), 4.15 (d, J = 6Hz, 2H), 3.80 (dd, J = 15.3, 13.6Hz, 2H), 3.07 (dd, J = 14.1, 5.9Hz, 1H), 2.87 (dd, J = 14.1, 7.1Hz, 1H); MS (393.83);

N-(2-benzylsulfanyl-1R-cyanomethylcarbamoylethyl)biphenyl-4-carboxamide (Compound 151); \(^1^H\) NMR (CDCl\(_3\)): 7.81 (dt, J = 8.7, 1.5Hz, 2H), 7.66 (m, 2H), 7.59 (m, 2H), 7.26 – 7.49 (m, 7H), 7.02 (d, J = 7.2Hz, 1H), 4.73 (m, 1H), 4.14 (dd, J = 5.9, 1.2Hz, 2H), 3.80 (s, 2H), 3.10 (dd, J = 14.0, 7.2Hz, 1H), 2.86 (dd, J = 14.1, 7.2Hz, 1H); MS (429.99);

N-(2-benzylsulfanyl-1R-cyanomethylcarbamoylethyl)benzo[1,3]dioxole-5-carboxamide (Compound 152); \(^1^H\) NMR (CDCl\(_3\)): 7.21 – 7.38 (m, 7H), 6.82 (d, J = 8.2Hz, 1H), 6.82 (m, 1H), 4.67 (dd, J = 13.3, 6.9Hz, 1H), 4.11 (dd, J = 5.7, 1.6Hz, 1H), 3.77 (s, 2H), 3.03 (dd, J = 14.1, 6.2Hz, 1H), 2.82 (dd, J = 14.1, 6.9Hz, 1H); MS (397.82);

N-(2-tert-butylsulfanyl-1R-cyanomethylcarbamoylethyl)benzamide (Compound 153); \(^1^H\) NMR (DMSO): 8.77 (t, J = 6Hz, 1H), 8.69 (d, J = 9Hz, 1H), 7.89 (dd, J = 7Hz, 2H), 7.5 (m, 3H), 4.58 (m, 1H), 4.13 (t, J = 3Hz, 2H), 3.02 (dd, J = 6.14Hz, 1H), 2.90 (dd, J = 10.14Hz, 1H), 1.27 (s, 9H); MS: m/e = 319.80;

N-(1R-cyanomethylcarbamoyl-3-phenylsulfanylpropyl)benzamide (Compound 154); \(^1^H\) NMR (DMSO): 8.7 (m, 2H), 7.92 (d, J = 7Hz, 2H), 7.53 (m, 3H), 7.3 (m, 4H), 7.2 (m, 1H), 4.6 (q, J = 7Hz, 1H), 4.13 (d, J = 6Hz, 2H), 3.0 (m, 2H), 2.05 (m, 2H); MS: m/e = 353.83;

N-(1S-cyanomethylcarbamoyl-2-cyclohexylethyl)-3-methylthiophene-2-carboxamide (Compound 155); \(^1^H\) NMR: (CDCl\(_3\)) 7.75 (t, J = 6Hz, 1H), 7.32 (d, J = 5Hz, 1H), 6.90 (d, J = 5Hz, 1H), 6.30 (d, J = 7.9Hz, 1H), 4.72 (m, 1H), 4.19 (dd, J = 5.7Hz, J = 17.5Hz, 1H), 4.05 (dd, J = 5.7Hz, J = 17.3Hz, 1H), 2.51 (s, 3H), 1.85-0.85 (m, 13H); MS: (M\(^+\)+1) 333.9;

N-(1S-cyanomethylcarbamoyl-2-cyclohexylethyl)-5-methylthiophene-2-carboxamide (Compound 156); \(^1^H\) NMR: (CDCl\(_3\)) 8.14 (t, J = 5.7Hz, 1H), 7.39 (d, J = 3.7Hz, 1H), 6.93
(d, J=7.9Hz, 1H), 6.72 (dd, J=1Hz, J=3.7Hz, 1H), 4.74 (m, 1H), 4.17 (dd, J=5.9Hz, J=17Hz, 1H), 3.97 (dd, J=5.5Hz, J=17.1Hz, 1H), 2.50 (s, 3H), 1.80-0.82 (m, 13H); MS: (M^+1) 333.8;

\textit{N-(1S-cyanomethylcarbamoyl-2-cyclohexylethyl)-3-chlorothiophene-2-carboxamide}

(Compound 157); \textit{^1H NMR: (CDCl}_3\textit{) 7.52 (d, J=5.2Hz, 1H), 7.43 (t, J=5.7Hz, 1H), 7.32 (d, J=7.4Hz, 1H), 7.01 (d, J=5.2Hz, 1H), 4.68 (m, 1H), 4.23 (dd, J=5.9Hz, J=17.5Hz, 1H), 4.08 (dd, J=6Hz, J=17.3Hz, 1H), 1.90-0.85 (m, 13H); MS: (M^+1) 353.8;}

\textit{N-(1S-cyanomethylcarbamoyl-2-cyclohexylethyl)-3-chlorobenzo[b]thiophene-2-carboxamide} (Compound 158); \textit{^1H NMR: (CDCl}_3\textit{) 7.90-7.78 (m, 3H), 7.65 (d, J=7.9Hz, 1H), 7.51-7.42 (m, 2H), 4.86 (q, J=8Hz, 1H), 4.28 (dd, J=5.9Hz, J=17.3Hz, 1H), 4.12 (dd, J=5.7Hz, J=17.3Hz, 1H), 1.90-0.85 (m, 13H); MS: (M^+1) 403.8;}

\textit{N-(1S-cyanomethylcarbamoyl-2-cyclohexylethyl)-5-chlorothiophene-2-carboxamide}

(Compound 159); \textit{^1H NMR: (CDCl}_3\textit{) 8.18 (t, J=5.7Hz, 1H), 7.62 (d, J=7.9Hz, 1H), 7.40 (d, J=4Hz, 1H), 6.88 (d, J=4Hz, 1H), 4.70 (q, J=7.7Hz, 1H), 4.14 (dd, J=5.7Hz, J=17Hz, 1H), 4.05 (dd, J=6Hz, J=17Hz, 1H), 1.80-0.84 (m, 13H); MS: (M^+1) 353.8;}

\textit{N-(1S-cyanomethylcarbamoyl-2-cyclohexylethyl)-3-bromo thiophene-2-carboxamide}

(Compound 160); \textit{^1H NMR (CDCl}_3\textit{) 7.55-7.39 (m, 3H), 7.07 (d, J=5.5Hz, 1H), 4.68 (m, 1H), 4.25 (dt, 1H), 4.08 (dt, 1H), 2.0-0.8 (m, 13H); MS: m/e =399.74;}

\textit{N-(1S-cyanomethylcarbamoyl-2-cyclohexylethyl)-5-bromo thiophene-2-carboxamide}

(Compound 161); \textit{^1H NMR (CDCl}_3\textit{) 8.18 (t, J=5.4Hz, 1H), 7.62 (d, J=3.5Hz, 1H), 7.37 (d, J=4.0Hz, 1H), 7.04 (d, J=4.0Hz, 1H), 4.70 (dd, J=7.2, 18.7Hz, 1H), 4.15 (dd, J=5.7, 17.8Hz, 1H), 4.05 (dd, J=5.7, 17.8, 1H), 1.5-1.8 (m, 7H), 0.8-1.50 (m, 6H); MS: m/e (+1) 399.83;}

\textit{N-(1S-cyanomethylcarbamoyl-2-cyclohexylethyl)benzo[b]thiophene-2-carboxamide}

(Compound 162); NMR (MeOH): 8.06 (s, 1H), 7.91 (m, 2H), 7.43 (m, 2H), 4.64 (dd, J=6.7, 8.7Hz, 1H), 4.21 (d, J=17.3Hz, 1H), 4.13 (d, J=17.3Hz, 1H), 1.61-1.90 (m, 8H), 0.89-1.55 (m, 4H); MS: m/e=369.78;

\textit{N-(1S-cyanomethylcarbamoyl-2-cyclohexylethyl)-3-ethoxy benzamide}

(Compound 163); \textit{^1H NMR (MeOH): 8.50 (d, J=7.4Hz, 1H), 7.3-7.43 (m, 3H), 7.07 (d,}
J=8.2Hz, 1H), 4.64 (dd, J=7.7, 19.2Hz, 2H), 4.15 (d, J=4.2Hz, 2H), 4.09 (d, J=6.9Hz, 1H), 4.04 (d, J=6.9Hz, 1H), 1.35 (t, J=7.0, 3H), 0.9-1.9 (m, 13H); MS: m/e (+1) 357.94; tert-butyl 3-(1S-cyanomethylcarbamoyl-3-methylbutylcarbamoyl)phenylcarbamate

(Compound 164);

tert-butyl 3-(2-benzylsulfanyl-
1R-cyanomethylcarbamoylethylcarbamoyl)phenylcarbamate (Compound 165);

N-(1-cyanomethylcarbamoyl-3-phenoxypropyl)benzamide (Compound 166); 1H NMR (DMSO): 8.71 (m, = 2H), 7.90 (d, J = 14Hz, 2H), 7.5 (m, 3H), 7.25 (m, 2H), 6.9 (m, 3H), 4.65 (m, 1H), 4.14 (d, J = 6Hz, 2H), 4.04 (m, 2H), 2.25 (m, 2H); MS: m/e = 337.84;

ter-butyl 1S-cyanomethylcarbamoyl-2-(4-nitrophenyl)ethylcarbamate

(Compound 167);

N-(1-cyanomethylcarbamoyl-5-fluoropentyl)benzamide (Compound 168); 1H NMR (DMSO): 8.69 (t, J = 6Hz, 1H), 8.57 (d, J = 8Hz, 1H), 7.90 (d, J = 7Hz, 2H), 7.5 (m, 3H), 4.42 (dt, J = 52.6Hz, 2H), 4.43 (m, 1H), 4.13 (s, 2H), 1.83 – 1.3 (m, 6H); MS: m/e = 291.84;

ter-butyl 3-(1S-cyanomethylcarbamoylpentylcarbamoyl)phenylcarbamate

(Compound 169);

ter-butyl 3-cyanomethylcarbamoylmethylcarbamoylphenylcarbamate

(Compound 170);

N-(2-benzylsulfanyl-1R-cyanomethylcarbamoylthethyl)quinoline-3-carboxamide

(Compound 171); 1H NMR (DMSO): 9.30 (d, J = 2.5Hz, 1H), 8.58 (d, J = 2.5Hz, 1H), 8.16 (d, J = 8.7Hz, 1H), 7.90 (d, J = 9.2Hz, 1H), 7.83 (td, J = 8.7, 1.5Hz, 1H), 7.63 (td, J = 6.9, 1.2Hz, 1H), 7.17 – 7.42 (m, 5H), 4.77 (dd, J = 11.8, 7.2Hz, 1H), 3.81 (s, 2H), 3.12 (dd, J = 13.9, 6.2Hz, 1H), 2.90 (dd, J = 14.0, 7.4Hz, 1H); MS (404.77);

ter-butyl 3-(1S-cyanomethylcarbamoyl-
2-cyclohexylethylcarbamoylbznyl)carbamate (Compound 172); 1H NMR (CDCl3): 8.15 (bt, J=5.45Hz, 1H), 7.63 (d, J=8.1Hz, 2H), 7.43 (d, J=7.7Hz, 1H), 5.18 (s, 1H), 4.81 (dd, J=8.4, 18.8Hz, 1H), 4.25 (d, J=5.2Hz, 2H), 4.15 (dd, J=5.9, 17.1Hz, 1H), 3.98 (dd, J=5.9, 17.1Hz, 1H), 1.45 (s, 9H), 0.8-1.9 (m, 13H); MS: m/e (+1) 357.94;
3-acetylamino-N-(1S-cyanomethylcarbamoyl-2-cyclohexylethyl)benzamide
(Compound 173); 1H NMR (CDCl3): 8.43 (s, 1H), 8.32 (s, 1H), 7.94 (3, J=7.92Hz, 1H), 7.59 (s, 1H), 7.54 (s, 1H), 7.38 (d, J=7.9Hz, 1H), 4.83 (dd, J=7.4, 15.3Hz, 1H), 4.23 (dd, J=5.7, 17.3Hz, 1H), 4.06 (dd, J=5.7, 17.3Hz, 1H), 2.14 (s, 3H), 0.95-1.90 (m, 13H); MS: m/e=370.85;

2S-[2-(4-butoxyphenyl)acetylamino]-N-cyanomethyl-3-cyclohexylpropionamide
(Compound 174); NMR (MeOH): 7.19 (d, J=8.9Hz, 2H), 6.84 (d, J=8.9Hz, 2H), 4.38 (dd, J=5.9, 9.4Hz, 1H), 4.12 (d, J=2.2Hz, 2H), 3.94(t, J=6.4Hz, 2H), 3.60 (d, J=14.1Hz, 1H), 3.46 (d, J=14.1Hz, 1H), 1.40-1.78 (m, 4H), 1.05-1.3 (m, 3H), 0.95 (t, J=7.4Hz, 3H); MS: m/e=399.95;

N-[1S-cyanomethylcarbamoyl-2-(4-nitrophenyl)ethyl]morpholine-4-carboxamide
(Compound 175);

N-cyanomethyl-3-cyclohexyl-2S-(3-naphth-2-ylureido)propionamide
(Compound 176);

N-cyanomethyl-3-cyclohexyl-2S-(3-hexylureido)propionamide (Compound 177);

2S-(3-allylureido)-N-cyanomethyl-3-cyclohexylpropionamide (Compound 178);

N-cyanomethyl-3-cyclohexyl-2S-[3-(2,2,4-trimethylpenty1)ureidolpropionamide
(Compound 179);

N-(2-benzylsulfanyl-1R-cyanomethylcarbamoylthyl)quinoline-2-carboxamide
(Compound 180); 1H NMR (CDCl3): 8.90 (d, J = 7.8Hz, 1H), 8.35 (m, 1H), 8.22 (m, 3H), 7.89 (m, 1H), 7.81 (td, J = 7.2, 1.7Hz, 1H), 7.66 (td, J = 6.9, 1.0Hz, 1H), 7.37 (m, 2H), 7.14 – 7.32 (m, 3H), 4.77 (m, 1H), 4.16 (m, 2H), 3.82 (s, 2H), 3.11 (dd, J = 14.1, 6.2Hz, 1H), 3.00 (dd, J = 14.1, 6.9Hz, 1H); MS (404.8);

3-benzylsulfanyl-N-cyanomethyl-2R-(3,3-dimethylureido)propionamide
(Compound 181);

3-benzoil-N-(2-benzylsulfanyl-1R-cyanomethylcarbamoylthyl)benzamide
(Compound 182); 1H NMR (CDCl3): 8.19 (t, J = 1.6Hz, 1H), 7.96 (m, 2H), 7.78 (m, 2H), 7.61 (m, 2H), 7.51 (m, 2H), 7.23 – 7.37 (m, 5H), 6.99 (d, J = 6.2Hz, 2H), 4.64 (m, 1H), 4.13 (dd, J = 5.9, 1.0Hz, 2H), 3.80 (d, J = 2.5Hz, 2H), 3.09 (dd, J = 14.1, 6.9Hz, 2H), 2.81
(dd, J = 14.1, 7.7 Hz, 1H); MS (457.81);

*N-(1S-cyanomethylcarbamoyl-2-cyclohexylethyl)-
5-pyrid-2-ylthiophene-2-carboxamide* (Compound 183); ¹H NMR (CDCl₃): 8.55 (d, J=4.95 Hz, 1H), 8.05 (s, J=5.4 Hz, 1H), 7.67-7.73 (m, 2H), 7.62 (d, J=4.0 Hz, 1H), 7.54 (d, J=4.0 Hz, 1H), 7.21 (m, 1H), 7.11 (d, J=7.9 Hz, 1H), 4.77 (dd, J=8.4, 14.3 Hz, 1H), 4.21 (dd, J=5.7, 17.3 Hz, 1H), 4.06 (dd, J=5.7, 17.3 Hz, 1H), 0.8-2.0 (m, 13H); MS: m/e=396.8;

*N-(1S-cyanomethylcarbamoyl-2-cyclohexylethyl)-
4-methoxythiophene-3-carboxamide* (Compound 184); ¹H NMR (CDCl₃): 8.04 (d, J=3.7 Hz, 2H), 7.74 (d, J=7.4 Hz, 1H), 6.35 (d, J=3.4 Hz, 1H), 4.68 (dd, J=8.4, 13.9 Hz, 1H), 4.18 (dd, J=6.2, 17.3 Hz, 1H), 4.12 (dd, J=6.2, 17.13 Hz, 1H), 3.91 (s, 3H), 0.8-1.9 (m, 13H); MS: m/e=349.78;

*N-(1S-cyanomethylcarbamoyl-2-cyclohexylethyl)-
3-(3-methylbenzoyl)aminobenzamide* (Compound 185); ¹H NMR (CDCl₃): 8.47 (s, 1H), 8.30 (t, J=5.4 Hz, 1H), 7.98 (d, J=8.2 Hz, 1H), 7.84 (s, 1H), 7.68 (m, 2H), 7.2-7.48 (m, 4H), 4.84 (dd, J=8.2, 14.6 Hz, 1H), 4.26 (dd, J=6.2, 17.3 Hz, 1H), 4.02 (dd, J=6.2, 17.3 Hz, 1H), 2.35 (s, 3H), 0.8-1.9 (m, 14H); MS: m/e=446.90;

2S-(3-phenylsulfonylureido)-N-cyanomethyl-3-cyclohexylpropionamide
(Compound 186);

4-benzoyl-N-(2-benzylsulfanyl-1R-cyanomethylcarbamoylethyl)benzamide
(Compound 187); ¹H NMR (CDCl₃): 8.348 (1H), 8.11 (d, J = 6.6 Hz, 1H), 7.95 (d, J = 6.2 Hz, 1H), 7.56 (m, 1H), 7.14-7.54 (m, 7H), 4.73 (m, 1H), 4.16 (d, J = 5.9 Hz, 2H), 3.80 (m, 2H), 3.08 (dd, J = 13.9, 7.3 Hz, 1H), 2.87 (dd, J = 13.9, 6.2 Hz, 1H), 2.64 (s, 3H); MS (459.86);

*N-[2-(4-aminophenyl)-1S-cyanomethylcarbamoylethyl]morpholine-4-carboxamide
(Compound 188);

N-(2-benzylsulfanyl-1R-cyanomethylcarbamoylethyl)nicotinamide
(Compound 189);
N-(2-benzylsulfanyl-1R-cyanomethylcarbamoylethyl)isonicotinamide
(Compound 190);

2S-(3-tert-butyureido)-N-cyanomethyl-3-cyclohexylpropionamide
(Compound 191);

\(N-(1S\text{-cyanomethylcarbamoyl}-2\text{-cyclohexylethyl})4\text{-methylpentanamide}\)

(Compound 192); \(^1^H\text{NMR (CDCl}_3\text{)}: 8.25 (t, J=5.7Hz, 1H), 6.60 (d, J=8.2Hz, 1H), 4.60 (dd, J=8.7, 14.6Hz, 1H), 4.12 (dd, J=5.7, 14.8Hz, 1H), 4.04 (dd, J=5.7, 14.8Hz, 1H), 2.20 (t, J=8.2Hz, 2H), 0.85 (d, J=6.5, 6H), 1.1-1.8 (m, 16H); MS: m/e (+1) 307.92;

\(N-(1S\text{-cyanomethylcarbamoyl}-2\text{-cyclohexylethyl})\text{cyclopent-1-enecarboxamide}\)

(Compound 193); \(^1^H\text{NMR (CDCl}_3\text{)}: 7.79 (t, J=5.9Hz, 1H), 6.49 (m, 1H), 6.08 (d, J=7.9Hz, 1H), 4.58 (dd, J=8.4, 14.6Hz, 1H), 4.17 (dd, J=5.9, 17.3Hz, 1H), 4.04 (dd, J=5.9, 17.3Hz, 1H), 2.52 (m, 4H), 2.0 (m, 2H), 1.68 (m, 8H), 0.8-1.4 (m, 5H); MS: m/e (+1) 303.82;

\(\text{tert-butyl 2-benzylsulfanyl-1R-cyanomethylcarbamoylthiophene-carbamate}\)

(Compound 194);

\(N-(1S\text{-cyanomethylcarbamoyl}-2\text{-cyclohexylethyl})\text{-1H-imidazole-4-carboxamide}\)

(Compound 195); \(^1^H\text{NMR (DMSO)}: 8.10 (s, 1H), 7.60 (m, 4H), 4.62 (m, 1H), 4.10 (d, J=7.2Hz, 2H), 0.8-1.90 (m, 13H); MS: m/e (+1) 303.79;

\(N-(1S\text{-cyanomethylcarbamoyl}-2\text{-cyclohexylethyl})\text{-cyclopentanecarboxamide}\)

(Compound 196); \(^1^H\text{NMR (DMSO)}: 7.88 (t, J=5.45Hz, 1H), 6.15 (d, J=8.17Hz, 1H), 4.55 (dd, J=8.7, 14.6Hz, 1H), 4.16 (dd, J=5.7, 17.3Hz, 1H), 4.06 (dd, J=5.7, 17.3Hz, 1H), 2.65 (m, 1H), 0.8-1.95 (m, 21H); MS: m/e (+1) 305.91;

\(N-(1S\text{-cyanomethylcarbamoyl}-2\text{-cyclohexylethyl})\text{-cyclohex-1-enecarboxamide}\)

(Compound 197); \(^1^H\text{NMR (DMSO)}: 7.65 (t, J=5.2Hz, 1H), 6.69 (m, 1H), 6.02 (d, J=7.7Hz, 1H), 4.56 (dd, J=8.7, 14.1Hz, 1H), 4.17 (dd, J=5.9, 17.3Hz, 1H), 4.05 (dd, J=5.9, 17.3Hz, 1H), 2.19 (m, 4H), 1.48-1.85 (m, 13H), 0.8-1.4 (m, 4H); MS: m/e (+1) 317.86;

\(N-(1S\text{-cyanomethylcarbamoyl}-2\text{-cyclohexylethyl})\text{-5-methylsulfanylthiophene-2-carboxamide}\) (Compound 198); \(^1^H\text{NMR (CDCl}_3\text{)}: 8.12 (t, J=5.4Hz, 1H), 7.42 (d, J=4.0Hz, 1H), 7.18 (d, J=7.7Hz, 1H), 6.9 (d, J=4.0Hz, 1H), 4.73 (dd, J=8.2, 14.6Hz, 1H), 4.18 (dd, J=8.2, 14.6Hz, 1H), 2.55 (s, 3H), 1.75 (m, 8H), 0.8-1.5 (m, 6H); MS: m/e (+1) 365.77;

\(N-(1S\text{-cyanomethylcarbamoyl}-2\text{-cyclohexylethyl})\text{isobutyramide}\) (Compound 199); \(^1^H\text{NMR (CDCl}_3\text{)}: 8.12 (t, J=5.4Hz, 1H), 7.42 (d, J=4.0Hz, 1H), 7.18 (d, J=7.7Hz, 1H), 6.9 (d, J=4.0Hz, 1H), 4.73 (dd, J=8.2, 14.6Hz, 1H), 4.18 (dd, J=8.2, 14.6Hz, 1H), 2.55 (s, 3H), 1.75 (m, 8H), 0.8-1.5 (m, 6H); MS: m/e (+1) 365.77;
NMR (CDCl₃): 7.88 (t, J=5.7Hz, 1H), 6.14 (d, J=7.9Hz, 1H), 4.55 (dd, J=8.7, 14.6Hz, 1H), 4.15 (dd, J=5.7, 15.6Hz, 1H), 4.06 (dd, J=5.7, 15.6Hz, 1H), 2.40 (m, 1H), 1.57-1.80 (m, 8H), 0.8-1.40 (m, 11H); MS: m/e (+1) 279.89;

N-(1S-cyanomethylcarbamoyl-2-cyclohexylethyl)furan-2-carboxamide

(Compound 200); ¹H NMR (CDCl₃): 7.45 (m, 2H), 7.14 (d, J=3.5Hz, 1H), 6.67 (d, J=8.2Hz, 1H), 6.51 (m, 2H), 4.66 (dd, J=8.9, 14.1Hz, 1H), 4.20 (dd, J=5.9, 17.6Hz, 1H), 4.06 (dd, J=5.9, 17.6, 1H), 1.5-1.9 (m, 7H), 0.8-1.40 (m, 6H); MS: m/e (+1) 303.83;

N-cyanomethyl-3-cyclohexyl-2S-(3-cyclohexylureido)propionamide

(Compound 201);

N-cyanomethyl-3-cyclohexyl-2S-(3-phenylureido)propionamide (Compound 202);
3-acetylamino-N-(1S-cyanomethylcarbamoylpentyl)benzamide (Compound 203);

N-(1S-cyanomethylcarbamoyl-2-cyclohexylethyl)furan-3-carboxamide

(Compound 204); ¹H NMR (CDCl₃): 8.5 (t, J=6Hz, 1H), 7.95 (s, 1H), 7.8 (d, J=6Hz, 1H), 7.4 (s, 1H), 6.65 (s, 1H), 4.70 (m, 1H), 4.15 (dd, J=6, 6Hz, 1H), 3.95 (dd, J=6, 6Hz, 1H), 2.0-0.8 (m, 13H); MS:m/e =303.70;

N-(1S-cyanomethylcarbamoyl-2-cyclohexylethyl)-6-hydroxynicotinamide

(Compound 205); ¹H NMR (DMSO): 12.1 (s, 1H), 8.8 (t, J=5.7Hz, 1H), 8.4 (d, J=7.5Hz, 1H), 8.1 (d, J=2.1Hz, 1H), 7.9 (dd, J=3.10Hz, 1H), 6.43 (d, J=10Hz, 1H), 4.5-4.2 (m, 1H), 4.18 (d, J=6Hz, 1H), 1.8-0.8 (m, 13H); MS:m/e =330.82;

N-(1S-cyanomethylcarbamoyl-2-cyclohexylethyl)benzofuran-2-carboxamide

(Compound 206); ¹H NMR (CDCl₃): 7.95 (t, J=6Hz, 1H), 7.8-7.2 (m, 6H), 4.95 (m, 1H), 4.30 (dd, J=6, 6Hz, 1H), 4.10 (dd, J=6, 6Hz, 1H), 2.0-0.8 (m, 13H); MS:m/e =303.70;

N-(1S-cyanomethylcarbamoyl-2-cyclohexylethyl)quinoline-3-carboxamide

(Compound 207); ¹H NMR (DMSO): 9.2 (s, 1H), 8.8 (s, 1H), 8.0 (d, J=6Hz, 2H), 7.8 (t, J=6Hz, 1H), 7.65 (t, J=6Hz, 1H), 4.2 (m, 2H), 2.0-0.8 (m, 15H); MS:m/e =364.86;

N-(1S-cyanomethylcarbamoyl-2-cyclohexylethyl)-4-hydroxy-3-nitrobenzamide

(Compound 208); ¹H NMR (CDCl₃): 10.7 (s, 1H), 8.3 (s, 2H), 7.9 (d, J=6Hz, 1H), 7.1 (d, J=6Hz, 1H), 4.9 (m, 1H), 4.3 (m, 2H), 2.2-0.8 (m, 13H); MS:m/e =374.83;

N-(1S-cyanomethylcarbamoyl-2-cyclohexylethyl)-3-nitrobenzamide
(Compound 209); $^1$H NMR (DMSO): 8.8-8.2 (m, 4H), 8.1 (d, J=6.8Hz, 1H), 7.5 (t, J=6.8Hz, 1H), 4.9 (m, 1H), 4.45 (dd, J=6.6, 1H), 4.25 (dd, J=6.6, 1H), 2.0-0.8 (m, 13H); MS: m/e =358.75;

N-(1-cyanomethylcarbamoyl-2-cyclohexylethyl)-3-methylbutyramide

(Compound 210); $^1$H NMR (CDCl$_3$): 7.9 (t, J=3, 6Hz, 1H), 6.3 (d, J=6Hz, 1H), 4.6 (m, 1H), 4.1 (m, 2H), 2.3-0.8 (m, 22H); MS: m/e =293.73;

N-(2-benzylsulfanyl-1R-cyanomethylcarbamoylethyl)-1H-indole-5-carboxamide

(Compound 211); $^1$H NMR (CD$_2$OD): 8.12 (s, 1H), 7.61 (d, J = 7.7Hz, 1H), 7.39 (d, J = 8.4Hz, 1H), 7.28 (m, 6H), 7.22 (m, 1H), 7.16 (m, 1H), 6.52 (m, 1H), 4.73 (m, 1H), 4.14 (s, 2H), 3.75 (s, 1H), 2.97 (m, 1H), 2.79 (m, 1H); MS (393.2);

N-(2-benzylsulfanyl-1R-cyanomethylcarbamoylethyl)-3-phenoxybenzamide

(Compound 212); $^1$H NMR (CDCl$_3$): 7.55 (m, 1H), 7.45 (m, 1H), 7.39 (m, 1H), 7.26 (m, 6H), 7.12 (m, 3H), 6.97 (m, 2H), 4.67 (m, 1H), 4.11 (d, J = 3.7Hz, 2H), 3.72 (d, J = 3.7Hz, 2H), 2.93 (m, 1H), 2.73 (m, 1H); MS (446.4);

tert-butyl 3-(2-benzylsulfanyl-1R-cyanomethylcarbamoylethylcarbamoyl)benzylcarbamate (Compound 213); $^1$H NMR (CDCl$_3$): 7.69 (s, 1H), 7.62 (m, 1H), 7.48 (d, J = 7.2Hz, 1H), 7.41 (d, J = 7.8Hz, 1H), 7.28 (m, 4H), 7.12 (J = 7.2Hz, 1H), 4.74 (dd, J = 13.5, 6.9Hz, 1H), 4.33 (s, 2H), 4.13 (d, J = 5.4Hz, 2H), 3.77 (s, 2H), 3.01 (dd, J = 14.4, 6.3Hz, 1H), 2.85 (dd, J = 13.8, 7.2Hz, 1H), 1.45 (s, 9H); MS (483);

3-acetyl-N-(2-benzylsulfanyl-1R-cyanomethylcarbamoylethyl)benzamidine

(Compound 214); $^1$H NMR (CDCl$_3$): 8.348 (1H), 8.11 (d, J = 6.6Hz, 1H), 7.95 (d, J = 6.2Hz, 1H), 7.56 (m, 1H), 7.14 - 7.54 (m, 7H), 4.73 (m, 1H), 4.16 (d, J = 5.9Hz, 2H), 3.80 (m, 2H), 3.08 (dd, J = 13.9, 7.3Hz, 1H), 2.87 (dd, J = 13.9, 6.2Hz, 1H), 2.64 (s, 3H); MS (396.0);

3-(3-methylbenzoylamino-N-(2-benzylsulfanyl-1R-cyanomethylcarbamoylethyl)benzamidine (Compound 215); $^1$H NMR (CDCl$_3$): 8.12 (s, 1H), 7.95 (m, 2H), 7.70 (s, 1H), 7.66 (m, 1H), 7.20 - 7.47 (m, 8H), 7.12 (d, J = 6.9Hz, 1H), 4.74 (m, 1H), 4.16 (d, J = 5.7Hz, 2H), 3.77 (s, 2H), 3.01 (dd, J = 13.7, 5.9Hz, 1H),
2.86 (dd, J = 13.8, 6.8 Hz, 1H), 2.42 (s, 3H); MS: (487.4);

*N*-[cyanomethylcarbamoyl](propoxy)methyl]benzamide (Compound 216); ¹H NMR (DMSO): 9.25 (d, J = 10 Hz, 1H), 8.65 (t, J = 6 Hz, 1H), 7.92 (d, J = 7 Hz, 2H), 7.5 (m, 3H), 5.60 (d, J = 10 Hz, 1H), 4.18 (m, 2H), 3.51 (m, 2H), 1.56 (h, J = 8 Hz, 2H), 0.88 (t, J = 8 Hz, 3H);

*N*-(3-benzylsulfanyl-1R-cyanomethylcarbamoylpropyl)benzamide (Compound 217);
¹H NMR (DMSO): 8.69 (t, J = 6 Hz, 1H), 8.63 (d, J = 8 Hz, 1H), 7.90 (d, J = 9 Hz, 2H), 7.5 (m, 3H), 7.2 (m, 5H), 4.54 (m, 1H), 4.13 (d, J = 6 Hz, 2H), 3.73 (s, 2H), 2.46 (m, 2H), 2.02 (m, 2H); MS: m/e = 367.81;

*N*-[cyanomethylcarbamoyl](cyclohexyloxy)methyl]benzamide (Compound 218); ¹H NMR (DMSO): 9.26 (d, J = 9 Hz, 1H), 8.55 (t, J = 6 Hz, 1H), 7.92 (d, J = 7 Hz, 2H), 7.51 (m, 3H), 5.72 (d, J = 10 Hz, 1H), 4.17 (m, 2H), 3.56 (m, 1H), 1.95 (m, 3H), 1.75 (m, 3H), 1.3 (m, 6H); MS: m/e = 315.8;

*N*-(1S-cyanomethylcarbamoyl-2-cyclohexylethyl)succinamic acid (Compound 219);
¹H NMR (CDCl₃): 4.38 (m, 1H), 4.05 (s, 2H), 2.45 (d, J=6.3 Hz, 2H), 2.58 (d, J=6.3 Hz, 2H), 0.8-1.9 (m, 15H); MS: m/e (+1) 309.72;

3-[3-(2-chloro-6-methylphenyl)ureido]-N-(1S-cyanomethylcarbamoyl-2-cyclohexylethyl]benzamide (Compound 220);

*tert*-butyl 4-(1S-cyanomethylcarbamoyl-2-cyclohexylethyl]carbamate (Compound 221);

*N*-(1S-cyanomethylcarbamoyl-2-pyrid-4-ylethyl]benzamide (Compound 222); ¹H NMR: (CDCl₃) 8.36 (d, J=6 Hz, 2H), 7.80 (d, J=6.5 Hz, 1H), 7.66 (d, J=7.3 Hz, 2H), 7.47-7.32 (m, 4H), 7.14 (d, J=6Hz, 2H), 4.79 (m, 1H), 4.06 (d, J=17 Hz, 1H), 3.94 (d, J=17 Hz, 1H), 3.15 (dd, J=6.6 Hz, J=13.6 Hz, 1H), 3.01 (dd, J=7.5 Hz, J=14 Hz, 1H); MS: (M⁺+1) 309;

*N*-[1S-cyanomethylcarbamoyl-2-(4-oxocyclohexyl)ethyl]benzamide (Compound 223); ¹H NMR: (CDCl₃) 7.93 (m, 1H), 7.81 (d, J=7 Hz, 2H), 7.59-7.44 (m, 3H), 7.13 (t, J=8 Hz, 1H), 4.85 (m, 1H), 4.23-4.08 (m, 2H), 2.38-1.25 (m, 11H); MS: (M⁺+1) 328;
**N-[1S-cyanomethylcarbamoyl-2-(4,4-difluorocyclohexyl)ethyl]benzamide**

(Compound 224); $^1$H NMR: (CDCl$_3$) 8.04 (m, 1H), 7.80 (d, $J$=7.4Hz, 2H), 7.58-7.42 (m, 3H), 7.20 (d, $J$=6Hz, 1H), 4.84 (m, 1H), 4.21-4.03 (m, 2H), 2.20-1.23 (m, 11H); MS: (M$^+$+1) 350;

**N-[1S-cyanomethylcarbamoyl-2-cyclohexylethyl]thiomorpholine-4-carboxamide**

(Compound 225); $^1$H NMR (DMSO): 7.75 (m, 1H), 4.99 (m, 1H), 4.37 (m, 1H), 4.12 (m, 1H), 3.7 (m, 4H), 2.61 (m, 4H), 2-0.8 (m, 13H); MS: m/e 339.4;

**4-(1S-cyanomethylcarbamoyl-2-cyclohexylethylcarbamoyl)butyric acid**

(Compound 226);

**N-[(cyanomethylcarbamoyl)(phenethoxy)methyl]benzamide** (Compound 227); $^1$H NMR (DMSO): 9.30 (d,$J$ = 9Hz, 1H), 8.69 (t,$J$ = 7Hz, 1H), 7.90 (d,$J$ = 8Hz, 2H), 7.51 (m, 3H), 7.2 (m, 5H), 5.66 (m, 1H), 4.19 (m, 2H), 3.77 (m, 2H), 2.92 (m, 2H); MS: m/e = 337.94;

**4-amino-N-(1S-cyanomethylcarbamoyl-2-cyclohexylethyl)benzamide**

(Compound 228);

tert-butyl 4-(2-benzylsulfanyl-1R-cyanomethylcarbamoylethylcarbamoyl)piperazine-1-carboxylate (Compound 229); $^1$H NMR (CDCl$_3$): 7.46 (t,$J$ = 5.7Hz, 1H), 7.31 (m, 5H), 5.27 (d,$J$ = 6.9Hz, 1H), 4.38 (dd,$J$ = 13.4,6.7Hz, 1H), 4.15 (dd,$J$ = 17.3,5.9Hz, 1H), 4.06 (dd,$J$ = 17.3,9.9Hz, 1H), 3.73 (s, 2H), 3.42 (t,$J$ = 4.9Hz, 4H), 3.31 (t,$J$ = 4.9Hz, 4H), 2.97 (dd,$J$ = 14.1,6.7Hz, 1H), 2.77 (dd,$J$ = 13.9,6.7Hz, 1H), 1.46 (s, 9H); MS (462.4);

**N-(2-benzylsulfanyl-1R-cyanomethylcarbamoylethyl)-4-fur-2-ylicarbonylpiperazine-1-carboxamide** (Compound 230); $^1$H NMR (CDCl$_3$): 7.59 (t,$J$ = 5.7Hz, 1H), 7.50 (dd,$J$ = 2.2,1.0Hz, 1H), 7.30 (m, 5H), 7.05 (dd,$J$ = 2.4,0.7Hz, 1H), 6.50 (dd,$J$ = 6.9,1.7Hz, 1H), 5.42 (d,$J$ = 6.9Hz, 1H), 4.42 (dd,$J$ = 13.3,6.7Hz, 1H), 4.15 (dd,$J$ = 11.6,5.9Hz, 1H), 4.06 (dd,$J$ = 16.2,7.2Hz, 1H), 3.73 (s, 4H), 3.45 (m, 4H), 3.38 (m, 4H), 2.95 (dd,$J$ = 13.9,6.4Hz, 1H), 2.78 (dd,$J$ = 13.9,6.7Hz, 1H); MS (456.2);

**ethyl 4-(2-benzylsulfanyl-1R-cyanomethylcarbamoylethylcarbamoyl)piperazine-1-carboxylate** (Compound 231); $^1$H NMR (CDCl$_3$): 7.58 (t,$J$ = 5.7Hz, 1H), 7.30 (m, 5H), 5.35 (d,$J$ = 6.9Hz, 1H), 4.41 (dd,$J$ = 13.3,6.7Hz, 1H), 4.15 (q,$J$ = 7.1Hz, 2H), 4.10 (t,$J$ = 4.1Hz, 2H), 2.78 (dd,$J$ = 13.9,6.7Hz, 1H), 2.78 (dd,$J$ = 13.9,6.7Hz, 1H); MS (456.2);
5.9 Hz, 2H), 3.72 (s, 2H), 3.47 (t, J = 4.9 Hz, 4H), 3.34 (t, J = 3.7 Hz, 4H), 2.93 (dd, J = 13.8, 6.4 Hz, 1H), 2.76 (dd, J = 13.8, 6.9 Hz, 1H), 1.26 (t, J = 7.1 Hz, 3H); MS (434.4); 

N-(2-benzylsulfanyl-1R-cyanomethylcarbamoylethyl)-4-hydroxybenzamide
(Compound 232);

N-(2-benzylsulfanyl-1R-cyanomethylcarbamoylethyl)-3-hydroxybenzamide
(Compound 233);

N-[2-(1-acetylpyridin-4-yl)-1S-cyanomethylcarbamoylethyl]benzamide
(Compound 234); MS: (M+Na) 379;

N-[[cyanomethylcarbamoyl](phenylamino)methyl]benzamide (Compound 235); ¹H NMR (DMSO): 9.02 (d, J = 9 Hz, 1H), 8.91 (t, J = 6 Hz, 1H), 7.86 (d, J = 10 Hz, 2H), 7.5 (m, 3H), 7.11 (t, J = 9 Hz, 2H), 6.78 (d, J = 8 Hz, 2H), 6.65 (t, J = 8 Hz, 1H), 6.08 (d, J = 9 Hz, 1H), 5.87 (m, 1H), 4.20 (t, J = 3 Hz, 2H); MS: m/e = 308.99;

N-[1S-cyanomethylcarbamoyl-2-(4-methylenecyclohexyl)ethyl]benzamide
(Compound 236); ¹H NMR: (CDCl₃) 7.81-7.75 (m, 3H), 7.58-7.43 (m, 3H), 6.88 (d, J=8Hz, 1H), 4.80 (m, 1H), 4.59 (s, 2H), 4.20 (dd, J=6Hz, J=17Hz, 1H), 4.08 (dd, J=5.5Hz, J=17Hz, 1H), 2.30-1.48 (m, 9H), 1.15-0.96 (m, 2H); MS: (M+Na) 348;

N-[1S-cyanomethylcarbamoyl-2-(4-ethylidenedicyclohexyl)ethyl]benzamide
(Compound 237); ¹H NMR: (CDCl₃) 7.87 (t, J=6Hz, 1H), 7.80 (d, J=7Hz, 2H), 7.58-7.43 (m, 3H), 6.94 (d, J=8Hz, 1H), 5.12 (q, J=6.5Hz, 2H), 4.80 (m, 1H), 4.20 (dd, J=6Hz, J=17Hz, 1H), 4.08 (dd, J=5.5Hz, J=17Hz, 1H), 2.55 (m, 1H), 2.17-1.50 (m, 8H), 1.53 (d, J=6.5Hz, 3H), 1.10-0.91 (m, 2H); MS: (M+Na) 362;

N-[1S-cyanomethylcarbamoyl-2-(4-propylidenedicyclohexyl)ethyl]benzamide
(Compound 238); ¹H NMR: (CDCl₃) 8.15 (m, 1H), 7.81 (d, J=8Hz, 2H), 7.56-7.41 (m, 3H), 7.22 (d, J=7Hz, 1H), 5.05 (t, J=7Hz, 1H), 4.84 (q, J=7Hz, 1H), 4.18 (dd, J=6Hz, J=17Hz, 1H), 4.05 (dd, J=5.5Hz, J=17Hz, 1H), 2.48 (m, 2H), 2.11-1.47 (m, 9H), 1.03-0.90 (m, 2H), 0.90 (t, J=7.7Hz, 3H); MS: (M+Na) 376;

N-[1S-cyanomethylcarbamoyl-2-(1-ethylpyridin-4-yl)ethyl]benzamide
(Compound 239); ¹H NMR: (DMSO) 8.68 (t, J=6Hz, 1H), 8.56 (d, J=7Hz, 1H), 7.87 (d, J=7Hz, 2H), 7.54-7.42 (m, 3H), 4.50 (m, 1H), 4.10 (m, 2H), 2.77 (m, 2H), 2.24 (m, 2H),
1.79-1.05 (m, 9H), 0.93 (t, J=7Hz, 3H); MS: (M+1) 343;

4-[2-benzoylamino-2-S-cyanomethyl]carbamoylmethyl]-1-methylcyclohexyl trifluoroacetate (Compound 240); 1H NMR: (CDCl₃) 8.25 (t, J=5Hz, 1H), 7.80 (d, J=7Hz, 2H), 7.58-7.39 (m, 4H), 4.86 (q, J=7.5Hz, 1H), 4.16 (dd, J=5.5Hz, J=17Hz, 1H), 4.04 (dd, J=5.5Hz, J=17Hz, 1H), 2.28 (m, 2H), 1.84-1.07 (m, 9H), 1.51 (s, 3H); MS: (M+1) 440;

N-(2-tert-butyl disulfanyl-1R-cyanomethyl carbamoyl)ethyl benzamide
(Compound 241); 1H NMR (CDCl₃): 7.83 (m, 1H), 7.65 (m, 1H), 7.55 (m, 1H), 7.43 (m, 2H), 7.16 (m, 1H), 5.00 (m, 1H), 4.19 (m, 2H), 3.33 (m, 1H), 3.27 (m, 1H), 1.34 (s, 9H);

N-[1S-cyanomethylcarbamoyl-2-(4-hydroxycyclohexyl)ethyl] benzamide
(Compound 242); 1H NMR: (CDCl₃+10% CD₃OD) 7.75 (d, J=7Hz, 2H), 7.54-7.35 (m, 3H), 4.60 (m, 1H), 4.14 (d, J=17.5Hz, 1H), 4.00 (d, J=17.3Hz, 1H), 3.44 (m, 1H), 1.91-1.60 (m, 6H), 1.28-0.90 (m, 5H); MS: (M+Na) 352;

cis-4-(2-benzoylamino-2-S-cyanomethyl carbamoyl)ethyl cyclohexyl acetate
(Compound 243); MS: (M+Na) 394, (M+CH₃COO) 312;

N-[(cyanomethyl carbamoyl)(phenethylsulfanyl)methyl] benzamide (Compound 244);
1H NMR (DMSO): 9.14 (d, J = 10Hz, 1H), 9.01 (t, J = 7Hz, 1H), 7.94 (d, J = 9Hz, 2H), 7.5 (m, 3H), 7.2 (m, 5H), 5.88 (d, J = 10Hz, 1H), 4.22 (m, 2H), 2.90 (m, 4H); MS: m/e = 354.01;

N-[1S-cyanomethyl carbamoyl-2-(1-thiazolol-2-ylpiperidin-4-yl)methyl] benzamide
(Compound 245); 1H NMR: (CDCl₃+10% CD₃OD) 7.77 (d, J=7Hz, 2H), 7.51-7.37 (m, 3H), 7.06 (d, J=3.6Hz, 1H), 6.48 (d, J=3.6Hz, 1H), 4.68 (t, J=7.3Hz, 1H), 4.14 (d, J=17.3Hz, 1H), 4.01 (d, J=17.3Hz, 1H), 3.91-3.85 (m, 2H), 2.99-2.89 (m, 2H), 1.90-1.27 (m, 7H); MS: (M+Na) 420;

N-[(cyanomethyl carbamoyl)(cyclohexylsulfanyl)methyl] benzamide (Compound 246);
1H NMR (DMSO): 9.10 (d, J = 10Hz, 1H), 8.94 (t, J = 6Hz, 1H), 7.92 (d, J = 9Hz, 2H), 7.50 (m, 3H), 5.80 (d, J = 10Hz, 1H), 4.19 (d, J = 6Hz, 2H), 2.96 (m, 1H), 2.00 (m, 1H), 1.88 (m, 1H), 1.67 (m, 2H), 1.53 (m, 1H), 1.27 (m 5H); MS: m/e = 331.58;

N-cyanomethyl-3-cyclohexyl-2R-(2-ethoxyacetyl)amino)propionamide
(Compound 247);
\textbf{N-(1S-cyanomethylcarbamoyl-2-cyclohexylethyl)-3-methoxypipronamide}

(Compound 248); \textsuperscript{1}H NMR (CDCl\textsubscript{3}): 7.68 (t, J=5.4Hz, 1H), 6.66 (d, J=7.9Hz, 1H), 4.52 (dd, J=9.4, 13.4Hz, 1H), 4.18 (dd, J=5.9, 17.6Hz, 1H), 4.06 (dd, J=5.9, 17.6Hz, 1H), 3.65 (m, 2H), 3.38 (s, 3H), 2.50 (t, J=5.7Hz, 2H), 0.8-1.70 (m, 13H);

\textit{cis}-\textbf{N-[1S-cyanomethylcarbamoyl-2-(4-methoxycyclohexyl)ethyl]benzamide}

(Compound 249); \textsuperscript{1}H NMR: (CDCl\textsubscript{3}) 8.01 (s, 1H), 7.80 (d, J=7Hz, 2H), 7.55-7.42 (m, 3H), 6.84 (d, J=8.3Hz, 1H), 5.26 (m, 1H), 4.59 (d, J=17.2Hz, 1H), 4.14 (d, J=17.2Hz, 1H), 3.54 (m, 1H), 3.29 (s, 3H), 2.18-0.94 (m, 11H); MS: (M\textsuperscript{+}+Na) 366;

\textbf{N-(2-benzylsulfanyl)-1R-cyanomethylcarbamoyl-3-[3-(1-benzylpyrrolidin-3R-yl)-3-methylureido]benzamide}

(Compound 250); ESI-MS m/z 585.3 (M+H\textsuperscript{+});

\textit{N-(2-benzylsulfanyl)-3-[3-(1-benzylpyrrolidin-3S-yl)-3-methylureido]benzamide}

(Compound 251); ESI-MS m/z 585.4 (M+H\textsuperscript{+});

\textbf{N-(2-benzylsulfanyl-1R-cyanomethylcarbamoylethyl)-3-[3-(4-benzylpiperazin-1-ylcarbonyl)aminolbenzamide}

(Compound 252); ESI-MS m/z 571.2 (M+H\textsuperscript{+});

\textbf{N-(1R-cyanomethylcarbamoyl-2-pentafluorobenzylsulfanylethyl)benzamide}

(Compound 253);

\textbf{N-[1R-cyanomethylcarbamoyl-2-naphth-2-ylmethylsulfanylethyl]benzamide}

(Compound 254); \textsuperscript{1}H NMR (CDCl\textsubscript{3}): 7.80 (m, 4H), 7.12-7.74 (m, 9H), 4.80 (m, 1H), 4.10 (m, 3H), 3.75 (s, 2H), 3.02 (m, 1H), 2.87 (m, 1H), 2.2-2.6 (m);

\textbf{N-(2-benzylsulfanyl-1R-cyanomethylcarbamoylethyl)-3-[(3-[1,3,4]thiadiazol-2-ylureido)benzamide}

(Compound 255); \textsuperscript{1}H NMR (270 MHz, DMSO-\textit{d}_6) \delta 2.78 (m, 1), 2.89 (m, 1), 3.79 (s, 2), 4.18 (d, 2), 4.71 (m, 1), 7.23-7.37 (m, 5), 7.45 (t, 1), 7.61 (d, 1), 7.71 (d, 1), 7.99 (s, 1), 8.75 (d, 1), 8.77 (t, 1), 9.08 (s, 1), 9.22 (s, 1); ESI-MS m/z 496.1 (M+H\textsuperscript{+});

\textbf{N-[2-(4-chlorobenzylsulfanyl)-1R-cyanomethylcarbamoylethyl]benzamide}

(Compound 256); \textsuperscript{1}H NMR: (DMSO) 8.85 (t, J=5Hz, 1H), 8.73 (d, J=8.4Hz, 1H), 7.92 (d, 1H),
J=7Hz, 2H), 7.60-7.47 (m, 3H), 7.40-7.33 (m, 4H), 4.69 (dd, J=5.2Hz, J=9.4Hz, 1H), 4.16 (s, 2H), 3.78 (s, 2H), 2.90 (dd, J=5.2Hz, J=13.6Hz, 1H), 2.77 (dd, J=9.6Hz, J=13.8Hz, 1H); MS: (M+1) 388/390;

N-[1R-cyanomethylcarbamoyl-2-(2-methylbenzylsulfanyl)ethyl]benzamide

(Compound 257); 1H NMR: (DMSO) 8.87 (t, J=5.4Hz, 1H), 8.74 (d, J=8.2Hz, 1H), 7.92 (d, J=7Hz, 2H), 7.60-7.47 (m, 3H), 7.25-7.08 (m, 4H), 4.75 (m, 1H), 4.17 (d, J=5.7Hz, 2H), 3.80 (s, 2H), 2.98 (dd, J=5.2Hz, J=13.6Hz, 1H), 2.82 (dd, J=9.6Hz, J=13.8Hz, 1H), 2.31 (s, 3H); MS: (M+1) 368;

N-[1R-cyanomethylcarbamoyl-2-(3,5-dimethylbenzylsulfanyl)ethyl]benzamide

(Compound 258); 1H NMR: (DMSO) 8.86 (t, J=5.4Hz, 1H), 8.73 (d, J=8.2Hz, 1H), 7.93 (d, J=7Hz, 2H), 7.60-7.46 (m, 3H), 6.91 (s, 2H), 6.85 (s, 1H), 4.71 (m, 1H), 4.17 (d, J=5.7Hz, 2H), 3.70 (s, 2H), 2.92 (dd, J=5.4Hz, J=13.6Hz, 1H), 2.76 (dd, J=9.6Hz, J=13.8Hz, 1H), 2.22 (s, 6H); MS: (M+1) 382;

N-[1R-cyanomethylcarbamoyl-2-(4-trifluoromethylbenzylsulfanyl)ethyl]benzamide

(Compound 259); 1H NMR: (DMSO) 8.86 (t, J=5.4Hz, 1H), 8.74 (d, J=7.9Hz, 1H), 7.93 (d, J=7Hz, 2H), 7.68 (d, J=8.2Hz, 2H), 7.60-7.46 (m, 5H), 4.71 (m, 1H), 4.17 (m, 2H), 3.88 (s, 2H), 2.92 (dd, J=5.4Hz, J=13.4Hz, 1H), 2.79 (dd, J=9.6Hz, J=13.8Hz, 1H); MS: (M+1) 422;

N-[1R-cyanomethylcarbamoyl-2-(4-trifluoromethoxybenzylsulfanyl)ethyl]benzamide

(Compound 260); 1H NMR: (DMSO) 8.86 (t, J=5.4Hz, 1H), 8.74 (d, J=8.2Hz, 1H), 7.93 (d, J=7Hz, 2H), 7.60-7.42 (m, 5H), 7.31 (d, J=7.9Hz, 2H), 4.71 (m, 1H), 4.17 (d, J=5.7Hz, 2H), 3.83 (s, 2H), 2.92 (dd, J=5.4Hz, J=13.8Hz, 1H), 2.79 (dd, J=9.6Hz, J=13.8Hz, 1H); MS: (M+1) 438;

N-[1R-cyanomethylcarbamoyl-2-(4-trifluoromethylsulfanylbenzylsulfanyl)ethyl]benzamide (Compound 261); 1H NMR: (DMSO) 8.86 (t, J=5.4Hz, 1H), 8.75 (d, J=8.2Hz, 1H), 7.92 (d, J=7Hz, 2H), 7.66 (d, J=7.9Hz, 2H), 7.60-7.45 (m, 5H), 4.72 (m, 1H), 4.17 (d, J=5.7Hz, 2H), 3.86 (s, 2H), 2.92 (dd, J=5.4Hz, J=13.8Hz, 1H), 2.80 (dd, J=9.6Hz, J=13.8Hz, 1H); MS: (M+1) 454;

N-[1R-cyanomethylcarbamoyl-2-(3-nitrobenzylsulfanyl)ethyl]benzamide
(Compound 262); $^1$H NMR: (DMSO) 8.83 (t, J=5Hz, 1H), 8.73 (d, J=7.7Hz, 1H), 8.21 (s, 1H), 8.09 (d, J=8Hz, 1H), 7.99 (m, 2H), 7.79 (d, J=7.7Hz, 1H), 7.63-7.45 (m, 4H), 4.66 (m, 1H), 4.14 (d, J=5Hz, 2H), 3.94 (s, 2H), 2.90-2.49 (m, 2H); MS: (M$^+$+1) 399.2;

$N$-[1R-cyanomethylcarbamoyl-2-(3-nitrobenzylsulfanyl)ethyl]benzamide

(Compound 263); $^1$H NMR (DMSO): 8.79 (m, 1H), 8.48 (d, J=5Hz, 1H), 7.93 (d, J=7Hz, 2H), 7.75 (dt, J=2,8Hz, 1H), 7.52 (m, 5H), 7.26 (m, 1H), 4.71 (m, 1H), 4.15 (m, 2H), 3.88 (s, 2H), 2.89 (m, 2H); MS: m/e=354.97;

$N$-(1R-cyanomethylcarbamoyl-2-pyrid-3-ylmethylsulfanyl)ethyl]benzamide

(Compound 264); $^1$H NMR (DMSO): 8.86 (t, J =6Hz, 1H), 8.74 (d, J=9Hz, 1H), 8.53 (d, J=2Hz, 1H), 8.44 (dd, J=5, 2Hz, 1H), 7.91 (m, 2H), 7.74 (m, 1H), 7.54 (m, 3H), 7.34 (m, 1H), 4.72 (m, 1H), 4.17 (m, 2H), 3.82 (s, 2H), 2.84 (m, 2H); MS: m/e=355.04;

$N$-(1R-cyanomethylcarbamoyl-2-pyrid-4-ylmethylsulfanyl)ethyl]benzamide

(Compound 265); $^1$H NMR (DMSO): 8.85 (t, J =6Hz, 1H), 8.75 (d, J =9Hz, 1H), 8.5 (m, 2H), 7.93 (m, 2H), 7.54 (m, 3H), 7.35 (m, 2H), 4.69 (m, 1H), 4.16 (d, J =6Hz, 2H), 3.8 (s =2H), 2.91 (dd, J =6,15Hz, 1H), 2.79 (dd, J =10,15Hz, 1H); MS: m/e = 355.02;

3-amino-$N$-(1S-cyanomethylcarbamoyl)-2-cyclohexylethylbenzamide

(Compound 266);

3-amino-$N$-(2-benzylsulfanyl-1R-cyanomethylcarbamoylethyl)benzamide

(Compound 267);

3-amino-$N$-(1S-cyanomethylcarbamoylpentyl)benzamide (Compound 268);

methyl 2S-benzyolamino-3-cyclohexylpropionylaminocymoacetate (Compound 269);

MS: (M$^+$+Na) 394;

2S-benzyolamino-3-cyclohexylpropionylaminocymoacetic acid (Compound 270);

MS: (M$^+$+1) 358;

$N$-[1R-cyanomethylcarbamoyl]-2-(3,4-dichlorobenzylsulfanyl)ethyl]benzamide

(Compound 271); $^1$H NMR (DMSO): 8.8 (d, t, 2H), 7.9 (d, J=8Hz, 2H), 7.8 (m, 3H), 7.1 (m, 4H), 4.7 (m, 1H), 4.2 (S, 2H), 3.7 (s, 2H), 2.9 (m, 1H), 2.7 (m, 1H), 2.3 (s, 3H);

MS: m/e = 368.0;

$N$-[1R-cyanomethylcarbamoyl]-2-(3-methylbenzylsulfanyl)ethyl]benzamide
(Compound 272);  
\[ N\-\{1R\-cyanomethylcarbamoyl\-2\-(4-nitrobenzylsulfanyl)ethyl\}benzamide \]  
(Compound 273); \(^1^H\) NMR: (DMSO) 8.83 (t, J=5.1 Hz, 1H), 8.72 (d, J=7.7 Hz, 1H), 8.17 (d, J=8 Hz, 2H), 7.89 (d, J=7 Hz, 2H), 7.62-7.45 (m, 5H), 4.67 (m, 1H), 4.15 (d, J=5.4 Hz, 2H), 3.92 (s, 2H), 2.89 (dd, J=5.4 Hz, J=13.8 Hz, 1H), 2.77 (dd, J=9.6 Hz, J=13.8 Hz, 1H); MS: (M\(^+\)+1) 399.2;  
\[ N\-\{1R\-cyanomethylcarbamoyl\-2\-(2-nitrobenzylsulfanyl)ethyl\}benzamide \]  
(Compound 274); \(^1^H\) NMR (CDCl\(_3\)) 8.81 (m, 1H), 8.79 (d, J=8.0 Hz, 1H), 7.95 (d, J=3.9 Hz, 1H), 7.84 (m, 2H), 7.42-7.65 (m, 6H), 4.63 (m, 1H), 4.05 (m, 4H), 3.80 (m, 2H); MS: m/e (+1) 399.2;  
\[ N\-\{1R\-cyanomethylcarbamoyl\-2\-(3-trifluoromethylbenzylsulfanyl)ethyl\}benzamide \]  
(Compound 275); \(^1^H\) NMR (DMSO) 8.86 (m, 1H), 8.74 (d, J=4.9 Hz, 1H), 7.90 (d, J=8.4 Hz, 2H), 4.72 (m, 1H), 4.15 (d, J=5.1 Hz, 2H), 3.88 (s, 2H), 2.78 (m, 2H), 2.22-2.74 (m, 7H); MS: m/e (+1) 422.2;  
\[ N\-\{1R\-cyanomethylcarbamoyl\-2\-(3-trifluoromethylbenzylsulfanyl)ethyl\}benzamide \]  
(Compound 276); \(^1^H\) NMR (DMSO) 8.81 (m, 1H), 8.76 (d, J=4.8 Hz, 1H), 7.85 (d, J=8.4 Hz, 2H), 7.10-7.55 (m, 7H), 4.7 (m, 1H), 4.15 (s, 2H), 3.80 (s, 2H), 2.80 (m, 2H); MS: m/e (+1) 438.2;  
\[ N\-\{1R\-cyanomethylcarbamoyl\-2\-(2-methylbenzylsulfanyl)ethyl\}morpholine-4-carboxamide \]  
(Compound 277); \(^1^H\) NMR (DMSO) 8.7 (t, J=6 Hz, 1H), 7.2 (m, 4H), 6.67 (d, J=7.8 Hz, 1H), 4.4 (m, 1H), 4.2 (s, 2H), 3.7 (s, 2H), 3.5 (t, 4H), 3.3 (t, 4H), 2.7 (m, 2H), 2.3 (s, 3H); MS m/e 377.2;  
\[ N\-\{1R\-cyanomethylcarbamoyl\-2\-(2-nitrobenzylsulfanyl)ethyl\}morpholine-4-carboxamide \]  
(Compound 278); \(^1^H\) NMR (DMSO) 8.67 (t, J=6 Hz, 1H), 7.97 (d, J=8.1 Hz, 1H), 7.5 (m, 4H), 4.28 (q, 1H), 4.1 (d, J=4 Hz, 2H), 4.05 (m, 2H), 3.5 (t, 4H), 3.2 (t, 4H), 2.6 (m, 2H); MS m/e 408.4;  
\[ N\-\{1R\-cyanomethylcarbamoyl\-2\-(3-nitrobenzylsulfanyl)ethyl\}morpholine-4-carboxamide \]  
(Compound 279); \(^1^H\) NMR (DMSO) 8.7 (t, J=3 Hz, 1H), 8.2 (m, 2H), 7.7 (m, 2H), 6.77 (d, J=3 Hz, 1H), 4.33 (m, 1H), 4.16 (m, 2H), 3.85 (d, J=2.4 Hz, 2H), 3.4 (m,
8H), 2.6 (m, 2H); MS m/e 408;

N-(1S-cyanomethylcarbamoyl-2-cyclohexylethyl)-1,1-dioxo-12S-thiomorpholine-4-carboxamide (Compound 280); $^1$H NMR (DMSO): 8.5 (t, J=3Hz, 1H), 6.9 (d, J=3Hz, 1H), 4.11 (m, 3H), 3.8 (t, 4H), 3.1 (t, 4H), 1.8-0.8 (m, 13H); MS m/e 370.8;

N-(2-allylsulfanyl-1S-cyanomethylcarbamoylethyl)benzamide (Compound 281); $^1$H NMR (DMSO): 8.72 (t, 1H), 8.65 (d, J=3Hz, 1H), 7.9 (d, 2H), 7.5 (m, 3H), 5.7 (m, 1H), 5.1 (m, 2H), 4.1 (d, J=3Hz, 2H), 2.8 (m, 2H); MS m/e 304.2;

N-(1R-cyanomethylcarbamoyl)-2-(2-fluorobenzylsulfanyl)ethyl]benzamide (Compound 282); $^1$H NMR (DMSO): 8.85 (m, 1H), 8.72 (d,J=4.9Hz, 1H), 7.90 (d, J=8.3Hz, 2H), 7.10-7.63 (m, 7H), 4.62 (m, 1H), 4.08 (d,J=5.0Hz, 2H), 3.89 (s, 2H), 2.88 (m, 2H); MS: m/e (+1) 369.8;

N-[2-(2-chlorobenzylsulfanyl)-1R-cyanomethylcarbamoylethyl]benzamide (Compound 283); $^1$H NMR (DMSO): 8.80 (m, 1H), 8.75 (d,J=4.8, 1H), 7.95 (d, J=8.2Hz, 2H), 7.12-7.58 (m, 7H), 4.75 (m, 1H), 4.18 (d,J=4.8Hz, 2H), 3.85 (s, 2H), 2.8 (m, 2H);

MS: m/e (+1) 388.2;

N-[2-(2-bromobenzylsulfanyl)-1R-cyanomethylcarbamoylethyl]benzamide (Compound 284); $^1$H NMR (DMSO): 8.85 (m, 1H), 8.73 (d,J=4.8Hz, 1H), 7.95 (d,J=8.2Hz, 2H), 7.4-7.65 (m, 5H), 7.37 (t, J=7.2Hz, 1H), 7.20 (t, J=7.2Hz, 1H), 4.70 (m, 1H), 4.08 (d,J=5.1Hz, 2H), 3.90 (s, 2H), 2.90 (m, 2H); MS: m/e (+1) 434.0;

N-[1R-cyanomethylcarbamoyl-2-(2-iodobenzylsulfanyl)ethyl]benzamide (Compound 285); $^1$H NMR (DMSO): 8.86 (m, 1H), 8.74 (d,J=8.1Hz, 1H), 7.9 (d,J=8.4Hz, 2H), 7.83 (d,J=7.6Hz, 5H), 7.40-7.60 (m, 4H), 7.33 (t, J=7.7Hz, 1H), 6.99 (t,J=7.4Hz, 1H), 4.71 (m, 1H), 4.16 (d,J=5.5Hz, 2H), 3.83 (s, 2H), 2.88 (m, 2H); MS: m/e (+1) 480.0;

N-[2-(4-tert-butyl-benzylsulfanyl)-1R-cyanomethylcarbamoylethyl]benzamide (Compound 286); $^1$H NMR (CDCl$_3$): 8.16 (m, 1H), 7.79 (d,J=7.2Hz, 2H), 7.51 (t,J=7.3Hz, 2H), 7.40 (t,J=8.0Hz, 2H), 7.19-7.29 (m, 4H), 4.98 (m, 1H), 4.08 (m, 2H), 3.72 (m, 2H), 2.94 (m, 2H);

N-[3-(2-chlorophenylsulfanyl)-1R-cyanomethylcarbamoylpropyl]benzamide (Compound 287); $^1$H NMR (DMSO): 8.73 (m, 2H), 7.92 (m, 2H), 7.38-7.56 (m, 5H); 7.32
(t,J=5.9Hz, 1H), 7.18 (t,J=5.9Hz, 1H), 4.64 (m, 1H), 4.14 (d, J=5.8Hz, 2H), 3.07 (m, 2H), 2.12 (m, 2H); MS:m/e (+1) = 385.9;

\[ N-(1R-cyanomethylcarbamoyl-3-o-tolylsulfonylpropyl)benzamide \] (Compound 288);

\(^1\)H NMR (DMSO): 8.70 (m, 2H), 7.92 (m, 2H), 7.45-7.60 (m, 3H), 7.30 (d,J=13.3Hz, 1H), 7.05-7.21 (m, 3H), 4.61 (dd, J=7.7Hz, 1H), 4.13 (d, J=5.4Hz, 2H), 3 (m, 2H), 2.28 (s, 3H), 2.10 (m, 2H); MS:m/e (+1) = 366.0;

\[ N-(1R-cyanomethylcarbamoyl-3-pyrid-2-ylsulfonylpropyl)benzamide \] (Compound 289); \(^1\)H NMR (DMSO): 8.70 (m, 2H), 8.39 (m, 1H), 7.95 (d,J=13.5, 2H), 7.45-7.68 (m, 4H), 7.29 (d,J=13.5Hz, 1H), 7.10 (m, 1H), 4.59 (m, 1H), 4.13 (d,J=5.7Hz, 2H), 2.20 (m, 2H), 2.14 (m, 2H); MS:m/e (+1) = 353.0;

\[ \text{tert-butyl 4-(1R-cyanomethylcarbamoyl-2-pyrid-2-ylmethylsulfonylcarbamoyl)piperidine-1-carboxylate} \] (Compound 290); \(^1\)H NMR (DMSO): 8.72 (t,J=6.5Hz, 1H), 8.48 (d,J=5.2Hz, 1H), 8.21 (d,J=11.8Hz, 1H), 7.75 (t,J=6.5Hz, 1H), 7.38 (d,J=7.9Hz, 1H), 7.25 (m, 1H), 4.80 (m, 1H), 4.14 (d,J=6.6Hz, 2H), 3.93 (d,J=13.6Hz, 2H), 3.85 (s, 2H), 3.33 (s, 4H), 2.56-2.83 (m, 4H), 2.35 (m, 1H), 1.35 (s, 9H); MS:m/e (+1) = 461.4;

\[ N-(1R-cyanomethylcarbamoyl-3-pyrid-4-ylsulfonylpropyl)benzamide \] (Compound 291); \(^1\)H NMR (DMSO): 8.73 (m, 2H), 8.35 (d,J=6.2Hz, 2H), 7.95 (m, 2H), 7.51 (m, 3H), 7.28 (d,J=6.2Hz, 2H), 4.62 (q,J=7.9Hz, 1H), 4.14 (d,J=5.7Hz, 2H), 3.13 (m, 2H), 2.14 (m, 2H); MS:m/e (+1) = 355.0;

\[ N-[1-(Cyanomethyl-carbamoyl)-2-cycloheptyl-ethyl]-benzamide \] (Compound 292); and

\[ 2-Benzylamino-N-cyanomethyl-3-cyclohexyl-propionamide \] (Compound 293).
EXAMPLE 11
Cathepsin B Assay

Solutions of test compounds in varying concentrations were prepared in 10 μL of dimethyl sulfoxide (DMSO) and then diluted into assay buffer (40 μL, comprising:

- N,N-bis(2-hydroxyethyl)-2-aminoethanesulfonic acid (BES), 50 mM (pH 6);
- polyoxyethylene sorbitan monolaurate, 0.05%; and dithiothreitol (DTT), 2.5 mM). Human cathepsin B (0.025 pMoles in 25 μL of assay buffer) was added to the dilutions. The assay solutions were mixed for 5-10 seconds on a shaker plate, covered and incubated for 30 minutes at room temperature. Z-FR-AMC (20 nMoles in 25 μL of assay buffer) was added to the assay solutions and hydrolysis was followed spectrophotometrically at (λ 460 nm) for 5 minutes. Apparent inhibition constants (K_i) were calculated from the enzyme progress curves using standard mathematical models.

Compounds of the invention were tested by the above-described assay and observed to exhibit cathepsin B inhibitory activity with a K_i of less than or equal to 10 μM.

EXAMPLE 12
Cathepsin K Assay

Solutions of test compounds in varying concentrations were prepared in 10 μL of dimethyl sulfoxide (DMSO) and then diluted into assay buffer (40 μL, comprising: MES, 50 mM (pH 5.5); EDTA, 2.5 mM; and DTT, 2.5 mM). Human cathepsin K (0.0906 pMoles in 25 μL of assay buffer) was added to the dilutions. The assay solutions were mixed for 5-10 seconds on a shaker plate, covered and incubated for 30 minutes at room temperature. Z-Phe-Arg-AMC (4 nMoles in 25 μL of assay buffer) was added to the assay solutions and hydrolysis was followed spectrophotometrically at (λ 460 nm) for 5 minutes. Apparent inhibition constants (K_i) were calculated from the enzyme progress curves using standard mathematical models.

Compounds of the invention were tested by the above-described assay and observed
to exhibit cathepsin K inhibitory activity with a $K_i$ of less than or equal to 10 $\mu$M.

EXAMPLE 13
Cathepsin L Assay

Solutions of test compounds in varying concentrations were prepared in 10 $\mu$L of dimethyl sulfoxide (DMSO) and then diluted into assay buffer (40 $\mu$L, comprising: MES, 50 mM (pH 5.5); EDTA, 2.5 mM; and DTT, 2.5 mM). Human cathepsin L (0.05 pMoles in 25 $\mu$L of assay buffer) was added to the dilutions. The assay solutions were mixed for 5-10 seconds on a shaker plate, covered and incubated for 30 minutes at room temperature. Z-Phe-Arg-AMC (1 nMoles in 25 $\mu$L of assay buffer) was added to the assay solutions and hydrolysis was followed spectrophotometrically at ($\lambda$ 460 nm) for 5 minutes. Apparent inhibition constants ($K_i$) were calculated from the enzyme progress curves using standard mathematical models.

Compounds of the invention were tested by the above-described assay and observed to exhibit cathepsin L inhibitory activity with a $K_i$ of less than or equal to 10 $\mu$M.

EXAMPLE 14
Cathepsin S Assay

Solutions of test compounds in varying concentrations were prepared in 10 $\mu$L of dimethyl sulfoxide (DMSO) and then diluted into assay buffer (40 $\mu$L, comprising: MES, 50 mM (pH 6.5); EDTA, 2.5 mM; and NaCl, 100 mM). Human cathepsin S (0.158 pMoles in 25 $\mu$L of assay buffer) was added to the dilutions. The assay solutions were mixed for 5-10 seconds on a shaker plate, covered and incubated for 30 minutes at room temperature. Z-Val-Val-Arg-AMC (9 nMoles in 25 $\mu$L of assay buffer) was added to the assay solutions and hydrolysis was followed spectrophotometrically at ($\lambda$ 460 nm) for 5 minutes. Apparent inhibition constants ($K_i$) were calculated from the enzyme progress curves using standard mathematical models.
Compounds of the invention were tested by the above-described assay and observed
to exhibit cathepsin S inhibitory activity with a Kᵢ of less than or equal to 10 µM.

EXAMPLE 15
Ovalbumin Challenge Mouse

5 C57 mice (female) were sensitised with ovalbumin (10µg, i.p.) administered together
with aluminium hydroxide adjuvant (20 mg, i.p.) on days 0 and 12. Mice are challenged on
either day 22, 23 or 24 by exposure for 60 minutes to an aerosol of ovalbumin (10 g / l) twice, 4
hours apart. Mice are dosed p.o. with either vehicle 5 ml/kg (0.5%MC/0.2 % Tween 80 in
H₂O) or test compound at 0, 8, 23.5 29, 33, 48 and 56 hours.

10 Mice were euthanized with pentobarbitone i.p. after 86 hours (72 hours after the first
challenge). The lungs were insufflated for histological examination as soon as possible after
euthanization. Lungs were insufflated with 10% neutral buffered formalin (NBF), at 30 cm
water pressure. The lungs were removed and placed in pots of 10% NBF. After fixation in
10% NBF for a minimum of 24 hours the lungs were processed through graded alcohols to wax.

15 The lungs were blocked longitudinally and one 2 µm section for each animal was cut at the level
of the main bronchi. Sections then were stained with haematoxylin and eosin. Pathological
assessment of sections is performed and a grading is assigned.

Histopathological evaluation of the lung tissue demonstrate a dose dependant anti-
inflammatory effect on vascular and mucosal beds after treatment with compounds of the
invention between 0.03 and 30 mg/kg.
EXAMPLE 16
Representative Pharmaceutical Formulations Containing a Compound of Formula I

ORAL FORMULATION

<table>
<thead>
<tr>
<th>Ingredient</th>
<th>Amount</th>
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<tbody>
<tr>
<td>Compound of Formula I</td>
<td>10-100 mg</td>
</tr>
<tr>
<td>Citric Acid Monohydrate</td>
<td>105 mg</td>
</tr>
<tr>
<td>Sodium Hydroxide</td>
<td>18 mg</td>
</tr>
<tr>
<td>Flavoring</td>
<td></td>
</tr>
<tr>
<td>Water</td>
<td>q.s. to 100 mL</td>
</tr>
</tbody>
</table>

INTRAVENOUS FORMULATION

<table>
<thead>
<tr>
<th>Ingredient</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>Compound of Formula I</td>
<td>0.1-10 mg</td>
</tr>
<tr>
<td>Dextrose Monohydrate</td>
<td>q.s. to make isotonic</td>
</tr>
<tr>
<td>Citric Acid Monohydrate</td>
<td>1.05 mg</td>
</tr>
<tr>
<td>Sodium Hydroxide</td>
<td>0.18 mg</td>
</tr>
<tr>
<td>Water for Injection</td>
<td>q.s. to 1.0 mL</td>
</tr>
</tbody>
</table>

TABLET FORMULATION

<table>
<thead>
<tr>
<th>Ingredient</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>Compound of Formula I</td>
<td>1%</td>
</tr>
<tr>
<td>Microcrystalline Cellulose</td>
<td>73%</td>
</tr>
<tr>
<td>Stearic Acid</td>
<td>25%</td>
</tr>
<tr>
<td>Colloidal Silica</td>
<td>1%</td>
</tr>
</tbody>
</table>
WE CLAIM:

1. A compound of Formula (I):

\[
\begin{array}{c}
\text{R}^1 \text{N} \text{C\equiv N} \\
\text{R}^2 \text{R}^3 \text{R}^4 \\
\end{array}
\]

(I)

in which:

5 \quad \text{R}^1 \text{ is a group of Formula (a) or (b):}

\[
\begin{array}{c}
\text{R}^1 \text{N} \text{X}^1 \text{X}^2 \text{X}^3 \text{X}^4 \\
\text{R}^5 \text{R}^6 \text{R}^7 \text{R}^8 \\
\end{array}
\]

(a)

\[
\begin{array}{c}
\text{R}^1 \text{N} \text{X}^1 \text{X}^2 \text{X}^3 \text{X}^4 \\
\text{R}^5 \text{R}^6 \text{R}^7 \text{R}^8 \\
\end{array}
\]

(b)

wherein:

\[
\begin{align*}
X^1 \text{ and } X^2 & \text{ independently are } -\text{C(O)- or } -\text{CH}_2\text{S(O)}_2-; \\
R^5 \text{ and } R^6 & \text{ are hydrogen or (C}_1\text{-alkyl);} \\
R^7 \text{ and } R^8 & \text{ are hydrogen or (C}_1\text{-alkyl or as defined below;}
\end{align*}
\]

10 \quad R^9 \text{ and } R^{10} \text{ independently are (i) } (\text{C}_1\text{-alkyl optionally substituted with cyano,}}

\[
\begin{align*}
\text{halo or nitro or (ii) a group selected from } & \text{-X^3NR}^{12}\text{R}^{12}, \text{-X^3NR}^{13}\text{C(O)OR}^{12}, \\
& \text{-X^3NR}^{12}\text{C(O)NR}^{12}\text{R}^{12}, \text{-X^3NR}^{13}\text{C(NR}^{12})\text{NR}^{12}\text{R}^{12}, \text{-X^3OR}^{12}, \text{-X^3SR}^{12}, \\
& \text{-X^3C(O)OR}^{12}, \text{-X^3C(O)NR}^{12}\text{R}^{12}, \text{-X^3S(O)NR}^{12}\text{R}^{12}, \text{-X^3P(O)(OR}^{12})\text{OR}^{12}, \\
& \text{-X^3OP(O)(OR}^{12})\text{OR}^{12}, \text{-X^3NR}^{13}\text{C(O)R}^{13}, \text{-X^3S(O)R}^{13}, \text{-X^3S(O)R}^{13}, \text{-X^3C(O)R}^{13}, \\
& \text{-X^3C(O)R}^{14}, \text{-X^3C(O)R}^{14}, \text{-X^3OC(O)R}^{14}, \text{-X^3NR}^{15}\text{C(O)R}^{14}, \text{-X^3NR}^{15}\text{C(O)OR}^{14}, \\
& \text{-X^3C(O)NR}^{14}\text{R}^{15}, \text{-X^3S(O)NR}^{14}\text{R}^{15}, \text{-X^3S(O)NR}^{15}\text{C(O)NR}^{14}\text{R}^{15}, \\
& \text{-X^3NR}^{15}\text{C(NR}^{15})\text{NR}^{14}\text{R}^{15}, \text{-X^4SR}^{14}, \text{-X^4S(O)R}^{14}, \text{-X^4S(O)R}^{14}, \text{-X^4OR}^{14}, \text{or} \\
& \text{-X^4NR}^{14}\text{R}^{15}, \text{wherein } X^3 \text{ is (C}_1\text{-alkylene, } X^4 \text{ is a bond or (C}_1\text{-alkylene, } R^{12} \text{ at each}
\end{align*}
\]

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occurrence independently is hydrogen, \( (C_{1,6}) \text{alkyl} \) or halo-substituted \( (C_{1,3}) \text{alkyl} \), \( R^{13} \) is \( (C_{1,6}) \text{alkyl} \) or halo-substituted \( (C_{1,3}) \text{alkyl} \), \( R^{14} \) is \( (C_{3,12}) \text{cycloalkyl}(C_{0,6}) \text{alkyl} \), hetero\( (C_{3,12}) \text{cycloalkyl}(C_{0,6}) \text{alkyl} \), \( (C_{0,6}) \text{aryl}(C_{0,6}) \text{alkyl} \), hetero\( (C_{5,12}) \text{aryl}(C_{0,6}) \text{alkyl} \), \( (C_{9,12}) \text{polycycloaryl}(C_{0,6}) \text{alkyl} \) or hetero\( (C_{8,12}) \text{polycycloaryl}(C_{0,6}) \text{alkyl} \) and \( R^{15} \) is hydrogen or \( (C_{1,6}) \text{alkyl} \), and wherein within \( R^{14} \) said cycloalkyl, heterocycloalkyl, aryl, heteroaryl, polycycloaryl or heteropolycycloaryl ring optionally is substituted by a group selected from \(-R^{16}\), \(-X^{4} \text{OR}^{16}\), \(-X^{4} \text{SR}^{16}\), \(-X^{4} \text{S}(O) \text{R}^{16}\), \(-X^{4} \text{S}(O)_{2} \text{R}^{16}\), \(-X^{4} \text{C}(O) \text{R}^{16}\), \(-X^{4} \text{C}(O) \text{OR}^{16}\), \(-X^{4} \text{OC}(O) \text{R}^{16}\), \(-X^{4} \text{N}^{16} \text{R}^{17}\), \(-X^{4} \text{N}^{17} \text{C}(O) \text{R}^{16}\), \(-X^{4} \text{N}^{17} \text{C}(O) \text{OR}^{16}\), \(-X^{4} \text{N}^{17} \text{C}(O) \text{NR}^{16} \text{R}^{17}\), \(-X^{4} \text{N}^{17} \text{C}(O) \text{N}^{16} \text{R}^{17}\), \(-X^{4} \text{N}^{17} \text{C}(O) \text{NR}^{16} \text{R}^{17}\), wherein \( X^{4} \) is a bond or \( (C_{1,6}) \text{alkylene} \), \( R^{16} \) is hydrogen or \( (C_{1,6}) \text{alkyl} \) and \( R^{17} \) is \( (C_{3,12}) \text{cycloalkyl}(C_{0,6}) \text{alkyl} \), hetero\( (C_{3,12}) \text{cycloalkyl}(C_{0,6}) \text{alkyl} \), \( (C_{0,6}) \text{aryl}(C_{0,6}) \text{alkyl} \), hetero\( (C_{5,12}) \text{aryl}(C_{0,6}) \text{alkyl} \), \( (C_{9,12}) \text{polycycloaryl}(C_{0,6}) \text{alkyl} \) or hetero\( (C_{8,12}) \text{polycycloaryl}(C_{0,6}) \text{alkyl} \), or (iii) a group selected from \( (C_{3,12}) \text{cycloalkyl}(C_{0,6}) \text{alkyl} \), hetero\( (C_{3,12}) \text{cycloalkyl}(C_{0,6}) \text{alkyl} \), \( (C_{0,6}) \text{aryl}(C_{0,6}) \text{alkyl} \), hetero\( (C_{5,12}) \text{aryl}(C_{0,6}) \text{alkyl} \), \( (C_{9,12}) \text{polycycloaryl}(C_{0,6}) \text{alkyl} \) and hetero\( (C_{8,12}) \text{polycycloaryl}(C_{0,6}) \text{alkyl} \), wherein said cycloalkyl, heterocycloalkyl, aryl, heteroaryl, polycycloaryl or heteropolycycloaryl ring optionally is substituted by a group selected from \(-R^{16}\), \(-X^{4} \text{OR}^{16}\), \(-X^{4} \text{SR}^{16}\), \(-X^{4} \text{S}(O) \text{R}^{16}\), \(-X^{4} \text{S}(O)_{2} \text{R}^{16}\), \(-X^{4} \text{C}(O) \text{R}^{16}\), \(-X^{4} \text{C}(O) \text{OR}^{16}\), \(-X^{4} \text{OC}(O) \text{R}^{16}\), \(-X^{4} \text{N}^{16} \text{R}^{17}\), \(-X^{4} \text{N}^{17} \text{C}(O) \text{R}^{16}\), \(-X^{4} \text{N}^{17} \text{C}(O) \text{OR}^{16}\), \(-X^{4} \text{N}^{17} \text{C}(O) \text{NR}^{16} \text{R}^{17}\), \(-X^{4} \text{N}^{17} \text{C}(O) \text{N}^{16} \text{R}^{17}\), \(-X^{4} \text{N}^{17} \text{C}(O) \text{NR}^{16} \text{R}^{17}\), wherein \( X^{4} \), \( R^{16} \) and \( R^{17} \) are as defined above; wherein within \( R^{9} \) and/or \( R^{10} \) any alicyclic or aromatic ring system present may be substituted further by 1 to 5 radicals independently selected from \( (C_{1,6}) \text{alkyl} \), \( (C_{1,6}) \text{alkylidene} \), cyano, halo, halo-substituted \( (C_{1,4}) \text{alkyl} \), nitro, \(-X^{4} \text{NR}^{12} \text{R}^{12}\), \(-X^{4} \text{NR}^{12} \text{C}(O) \text{OR}^{12}\), \(-X^{4} \text{NR}^{12} \text{C}(O) \text{NR}^{12} \text{R}^{12}\), \(-X^{4} \text{OR}^{12}\), \(-X^{4} \text{SR}^{12}\), \(-X^{4} \text{C}(O) \text{OR}^{12}\), \(-X^{4} \text{C}(O) \text{NR}^{12} \text{R}^{12}\), \(-X^{4} \text{OC}(O) \text{R}^{12}\), \(-X^{4} \text{P}(O)(\text{OR})^{4} \text{OR}^{12}\), \(-X^{4} \text{OP}(O)(\text{OR})^{12}\), \(-X^{4} \text{OC}(O) \text{R}^{12}\), \(-X^{4} \text{NR}^{12} \text{C}(O) \text{R}^{12}\), \(-X^{4} \text{S}(O) \text{R}^{12}\), \(-X^{4} \text{S}(O)_{2} \text{R}^{12}\), and \(-X^{4} \text{C}(O) \text{R}^{12}\), wherein \( X^{4} \), \( R^{12} \) and \( R^{13} \) are as defined above, or \( R^{9} \) taken together with \( R^{7} \) and/or \( R^{10} \) taken together with \( R^{8} \) form.
trimethylene, tetramethylene or phenylene-1,2-dimethylene, optionally substituted with hydroxy, oxo or methylene; and

\[ R^{11} = -X^5X^6R^{18}, \]
wherein \( X^5 \) is \(-\text{C(O)}\), \(-\text{C(O)C(O)}\) or \(-\text{S(O)}_2\), \( X^6 \) is a bond, \(-\text{O}\) or \(-\text{NR}^{19}\), wherein \( R^{19} \) is hydrogen or \((C_{1-6})\text{alkyl}\), and \( R^{18} \) is

(i) \((C_{1-10})\text{alkyl}\) optionally substituted by cyano, halo, nitro, \(-\text{NR}^{12}R^{12}\), \(-\text{NR}^{12}\text{C(O)OR}^{12}\), \(-\text{NR}^{12}\text{C(O)NR}^{12}R^{12}\), \(-\text{NR}^{12}\text{C(NR}^{12}\text{)NR}^{12}R^{12}\), \(-\text{OR}^{12}\), \(-\text{SR}^{12}\), \(-\text{C(O)OR}^{12}\), \(-\text{C(O)NR}^{12}R^{12}\), \(-\text{S(O)}_2\text{NR}^{12}R^{12}\), \(-\text{P(O)(OR)}^{12}\text{OR}^{12}\), \(-\text{OP(O)(OR)}^{12}\text{OR}^{12}\), \(-\text{NR}^{12}\text{C(O)R}^{13}\), \(-\text{S(O)R}^{13}\), \(-\text{S(O)}_2\text{R}^{13}\), \(-\text{C(O)R}^{13}\), \(-\text{OR}^{20}\), \(-\text{SR}^{20}\), \(-\text{S(O)}R^{20}\), \(-\text{S(O)}_2R^{20}\), \(-\text{C(O)OR}^{20}\), \(-\text{C(O)NR}^{30}R^{21}\), \(-\text{NR}^{20}R^{21}\), \(-\text{NR}^{21}\text{C(O)R}^{20}\), \(-\text{NR}^{21}\text{C(O)OR}^{20}\), \(-\text{NR}^{21}\text{C(O)NR}^{30}R^{21}\) or \(-\text{NR}^{21}\text{C(NR}^{21}\text{)NR}^{30}R^{21}\), wherein \( R^{12} \) and \( R^{13} \) are as defined above, \( R^{20} \) is \((C_{2-12})\text{cycloalkyl(C}_{0-6}\text{)alkyl}\), \((C_{9-12})\text{bicycloalkyl(C}_{0-6}\text{)alkyl or hetero(C}_{9-12}\text{)bicycloalkyl(C}_{0-6}\text{)alkyl and R}^{21} \) at each occurrence independently is hydrogen or \((C_{1-6})\text{alkyl}\), or

(ii) \((C_{3-10})\text{cycloalkyl(C}_{0-6}\text{)alkyl, hetero(C}_{3-10}\text{)cycloalkyl(C}_{0-6}\text{)alkyl, (C}_{6-12}\text{aryloalkyl(C}_{0-6}\text{)alkyl, hetero(C}_{5-12}\text{)aryl(C}_{0-6}\text{)alkyl, (C}_{9-12}\text{bicycloalkyl(C}_{0-6}\text{)alkyl or hetero(C}_{9-12}\text{)bicycloalkyl(C}_{0-6}\text{)alkyl or (iii) (C}_{3-6}\text{cycloalkyl(C}_{0-6}\text{)alkyl, hetero(C}_{3-6}\text{)cycloalkyl(C}_{0-6}\text{)alkyl, phenyl(C}_{0-6}\text{)alkyl or hetero(C}_{5-6}\text{)aryl(C}_{0-6}\text{)alkyl, wherein said cycloalkyl, heterocycloalkyl, phenyl or heteroaryl is substituted by \(-\text{X}^4\text{OR}^{22}, \text{-X}^4\text{SR}^{22}, \text{-X}^4\text{S(O)R}^{22}, \text{-X}^4\text{S(O)}_2\text{R}^{22}, \text{-X}^4\text{C(O)OR}^{22}, \text{-X}^4\text{C(O)NR}^{23}R^{23}, \text{-X}^4\text{NR}^{22}R^{23}, \text{-X}^4\text{NR}^{23}\text{C(O)R}^{22}, \text{-X}^4\text{NR}^{23}\text{C(O)OR}^{22}, \text{-X}^4\text{NR}^{23}\text{C(O)NR}^{23}\text{R}^{23}\) or \(-\text{X}^4\text{NR}^{23}\text{C(NR}^{23}\text{)NR}^{22}R^{23}\), wherein \( X^4 \) is as defined above, \( R^{22} \) is \((C_{3-6})\text{cycloalkyl(C}_{0-6}\text{)alkyl, hetero(C}_{3-6}\text{)cycloalkyl(C}_{0-6}\text{)alkyl, phenyl(C}_{0-6}\text{)alkyl or hetero(C}_{5-6}\text{)aryl(C}_{0-6}\text{)alkyl and R}^{23} \) at each occurrence independently is hydrogen or \((C_{1-6})\text{alkyl}\); wherein within \( R^{11} \) any alicyclic or aromatic ring system present may be substituted further by 1 to 5 radicals independently selected from \((C_{1-6})\text{alkyl}, (C_{1-6})\text{alkylidene, cyano, halo, halo-substituted (C}_{1-6}\text{)alkyl, nitro, -X}^4\text{NR}^{12}R^{12}, \text{-X}^4\text{NR}^{12}\text{C(O)OR}^{12}, \text{-X}^4\text{NR}^{12}\text{C(O)NR}^{12}R^{12}, \text{-X}^4\text{NR}^{12}\text{C(NR}^{12}\text{)NR}^{12}R^{12}, \text{-X}^4\text{OR}^{12}, \text{-X}^4\text{SR}^{12}, \text{-X}^4\text{C(O)OR}^{12}, \text{-X}^4\text{C(O)NR}^{12}R^{12}, \text{-X}^4\text{C(O)}\), \text{-X}^4\text{C(O)OR}^{12}, \text{-X}^4\text{C(O)NR}^{12}R^{12}, \text{-X}^4\text{C(O)NR}^{12}R^{12} \)}
-X^4S(O)_2NR^{12}R^{12}, -X^4P(O)(OR^3)OR^{12}, -X^4OP(O)(OR^3)OR^{12}, -X^4OC(O)R^{13},
-X^4NR^{12}C(O)R^{13}, -X^4S(O)R^{13}, -X^4S(O)R^{13} and -X^4C(O)R^{13}, wherein X^4, R^{12} and R^{13} are as defined above;
R^2 is hydrogen or (C_{1-6})alkyl or as defined below;
R^3 is hydrogen, (C_{1-6})alkyl or as defined below; and
R^4 is (i) hydrogen or (C_{1-6})alkyl, wherein said alkyl is optionally substituted with
cyano, halo, nitro, -NR^{12}R^{12}, -NR^{12}C(O)OR^{12}, -NR^{12}C(O)NR^{12}R^{12},
-NR^{12}C(NR^{12})NR^{12}R^{12}, -OR^{12}, -SR^{12}, -C(O)OR^{12}, -C(O)NR^{12}R^{12}, -S(O)_2NR^{12}R^{12},
-P(O)(OR^{12})OR^{12}, -OP(O)(OR^{12})OR^{12}, -NR^{12}C(O)R^{13}, -S(O)R^{13}, -S(O)_2R^{13}, -C(O)R^{13},
-OR^{14}, -SR^{14}, -S(O)_2R^{14}, -C(O)R^{14}, -C(O)OR^{14}, -OC(O)R^{14}, -NR^{14}R^{15},
-NR^{15}C(O)R^{14}, -NR^{15}C(O)OR^{14}, -C(O)NR^{14}R^{15}, -S(O)_2NR^{14}R^{15}, -NR^{15}C(O)NR^{14}R^{15} or
-NR^{15}C(NR^{15})NR^{14}R^{15}, wherein R^{12}, R^{13}, R^{14} and R^{15} are as defined above, or (ii) a group
selected from (C_{3,12})cycloalkyl(C_{0,6})alkyl, hetero(C_{3,12})cycloalkyl(C_{0,6})alkyl,
(C_{6,12})aryl(C_{0,6})alkyl, hetero(C_{5,12})aryl(C_{0,6})alkyl, (C_{9,12})polycycloaryl(C_{0,6})alkyl and
hetero(C_{8,12})polycycloaryl(C_{0,6})alkyl, wherein said cycloalkyl, heterocycloalkyl, aryl,
heteroaryl, polycycloaryl or heteropolycycloaryl ring optionally is substituted by a group
selected from -R^{16}, -X^4OR^{16}, -X^4SR^{16}, -X^4S(O)R^{16}, -X^4S(O)R^{16}, -X^4C(O)R^{16},
-X^4C(O)OR^{16}, -X^4OC(O)R^{16}, -X^4NR^{16}R^{17}, -X^4NR^{17}C(O)R^{16}, -X^4NR^{17}C(O)OR^{16},
-X^4C(O)NR^{16}R^{17}, -X^4S(O)_2NR^{16}R^{17}, -X^4NR^{17}C(O)NR^{16}R^{17} or -X^4NR^{17}C(NR^{17})NR^{16}R^{17},
wherein X^4, R^{16} and R^{17} are as defined above; wherein within R^2 and/or R^10 any alicyclic or
aromatic ring system present may be substituted further by 1 to 5 radicals independently
selected from (C_{1-6})alkyl, (C_{1-6})alkylidene, cyano, halo, halo-substituted (C_{1-6})alkyl, nitro,
-X^4NR^{12}R^{12}, -X^4NR^{12}C(O)OR^{12}, -X^4NR^{12}C(O)NR^{12}R^{12}, -X^4NR^{12}C(NR^{12})NR^{12}R^{12},
-X^4OR^{12}, -X^4SR^{12}, -X^4C(O)OR^{12}, -X^4C(O)NR^{12}R^{12}, -X^4S(O)_2NR^{12}R^{12},
-X^4P(O)(OR^3)OR^{12}, -X^4OP(O)(OR^3)OR^{12}, -X^4OC(O)R^{13}, -X^4NR^{12}C(O)R^{13}, -X^4S(O)R^{13},
-X^4S(O)_2R^{13} and -X^4C(O)R^{13}, wherein X^4, R^{12} and R^{13} are as defined above, or
R^4 and R^2 taken together form trimethylene, tetramethylene or
phenylene-1,2-dimethylene, optionally substituted with hydroxy, oxo or methylene, or
R^4 and R^1 taken together with the carbon atom to which both R^4 and R^1 are attached form
(C₃₈) cycloalkylene or (C₃₈) heterocycloalkylene; and the N-oxide derivatives, prodrug derivatives, protected derivatives, individual isomers and mixtures of isomers; and the pharmaceutically acceptable salts thereof.

2. The compound of Claim 1 in which:

R¹ is a group of Formula (a) wherein within Formula (a):

X¹ is -C(O)-;

R² is hydrogen or (C₁₀₆) alkyl;

R³ is hydrogen or methyl;

R⁰ is a group of (C⁵₆) alkyl optionally substituted with -OR¹₄, -SR¹₄, -S(O)R¹₄,

-S(O)₂R¹₄, -C(O)R¹₄, -C(O)OR¹₄, -OC(O)R¹₄, -NR¹₄R¹₅, -NR¹₅C(O)R¹₄,

-NR¹₅C(O)OR¹₄, -C(O)NR¹₅R¹₅, -S(O)₂NR¹₄R¹₅, -NR¹₅C(O)NR¹₄R¹₅ or

-NR¹₅C(NR¹₅)NR¹₄R¹₅, wherein R¹₄ is (C₃₁₀)cycloalkyl(C₆₀) alkyl,

hetero(C₃₁₀)cycloalkyl(C₆₀) alkyl, (C₆₁₀)aryl(C₆₀) alkyl, hetero(C₅₁₆)aryl(C₆₀) alkyl,

(C₉₁₀) polycycloalkyl(C₆₀) alkyl or hetero(C₈₁₀) polycycloalkyl(C₆₀) alkyl and R¹₅ is

hydrogen or (C₁₄₆) alkyl, and wherein within R¹⁴ said cycloalkyl, heterocycloalkyl, aryl,

heteroaryl, polycycloalkyl or heteropolycycloalkyl ring optionally is substituted by a

group selected from -R¹₆, -X³OR¹₆, -X³SR¹₆, -X³S(O)R¹₆, -X³S(O)₂R¹₆,

-X³C(O)R¹₆, -X³C(Ο)OR¹₆, -X³OC(O)R¹₆, -X³NR¹₆R¹₇, -X³NR¹₇C(O)R¹₆,

-X³NR¹₇C(O)OR¹₆, -X³C(O)NR¹₆R¹₇, -X³S(O)₂NR¹₆R¹₇, -X³NR¹₇C(O)NR¹₆R¹₇ or

-X³NR¹₇C(NR¹₇)NR¹₆R¹₇, wherein X³ is a bond or (C₁₄₆) alkylene, R¹₆ is hydrogen or

(C₁₄₆) alkyl and R¹₇ is (C₃₁₀)cycloalkyl(C₆₀) alkyl, hetero(C₃₁₀)cycloalkyl(C₆₀) alkyl,

(C₆₁₀) aryl(C₆₀) alkyl, hetero(C₅₁₆) aryl(C₆₀) alkyl, (C₉₁₀) polycycloalkyl(C₆₀) alkyl or

hetero(C₈₁₀) polycycloalkyl(C₆₀) alkyl, or (ii) a group selected from

(C₃₁₀)cycloalkyl(C₆₀) alkyl, hetero(C₃₁₀)cycloalkyl(C₆₀) alkyl, (C₆₁₀) aryl(C₆₀) alkyl,

hetero(C₅₁₆) aryl(C₆₀) alkyl, (C₉₁₀) polycycloalkyl(C₆₀) alkyl and

hetero(C₈₁₀) polycycloalkyl(C₆₀) alkyl, wherein said cycloalkyl, heterocycloalkyl, aryl,

heteroaryl, polycycloalkyl or heteropolycycloalkyl ring optionally is substituted by a

group selected from -R¹₆, -X³OR¹₆, -X³SR¹₆, -X³S(O)R¹₆, -X³S(O)₂R¹₆,
-X^3C(O)R^{16}, -X^3C(O)OR^{16}, -X^3OC(O)R^{16}, -X^3NR^{16}R^{17}, -X^3NR^{17}C(O)R^{16},
-X^3NR^{17}C(O)OR^{16}, -X^3C(O)NR^{16}R^{17}, -X^3S(O)_2NR^{16}R^{17}, -X^3NR^{17}C(O)NR^{16}R^{17} or
-X^3NR^{17}C(NR^{17})NR^{16}R^{17}, wherein X^3, R^{16} and R^{17} are as defined above; wherein
within R^9 any alicyclic or aromatic ring system present may be substituted further by 1 to 5 radicals independently selected from (C_{1-6})alkyl, (C_{1-6})alkylidene, cyano, halo,
halo-substituted (C_{1-6})alkyl, nitro, -X^3NR^{12}R^{12}, -X^3NR^{12}C(O)OR^{12},
-X^3NR^{12}C(O)NR^{12}R^{12}, -X^3NR^{12}C(NR^{12})NR^{12}R^{12}, -X^3OR^{12}, -X^3SR^{12},
-X^3C(O)R^{12}, -X^3C(O)NR^{12}R^{12}, -X^3C(O)NR^{12}R^{12}, -X^3S(O)_2NR^{12}R^{12}, -X^3P(O)(OR^3)OR^{12},
-X^3OP(O)(OR^3)OR^{12}, -X^3OC(O)R^{13}, -X^3NR^{12}C(O)R^{13}, -X^3S(O)R^{13}, -X^3S(O)_2R^{13}
and -X^3C(O)R^{13}, wherein X^3 is as defined above, R^{12} at each occurrence
independently is hydrogen, (C_{1-6})alkyl or halo-substituted (C_{1-3})alkyl and R^{13} is
(C_{1-6})alkyl or halo-substituted (C_{1-3})alkyl; and

R^{11} is -X^4X^5R^{18}, wherein X^4 is -C(O)- or -S(O)_2-, X^5 is a bond, -O- or
-NR^{19}-, wherein R^{19} is hydrogen or (C_{1-6})alkyl, and R^{18} is (i) (C_{1-10})alkyl or
(ii) (C_{3-12})cycloalkyl(C_{0-6})alkyl, hetero(C_{3-12})cycloalkyl(C_{0-6})alkyl,
(C_{6-12})aryl(C_{0-6})alkyl or hetero(C_{5-12})aryl(C_{0-6})alkyl or (iii) (C_{3-6})cycloalkyl(C_{0-6})alkyl, hetero(C_{3-6})cycloalkyl(C_{0-6})alkyl, phenyl(C_{0-6})alkyl or hetero(C_{5-6})aryl(C_{0-6})alkyl,
wherein said cycloalkyl, heterocycloalkyl, phenyl or heteroaryl is substituted by
-X^9OR^{24}, -X^9C(O)R^{24}, -X^9C(O)OR^{24}, -X^9C(O)NR^{24}R^{25}, -X^9NR^{24}R^{25},
-X^9NR^{25}C(O)R^{24}, -X^9NR^{25}C(O)OR^{24}, -X^9NR^{25}C(O)NR^{25}R^{25} or
-X^9NR^{25}C(NR^{25})NR^{25}R^{25}, wherein X^9 is a bond or (C_{1-6})alkylene, R^{24} is
(C_{3-6})cycloalkyl(C_{0-6})alkyl, hetero(C_{3-6})cycloalkyl(C_{0-6})alkyl, phenyl(C_{0-6})alkyl or
hetero(C_{5-6})aryl(C_{0-6})alkyl and R^{25} is hydrogen or (C_{1-6})alkyl, wherein within R^{11} any
alicyclic or aromatic ring system present may be substituted further by 1 to 5
substituents independently selected from (C_{1-6})alkyl, halo, halo-substituted (C_{1-4})alkyl,
-OR^{12}, -X^3SR^{12}, -C(O)OR^{12} and -X^3NR^{13}C(O)OR^{12}, wherein X^3 is a bond or
(C_{1-6})alkylene and R^{14} is hydrogen or (C_{1-6})alkyl;
R^2 is hydrogen;
R^3 is hydrogen or (C_{1-4})alkyl or taken with R^4 together with the carbon atom to which
both $R^3$ and $R^4$ are attached forms $(C_{3,4})$cycloalkylene; and

$R^4$ is hydrogen or as defined above; and the $N$-oxide derivatives, prodrug derivatives, protected derivatives, individual isomers and mixtures of isomers; and the pharmaceutically acceptable salts thereof.

3. The compound of Claim 2 in which:

$R^1$ is a group of Formula (a) wherein within Formula (a):

$R^5$ and $R^7$ both are hydrogen;

$R^9$ is (i) $(C_{1-6})$alkyl optionally substituted with -OR$^{14}$ or -SR$^{14}$, wherein $R^{14}$ is $(C_{3,4})$cycloalkyl$(C_{0-6})$alkyl, phenyl$(C_{0-6})$alkyl, biphenylyl$(C_{0-6})$alkyl or hetero$(C_{5-10})$aryl$(C_{0-6})$alkyl, or (ii) a group selected from $(C_{3,4})$cycloalkyl$(C_{0-6})$alkyl, phenyl$(C_{0-6})$alkyl, biphenylyl$(C_{0-6})$alkyl or hetero$(C_{5-10})$aryl$(C_{0-6})$alkyl; wherein within $R^9$ any alicyclic or aromatic ring system present may be substituted further by 1 to 5 radicals independently selected from $(C_{1-6})$alkyl, $(C_{1,6})$alkylidene, cyano, halo, halo-substituted $(C_{1,6})$alkyl, nitro, -X$^3$NR$^{12}$R$^{12}$, -X$^3$NR$^{12}$C(O)OR$^{12}$,

-X$^2$NR$^{12}$C(O)NR$^{12}$R$^{12}$, -X$^2$NR$^{12}$C(NR$^{12}$)NR$^{12}$R$^{12}$, -X$^2$OR$^{12}$, -X$^2$SR$^{12}$,

-X$^2$C(O)OR$^{12}$, -X$^2$C(O)NR$^{12}$R$^{12}$, -X$^2$S(O)$^2$NR$^{12}$R$^{12}$, -X$^2$P(O)(OR$^3$)OR$^{12}$,

-X$^2$OP(O)(OR$^3$)OR$^{12}$, -X$^2$OC(O)R$^{13}$, -X$^2$OC(O)R$^{13}$, -X$^2$NR$^{12}$C(O)R$^{13}$,

-X$^2$S(O)R$^{13}$, -X$^2$S(O)$^2$R$^{13}$ and -X$^3$C(O)R$^{13}$, wherein $X^3$ is a bond or $(C_{1-6})$alkylene, $R^{12}$ at each occurrence independently is hydrogen, $(C_{1-2})$alkyl or halo-substituted $(C_{1-3})$alkyl and $R^{13}$ is $(C_{1-2})$alkyl or halo-substituted $(C_{1-3})$alkyl; and

$R^{11}$ is -X$^4$X$^5$R$^{18}$, wherein $X^4$ is -C(O)-, $X^5$ is a bond and $R^{18}$ is (i) $(C_{3,12})$cycloalkyl$(C_{0-6})$alkyl, hetero$(C_{3,12})$cycloalkyl$(C_{0-6})$alkyl, $(C_{6-12})$aryl$(C_{0-6})$alkyl or hetero$(C_{5-12})$aryl$(C_{0-6})$alkyl or (ii) phenyl$(C_{0-6})$alkyl or hetero$(C_{5-6})$aryl$(C_{0-6})$alkyl, wherein said phenyl or heteroaryl is substituted by

-X$^9$OR$^{24}$, -X$^9$C(O)R$^{24}$, -X$^9$C(O)OR$^{24}$, -X$^9$C(O)NR$^{24}$R$^{25}$, -X$^9$NR$^{24}$R$^{25}$,

-X$^9$NR$^{25}$C(O)R$^{24}$, -X$^9$NR$^{25}$C(O)OR$^{24}$, -X$^9$NR$^{25}$C(O)NR$^{24}$R$^{25}$ or

-X$^9$NR$^{25}$C(NR$^{25}$)NR$^{24}$R$^{25}$, wherein $X^9$ is a bond or $(C_{1-6})$alkylene, $R^{24}$ is phenyl$(C_{0-6})$alkyl or hetero$(C_{5-6})$aryl$(C_{0-6})$alkyl and $R^{25}$ is hydrogen or $(C_{1-6})$alkyl,
wherein within R¹¹ any aromatic ring system present may be substituted further by 1 to 5 substituents independently selected from (C₁₋₄)alkyl, halo, halo-substituted (C₁₋₄)alkyl, -OR¹², -X³SR¹², -C(O)OR¹² and -X³NR¹²C(O)OR¹² wherein X³ is a bond or (C₁₋₄)alkylene and R¹² is hydrogen or (C₁₋₄)alkyl; and

R³ and R⁴ are both hydrogen; and the N-oxide derivatives, prodrug derivatives, protected derivatives, individual isomers and mixtures of isomers; and the pharmaceutically acceptable salts thereof; and the N-oxide derivatives, prodrug derivatives, protected derivatives, individual isomers and mixtures of isomers; and the pharmaceutically acceptable salts thereof.

4. The compound of Claim 3 in which within Formula (a) R⁹ is cyclohexylmethyl, wherein said cyclohexyl may be substituted by 1 to 5 radicals independently selected from (C₁₋₄)alkyl, (C₁₋₄)alkyldiene or -X³OC(O)R¹³, or phenylmethylsulfanylmethyl or phenylsulfanylethyl, wherein said phenyl may be substituted by 1 to 5 radicals independently selected from (C₁₋₄)alkyl, cyano, halo, halo-substituted (C₁₋₄)alkyl, nitro, -OR¹², -SR¹² and -C(O)OR¹², wherein R¹² is hydrogen, (C₁₋₃)alkyl or halo-substituted (C₁₋₃)alkyl and R¹³ is (C₁₋₆)alkyl or halo-substituted (C₁₋₃)alkyl; and R¹¹ is benzoyl, furylcarbonyl, phenyloxybenzoyl, pyridylthienylcarbonyl, benzoylbisoxazolyl, thiencylcarbonyl, morpholinylcarbonyl, phenylureidobenzoyl, cyclohexenylcarbonyl or piperazinylcarbonyl, wherein within R¹¹ any aromatic ring system present may be substituted further by 1 to 2 substituents independently selected from (C₁₋₆)alkyl, tert-butoxycarbonylamino, tert-butoxycarbonylaminomethyl, bromo, chloro, ethoxy, fluoro, hydroxy, methoxy and methylsulfanyl; and the N-oxide derivatives, prodrug derivatives, protected derivatives, individual isomers and mixtures of isomers; and the pharmaceutically acceptable salts thereof.
5. The compound of Claim 4 in which within Formula (a), R$^9$ is a group having the following formula:

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  (R^{26})_q

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in which q is 0 to 5 and R$^{26}$ at each occurrence is independently selected from (C$_{1-4}$)alkyl, cyano, halo, halo-substituted (C$_{1-4}$)alkyl, nitro, -OR$^{12}$, -SR$^{12}$ and -C(O)OR$^{12}$, wherein R$^{12}$ is hydrogen, (C$_{1-3}$)alkyl or halo-substituted (C$_{1-3}$)alkyl and R$^{13}$ is (C$_{1-5}$)alkyl or halo-substituted (C$_{1-3}$)alkyl; and the N-oxide derivatives, prodrug derivatives, protected derivatives, individual isomers and mixtures of isomers; and the pharmaceutically acceptable salts thereof.

6. The compound of Claim 3 in which within Formula (a), R$^9$ is benzylsulfanyl methyl, 2-bromobenzylsulfanyl methyl, 2-chlorobenzylsulfanyl, 2-(2-chlorophenylsulfanyl)ethyl, cyclohexyl, 4-ethylidenecyclohexyl, 2-iodobenzylsulfanyl methyl, 2-methylbenzylsulfanyl methyl, 3-methyl-3-trifluorocarbonyl oxy cyclohexyl methyl, 4-methylenecyclohexyl methyl or 2-nitrobenzylsulfanyl methyl and R$^{11}$ is 4-tert-butoxycarbonylaminobenzoyl, 3-tert-butoxycarbonylaminomethylbenzoyl, 2-(3,5-dimethoxyphenyl)thiazol-4-ylcarbonyl, fur-3-ylcarbonyl, 4-methoxybenzoyl, 3-methylbenzoyl, 3-phenoxybenzoyl, 5-pyrid-2-ylthien-2-ylcarbonyl, 3-benzoylbenzoyl, 4-methylbenzoyl, thien-2-ylcarbonyl, morpholin-4-ylcarbonyl, 5-bromo thi en-2-ylcarbonyl, 5-chlorothien-2-ylcarbonyl, 5-methylthien-2-ylcarbonyl, 2-(2-chloro-6-methylphenyl)ureidobenzoyl, cyclohexyl-1-en-1-ylcarbonyl, 3-ethoxybenzoyl, 3-fluorobenzoyl, 4-fluorobenzoyl and piperidin-1-ylcarbonyl; and the N-oxide derivatives, prodrug derivatives, protected derivatives, individual isomers and...
mixtures of isomers; and the pharmaceutically acceptable salts thereof.

7. The compound of Claim 6 selected from a group consisting of:
N-(2-benzylsulfanyl-1R-cyanomethylcarbamoylethyl)-4-hydroxybenzamide;
N-[2-(2-bromobenzylsulfanyl)-1R-cyanomethylcarbamoylethyl]benzamide;
N-[1R-cyanomethylcarbamoyl-2-(2-iodobenzylsulfanyl)ethy]lbenzamide;
N-[1R-cyanomethylcarbamoyl-2-(2-cyanobenzylsulfanyl)ethy]lmorpholine-4-carboxamide;
N-[3-(2-chlorophenylsulfanyl)-1R-cyanomethylcarbamoylpropyl]benzamide;
N-[1R-cyanomethylcarbamoyl-2-(2-nitrobenzylsulfanyl)ethy]lmorpholine-4-carboxamide; and
N-[1R-cyanomethylcarbamoyl-2-(2-methylbenzylsulfanyl)ethy]lmorpholine-4-carboxamide; and the N-oxide derivatives, prodrug derivatives, protected derivatives, individual isomers and mixtures of isomers; and the pharmaceutically acceptable salts thereof.

8. A pharmaceutical composition comprising a compound of Claim 1, or a N-oxide derivative, prodrug derivative, individual isomer, mixture of isomers, or a pharmaceutically acceptable salt thereof in admixture with one or more suitable excipients.

9. A method of treating a disease in an animal in which cysteine protease activity contributes to the pathology and/or symptomatology of the disease, which method comprises administering to the animal a therapeutically effective amount of compound of Claim 1; or a N-oxide derivative, prodrug derivative, individual isomer or mixture of isomers or a pharmaceutically acceptable salt thereof.

10. The method of Claim 9 in which the cysteine protease is cathepsin S.
11. The method of Claim 10 in which the disease is an autoimmune disorder, allergic disorder, allogeneic immune response, a disorder involving excessive elastolysis, cardiovascular disorders or a disorder involving fibril formation.

12. The method of Claim 11 in which the disorder is selected from juvenile onset diabetes, multiple sclerosis, pemphigus vulgaris, Graves' disease, myasthenia gravis, systemic lupus erythematosus, rheumatoid arthritis, Hashimoto's thyroiditis, asthma, organ transplant or tissue graft rejections, chronic obstructive pulmonary disease, bronchiolitis, excessive airway elastolysis in asthma and bronchitis, pneumonitides, plaque rupture, atheroma and systemic amyloidosis.

13. A compound according to claim 1 in which $R^1$ is a group of formula (a) wherein $X^1$ is $\text{-CH}_2\text{S(O)}_2\text{-}$; and the $N$-oxide derivatives, prodrug derivatives, protected derivatives, individual isomers and mixtures of isomers; and the pharmaceutically acceptable salts thereof.

14. A compound according to any one of claims 1-3 and 13 in which $R^1$ is a group of formula (a) wherein $R^9$ is a group having the formula

![Chemical Structure](image)

in which $q$ is 0 to 5 and $R^{26}$ at each occurrence is independently selected from ($C_{1-4}$)alkyl, cyano, halo, halo-substituted ($C_{1-4}$)alkyl, nitro, $-\text{OR}^{12}$, $-\text{SR}^{12}$ and $-\text{C(O)OR}^{12}$, wherein $R^{12}$ is hydrogen, ($C_{1-3}$)alkyl or halo-substituted ($C_{1-3}$)alkyl and $R^{13}$ is ($C_{1-6}$)alkyl or halo-substituted.
(C\textsubscript{1-3})alkyl; and the N-oxide derivatives, prodrug derivatives, protected derivatives, individual isomers and mixtures of isomers; and the pharmaceutically acceptable salts thereof.

15. A compound according to claim 14 in which at least one R\textsuperscript{26} group is attached at the benzene ring 2-position; and the N-oxide derivatives, prodrug derivatives, protected derivatives, individual isomers and mixtures of isomers; and the pharmaceutically acceptable salts thereof.

16. A compound according to claim 15 in which the benzene ring is substituted by one R\textsuperscript{26} group at the 2-position wherein R\textsuperscript{26} is selected from at each occurrence is independently selected from (C\textsubscript{1-4})alkyl, cyano, halo, halo-substituted (C\textsubscript{1-4})alkyl, nitro, -OR\textsuperscript{12}, -SR\textsuperscript{12} and -C(O)OR\textsuperscript{12}, wherein R\textsuperscript{12} is hydrogen, (C\textsubscript{1-3})alkyl or halo-substituted (C\textsubscript{1-3})alkyl and R\textsuperscript{13} is (C\textsubscript{1-6})alkyl or halo-substituted (C\textsubscript{1-3})alkyl; and the N-oxide derivatives, prodrug derivatives, protected derivatives, individual isomers and mixtures of isomers; and the pharmaceutically acceptable salts thereof.

17. A compound according to claim 16 in which R\textsuperscript{26} is difluoromethoxy; and the N-oxide derivatives, prodrug derivatives, protected derivatives, individual isomers and mixtures of isomers; and the pharmaceutically acceptable salts thereof.

18. A compound of Formula (II):

\[
\begin{align*}
\text{(II)}
\end{align*}
\]

wherein:

20 R\textsuperscript{2} is hydrogen or (C\textsubscript{1-6})alkyl or as defined below;
R³ is hydrogen, (C₁-₆)alkyl or as defined below;
R⁴ is (i) hydrogen or (C₁-₆)alkyl, wherein said alkyl optionally is substituted with
cyano, halo, nitro, -NR¹²R¹², -NR¹²C(O)OR¹², -NR¹²C(O)NR¹²R¹²,
-NR¹²C(NR¹²)NR¹²R¹², -OR¹², -SR¹², -C(O)OR¹², -C(O)NR¹²R¹², -S(O)₂NR¹²R¹²,
-P(O)(OR¹²)OR¹², -OP(O)(OR¹²)OR¹², -NR¹²C(O)R¹³, -S(O)R¹³, -S(O)₂R¹³, -C(O)R¹³,
-OR¹⁴, -SR¹⁴, -S(O)R¹⁴, -S(O)₂R¹⁴, -C(O)R¹⁴, -C(O)OR¹⁴, -OC(O)R¹⁴, -NR¹⁴R¹⁵,
-NR¹⁵C(O)R¹⁴, -NR¹⁵C(O)OR¹⁴, -C(O)NR¹⁵R¹⁴, -S(O)₂NR¹⁵R¹⁴, -NR¹⁵C(O)NR¹⁵R¹⁴ or
-NR¹⁵C(NR¹⁵)NR¹⁴R¹⁴, wherein R¹² at each occurrence independently is hydrogen,
(C₁-₆)alkyl or halo-substituted (C₁-₃)alkyl, R¹³ is (C₁-₆)alkyl or halo-substituted (C₁-₃)alkyl, R¹⁴
is (C₃-₁₂)cycloalkyl(C₆-₆)alkyl, hetero(C₃-₁₂)cycloalkyl(C₆-₆)alkyl, (C₆-₁₂)aryl(C₆-₆)alkyl,
hetero(C₅-₁₂)aryl(C₆-₆)alkyl, (C₉-₁₂)polycycloaryl(C₆-₆)alkyl or
hetero(C₈-₁₂)polycycloaryl(C₆-₆)alkyl and R¹⁵ is hydrogen or (C₁-₆)alkyl, and wherein within
R¹⁴ said cycloalkyl, heterocycloalkyl, aryl, heteroaryl, polycycloaryl or heteropolycycloaryl ring
optionally is substituted by a group selected from -R¹⁶, -X⁴OR¹⁶, -X⁴SR¹⁶, -X⁴S(O)R¹⁶,
-X⁴S(O)₂R¹⁶, -X⁴C(O)R¹⁶, -X⁴C(O)OR¹⁶, -X⁴OC(O)R¹⁶, -X⁴NR¹⁶R¹⁷, -X⁴NR¹⁷C(O)R¹⁶,
-X⁴NR¹⁷C(O)OR¹⁶, -X⁴C(O)NR¹⁶R¹⁷, -X⁴S(O)₂NR¹⁶R¹⁷, -X⁴NR¹⁷C(O)NR¹⁶R¹⁷ or
-X⁴NR¹⁷C(NR¹⁷)NR¹⁶R¹⁷, wherein X⁴ is a bond or (C₁-₆)alkylene, R¹⁶ is hydrogen or
(C₁-₆)alkyl and R¹⁷ is (C₃-₁₂)cycloalkyl(C₆-₆)alkyl, hetero(C₃-₁₂)cycloalkyl(C₆-₆)alkyl,
(C₆-₁₂)aryl(C₆-₆)alkyl, hetero(C₅-₁₂)aryl(C₆-₆)alkyl, (C₉-₁₂)polycycloaryl(C₆-₆)alkyl or
hetero(C₈-₁₂)polycycloaryl(C₆-₆)alkyl, or (ii) a group selected from
(C₃-₁₂)cycloalkyl(C₆-₆)alkyl, hetero(C₃-₁₂)cycloalkyl(C₆-₆)alkyl, (C₆-₁₂)aryl(C₆-₆)alkyl,
hetero(C₅-₁₂)aryl(C₆-₆)alkyl, (C₉-₁₂)polycycloaryl(C₆-₆)alkyl and
hetero(C₈-₁₂)polycycloaryl(C₆-₆)alkyl, wherein said cycloalkyl, heterocycloalkyl, aryl,
heteroaryl, polycycloaryl or heteropolycycloaryl ring optionally is substituted by a group
selected from -R¹⁶, -X⁴OR¹⁶, -X⁴SR¹⁶, -X⁴S(O)R¹⁶, -X⁴S(O)₂R¹⁶, -X⁴C(O)R¹⁶,
-X⁴C(O)OR¹⁶, -X⁴OC(O)R¹⁶, -X⁴NR¹⁶R¹⁷, -X⁴NR¹⁷C(O)R¹⁶, -X⁴NR¹⁷C(O)OR¹⁶,
-X⁴C(O)NR¹⁶R¹⁷, -X⁴S(O)₂NR¹⁶R¹⁷, -X⁴NR¹⁷C(O)NR¹⁶R¹⁷ or -X⁴NR¹⁷C(NR¹⁷)NR¹⁶R¹⁷,
wherein X⁴, R¹⁶ and R¹⁷ are as defined above; wherein within R⁴ any alicyclic or aromatic ring
system present may be substituted further by 1 to 5 radicals independently selected from
(C₁₋₆)alkyl, (C₁₋₆)alkylidene, cyano, halo, halo-substituted (C₁₋₆)alkyl, nitro, -X⁴NR¹²R¹², -X⁴NR¹²C(O)OR¹², -X⁴NR¹²C(O)NR¹²R¹², -X⁴NR¹²C(NR¹²)NR¹²R¹², -X⁴OR¹², -X⁴SR¹², -X⁴C(O)OR¹², -X⁴C(O)NR¹²R¹², -X⁴S(O)₂NR¹²R¹², -X⁴P(O)(OR³)OR¹², -X⁴OP(O)(OR³)OR¹², -X⁴OC(O)R¹³, -X⁴NR¹²C(O)R¹³, -X⁴S(O)R¹³, -X⁴S(O)₂R¹³ and

- X⁴C(O)R¹³, wherein X⁴, R¹² and R¹³ are as defined above, or

R⁴ and R² taken together form trimethylene, tetramethylene or phenylene-1,2-dimethylene, optionally substituted with hydroxy, oxo or methylene, or

R⁴ and R³ together with the carbon atom to which both R⁴ and R³ are attached form (C₃₋₈)cycloalkylene or (C₃₋₈)heterocycloalkylene;

R³ is hydrogen or (C₁₋₆)alkyl;

R⁷ is hydrogen or (C₁₋₆)alkyl;

R⁹ is (C₆₋₁₂)aryl(C₁₋₆)alkyl, hetero(C₅₋₁₂)aryl(C₁₋₆)alkyl, -X⁴OR¹⁴, -X⁴SR¹⁴, -X⁴S(O)R¹⁴, -X⁴S(O)₂R¹⁴ or -X⁴NR¹⁴R¹⁵, wherein X⁴, R¹⁴ and R¹⁵ are as defined above and wherein within R³ said aryl or heteroaryl ring optionally is substituted by 1 to 5 radicals independently selected from (C₁₋₆)alkyl, cyano, halo, halo-substituted (C₁₋₆)alkyl, nitro, -X⁴NR¹²R¹², -X⁴NR¹²C(O)OR¹², -X⁴NR¹²C(O)NR¹²R¹², -X⁴NR¹²C(NR¹²)NR¹²R¹², -X⁴OR¹², -X⁴SR¹², -X⁴C(O)R¹², -X⁴C(O)OR¹², -X⁴C(O)NR¹²R¹², -X⁴S(O)₂NR¹²R¹², -X⁴P(O)(OR³)OR¹², -X⁴OP(O)(OR³)OR¹², -X⁴OC(O)R¹³, -X⁴NR¹²C(O)R¹³, -X⁴S(O)R¹³, -X⁴S(O)₂R¹³, wherein X⁴, R¹² and R¹³ are as defined above; and

R¹¹ is -X⁴X⁵R¹⁸, wherein X⁵ is -C(O)-, -C(O)C(O)- or -S(O)₂-, X⁶ is a bond, -O- or -NR¹⁹-, wherein R¹⁹ is hydrogen or (C₁₋₆)alkyl, and R¹⁸ is (i) (C₁₋₁₀)alkyl optionally substituted by cyano, halo, nitro, -NR¹²R¹², -NR¹²C(O)OR¹², -NR¹²C(O)NR¹²R¹², -NR¹²C(NR¹²)NR¹²R¹², -OR¹², -SR¹², -C(O)OR¹², -C(O)NR¹²R¹², -S(O)₂NR¹²R¹², -P(O)(OR¹²)OR¹², -OP(O)(OR¹²)OR¹², -NR¹²C(O)R¹³, -S(O)R¹³, -S(O)₂R¹³, -C(O)R¹³, -OR²⁰, -SR²⁰, -S(O)R²⁰, -S(O)₂R²⁰, -C(O)R²⁰, -C(O)OR²⁰, -C(O)NR²⁰R²¹, -NR²⁰R²¹, -NR²¹C(O)R²⁰, -NR²¹C(O)OR²⁰, -NR²¹C(O)NR²⁰R²¹ or -NR²¹C(NR²¹)NR²⁰R²¹, wherein R¹² and R¹³ are as defined above, R²⁰ is (C₃₋₁₂)cycloalkyl(C₀₋₆)alkyl, hetero(C₃₋₁₂)cycloalkyl(C₀₋₆)alkyl, (C₆₋₁₂)aryl(C₀₋₆)alkyl, hetero(C₅₋₁₂)aryl(C₀₋₆)alkyl, (C₆₋₁₂)bicycloaryl(C₀₋₆)alkyl or hetero(C₆₋₁₂)bicycloaryl(C₀₋₆)alkyl and R²¹ at each occurrence
independently is hydrogen or (C₁₋₆)alkyl, or (ii) (C₃₋₁₂)cycloalkyl(C₀₋₆)alkyl, hetero(C₃₋₁₂)cycloalkyl(C₀₋₆)alkyl, (C₁₋₆)ary(C₀₋₆)alkyl, hetero(C₅₋₁₂)aryl(C₀₋₆)alkyl, (C₉₋₁₂)bicycloalkyl(C₀₋₆)alkyl or hetero(C₅₋₁₂)bicycloalkyl(C₀₋₆)alkyl or (iii) (C₃₋₆)cycloalkyl(C₀₋₆)alkyl, hetero(C₃₋₆)cycloalkyl(C₀₋₆)alkyl, phenyl(C₀₋₆)alkyl or hetero(C₅₋₆)aryl(C₀₋₆)alkyl, wherein said cycloalkyl, heterocycloalkyl, phenyl or heteroaryl is substituted by -X⁴OR₂², -X⁴SR₂², -X⁴S(O)R₂², -X⁴S(O)₂R₂², -X⁴C(O)R²², -X⁴C(O)OR₂², -X⁴C(O)NR₂²R₂³, -X⁴NR₂²R₂³, -X⁴NR₂²C(O)R₂², -X⁴NR₂²C(O)OR₂², -X⁴NR₂²C(O)NR₂²R₂³ or -X⁴NR₂²C(NR₂³)NR₂²R₂³, wherein X⁴ is as defined above, R₂² is (C₃₋₆)cycloalkyl(C₀₋₆)alkyl, hetero(C₃₋₆)cycloalkyl(C₀₋₆)alkyl, phenyl(C₀₋₆)alkyl or hetero(C₅₋₆)aryl(C₀₋₆)alkyl and R₂³ at each occurrence independently is hydrogen or (C₁₋₆)alkyl; wherein within R¹¹ any alicyclic or aromatic ring system present may be substituted further by 1 to 5 radicals independently selected from (C₁₋₆)alkyl, (C₁₋₆)alkylidene, cyano, halo, halo-substituted (C₁₋₆)alkyl, nitro, -X⁴NR₁²R₁², -X⁴NR₁²C(O)OR₁², -X⁴NR₁²C(O)NR₁²R₁², -X⁴NR₁²C(NR₁²)NR₁²R₁², -X⁴OR₁², -X⁴SR₁², -X⁴C(O)OR₁², -X⁴C(O)NR₁²R₁², -X⁴C(O)₂NR₁²R₁², -X⁴P(O)(OR₃)OR₁², -X⁴OP(O)(OR₃)OR₁², -X⁴OC(O)R₁³, -X⁴NR₁³C(O)R₁³, -X⁴S(O)R₁³, -X⁴S(O)₂R₁³, -X⁴C(O)R₁³, wherein X³, R₁² and R₁³ are as defined above; and the N-oxide derivatives, prodrug derivatives, protected derivatives, individual isomers and mixtures of isomers; and the pharmaceutically acceptable salts thereof.

19. The compound of Claim 18 in which:
R² is hydrogen;
R³ is hydrogen, methyl or taken with R⁴ together with the carbon atom to which both R² and R⁴ are attached forms (C₃₋₈)cycloalkylene;
R⁴ is hydrogen, methyl or as defined above;
R⁵ is hydrogen or (C₁₋₆)alkyl;
R⁷ is hydrogen or methyl;
R⁹ represents (C₆₋₁₂)aryl(C₀₋₆)alkyl, hetero(C₅₋₁₂)aryl(C₀₋₆)alkyl, -X⁴OR₁⁴, -X⁴SR₁⁴, -X⁴S(O)R₁⁴ or -X⁴NR₁⁴R₁⁵, wherein X⁴ is a bond or (C₁₋₆)alkylene, R₁⁴ is
(C\textsubscript{6-12})aryl(C\textsubscript{0-6})alkyl or hetero(C\textsubscript{5-12})aryl(C\textsubscript{0-6})alkyl and R\textsuperscript{15} is hydrogen or (C\textsubscript{1-6})alkyl, and wherein within R\textsuperscript{9} said aryl or heteroaryl ring optionally is substituted by 1 to 5 radicals independently selected from (C\textsubscript{1-6})alkyl, cyano, halo, halo-substituted (C\textsubscript{1-6})alkyl, nitro, -X\textsuperscript{4}NR\textsuperscript{12}R\textsuperscript{12}, -X\textsuperscript{4}OR\textsuperscript{12}, -X\textsuperscript{4}C(O)R\textsuperscript{12}, -X\textsuperscript{4}SR\textsuperscript{12}, wherein X\textsuperscript{4} is a bond or (C\textsubscript{1-6})alkylene, R\textsuperscript{12} at each occurrence independently is hydrogen, (C\textsubscript{1-6})alkyl or halo-substituted (C\textsubscript{1-3})alkyl, and R\textsuperscript{13} is (C\textsubscript{1-6})alkyl or halo-substituted (C\textsubscript{1-3})alkyl; and

R\textsuperscript{11} is -X\textsuperscript{4}X\textsuperscript{5}R\textsuperscript{18}, wherein X\textsuperscript{4} is -C(O)- or -S(O)\textsubscript{2}-, X\textsuperscript{5} is a bond, -O- or -NR\textsuperscript{19}-, wherein R\textsuperscript{19} is hydrogen or (C\textsubscript{1-6})alkyl, and R\textsuperscript{18} is (i) (C\textsubscript{1-10})alkyl or (ii) (C\textsubscript{3-12})cycloalkyl(C\textsubscript{0-6})alkyl, hetero(C\textsubscript{3-12})cycloalkyl(C\textsubscript{0-6})alkyl, (C\textsubscript{6-12})aryl(C\textsubscript{0-6})alkyl or hetero(C\textsubscript{5-12})cycloalkyl(C\textsubscript{0-6})alkyl, phenyl(C\textsubscript{0-6})alkyl or hetero(C\textsubscript{5-6})aryl(C\textsubscript{0-6})alkyl, wherein said cycloalkyl, heterocycloalkyl, phenyl or heteroaryl is substituted by -X\textsuperscript{9}OR\textsuperscript{24}, -X\textsuperscript{9}C(O)R\textsuperscript{24}, -X\textsuperscript{9}C(O)OR\textsuperscript{24}, -X\textsuperscript{9}C(O)NR\textsuperscript{24}R\textsuperscript{25}, -X\textsuperscript{9}NR\textsuperscript{24}R\textsuperscript{25}, -X\textsuperscript{9}NR\textsuperscript{25}C(O)R\textsuperscript{24}, -X\textsuperscript{9}NR\textsuperscript{25}C(O)OR\textsuperscript{24}, -X\textsuperscript{9}NR\textsuperscript{25}C(O)NR\textsuperscript{24}R\textsuperscript{25} or -X\textsuperscript{9}NR\textsuperscript{25}C(O)NR\textsuperscript{25}R\textsuperscript{25}, wherein X\textsuperscript{9} is a bond or (C\textsubscript{1-6})alkylene,

R\textsuperscript{24} is (C\textsubscript{3-6})cycloalkyl(C\textsubscript{0-6})alkyl, hetero(C\textsubscript{3-6})cycloalkyl(C\textsubscript{0-6})alkyl, phenyl(C\textsubscript{0-6})alkyl or hetero(C\textsubscript{5-6})aryl(C\textsubscript{0-6})alkyl and R\textsuperscript{25} is hydrogen or (C\textsubscript{1-6})alkyl, wherein within R\textsuperscript{11} any alicyclic or aromatic ring system present may be substituted further by 1 to 5 substituents independently selected from (C\textsubscript{1-6})alkyl, halo, halo-substituted (C\textsubscript{1-6})alkyl, -OR\textsuperscript{12}, -X\textsuperscript{3}SR\textsuperscript{12}, -C(O)OR\textsuperscript{12} and -X\textsuperscript{3}NR\textsuperscript{12}C(O)OR\textsuperscript{12}, wherein X\textsuperscript{3} is a bond or (C\textsubscript{1-6})alkylene and R\textsuperscript{14} is hydrogen or (C\textsubscript{1-6})alkyl; and the N-oxide derivatives, prodrug derivatives, protected derivatives, individual isomers and mixtures of isomers; and the pharmaceutically acceptable salts thereof.

20. The compound of Claim 19 in which:

R\textsuperscript{3}, R\textsuperscript{4}, R\textsuperscript{5} and R\textsuperscript{7} each are hydrogen;

R\textsuperscript{9} represents benzyl, benzyloxymethyl, benzylsulfanylethyl, benzylsulfanyl methyl, benzylsulfanyl methyl, indolylmethyl, naphthylmethyl, phenethyl, phenoxyethyl, phenylamino, pyridylmethyl, pyridylsulfanylethyl, phenylsulfanylethyl, thiazolyl or thienyl, wherein within R\textsuperscript{9} the aromatic ring may be substituted further by 1 to 5 radicals independently selected from
(C_{1-6})alkyl, cyano, halo, halo-substituted (C_{1-6})alkyl, nitro, \(-X^iNR^{12}\), \(-X^iOR^{12}\), \(-X^iC(O)R^{12}\), \(-X^iSR^{12}\), wherein \(X^i\) is a bond or (C_{1-6})alkylene, \(R^{12}\) at each occurrence independently is hydrogen, (C_{1-6})alkyl or halo-substituted (C_{1-6})alkyl, and \(R^{12}\) is (C_{1-6})alkyl or halo-substituted (C_{1-6})alkyl; and

\[ R^{11} \text{ is } -X^iX^jR^{18}, \text{ wherein } X^i \text{ is } -C(O)-, \text{ and } X^j \text{ is a bond and } R^{18} \text{ is} \]

(i) \((C_{3-12})\text{cycloalkyl}(C_{0-6})\text{alkyl, hetero}(C_{3-12})\text{cycloalkyl}(C_{0-6})\text{alkyl, (C}_{6-12}\text{aryl}(C_{0-6})\text{alkyl or}\]

hetero(C_{5-12})aryl(C_{0-6})alkyl or (ii) phenyl(C_{0-6})alkyl or hetero(C_{5-6})aryl(C_{0-6})alkyl, wherein said phenyl or heteroaryl is substituted by \(-X^iOR^{24}, -X^iC(O)R^{24}, -X^iC(O)OR^{24}, \]

\(-X^iC(O)NR^{24}R^{25}, -X^iNR^{24}R^{25}, -X^iNR^{25}C(O)R^{24}, -X^iNR^{25}C(O)OR^{24}, \]

\(-X^iNR^{23}C(O)NR^{24}R^{25} \text{ or } -X^iNR^{25}C(NR^{25})NR^{24}R^{25}, \text{ wherein } X^i \text{ is a bond or (C}_{1-6}\text{)alkylene,} \]

\(R^24 \text{ is phenyl}(C_{0-6})\text{alkyl or hetero}(C_{5-6})\text{aryl}(C_{0-6})\text{alkyl and } R^{25} \text{ is hydrogen or (C}_{1-6}\text{)alkyl,} \]

wherein within \(R^{11}\) any aromatic ring system present may be substituted further by 1 to 5 substituents independently selected from (C_{1-6})alkyl, halo, halo-substituted (C_{1-6})alkyl, \(-OR^{12}, \]

\(-X^iSR^{12}, -C(O)OR^{12} \text{ and } -X^iNR^{12}C(O)OR^{12}, \text{ wherein } X^{3} \text{ is a bond or (C}_{1-6}\text{)alkylene and } R^{12} \]

is hydrogen or (C_{1-6})alkyl; and the N-oxide derivatives, prodrug derivatives, protected derivatives, individual isomers and mixtures of isomers; and the pharmaceutically acceptable salts thereof.

21. The compound of Claim 20 in which \(R^2\) is a group having the following formula:

\[
\begin{align*}
\text{(R}^{26}\text{)}_q \\
\text{S} \\
\end{align*}
\]

in which \(q\) is 0 to 5 and \(R^{26}\) at each occurrence is independently selected from (C_{1-6})alkyl,
cyano, halo, halo-substituted (C\textsubscript{1-4})alkyl, nitro, -OR\textsuperscript{12}, -SR\textsuperscript{12} and -C(O)OR\textsuperscript{12}, wherein R\textsuperscript{12} is hydrogen, (C\textsubscript{1-3})alkyl or halo-substituted (C\textsubscript{1-3})alkyl and R\textsuperscript{13} is (C\textsubscript{1-4})alkyl or halo-substituted (C\textsubscript{1-4})alkyl; and the N-oxide derivatives, prodrug derivatives, protected derivatives, individual isomers and mixtures of isomers; and the pharmaceutically acceptable salts thereof.

22. The compound of Claim 20 in which R\textsuperscript{3} is 4-aminobenzyl, benzyl, benzyloxymethyl, 2-benzylsulfanylethyl, benzyloxysulfanylmethyl, 2-bromobenzylsulfanylmethyl, 4-tert-butylbenzylsulfanylmethyl, 2-chlorobenzyl, 4-chlorobenzyl,
2-chlorobenzylsulfanylmethyl, 4-chlorobenzylsulfanylmethyl, 2-(2-chlorophenylsulfanyl)ethyl, 4-cyanobenzyl, 3,4-dichlorobenzylsulfanylmethyl, 1,6-dichlorobenzyl,
3,5-dimethylbenzylsulfanylmethyl, 2-fluorobenzyl, 4-fluorobenzyl,
2-fluorobenzylsulfanylmethyl, 1-formylindol-3-ylmethyl, indol-3-ylmethyl,
2-iodobenzylsulfanylmethyl, 2-methylbenzylsulfanylmethyl, 3-methylbenzylsulfanylmethyl, 3-methylbenzylsulfanylmethyl, 4-methylbenzylsulfanylmethyl, 2-(2-methylphenylsulfanyl)ethyl, 4-methoxybenzyl, 4-methoxybenzylsulfanylmethyl, 4-methoxybenzylsulfanylmethyl,
naphth-2-ylmethyl, naphth-2-ylmethysulfanylmethyl, 3-nitrobenzyl,
1-nitrobenzylsulfanylmethyl, 2-nitrobenzylsulfanylmethyl, 3-nitrobenzylsulfanylmethyl,
4-nitrobenzylsulfanylmethyl, 4-nitrobenzyl, pentafluorobenzylsulfanylmethyl, phenylamino, phenethyl, phenethyloxy, 2-phenoxyethyl, 2-phenoxyethyl 2-phenylsulfanyethyl,
pyrid-4-ylmethyl, pyrid-2-ylmethysulfanylmethyl, pyrid-3-ylmethysulfanylmethyl,
pyrid-4-ylmethysulfanylmethyl, 2-pyrid-2-ylsulfanylethyl, 2-pyrid-4-ylsulfanylethyl,
thiazol-5-yl, thien-2-ylmethyl, 4-trifluoromethylbenzylsulfanylmethyl,
3-trifluoromethylbenzylsulfanylmethyl, 3-trifluoromethoxybenzylsulfanylmethyl, 4-trifluoromethoxybenzylsulfanylmethyl or 4-trifluorosulfanybenzylsulfanylmethyl; and the N-oxide derivatives, prodrug derivatives, protected derivatives, individual isomers and mixtures of isomers; and the pharmaceutically acceptable salts thereof.

23. The compound of Claim 22 which is selected a group from consisting of:
\(\text{N-}(2\text{-benzylsulfanyl-1R-cyanomethylcarbamoylethyl)-4-hydroxybenzamide;}\)
N-[2-(2-bromobenzylsulfanyl)-1R-cyanomethylcarbamoylethyl]benzamide;
N-[1R-cyanomethylcarbamoyl-2-(2-iodobenzylsulfanyl)ethyl]benzamide;
N-[1R-cyanomethylcarbamoyl-2-(2-cyanobenzylsulfanyl)ethyl]morpholine-4-carboxamide;
N-[3-(2-chlorophenylsulfanyl)-1R-cyanomethylcarbamoylpropyl]benzamide;
N-[1R-cyanomethylcarbamoyl-2-(2-nitrobenzylsulfanyl)ethyl]morpholine-4-carboxamide
N-[1R-cyanomethylcarbamoyl-2-(2-methylbenzylsulfanyl)ethyl]morpholine-4-carboxamide; and
N-[1R-cyanomethylcarbamoyl-2-(2-methylbenzylsulfanyl)ethyl]benzamide; and the
N-oxide derivatives, prodrug derivatives, protected derivatives, individual isomers and
mixtures of isomers; and the pharmaceutically acceptable salts thereof.


25. A compound or pharmaceutical composition according to any preceding
claim for use in treating a disease in an animal in which cysteine protease activity contributes to
the pathology and/or symptomatology of the disease.

26. A compound or pharmaceutical composition for use according to claim 25 in
which the cysteine protease is cathepsin S.

27. A compound or pharmaceutical composition for use according to claim 26 to
treat asthma.

28. Use of a compound according to any preceding claim for the manufacture of a
medicament for the treatment of a disease in an animal in which cysteine protease activity
contributes to the pathology and/or symptomatology of the disease.
29. Use according to claim 28 for the treatment of a disease in an animal in which cathepsin S activity contributes to the pathology and/or symptomatology of the disease.

30. Use according to claim 29 for the treatment of asthma.

31. A compound or pharmaceutical composition according to any preceding claim and an anti-inflammatory agent as a combined preparation for simultaneous, separate or sequential use in the treatment of asthma.

32. A compound, pharmaceutical composition or use thereof substantially as herein described with reference to the Examples.

33. A method of treating a disease in an animal in which cathepsin S activity contributes to the pathology and/or symptomatology of the disease, which method comprising administering to the animal a therapeutically effective amount of a compound of Formula (I):

![Chemical Structure](attachment:structure.png)

(I)

in which:

R¹ is a group of Formula (a) or (b):

![Chemical Structures](attachment:structures.png)

(a) (b)

wherein:

X¹ and X² independently are -C(O)- or -CH₂S(O)₂⁻;
R⁵ and R⁶ are hydrogen or (C₃₋₆)alkyl;
R⁷ and R⁸ are hydrogen or (C₃₋₆)alkyl or as defined below;
R⁹ and R¹⁰ independently are (i) (C₁₋₆)alkyl optionally substituted with cyano, halo or nitro or (ii) a group selected from -X³NR¹²R¹², -X³NR¹²C(O)OR¹²,
  -X³NR¹²C(O)NR¹²R¹², -X³NR¹²C(NR¹²)NR¹²R¹², -X³OR¹², -X³SR¹²,
  -X³C(O)OR¹², -X³C(O)NR¹²R¹², -X³S(O)₂NR¹²R¹², -X³P(O)(OR¹²)OR¹²,
  -X³OP(O)(OR¹²)OR¹², -X³NR¹²C(O)R¹², -X³S(O)₂R¹², -X³C(O)R¹²,
  -X³C(O)R¹⁴, -X³C(O)OR¹⁴, -X³OC(O)R¹⁴, -X³NR¹⁵C(O)R¹⁴, -X³NR¹⁵C(O)OR¹⁴,
  -X³C(O)NR¹⁴R¹⁵, -X³S(O)₂NR¹⁴R¹⁵, -X³NR¹³C(O)NR¹⁴R¹⁵,
  -X³NR¹⁴C(NR¹⁵)NR¹⁴R¹⁵, -X³SR¹⁴ -X³S(O)₂R¹⁴, -X³OR¹⁴, or
  -X³NR¹⁴R¹⁵, wherein X³ is (C₁₋₆)alkylene, X⁴ is a bond or (C₁₋₆)alkylene, R¹² at each occurrence independently is hydrogen, (C₁₋₆)alkyl or halo-substituted (C₁₋₃)alkyl, R¹³ is (C₁₋₆)alkyl or halo-substituted (C₁₋₃)alkyl, R¹⁴ is (C₅₋₁₂)cycloalkyl(C₀₋₆)alkyl,
hetero(C₃₋₁₂)cycloalkyl(C₀₋₆)alkyl, (C₆₋₁₂)aryl(C₀₋₆)alkyl, hetero(C₅₋₁₂)aryl(C₀₋₆)alkyl,
(C₉₋₁₂)polycycloaryl(C₀₋₆)alkyl or hetero(C₈₋₁₂)polycycloaryl(C₀₋₆)alkyl and R¹⁵ is hydrogen or (C₁₋₆)alkyl, and wherein within R¹⁴ said cycloalkyl, heterocycloalkyl, aryl, heteroaryl, polycycloaryl or heteropolycycloaryl ring optionally is substituted by a group selected from -R¹⁶, -X⁴OR¹⁶, -X⁴SR¹⁶, -X⁴S(O)₂R¹⁶,
  -X⁴C(O)R¹⁶, -X⁴C(O)OR¹⁶, -X⁴OC(O)R¹⁶, -X⁴NR¹⁶R¹⁷, -X⁴NR¹⁶C(O)R¹⁶,
  -X⁴NR¹⁷C(O)OR¹⁶, -X⁴C(O)NR¹⁷R¹⁶, -X⁴S(O)₂NR¹⁶R¹⁷, -X⁴NR¹⁷C(O)NR¹⁶R¹⁷ or
  -X⁴NR¹⁷C(NR¹⁷)NR¹⁶R¹⁷, wherein X⁴ is a bond or (C₁₋₆)alkylene, R¹⁶ is hydrogen or (C₁₋₆)alkyl and R¹⁷ is (C₃₋₁₂)cycloalkyl(C₀₋₆)alkyl, hetero(C₃₋₁₂)cycloalkyl(C₀₋₆)alkyl,
(C₆₋₁₂)aryl(C₀₋₆)alkyl, hetero(C₅₋₁₂)aryl(C₀₋₆)alkyl, (C₉₋₁₂)polycycloaryl(C₀₋₆)alkyl or hetero(C₈₋₁₂)polycycloaryl(C₀₋₆)alkyl, or (iii) a group selected from
(C₃₋₁₂)cycloalkyl(C₀₋₆)alkyl, hetero(C₃₋₁₂)cycloalkyl(C₀₋₆)alkyl, (C₆₋₁₂)aryl(C₀₋₆)alkyl,
hetero(C₅₋₁₂)aryl(C₀₋₆)alkyl, (C₉₋₁₂)polycycloaryl(C₀₋₆)alkyl and
hetero(C₈₋₁₂)polycycloaryl(C₀₋₆)alkyl, wherein said cycloalkyl, heterocycloalkyl, aryl, heteroaryl, polycycloaryl or heteropolycycloaryl ring optionally is substituted by a group selected from -R¹⁶, -X⁴OR¹⁶, -X⁴SR¹⁶, -X⁴S(O)₂R¹⁶, -X⁴S(O)₂R¹⁶,
-X^4C(O)R^{16}, -X^4C(O)OR^{16}, -X^4OC(O)R^{16}, -X^4NR^{16}R^{17}, -X^4NR^{17}C(O)R^{16},
-X^4NR^{17}C(O)OR^{16}, -X^4C(O)NR^{16}R^{17}, -X^4S(O)NR^{16}R^{17}, -X^4NR^{17}C(O)NR^{16}R^{17}

or
-X^4NR^{17}C(NR^{17})NR^{16}R^{17}, wherein X^4, R^{16} and R^{17} are as defined above; wherein
within R^9 and/or R^10 any alicyclic or aromatic ring system present may be substituted
further by 1 to 5 radicals independently selected from (C_{1-6})alkyl, (C_{1-6})alkyldiene,
cyano, halo, halo-substituted (C_{1-4})alkyl, nitro, -X^4NR^{12}R^{12}, -X^4NR^{12}C(O)OR^{12},
-X^4NR^{12}C(O)NR^{12}R^{12}, -X^4NR^{12}C(NR^{12})NR^{12}R^{12}, -X^4OR^{12}, -X^4SR^{12},
-X^4(C(O)OR)^{12}, -X^4(C(O)NR)^{12}R^{12}, -X^4(S(O)NR)^{12}R^{12}, -X^4P(O)(OR)^{12},
-X^4OP(O)(OR)^{12}, -X^4OC(O)R^{13}, -X^4NR^{13}C(O)R^{13}, -X^4S(O)R^{13}, -X^4S(O)_{2}R^{13}
and -X^4C(O)R^{13}, wherein X^4, R^{12} and R^{13} are as defined above, or

R^9 taken together with R^7 and/or R^10 taken together with R^8 form
trimethylene, tetramethylene or phenylene-1,2-dimethylene, optionally substituted with
hydroxy, oxo or methylene; and

R^{11} is -X^5X^6R^{18}, wherein X^5 is -C(O)-, -C(O)C(O)- or -S(O)_{2}-, X^6 is a
bond, -O- or -NR^{19}-, wherein R^{19} is hydrogen or (C_{1-6})alkyl, and R^{18} is
(i) (C_{1-10})alkyl optionally substituted by cyano, halo, nitro, -NR^{12}R^{12},
-NR^{12}C(O)OR^{12}, -NR^{12}C(O)NR^{12}R^{12}, -NR^{12}C(NR^{12})NR^{12}R^{12}, -OR^{12}, -SR^{12},
-C(O)OR^{12}, -C(O)NR^{12}R^{12}, -S(O)_{2}NR^{12}R^{12}, -P(O)(OR)^{12},
-OP(O)(OR)^{12}, -OR^{12}C(O)R^{13}, -S(O)_{2}R^{13}, -S(O)R^{13}, -C(O)R^{13}, -OR^{20}, -SR^{20},
-S(O)^{20}, -S(O)_{2}R^{20}, -(C(O)R)^{20}, -(C(O)OR)^{20}, -(C(O)NR)^{20}R^{21}, -(NR^{20}R)^{21},
-NR^{21}C(O)R^{20}, -NR^{21}C(O)OR^{20}, -NR^{21}C(O)NR^{20}R^{21} or -NR^{21}C(NR^{21})NR^{20}R^{21},

wherein R^{12} and R^{13} are as defined above, R^{20} is (C_{3-12})cycloalkyl(C_{6-6})alkyl,
hetero(C_{3-12})cycloalkyl(C_{6-6})alkyl, (C_{6-12})aryl(C_{6-6})alkyl, hetero(C_{5-12})aryl(C_{6-6})alkyl,
(C_{9-12})bicycloaryl(C_{6-6})alkyl or hetero(C_{8-12})bicycloaryl(C_{6-6})alkyl and R^{21} at each
occurrence independently is hydrogen or (C_{1-6})alkyl, or

(ii) (C_{3-12})cycloalkyl(C_{6-6})alkyl, hetero(C_{3-12})cycloalkyl(C_{6-6})alkyl,
(C_{6-12})aryl(C_{6-6})alkyl, hetero(C_{5-12})aryl(C_{6-6})alkyl, (C_{9-12})bicycloaryl(C_{6-6})alkyl or
hetero(C_{8-12})bicycloaryl(C_{6-6})alkyl or (iii) (C_{5-6})cycloalkyl(C_{6-6})alkyl,
hetero(C_{3-6})cycloalkyl(C_{6-6})alkyl, phenyl(C_{6-6})alkyl or hetero(C_{5-6})aryl(C_{6-6})alkyl,
wherein said cycloalkyl, heterocycloalkyl, phenyl or heteroaryl is substituted by
-X^4OR^{22}, -X^4SR^{22}, -X^4S(O)R^{22}, -X^4S(O)_2R^{22}, -X^4C(O)R^{22}, -X^4C(O)OR^{22},
-X^4C(O)NR^{23}R^{22}, -X^4NR^{22}R^{22}, -X^4NR^{23}C(O)R^{22}, -X^4NR^{23}C(O)OR^{22},
-X^4NR^{23}C(O)NR^{22}R^{23} or -X^4NR^{23}C(NR^{23})NR^{22}R^{23}, wherein X^4 is as defined
above, R^{22} is (C_{3−6})cycloalkyl(C_{0−6})alkyl, hetero(C_{3−6})cycloalkyl(C_{0−6})alkyl,
phenyl(C_{0−6})alkyl or hetero(C_{5−6})aryl(C_{0−6})alkyl and R^{23} at each occurrence
independently is hydrogen or (C_{1−6})alkyl; wherein within R^{11} any alicyclic or aromatic
ring system present may be substituted further by 1 to 5 radicals independently
selected from (C_{1−6})alkyl, (C_{1−6})alkylidene, cyano, halo, halo-substituted (C_{1−4})alkyl,
nitro, -X^4NR^{12}R^{12}, -X^4NR^{12}C(O)OR^{12}, -X^4NR^{12}C(O)NR^{12}R^{12},
-X^4NR^{12}C(NR^{12})NR^{12}R^{12}, -X^4C(O)OR^{12}, -X^4C(S)OR^{12}, -X^4C(O)OR^{12}, -X^4C(O)NR^{12}R^{12},
-X^4S(O)NR^{12}R^{12}, -X^4P(O)(OR^{3})OR^{12}, -X^4OP(O)(OR^{3})OR^{12}, -X^4OC(O)R^{13},
-X^4NR^{12}C(O)R^{13}, -X^4S(O)R^{13}, -X^4S(O)NR^{12}R^{13} and -X^4C(O)R^{13}, wherein X^4, R^{12} and
R^{13} are as defined above;

R^2 is hydrogen or (C_{1−6})alkyl or as defined below;
R^3 is hydrogen, (C_{1−6})alkyl or as defined below; and
R^4 is (i) hydrogen or (C_{1−6})alkyl, wherein said alkyl is optionally substituted with
cyano, halo, nitro, -NR^{12}R^{12}, -NR^{12}C(O)OR^{12}, -NR^{12}C(O)NR^{12}R^{12},
-NR^{12}C(NR^{12})NR^{12}R^{12}, -OR^{12}, -SR^{12}, -C(O)OR^{12}, -C(O)NR^{12}R^{12}, -S(O)NR^{12}R^{12},
-P(O)(OR^{12})OR^{12}, -OP(O)(OR^{12})OR^{12}, -NR^{12}C(O)OR^{12}, -S(O)R^{13}, -S(O)NR^{12}R^{13}, -C(O)R^{13},
-OR^{14}, -SR^{14}, -S(O)R^{14}, -S(O)NR^{14}R^{14}, -C(O)R^{14}, -C(O)OR^{14}, -OC(O)R^{14}, -NR^{14}R^{15},
-NR^{15}C(O)R^{14}, -NR^{15}C(O)OR^{14}, -C(O)NR^{14}R^{15}, -S(O)NR^{14}R^{15}, -NR^{15}C(O)NR^{14}R^{15} or
-NR^{15}C(NR^{15})NR^{14}R^{15}, wherein R^{12}, R^{13}, R^{14} and R^{15} are as defined above, or (ii) a group
selected from (C_{3−12})cycloalkyl(C_{0−6})alkyl, hetero(C_{3−12})cycloalkyl(C_{0−6})alkyl,
(C_{6−12})aryl(C_{0−6})alkyl, hetero(C_{3−12})aryl(C_{0−6})alkyl, (C_{9−12})polycycloaryl(C_{0−6})alkyl and
hetero(C_{8−12})polycycloaryl(C_{0−6})alkyl, wherein said cycloalkyl, heterocycloalkyl, aryl,
heteroaryl, polycycloaryl or heteropolycycloaryl ring optionally is substituted by a group
selected from -R^16, -X^4OR^16, -X^4SR^16, -X^4S(O)R^16, -X^4S(O)NR^16, -X^4C(O)R^16,
-X^4C(O)OR^16, -X^4OC(O)R^16, -X^4NR^16R^17, -X^4NR^17C(O)R^16, -X^4NR^17C(O)OR^16,
-X^4C(O)NR^16R^{17}, -X^4S(O)_{2}NR^{16}R^{17}, -X^4NR^{17}C(O)NR^{16}R^{17} or -X^4NR^{17}C(NR^{17})NR^{16}R^{17},
wherein X^4, R^{16} and R^{17} are as defined above; wherein within R^9 and/or R^{10} any alicyclic or aromatic ring system present may be substituted further by 1 to 5 radicals independently selected from (C_{1-6})alkyl, (C_{1-6})alkylidene, cyano, halo, halo-substituted (C_{1-4})alkyl, nitro,
-X^4NR^{12}R^{12}, -X^4NR^{12}C(O)OR^{12}, -X^4NR^{12}C(O)NR^{12}R^{12}, -X^4NR^{12}C(NR^{12})NR^{12}R^{12},
-X^4OR^{12}, -X^4SR^{12}, -X^4C(O)OR^{12}, -X^4C(O)NR^{12}R^{12}, -X^4S(O)_{2}NR^{12}R^{12},
-X^4P(O)(OR^{3})OR^{12}, -X^4OP(O)(OR^{3})OR^{12}, -X^4OC(O)R^{13}, -X^4NR^{12}C(O)R^{13}, -X^4S(O)R^{13},
-X^4S(O)_{2}R^{13} and -X^4C(O)R^{13}, wherein X^4, R^{12} and R^{13} are as defined above, or
R^4 and R^3 taken together form trimethylene, tetramethylene or
phenylene-1,2-dimethylene, optionally substituted with hydroxy, oxo or methylene, or
R^4 and R^3 together with the carbon atom to which both R^4 and R^3 are attached form
(C_{3-8})cycloalkylene or (C_{3-8})heterocycloalkylene; or an N-oxide derivative, prodrug
derivative, individual isomer and mixtures of isomers; or a pharmaceutically acceptable salt
thereof, but excluding compounds of the formula

![Chemical structure diagram]

in which R^3 and R^4 are each hydrogen or (C_{1-6})alkyl, or together with the carbon atom to
which they are both attached form (C_{3-5})cycloalkylene; R^5 is hydrogen or (C_{1-6})alkyl; R^9 is
(C_{6-12})aryl(C_{1-6})alkyl, hetero(C_{5-12})aryl(C_{1-6})alkyl, (C_{4-5})alkyl or cyclohexylmethyl; and R^{11} is
C(O)R^{18} wherein R^{18} is hetero(C_{3-12})cycloalkyl, (C_{6-12})aryl(C_{1-6})alkyl or hetero(C_{5-12})aryl(C_{1-6})alkyl.
34. The use of a compound of Formula (I):

![Formula Image]

(I)

in which:

R¹ is a group of Formula (a) or (b):

![Formula Images]

(a)  
(b)

wherein:

X¹ and X² independently are -C(O) or -CH₂S(O)₂⁻;
R⁵ and R⁶ are hydrogen or (C₁₋₆)alkyl;
R⁷ and R⁸ are hydrogen or (C₁₋₆)alkyl or as defined below;
R⁹ and R¹⁰ independently are (i) (C₁₋₆)alkyl optionally substituted with cyano,
halo or nitro or (ii) a group selected from -X³NR₁²R¹₂, -X³NR₂¹C(O)OR¹₂,
-X³NR⁻¹²C(O)NR⁻¹²R¹₂, -X³NR⁻¹²C(NR¹₂)NR⁻¹²R¹₂, -X³OR¹₂, -X³SR¹₂,
-X³C(O)OR¹₂, -X³C(O)NR⁻¹²R¹₂, -X³S(O)₂NR⁻¹²R¹₂, -X³P(O)(OR¹₂)OR¹₂,
-X³OP(O)(OR¹₂)OR¹₂, -X³NR⁻¹²C(O)R¹₃, -X³S(O)R¹₃, -X³S(O)₂R¹₃, -X³C(O)R¹₃,
-X³C(O)R¹₄, -X³C(O)OR¹₄, -X³OC(O)R¹₄, -X³NR⁻¹⁵C(O)R¹₄, -X³NR⁻¹⁵C(O)OR¹₄,
-X³C(O)NR⁻¹⁵R¹₅, -X³S(O)₂NR⁻¹⁵R¹₅, -X³NR⁻¹⁵C(O)NR⁻¹⁵R¹₅,
-X³NR⁻¹⁵C(NR¹₃)NR⁻¹⁵R¹₅, -X³SR⁻¹⁴, -X³S(O)R¹₄, -X³S(O)₂R¹₄, -X³OR¹₄, or
-X³NR⁻¹⁴R¹₅, wherein X³ is (C₁₋₆)alkylene, X⁴ is a bond or (C₁₋₆)alkylene, R¹₂ at each occurrence independently is hydrogen, (C₁₋₆)alkyl or halo-substituted (C₁₋₆)alkyl, R¹₃
is (C₁₋₆)alkyl or halo-substituted (C₁₋₆)alkyl, R¹₄ is (C₃₋₁₂)cycloalkyl(C₀₋₆)alkyl,
hetero(C₃₋₁₂)cycloalkyl(C₀₋₆)alkyl, (C₆₋₁₂)aryl(C₀₋₆)alkyl, hetero(C₅₋₁₂)aryl(C₀₋₆)alkyl,
(C₉₋₁₂)polycycloaryl(C₆₋₆)alkyl or hetero(C₉₋₁₂)polycycloaryl(C₆₋₆)alkyl and R¹⁵ is hydrogen or (C₁₋₆)alkyl, and wherein within R¹⁴ said cycloalkyl, heterocycloalkyl, aryl, heteroaryl, polycycloalkyl or heteropolycycloalkyl ring optionally is substituted by a group selected from -R¹⁶, -X⁴OR¹⁶, -X⁴SR¹⁶, -X⁴S(O)R¹⁶, -X⁴S(O)₂R¹⁶, -X⁴C(O)R¹⁶, -X⁴C(O)OR¹⁶, -X⁴OC(O)R¹⁶, -X⁴NR¹⁶R¹⁷, -X⁴NR¹⁶⁻¹⁷C(O)R¹⁶, -X⁴NR¹⁶⁻¹⁷C(O)OR¹⁶, -X⁴NR¹⁶⁻¹⁷C(O)OR¹⁶, -X⁴NR¹⁶⁻¹⁷C(O)NR¹⁶⁻¹⁷, -X⁴NR¹⁶⁻¹⁷C(O)NR¹⁶⁻¹⁷ or -X⁴NR¹⁶⁻¹⁷C(NR¹⁷)NR¹⁶⁻¹⁷, wherein X¹ is a bond or (C₁₋₆)alkylene, R¹⁶ is hydrogen or (C₁₋₆)alkyl and R¹⁷ is (C₃₋₁₂)cycloalkyl(C₆₋₆)alkyl, hetero(C₃₋₁₂)cycloalkyl(C₆₋₆)alkyl, (C₆₋₁₂)aryl(C₆₋₆)alkyl, hetero(C₆₋₁₂)aryl(C₆₋₆)alkyl, (C₆₋₁₂)polycycloaryl(C₆₋₆)alkyl or hetero(C₆₋₁₂)polycycloaryl(C₆₋₆)alkyl, or (iii) a group selected from (C₃₋₁₂)cycloalkyl(C₆₋₆)alkyl, hetero(C₃₋₁₂)cycloalkyl(C₆₋₆)alkyl, (C₆₋₁₂)aryl(C₆₋₆)alkyl, hetero(C₆₋₁₂)aryl(C₆₋₆)alkyl, (C₆₋₁₂)polycycloaryl(C₆₋₆)alkyl and hetero(C₆₋₁₂)polycycloaryl(C₆₋₆)alkyl, wherein said cycloalkyl, heterocycloalkyl, aryl, heteroaryl, polycycloalkyl or heteropolycycloalkyl ring optionally is substituted by a group selected from -R¹⁶, -X⁴OR¹⁶, -X⁴SR¹⁶, -X⁴S(O)R¹⁶, -X⁴S(O)₂R¹⁶, -X⁴C(O)R¹⁶, -X⁴C(O)OR¹⁶, -X⁴OC(O)R¹⁶, -X⁴NR¹⁶R¹⁷, -X⁴NR¹⁶⁻¹⁷C(O)R¹⁶, -X⁴NR¹⁶⁻¹⁷C(O)OR¹⁶, -X⁴NR¹⁶⁻¹⁷C(O)OR¹⁶, -X⁴NR¹⁶⁻¹⁷C(O)NR¹⁶⁻¹⁷, -X⁴NR¹⁶⁻¹⁷C(O)NR¹⁶⁻¹⁷ or -X⁴NR¹⁶⁻¹⁷C(NR¹⁷)NR¹⁶⁻¹⁷, wherein X¹, R¹⁶ and R¹⁷ are as defined above; wherein within R⁹ and/or R¹⁰ any alicyclic or aromatic ring system present may be substituted further by 1 to 5 radicals independently selected from (C₁₋₆)alkyl, (C₁₋₆)alkylidene, cyano, halo, halo-substituted (C₁₋₆)alkyl, nitro, -X⁴NR¹²R¹², -X⁴NR¹²C(O)OR¹², -X⁴NR¹²⁻¹⁴⁻¹²C(O)OR¹², -X⁴NR¹²⁻¹⁴⁻¹²C(O)OR¹², -X⁴NR¹²⁻¹⁴⁻¹²C(O)OR¹², -X⁴NR¹²⁻¹⁴⁻¹²C(O)OR¹², -X⁴OR¹², -X⁴SR¹², -X⁴C(O)OR¹², -X⁴C(O)NR¹²⁻¹⁴⁻¹², -X⁴S(O)₂R¹²⁻¹⁴⁻¹², -X⁴P(O)(OR⁴)OR¹², -X⁴OP(O)(OR⁴)OR¹², -X⁴OC(O)R¹³, -X⁴NR¹³⁻¹⁴⁻¹²C(O)R¹³, -X⁴S(O)R¹³, -X⁴S(O)₂R¹³ and -X⁴C(O)R¹³, wherein X¹, R¹² and R¹³ are as defined above, or

R⁹ taken together with R⁷ and/or R¹⁰ taken together with R⁸ form trimethylene, tetramethylene or phenylene-1,2-dimethylene, optionally substituted with hydroxy, oxo or methylene; and

R¹¹ is -X⁵X⁶R¹⁸, wherein X⁵ is -C(O)-, -C(O)C(O)- or -S(O)₂-, X⁶ is a
bond, -O- or -NR\(^{19}\), wherein R\(^{19}\) is hydrogen or (C\(_{1,6}\))alkyl, and R\(^{18}\) is

(i) (C\(_{1,10}\))alkyl optionally substituted by cyano, halo, nitro, -NR\(^{12}\)R\(^{12}\),
-\(\textit{NR}^{12}\textit{C(O)OR}^{12}\), -\(\textit{NR}^{12}\textit{C(O)NR}^{12}\)R\(^{12}\), -\(\textit{NR}^{12}\textit{C(NR}^{12}\textit{)}NR^{12}\)R\(^{12}\), -\(\textit{OR}^{12}\), -\(\textit{SR}^{12}\),
-\(\textit{C(O)OR}^{12}\), -\(\textit{C(O)NR}^{12}\)R\(^{12}\), -\(\textit{S(O)\_2NR}^{12}\)R\(^{12}\), -\(\textit{P(O)(OR}^{12}\)OR\(^{12}\),
-\(\textit{OP(O)(OR}^{12}\)OR\(^{12}\), -\(\textit{NR}^{12}\textit{C(O)R}^{13}\), -\(\textit{S(O)R}^{13}\), -\(\textit{S(O)\_2R}^{13}\), -\(\textit{C(O)R}^{13}\), -\(\textit{OR}^{20}\), -\(\textit{SR}^{20}\),
-\(\textit{S(O)\_2R}^{20}\), -\(\textit{C(O)R}^{20}\), -\(\textit{C(O)OR}^{20}\), -\(\textit{C(O)NR}^{20}\)R\(^{21}\), -\(\textit{NR}^{20}\)R\(^{21}\),
-\(\textit{NR}^{21}\textit{C(O)R}^{20}\), -\(\textit{NR}^{21}\textit{C(O)OR}^{20}\), -\(\textit{NR}^{21}\textit{C(O)NR}^{20}\)R\(^{21}\) or -\(\textit{NR}^{21}\textit{C(NR}^{21}\textit{)}NR^{20}\)R\(^{21}\),
wherein R\(^{12}\) and R\(^{13}\) are as defined above, R\(^{20}\) is (C\(_{3,12}\))cycloalkyl(C\(_{0,6}\))alkyl,
hetero(C\(_{3,12}\))cycloalkyl(C\(_{0,6}\))alkyl, (C\(_{6,12}\))aryl(C\(_{0,6}\))alkyl, hetero(C\(_{5,12}\))aryl(C\(_{0,6}\))alkyl,
(C\(_{9,12}\))bicycloaryl(C\(_{0,6}\))alkyl or hetero(C\(_{0,12}\))bicycloaryl(C\(_{0,6}\))alkyl and R\(^{31}\) at each occurrence independently is hydrogen or (C\(_{1,6}\))alkyl, or

(ii) (C\(_{3,12}\))cycloalkyl(C\(_{0,6}\))alkyl, hetero(C\(_{3,12}\))cycloalkyl(C\(_{0,6}\))alkyl,
(C\(_{6,12}\))aryl(C\(_{0,6}\))alkyl, hetero(C\(_{5,12}\))aryl(C\(_{0,6}\))alkyl, (C\(_{9,12}\))bicycloaryl(C\(_{0,6}\))alkyl or hetero(C\(_{0,12}\))bicycloaryl(C\(_{0,6}\))alkyl or (iii) (C\(_{3,6}\))cycloalkyl(C\(_{0,6}\))alkyl,
hetero(C\(_{3,6}\))cycloalkyl(C\(_{0,6}\))alkyl, phenyl(C\(_{0,6}\))alkyl or hetero(C\(_{5,6}\))aryl(C\(_{0,6}\))alkyl,
wherein said cycloalkyl, heterocycloalkyl, phenyl or heteroaryl is substituted by
-\(\textit{X^4OR}^{22}\), -\(\textit{X^4SR}^{22}\), -\(\textit{X^4S(O)R}^{22}\), -\(\textit{X^4S(O)\_2R}^{22}\), -\(\textit{X^4C(O)R}^{22}\), -\(\textit{X^4C(O)OR}^{22}\),
-\(\textit{X^4C(O)NR}^{23}\)R\(^{23}\), -\(\textit{X^4NR}^{23}\)R\(^{23}\), -\(\textit{X^4NR}^{23}\textit{C(O)R}^{22}\), -\(\textit{X^4NR}^{23}\textit{C(O)OR}^{22}\),
-\(\textit{X^4NR}^{23}\textit{C(O)NR}^{23}\)R\(^{23}\) or -\(\textit{X^4NR}^{23}\textit{C(NR}^{23}\textit{)}NR^{22}\)R\(^{23}\), wherein X\(^4\) is as defined
above, R\(^{22}\) is (C\(_{3,6}\))cycloalkyl(C\(_{0,6}\))alkyl, hetero(C\(_{3,6}\))cycloalkyl(C\(_{0,6}\))alkyl,
phenyl(C\(_{0,6}\))alkyl or hetero(C\(_{5,6}\))aryl(C\(_{0,6}\))alkyl and R\(^{23}\) at each occurrence independently is hydrogen or (C\(_{1,6}\))alkyl; wherein within R\(^{11}\) any alicyclic or aromatic ring system present may be substituted further by 1 to 5 radicals independently selected from (C\(_{1,6}\))alkyl, (C\(_{1,6}\))alkylidene, cyano, halo, halo-substituted (C\(_{1,4}\))alkyl,
nitro, -\(\textit{X^4NR}^{12}\)R\(^{12}\), -\(\textit{X^4NR}^{12}\textit{C(O)OR}^{12}\), -\(\textit{X^4NR}^{12}\textit{C(O)NR}^{12}\)R\(^{12}\),
-\(\textit{X^4NR}^{12}\textit{C(NR}^{12}\textit{)}NR^{12}\)R\(^{12}\), -\(\textit{X^4OR}^{12}\), -\(\textit{X^4SR}^{12}\), -\(\textit{X^4C(O)OR}^{12}\), -\(\textit{X^4C(O)NR}^{12}\)R\(^{12}\),
-\(\textit{X^4S(O)\_2NR}^{12}\)R\(^{12}\), -\(\textit{X^4P(O)(OR}^{3}\)OR\(^{12}\), -\(\textit{X^4P(O)(OR}^{3}\)OR\(^{12}\), -\(\textit{X^4OC(O)R}^{13}\),
-\(\textit{X^4NR}^{12}\textit{C(O)R}^{13}\), -\(\textit{X^4S(O)R}^{13}\), -\(\textit{X^4S(O)\_2R}^{13}\) and -\(\textit{X^4C(O)R}^{13}\), wherein X\(^4\), R\(^{12}\) and
R\(^{13}\) are as defined above;
R² is hydrogen or (C₁₋₆)alkyl or as defined below;
R² is hydrogen, (C₁₋₆)alkyl or as defined below; and
R⁴ is (i) hydrogen or (C₁₋₆)alkyl, wherein said alkyl is optionally substituted with
cyano, halo, nitro, -NR₁²R₁², -NR₁²C(O)OR₁², -NR₁²C(O)NR₁²R₁²,
-OR₁², -SR₁², -C(O)OR₁², -C(O)NR₁²R₁², -S(O)₂NR₁²R₁²,
-P(O)(OR₁²)OR₁², -OP(O)(OR₁²)OR₁², -NR₁²C(O)R₁³, -S(O)R₁³, -S(O)₂R₁³, -C(O)R₁³,
-OR₁⁴, -SR₁⁴, -S(O)R₁⁴, -S(O)₂R₁⁴, -C(O)R₁⁴, -C(O)OR₁⁴, -OC(O)R₁⁴, -NR₁⁴R₁⁵,
-NR₁⁵C(O)R₁⁴, -NR₁⁵C(O)OR₁⁴, -C(O)NR₁⁴R₁⁵, -S(O)₂NR₁⁴R₁⁵, -NR₁⁵C(O)NR₁⁴R₁⁵ or
-NR₁⁵C(NR₁⁵)NR₁⁴R₁⁵, wherein R₁², R₁³, R₁⁴ and R₁⁵ are as defined above, or (ii) a group
selected from (C₃₋₁₂)cycloalkyl(C₆₋₁₆)alkyl, hetero(C₃₋₁₂)cycloalkyl(C₆₋₁₆)alkyl,
(C₆₋₁₆)aryl(C₆₋₁₆)alkyl, hetero(C₅₋₁₃)aryl(C₆₋₁₆)alkyl, (C₆₋₁₂)polycycloaryl(C₆₋₁₆)alkyl and
hetero(C₈₋₁₂)polycycloaryl(C₆₋₁₆)alkyl, wherein said cycloalkyl, heterocycloalkyl, aryl,
heteroaryl, polycycloaryl or heteropolycycloaryl ring optionally is substituted by a group
selected from -R₁⁶, -X₄OR₁⁶, -X₄SR₁⁶, -X₄S(O)₂R₁⁶, -X₄C(O)R₁⁶,
-X₄C(O)OR₁⁶, -X₄OC(O)R₁⁶, -X₄NR₁⁴R₁⁷, -X₄NR₁⁷C(O)R₁⁶, -X₄NR₁⁷C(O)OR₁⁶,
-X₄C(O)NR₁⁴R₁⁷, -X₄S(O)₂NR₁⁴R₁⁷, -X₄NR₁⁷C(O)NR₁⁴R₁⁷ or -X₄NR₁⁷C(NR₁⁷)NR₁⁶R₁⁷,
wherein X⁴, R₁⁶ and R₁⁷ are as defined above; wherein within R⁹ and/or R₁⁰ any alicyclic or
aromatic ring system present may be substituted further by 1 to 5 radicals independently
selected from (C₁₋₆)alkyl, (C₁₋₆)alkylidene, cyano, halo, halo-substituted (C₁₋₆)alkyl, nitro,
-X₄NR₁⁵R₁², -X₄NR₁²C(O)OR₁³, -X₄NR₁²C(O)NR₁²R₁³, -X₄NR₁³C(NR₁²)NR₁²R₁³,
-X₄OR₁², -X₄SR₁², -X₄C(O)OR₁², -X₄C(O)NR₁²R₁², -X₄S(O)₂NR₁²R₁²,
-X₄P(O)(OR₃)OR₁², -X₄OP(O)(OR₃)OR₁², -X₄OC(O)R₁³, -X₄NR₁²C(O)R₁³, -X₄S(O)R₁³,
-X₄S(O)₂R₁³ and -X₄C(O)R₁³, wherein X⁴, R₁² and R₁³ are as defined above, or
R⁴ and R² taken together form trimethylene, tetramethylene or
phenylene-1,2-dimethylene, optionally substituted with hydroxy, oxo or methylene, or
R⁴ and R² together with the carbon atom to which both R⁴ and R² are attached form
(C₃₋₈)cycloalkylene or (C₃₋₈)heterocycloalkylene; or an N-oxide derivative, prodrug
derivative, individual isomer and mixtures of isomers; or a pharmaceutically acceptable salt
thereof, but excluding compounds of the formula
in which \( R^2 \) and \( R^4 \) are each hydrogen or \((C_{1-6})\)alkyl, or together with the carbon atom to which they are both attached form \((C_{3-5})\)cycloalkylene; \( R^5 \) is hydrogen or \((C_{1-6})\)alkyl; \( R^9 \) is \((C_{6-12})\)aryl\((C_{1-6})\)alkyl, hetero\((C_{5-12})\)aryl\((C_{1-6})\)alkyl, \((C_{4-5})\)alkyl or cyclohexylmethyl; and \( R^{11} \) is \( C(O)R^{18} \) wherein \( R^{18} \) is hetero\((C_{3-12})\)cycloalkyl, \((C_{6-12})\)aryl\((C_{0-6})\)alkyl or hetero\((C_{5-12})\)aryl\((C_{0-6})\)alkyl, in the manufacture of a medicament for treating a disease in an animal in which cathepsin \( S \) activity contributes to the pathology and/or symptomatology of the disease.

35. A process for preparing a compound of Formula I:

in which:

\( R^1 \) is a group of Formula (a) or (b):

\[
\begin{align*}
\text{(a)} & \quad \begin{align*}
R^{11} & \quad R^5 \\
R^7 & \quad R^9
\end{align*} \\
\text{(b)} & \quad \begin{align*}
R^8 & \quad R^5 \\
R^6 & \quad R^9
\end{align*}
\]

wherein:

\( X^1 \) and \( X^2 \) independently are \(-C(O)-\) or \(-\text{CH}_2\text{S(O)}_2^-\);
R² and R⁶ are hydrogen or (C₁₋₆)alkyl;
R⁷ and R⁸ are hydrogen or (C₁₋₆)alkyl or as defined below;
R⁹ and R¹₀ independently are (i) (C₁₋₆)alkyl optionally substituted with cyano,
halo, nitro, -NR¹²R¹², -NR¹²C(O)OR¹², -NR¹²C(O)NR¹²R¹²,
-NR¹²C(NR¹²)NR¹²R¹², -OR¹², -SR¹², -C(O)OR¹², -C(O)NR¹²R¹², -S(O)₂NR¹²R¹²,
-P(O)(OR¹²)OR¹², -OP(O)(OR¹²)OR¹², -NR¹²C(O)R¹³, -S(O)R¹³, -S(O)₂R¹³,
-C(O)R¹³, -OR¹⁴, -SR¹⁴, -S(O)R¹⁴, -S(O)₂R¹⁴, -C(O)R¹⁴, -C(O)OR¹⁴, -OC(O)R¹⁴,
-NR¹⁴R¹⁵, -NR¹⁵C(O)R¹⁴, -NR¹⁵C(O)OR¹⁴, -C(O)NR¹⁴R¹⁵, -S(O)₂NR¹⁴R¹⁵,
-NR¹⁵C(O)NR¹⁴R¹⁵ or -NR¹⁵C(NR¹⁵)NR¹⁴R¹⁵, wherein R¹² at each occurrence
independently is hydrogen, (C₁₋₆)alkyl or halo-substituted (C₁₋₆)alkyl, R¹³ is (C₁₋₆)alkyl
or halo-substituted (C₁₋₆)alkyl, R¹⁴ is (C₁₋₆)alkyl, R¹⁵ is (C₁₋₆)cycloalkyl(C₁₋₆)alkyl,
hetero(C₃₋₁₂)cycloalkyl(C₁₋₆)alkyl, (C₆₋₁₂)aryl(C₁₋₆)alkyl, hetero(C₅₋₁₂)aryl(C₁₋₆)alkyl,
(C₉₋₁₂)polycycloaryl(C₁₋₆)alkyl or hetero(C₈₋₁₂)polycycloaryl(C₁₋₆)alkyl and R¹⁷ is
hydrogen or (C₁₋₆)alkyl, and wherein within R¹⁴ said cycloalkyl, heterocycloalkyl, aryl,
heteroaryl, polycycloaryl or heteropolycycloaryl ring optionally is substituted by a

- group selected from -R¹⁶, -X₃OR¹⁶, -X₃SR¹⁶, -X₃S(O)R¹⁶, -X₃S(O)₂R¹⁶,
- X₃C(O)R¹⁶, -X₃C(O)OR¹⁶, -X₃OC(O)R¹⁶, -X₃NR¹⁶R¹⁷, -X₃NR¹⁷C(O)R¹⁶,
- X₃NR¹⁷C(O)OR¹⁶, -X₃C(O)NR¹⁶R¹⁷, -X₃S(O)₂NR¹⁶R¹⁷, -X₃NR¹⁷C(O)NR¹⁶R¹⁷ or
- X₃NR¹⁷C(NR¹⁷)NR¹⁶R¹⁷, wherein X³ is a bond or (C₁₋₆)alkylene, R¹⁶ is hydrogen or
(C₁₋₆)alkyl and R¹⁷ is (C₃₋₁₂)cycloalkyl(C₁₋₆)alkyl, hetero(C₃₋₁₂)cycloalkyl(C₁₋₆)alkyl,
(C₆₋₁₂)aryl(C₁₋₆)alkyl, hetero(C₅₋₁₂)aryl(C₁₋₆)alkyl, (C₉₋₁₂)polycycloaryl(C₁₋₆)alkyl or
hetero(C₈₋₁₂)polycycloaryl(C₁₋₆)alkyl, or (ii) a group selected from
(C₃₋₁₂)cycloalkyl(C₁₋₆)alkyl, hetero(C₃₋₁₂)cycloalkyl(C₁₋₆)alkyl, (C₆₋₁₂)aryl(C₁₋₆)alkyl,
hetero(C₅₋₁₂)aryl(C₁₋₆)alkyl, (C₉₋₁₂)polycycloaryl(C₁₋₆)alkyl and

hetero(C₈₋₁₂)polycycloaryl(C₁₋₆)alkyl, wherein said cycloalkyl, heterocycloalkyl, aryl,
heteroaryl, polycycloaryl or heteropolycycloaryl ring optionally is substituted by a
group selected from -R¹⁶, -X₃OR¹⁶, -X₃SR¹⁶, -X₃S(O)R¹⁶, -X₃S(O)₂R¹⁶,
- X₃C(O)R¹⁶, -X₃C(O)OR¹⁶, -X₃OC(O)R¹⁶, -X₃NR¹⁶R¹⁷, -X₃NR¹⁷C(O)R¹⁶,
- X₃NR¹⁷C(O)OR¹⁶, -X₃C(O)NR¹⁶R¹⁷, -X₃S(O)₂NR¹⁶R¹⁷, -X₃NR¹⁷C(O)NR¹⁶R¹⁷ or

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-X^3NR^{12}C(NR^{17})R^{16}R^{17}$, wherein $X^3$, $R^{16}$ and $R^{17}$ are as defined above; wherein within $R^9$ and/or $R^{10}$ any alicyclic or aromatic ring system present may be substituted further by 1 to 5 radicals independently selected from (C_{1-6})alkyl, (C_{1-6})alkyldene, cyano, halo, halo-substituted (C_{1-4})alkyl, nitro, -X^3NR^{12}R^{12}, -X^3NR^{12}C(O)OR^{12}, -X^3NR^{12}C(O)NR^{12}R^{12}, -X^3OR^{12}, -X^3SR^{12}, -X^3C(O)OR^{12}, -X^3C(O)NR^{12}R^{12}, -X^3S(O)_2NR^{12}R^{12}, -X^3P(O)(OR^3)OR^{12}, -X^3OP(O)(OR^3)OR^{12}, -X^3OC(O)R^{13}, -X^3NR^{12}C(O)R^{13}, -X^3S(O)R^{13}, -X^3S(O)_2R^{13} and -X^3C(O)R^{13}, wherein $X^3$, $R^{12}$ and $R^{13}$ are as defined above, or $R^9$ taken together with $R^7$ and/or $R^{10}$ taken together with $R^8$ form trimethylene, tetramethylene or phenylene-1,2-dimethylene, optionally substituted with hydroxy, oxo or methylene; and $R^{11}$ is -X^4X^5R^{18}, wherein $X^4$ is -C(O)-, -C(O)C(O)- or -S(O)_{2-}, $X^5$ is a bond, -O- or -NR^{19}-, wherein $R^{19}$ is hydrogen or (C_{1-6})alkyl, and $R^{18}$ is (i) (C_{1-10})alkyl optionally substituted by cyano, halo, nitro, -NR^{12}R^{12}, -NR^{12}C(O)OR^{12}, -NR^{12}C(O)NR^{12}R^{12}, -NR^{12}C(NR^{12})NR^{12}R^{12}, -OR^{12}, -SR^{12}, -C(O)OR^{12}, -C(O)NR^{12}R^{12}, -S(O)_2NR^{12}R^{12}, -P(O)(OR^3)OR^{12}, -OP(O)(OR^3)OR^{12}, -NR^{12}C(O)R^{13}, -S(O)_{2}R^{13}, -S(O)R^{13}, -C(O)R^{13}, -OR^{20}, -SR^{20}, -S(O)R^{20}, -S(O)_2R^{20}, -C(O)R^{20}, -C(O)OR^{20}, -C(O)NR^{20}R^{21}, -NR^{20}R^{21}, -NR^{21}C(O)R^{20}, -NR^{21}C(O)OR^{20}, -NR^{21}C(O)NR^{20}R^{21} or -NR^{21}C(NR^{21})NR^{20}R^{21}, wherein $R^{12}$ and $R^{13}$ are as defined above, $R^{20}$ is (C_{3-12})cycloalkyl(C_{0-6})alkyl, hetero(C_{3-12})cycloalkyl(C_{0-6})alkyl, (C_{6-12})arylcycloalkyl(C_{0-6})alkyl, hetero(C_{5-12})arylcycloalkyl(C_{0-6})alkyl, (C_{6-12})bicycloalkyl(C_{0-6})alkyl or hetero(C_{8-12})bicycloalkyl(C_{0-6})alkyl and $R^{21}$ at each occurrence independently is hydrogen or (C_{1-6})alkyl, or (ii) (C_{3-12})cycloalkyl(C_{0-6})alkyl, hetero(C_{3-12})cycloalkyl(C_{0-6})alkyl, (C_{6-12})arylcycloalkyl(C_{0-6})alkyl, hetero(C_{5-12})arylcycloalkyl(C_{0-6})alkyl or hetero(C_{6-12})bicycloalkyl(C_{0-6})alkyl or (iii) (C_{3-6})cycloalkyl(C_{0-6})alkyl, hetero(C_{3-6})cycloalkyl(C_{0-6})alkyl, phenyl(C_{0-6})alkyl or hetero(C_{5-6})arylcycloalkyl(C_{0-6})alkyl, wherein said cycloalkyl, heterocycloalkyl, phenyl or heteroaryl is substituted by -X^{2}OR^{22}, -X^{2}SR^{22}, -X^{2}S(O)R^{22}, -X^{2}S(O)_2R^{22}, -X^{2}C(O)R^{22}, -X^{2}C(O)OR^{22},
-X^2C(O)NR^2R^2, -X^2NR^2R^2, -X^2NR^2C(O)R^2, -X^3NR^2C(O)OR^2,
-X^2NR^2C(O)NR^2R^2 or -X^2NR^2C(NR^2)NR^2R^2, wherein X^3 is as defined
above, R^2 is (C_3-6)cycloalkyl(C_6),alkyl, hetero(C_3-6)cycloalkyl(C_6),alkyl,
phenyl(C_6),alkyl or hetero(C_5-8)arylcycloalkyl(C_6),alkyl and R^3 at each occurrence
independently is hydrogen or (C_1-6)alkyl; wherein within R^1 any alicyclic or aromatic
ring system present may be substituted further by 1 to 5 radicals independently
selected from (C_1-6)alkyl, (C_1-6)alkylidene, cyano, halo, halo-substituted (C_1-4)alkyl,
nitro, -X^3NR^2C(O)R^12, -X^3NR^2C(O)OR^12, -X^3NR^2C(O)NR^2R^12,
-X^3NR^2C(O)NR^2R^12, -X^3OR^12, -X^3SR^12, -X^3C(O)OR^12, -X^3C(O)NR^2R^12,
-X^3C(O)R^13, -X^3S(O)R^13, -X^3S(O)OR^13, and -X^3C(O)R^13, wherein X^3, R^12 and
R^13 are as defined above;
R^2 is hydrogen or (C_1-6)alkyl or as defined below;
R^3 is hydrogen, (C_1-6)alkyl or as defined below; and
R^4 is (i) hydrogen or (C_1-6)alkyl, wherein said alkyl is optionally substituted with
cyano, halo, nitro, -NR^2C(O)OR^12, -NR^2C(O)NR^2R^12, -NR^12C(O)OR^12,
-NR^12C(O)NR^2R^12, -OR^12, -SR^12, -C(O)OR^12, -C(O)NR^2R^12, -S(O)_2NR^2R^12,
-P(O)(OR^12)OR^12, -PO(O)(OR^12)OR^12, -NR^12C(O)R^13, -S(O)R^13, -S(O)_2R^13, -C(O)R^13,
-OR^14, -SR^14, -S(O)R^14, -S(O)_2R^14, -C(O)R^14, -C(O)OR^14, -OC(O)R^14, -NR^14R^15,
-NR^15C(O)R^14, -NR^15C(O)OR^14, -C(O)NR^15R^15, -S(O)_2NR^15R^15, -NR^15C(O)NR^15R^15 or
-NR^15C(NR^15)NR^14R^15, wherein R^12, R^13, R^14 and R^15 are as defined above, or (ii) a group
selected from (C_3-12)cycloalkyl(C_6),alkyl, hetero(C_3-12)cycloalkyl(C_6),alkyl,
(C_9-12)arylcycloalkyl(C_6),alkyl, hetero(C_5-8)arylcycloalkyl(C_6),alkyl, (C_9-12)polycycloaryl(C_6),alkyl and
hetero(C_9-12)polycycloaryl(C_6),alkyl, wherein said cycloalkyl, heterocycloalkyl, aryl,
heteroaryl, polycycloaryl or heteropolycycloaryl ring optionally is substituted by a group
selected from -R^16, -X^3OR^16, -X^3SR^16, -X^3S(O)R^16, -X^3S(O)_2R^16, -X^3C(O)R^16,
-X^3C(O)OR^16, -X^3OC(O)R^16, -X^3NR^16R^17, -X^3NR^17C(O)R^16, -X^3NR^17C(O)OR^16,
-X^3C(O)NR^16R^17, -X^3S(O)_2NR^16R^17, -X^3NR^17C(O)NR^16R^17 or -X^3NR^17C(NR^17)NR^16R^17,
wherein X^3, R^16 and R^17 are as defined above; wherein within R^9 and/or R^10 any alicyclic or
aromatic ring system present may be substituted further by 1 to 5 radicals independently selected from (C₁₋₆)alkyl, (C₁₋₆)alkylidene, cyano, halo, halo-substituted (C₁₋₄)alkyl, nitro, -X²NR¹²R¹², -X²NR¹²C(O)OR¹², -X³NR¹²C(O)NR¹²R¹², -X²NR¹²C(NR¹²)NR¹²R¹², -X³OR¹², -X³SR¹², -X³C(O)OR¹², -X³C(O)NR¹²R¹², -X³S(O)²NR¹²R¹², -X³P(O)(OR³)OR¹², -X³OP(O)(OR³)OR¹², -X³OC(O)R¹³, -X³NR¹²C(O)R¹³, -X³S(O)R¹³, -X³S(O)²R¹³ and -X³C(O)R¹³, wherein X³, R¹² and R¹³ are as defined above, or

R⁴ and R² taken together form trimethylene, tetramethylene or phenylene-1,2-dimethylene, optionally substituted with hydroxy, oxo or methylene, or

R⁴ and R³ together with the carbon atom to which both R⁴ and R³ are attached form (C₃₋₈)cycloalkylene or (C₃₋₈)heterocycloalkylene; and the N-oxide derivatives, prodrug derivatives, protected derivatives, individual isomers and mixtures of isomers; and the pharmaceutically acceptable salts thereof; which process comprises:

(A) reacting a compound of Formula 2:

\[
\begin{align*}
\text{R}^2 & \quad \text{H} \\
\text{N} & \quad \text{C} = \text{N} \\
\text{R}^3 & \quad \text{R}^4 \\
\text{2} &
\end{align*}
\]

or a protected derivative thereof, with a compound of the formula R¹'OY, or a protected derivative thereof, in which Y is hydrogen or 2,5-dioxopyrrolidin-1-yl and each R¹, R², R³ and R⁴ are as defined above; or

(B) reacting a compound of Formula 3:

\[
\begin{align*}
\text{R}^1 & \quad \text{R}^2 \\
\text{N} & \quad \text{O} \\
\text{R}^3 & \quad \text{R}^4 \\
\text{3} &
\end{align*}
\]

or a protected derivative thereof, with ammonia to provide a corresponding amide and then
reacting the amide with trifluoroacetic anhydride, in which each $R^1$, $R^2$, $R^3$ and $R^4$ are as defined above;

(C) optionally deprotecting a protected derivative of a compound of Formula I to provide a corresponding unprotected derivative;

(D) optionally converting a compound of Formula I into a pharmaceutically acceptable salt;

(E) optionally converting a salt form of a compound of Formula I to non-salt form;

(F) optionally converting an unoxidized form of a compound of Formula I into a pharmaceutically acceptable $N$-oxide;

(G) optionally converting an $N$-oxide form of a compound of Formula I its unoxidized form;

(H) optionally converting a non-derivatized compound of Formula I into a pharmaceutically prodrug derivative; and

(I) optionally converting a prodrug derivative of a compound of Formula I to its non-derivatized form.