ASPARTYL PROTEASE INHIBITORS

FIELD OF THE INVENTION

This invention relates to aspartyl protease inhibitors, pharmaceutical compositions comprising said compounds, their use in the treatment of cardiovascular diseases, cognitive and neurodegenerative diseases, and their use as inhibitors of the Human Immunodeficiency Virus, plasmepsins, cathepsin D and protozoal enzymes.

BACKGROUND

There are a number of aspartic proteases known to date, including pepsin A and C, renin, BACE, BACE 2, Napsin A, and cathepsin D, which have been implicated in pathological conditions.

The role of renin-angiotensin system (RAS) in regulation of blood pressure and fluid electrolyte has been well established (Oparil, S, etal. N Engl J Med 1974; 291:381-401/446-57). The octapeptide Angiotensin-II, a potent vasoconstrictor and stimulator for release of adrenal aldosterone, was processed from the precursor decapeptide Angiotensin-I, which in turn is processed from angiotensinogen by the renin enzyme. Angiotensin-II is also found to play roles in vascular smooth muscle cell growth, inflammation, reactive oxygen species generation and thrombosis and influence atherogenesis and vascular damage. Clinically, the benefit of interruption of the generation of angiotensin-II through antagonism of conversion of angiotensin-I has been well known and there are a number of ACE inhibitor drugs on the market. The blockade of the earlier conversion of angiotensinogen to angiotensin-I, i.e.the inhibition of renin enzyme, is expected to have similar but not identical effects. Since renin is an aspartyl protease whose only natural substrate is angiotensinogen, it is believed that there would be less frequent adverse effect for controlling high blood pressure and related symptoms regulated by angiotensin-II through its inhibition.

Another protease, Cathepsin-D, is involved in lysosomal biogenesis and protein targeting, and may also be involved in antigen processing and presentation of

peptide fragments. It has been linked to numerous diseases including, Alzheimer's, Disease, connective tissue disease, muscular dystrophy and breast cancer.

Alzheimer's Disease (AD) is a progressive neurodegenerative disease that is ultimately fatal. Disease progression is associated with gradual loss of cognitive function related to memory, reasoning, orientation and judgment. Behavioral changes including confusion, depression and aggression also manifest as the disease progresses. The cognitive and behavioral dysfunction is believed to result from altered neuronal function and neuronal loss in the hippocampus and cerebral cortex. The currently available AD treatments are palliative, and while they ameliorate the cognitive and behavioral disorders, they do not prevent disease progression. Therefore there is an unmet medical need for AD treatments that halt disease progression.

Pathological hallmarks of AD are the deposition of extracellular β-amyloid (Aβ) plaques and intracellular neurofibrillary tangles comprised of abnormally phosphorylated protein tau. Individuals with AD exhibit characteristic Aβ deposits, in brain regions known to be important for memory and cognition. It is believed that Aβ is the fundamental causative agent of neuronal cell loss and dysfunction which is associated with cognitive and behavioral decline. Amyloid plaques consist predominantly of Aβ peptides comprised of 40 – 42 amino acid residues, which are derived from processing of amyloid precursor protein (APP). APP is processed by multiple distinct protease activities. Aβ peptides result from the cleavage of APP by β-secretase at the position corresponding to the N-terminus of Aβ, and at the C-terminus by γ-secretase activity. APP is also cleaved by α-secretase activity resulting in the secreted, non-amyloidogenic fragment known as soluble APP.

An aspartyl protease known as BACE-1 has been identified as the β-secretase activity responsible for cleavage of APP at the position corresponding to the N-terminus of Aβ peptides.

Accumulated biochemical and genetic evidence supports a central role of Aβ in the etiology of AD. For example, Aβ has been shown to be toxic to neuronal cells in vitro and when injected into rodent brains. Furthermore inherited forms of early-onset AD are known in which well-defined mutations of APP or the presenilins are present. These mutations enhance the production of Aβ and are considered causative of AD.

Since Aβ peptides are formed as a result of β-secretase activity, inhibition of BACE-1 should inhibit formation of Aβ peptides. Thus inhibition of BACE-1 is a therapeutic approach to the treatment of AD and other cognitive and neurodegenerative diseases caused by Aβ plaque deposition.

Human immunodeficiency virus (HIV), is the causative agent of acquired immune deficiency syndrome (AIDS). It has been clinically demonstrated that compounds such as indinavir, ritonavir and saquinavir which are inhibitors of the HIV aspartyl protease result in lowering of viral load. As such, the compounds described herein would be expected to be useful for the treatment of AIDS. Traditionally, a major target for researchers has been HIV-1 protease, an aspartyl protease related to renin.

In addition, Human T-cell leukemia virus type I (HTLV-I) is a human retrovirus that has been clinically associated with adult T-cell leukemia and other chronic diseases. Like other retroviruses, HTLV-I requires an aspartyl protease to process viral precursor proteins, which produce mature virions. This makes the protease an attractive target for inhibitor design. (Moore, et al. Purification of HTLV-I Protease and Synthesis of Inhibitors for the treatment of HTLV-I Infection 55th Southeast Regional Meeting of the American Chemical Society, Atlanta, GA, US November 16-19, 2003 (2003), 1073. CODEN; 69EUCH Conference, AN 2004:137641 CAPLUS).

Plasmepsins are essential aspartyl protease enzymes of the malarial parasite. Compounds for the inhibition of aspartyl proteases plasmepsins, particularly I, II, IV and HAP, are in development for the treatment of malaria. (Freire, et al. WO 2002074719. Na Byoung-Kuk, et al., Aspartic proteases of Plasmodium vivax are highly conserved in wild isolates, Korean Journal of Parasitology (2004 June), 42(2) 61-6. Journal code: 9435800) Furthermore, compounds used to target aspartyl proteases plasmepsins (e.g. I, II, IV and HAP), have been used to kill malarial parasites, thus treating patients thus afflicted.

Compounds that act as aspartyl protease inhibitors are described, for example, in application USSN 11/010,772, filed on December 13, 2004, herein incorporated by reference.

WO/9304047, herein incorporated by reference, describes compounds having a quinazolin-2-(thi)one nucleus. The document alleges that the compounds described therein are inhibitors of HIV reverse transcriptase.

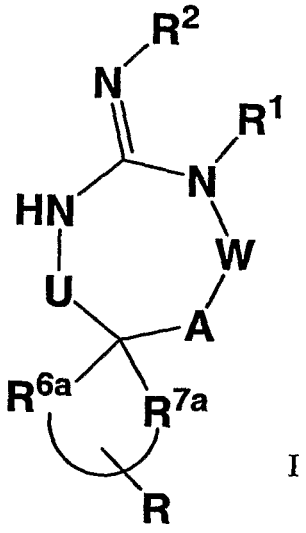
US Publication No. US 2005/0282826 A1, herein incorporated by reference, describes diphenylimidazopyrimidine or –imidazole amines, which are said to be useful for the therapeutic treatment, prevention or amelioration of a disease or disorder characterized by elevated β-amyloid deposits or β-amyloid levels in a patient. Disease states mentioned in the publication include Alzheimer's disease, mild cognative impairment, Down's syndrome, hereditary cerebral hemorrhage with amyloidosis of the Dutch type, cerebral amyloid angiopathy and degenerative dementia.

US Publication No. US 2005/0282825 A1, herein incorporated by reference, describes amino-5,5-diphenylimidazolones, which are said to be useful for the therapeutic treatment, prevention or amelioration of a disease or disorder characterized by elevated β-amyloid deposits or β-amyloid levels in a patient. Disease states mentioned in the publication include Alzheimer's disease, mild cognative impairment, Down's syndrome, hereditary cerebral hemorrhage with amyloidosis of the Dutch type, cerebral amyloid angiopathy and degenerative dementia.

Other publications that disclosed compounds that are useful for treating Alzherimer's disease include WO 2006/044492, which discloses spiropiperidine compounds that are said to be inhibitors of β-secretase, and WO 2006/041404, which discloses substituted amino compounds that are said to be useful for the treatment or prophylaxix of Aβ related pathologies. Both these publications are incorporated by reference.

SUMMARY OF THE INVENTION

The present invention relates to compounds having the structural formula I



I

or a pharmaceutically acceptable salt or solvate thereof, wherein

W is a bond, -C(=S)-, –S(O)-, -S(O)$_2$-, -C(=O)-, -O-, -C(R^6)(R^7)-, -N(R^5)- or –C(=N(R^5))-;

U is a bond, -N(R^5)-, -(C(R^6)(R^7))- or -(C(R^6)(R^7))(C(R^6)(R^7))-;

A is a bond or -(C(R^3)(R^4))-;

R is 1-5 substituents independently selected from the group consisting of H, alkyl, arylalkyl, heteroarylalkyl, cycloalkylalkyl, heterocycloalkylalkyl, arylcycloalkylalkyl, heteroarylcycloalkylalkyl, arylheterocycloalkylalkyl, heteroarylheterocycloalkylalkyl, cycloalkyl, arylcycloalkyl, heteroarylcycloalkyl, heterocycloalkyl, arylheterocycloalkyl, heteroarylheterocycloalkyl, alkenyl, arylalkenyl, cycloalkenyl, arylcycloalkenyl, heteroarylcycloalkenyl, heterocycloalkenyl, arylheterocycloalkenyl, heteroarylheterocycloalkenyl, alkynyl, arylalkynyl, aryl, cycloalkylaryl, heterocycloalkylaryl, cycloalkenylaryl, heterocycloalkenylaryl, heteroaryl, cycloalkylheteroaryl, heterocycloalkylheteroaryl, cycloalkenylheteroaryl, heterocycloalkenylheteroaryl, -NO$_2$, halo, HO-alkoxyalkyl, -CF$_3$, -CN, alkyl-CN, -C(O)R^{30}, -C(O)OH, -C(O)OR^{30}, -C(O)NHR^{31}, -C(O)NH$_2$, -C(O)NH$_2$-C(O)N(alkyl)$_2$, -C(O)N(alkyl)(aryl), -C(O)N(alkyl)(heteroaryl), -SR^{30}, -S(O)R^{31}, -S(O)$_2$R^{31}, -S(O)NH$_2$, -S(O)NH(alkyl), -S(O)N(alkyl)(alkyl), -S(O)NH(aryl), -S(O)$_2$NH$_2$, -S(O)$_2$NHR^{30}, -S(O)$_2$NH(heterocycloalkyl), -S(O)$_2$N(alkyl)$_2$, -S(O)$_2$N(alkyl)(aryl), -OCF$_3$, -OH, -OR^{31}, -O-heterocycloalkyl, -O-cycloalkylalkyl, -O-heterocycloalkylalkyl, -NH$_2$, -NHR^{31}, -N(alkyl)$_2$, -N(arylalkyl)$_2$, -N(arylalkyl)-(heteroarylalkyl), -NHC(O)R^{31}, -NHC(O)NH$_2$, -NHC(O)NH(alkyl), -NHC(O)N(alkyl)(alkyl), -N(alkyl)C(O)NH(alkyl),

-N(alkyl)C(O)N(alkyl)(alkyl), -NHS(O)$_2$R^{31}, -NHS(O)$_2$NH(alkyl), -NHS(O)$_2$N(alkyl)(alkyl), -N(alkyl)S(O)$_2$NH(alkyl) and –N(alkyl)S(O)$_2$N(alkyl)(alkyl);

R^1, R^2 and R^5 are independently selected from the group consisting of H, alkyl, arylalkyl, heteroarylalkyl, cycloalkylalkyl, heterocycloalkylalkyl, arylcycloalkylalkyl, heteroarylcycloalkylalkyl, arylheterocycloalkylalkyl, heteroarylheterocycloalkylalkyl, cycloalkyl, arylcycloalkyl, heteroarylcycloalkyl, heterocycloalkyl, arylheterocycloalkyl, heteroarylheterocycloalkyl, alkenyl, arylalkenyl, cycloalkenyl, arylcycloalkenyl, heteroarylcycloalkenyl, heterocycloalkenyl, arylheterocycloalkenyl, heteroarylheterocycloalkenyl, alkynyl, arylalkynyl, aryl, cycloalkylaryl, heterocycloalkylaryl, cycloalkenylaryl, heterocycloalkenylaryl, heteroaryl, cycloalkylheteroaryl, heterocycloalkylheteroaryl, cycloalkenylheteroaryl, heterocycloalkenylheteroaryl, –OR^{15}, -CN, -C(O)R^8, -C(O)OR^9, -S(O)R^{10}, -S(O)$_2$R^{10}, -C(O)N(R^{11})(R^{12}), -S(O)N(R^{11})(R^{12}), -S(O)$_2$N(R^{11})(R^{12}), -NO$_2$, -N=C(R^8)$_2$ and –N(R^{11})(R^{12}), provided that R^1 and R^5 are not both selected from -NO$_2$, -N=C(R^8)$_2$ and –N(R^{11})(R^{12});

R^3, R^4, R^6 and R^7 are independently selected from the group consisting of H, alkyl, arylalkyl, heteroarylalkyl, cycloalkylalkyl, heterocycloalkylalkyl, arylcycloalkylalkyl, heteroarylcycloalkylalkyl, arylheterocycloalkylalkyl, heteroarylheterocycloalkylalkyl, cycloalkyl, arylcycloalkyl, heteroarylcycloalkyl, heterocycloalkyl, arylheterocycloalkyl, heteroarylheterocycloalkyl, alkenyl, arylalkenyl, cycloalkenyl, arylcycloalkenyl, heteroarylcycloalkenyl, heterocycloalkenyl, arylheterocycloalkenyl, heteroarylheterocycloalkenyl, alkynyl, arylalkynyl, aryl, cycloalkylaryl, heterocycloalkylaryl, cycloalkenylaryl, heterocycloalkenylaryl, heteroaryl, cycloalkylheteroaryl, heterocycloalkylheteroaryl, cycloalkenylheteroaryl, heterocycloalkenylheteroaryl, halo, -CH$_2$-O-Si(R^9)(R^{10})(R^{19}), -SH, -CN, -OR^9, -C(O)R^8, -C(O)OR^9, -C(O)N(R^{11})(R^{12}), -SR^{19}, -S(O)N(R^{11})(R^{12}), -S(O)$_2$N(R^{11})(R^{12}), -N(R^{11})(R^{12}), -N(R^{11})C(O)R^8, -N(R^{11})S(O)R^{10}, -N(R^{11})S(O)$_2$R^{10}, -N(R^{11})C(O)N(R^{12})(R^{13}), -N(R^{11})C(O)OR^9 and –C(=NOH)R^8;

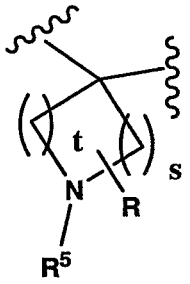
R^{6a} and R^{7a} are independently selected from the group consisting of alkylene, arylalkylene, heteroarylalkylene, cycloalkylalkylene, heterocycloalkylalkylene, arylcycloalkylalkylene, heteroarylcycloalkylalkylene, arylheterocycloalkylalkylene, heteroarylheterocycloalkylalkylene, cycloalkylene, arylcycloalkylene, heteroarylcycloalkylene, heterocycloalkylene, arylheterocycloalkylene,

heteroarylheterocycloalkylene, alkenylene, arylalkenylene, cycloalkenylene, arylcycloalkenylene, heteroarylcycloalkenylene, heterocycloalkenylene, arylheterocycloalkenylene, heteroarylheterocycloalkenylene, alkynylene, arylalkynylene, arylene, cycloalkylarylene, heterocycloalkylarylene, cycloalkyenylarylene, cycloalkenylarylene, heterocycloalkenylarylene, heteroarylene, cycloalkylheteroarylene, heterocycloalkylheteroarylene, cycloalkenylheteroarylene and heterocycloalkenylheteroarylene, or

R^{6a} and R^{7a} together are optionally a C_2 to C_7 carbon chain, wherein, one, two or three ring carbons are optionally replaced by –O-, -C(O)-, -S-, -C(S)-, -S(O)-, -$S(O)_2$- or –$N(R^5)$-, and R^{6a} and R^{7a} together with the carbon atoms to which they are attached, form a 3 to 8 membered ring, optionally substituted by R;

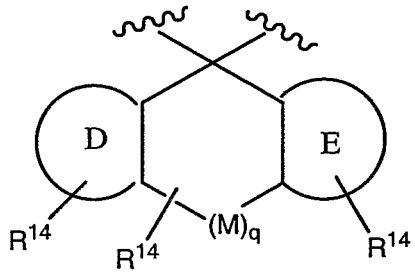
provided that when only one ring carbon is replaced with –O-, -C(O)-, -C(S)-, -S-, -S(O)- ,–$S(O)_2$-or –$N(R^5)$-, R^4 and R^{7a} cannot form a cycloalkylether;

or R^{6a} and R^{7a} together are



wherein s is 0 to 3 and t is 0 to 3, with the proviso that s or t cannot both be zero;

or R^{6a}, R^{7a}, D and E together are



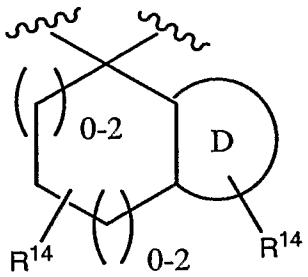
wherein D or E is cycloalkenylene, heterocycloalkenylene, cycloalkylene, heterocycloalkylene, arylene or heteroarylene,

M is –O-, -C(O)-, -S-, -CH_2-, -C(S)-, -S(O)-, -$S(O)_2$- or –$N(R^5)$-;

wherein, one to five ring carbons is replaced by –O-, -C(O)-, -S-, -C(S)-, -S(O)-, -$S(O)_2$- or –$N(R^5)$-;

q is 0, 1 or 2;

or R^{6a}, R^{7a} and D together are

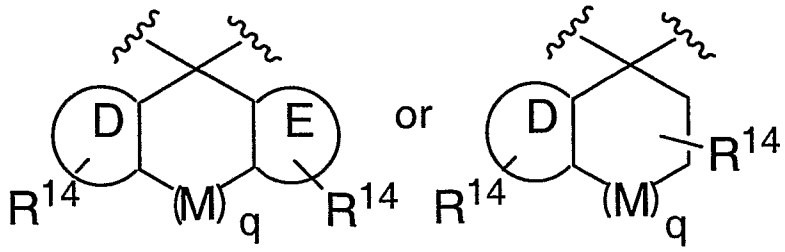


wherein D is cycloalkenylene, heterocycloalkenylene, cycloalkylene, heterocycloalkylene, arylene or heteroarylene,

wherein, one to five ring carbons is replaced by –O-, -C(O)-, -S-, -C(S)-, -S(O)-, $-S(O)_2-$ or $-N(R^5)-$;

R^{14} is 1-5 substituents independently selected from the group consisting of alkyl, arylalkyl, heteroarylalkyl, cycloalkylalkyl, heterocycloalkylalkyl, arylcycloalkylalkyl, heteroarylcycloalkylalkyl, arylheterocycloalkylalkyl, heteroarylheterocycloalkylalkyl, cycloalkyl, arylcycloalkyl, heteroarylcycloalkyl, heterocycloalkyl, arylheterocycloalkyl, heteroarylheterocycloalkyl, alkenyl, arylalkenyl, cycloalkenyl, arylcycloalkenyl, heteroarylcycloalkenyl, heterocycloalkenyl, arylheterocycloalkenyl, heteroarylheterocycloalkenyl, alkynyl, arylalkynyl, aryl, cycloalkylaryl, heterocycloalkylaryl, cycloalkenylaryl, heterocycloalkenylaryl, heteroaryl, cycloalkylheteroaryl, heterocycloalkylheteroaryl, cycloalkenylheteroaryl, heterocycloalkenylheteroaryl, halo, -CN, $-OR^{15}$, $-C(O)R^{15}$, $-C(O)OR^{15}$, $-C(O)N(R^{15})(R^{16})$, $-SR^{15}$, $-S(O)N(R^{15})(R^{16})$, $-S(O)_2N(R^{15})(R^{16})$, $-C(=NOR^{15})R^{16}$, $-P(O)(OR^{15})(OR^{16})$, $-N(R^{15})(R^{16})$, $-N(R^{15})C(O)R^{16}$, $-N(R^{15})S(O)R^{16}$, $-N(R^{15})S(O)_2R^{16}$, $-N(R^{15})S(O)_2N(R^{16})(R^{17})$, $-N(R^{15})S(O)N(R^{16})(R^{17})$, $-N(R^{15})C(O)N(R^{16})(R^{17})$ and $-N(R^{15})C(O)OR^{16}$;

with the following provisos that R^{6a} and R^{7a} cannot be combined to form said multicyclic groups



wherein

M is $-CH_2-$, -S-, $-N(R^{19})-$, or –O-;

D and E are independently arylene or heteroarylene;

and q is 0, 1 or 2 provided that when q is 2, one M must be a carbon atom and when q is 2, M is optionally a double bond;

and provided that when there are at least two heteroatoms present, there cannot be any adjacent oxygen and/or sulfur atoms present in the above-described ring systems;

R^8 is independently selected from the group consisting of H, alkyl, arylalkyl, heteroarylalkyl, cycloalkylalkyl, heterocycloalkylalkyl, arylcycloalkylalkyl, heteroarylcycloalkylalkyl, arylheterocycloalkylalkyl, heteroarylheterocycloalkylalkyl, cycloalkyl, arylcycloalkyl, heteroarylcycloalkyl, heterocycloalkyl, arylheterocycloalkyl, heteroarylheterocycloalkyl, alkenyl, arylalkenyl, cycloalkenyl, arylcycloalkenyl, heteroarylcycloalkenyl, heterocycloalkenyl, arylheterocycloalkenyl, heteroarylheterocycloalkenyl, alkynyl, arylalkynyl, aryl, cycloalkylaryl, heterocycloalkylaryl, cycloalkenylaryl, heterocycloalkenylaryl, heteroaryl, cycloalkylheteroaryl, heterocycloalkylheteroaryl, cycloalkenylheteroaryl, heterocycloalkenylheteroaryl, $-OR^{15}$, $-N(R^{15})(R^{16})$, $-N(R^{15})C(O)R^{16}$, $-N(R^{15})S(O)R^{16}$, $-N(R^{15})S(O)_2R^{16}$, $-N(R^{15})S(O)_2N(R^{16})(R^{17})$, $-N(R^{15})S(O)N(R^{16})(R^{17})$, $-N(R^{15})C(O)N(R^{16})(R^{17})$ and $-N(R^{15})C(O)OR^{16}$;

R^9 is independently selected from the group consisting of H, alkyl, arylalkyl, heteroarylalkyl, cycloalkylalkyl, heterocycloalkylalkyl, arylcycloalkylalkyl, heteroarylcycloalkylalkyl, arylheterocycloalkylalkyl, heteroarylheterocycloalkylalkyl, cycloalkyl, arylcycloalkyl, heteroarylcycloalkyl, heterocycloalkyl, arylheterocycloalkyl, heteroarylheterocycloalkyl, alkenyl, arylalkenyl, cycloalkenyl, arylcycloalkenyl, heteroarylcycloalkenyl, heterocycloalkenyl, arylheterocycloalkenyl, heteroarylheterocycloalkenyl, alkynyl, arylalkynyl, aryl, cycloalkylaryl, heterocycloalkylaryl, cycloalkenylaryl, heterocycloalkenylaryl, heteroaryl, cycloalkylheteroaryl, heterocycloalkylheteroaryl, cycloalkenylheteroaryl and heterocycloalkenylheteroaryl;

R^{10} is independently selected from the group consisting of H, alkyl, arylalkyl, heteroarylalkyl, cycloalkylalkyl, heterocycloalkylalkyl, arylcycloalkylalkyl, heteroarylcycloalkylalkyl, arylheterocycloalkylalkyl, heteroarylheterocycloalkylalkyl, cycloalkyl, arylcycloalkyl, heteroarylcycloalkyl, heterocycloalkyl, arylheterocycloalkyl,

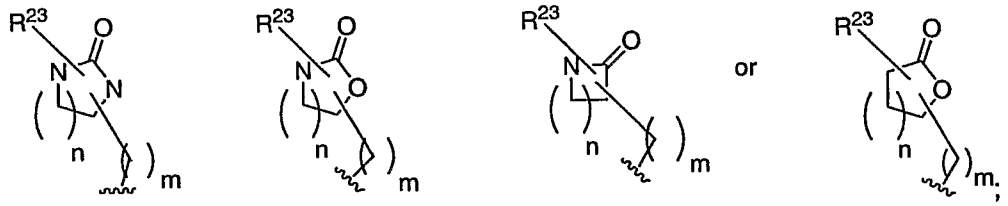
heteroarylheterocycloalkyl, alkenyl, arylalkenyl, cycloalkenyl, arylcycloalkenyl, heteroarylcycloalkenyl, heterocycloalkenyl, arylheterocycloalkenyl, heteroarylheterocycloalkenyl, alkynyl, arylalkynyl, aryl, cycloalkylaryl, heterocycloalkylaryl, cycloalkenylaryl, heterocycloalkenylaryl, heteroaryl, cycloalkylheteroaryl, heterocycloalkylheteroaryl, cycloalkenylheteroaryl, heterocycloalkenylheteroaryl and $-N(R^{15})(R^{16})$;

R^{11}, R^{12} and R^{13} are independently selected from the group consisting of H, alkyl, arylalkyl, heteroarylalkyl, cycloalkylalkyl, heterocycloalkylalkyl, arylcycloalkylalkyl, heteroarylcycloalkylalkyl, arylheterocycloalkylalkyl, heteroarylheterocycloalkylalkyl, cycloalkyl, arylcycloalkyl, heteroarylcycloalkyl, heterocycloalkyl, arylheterocycloalkyl, heteroarylheterocycloalkyl, alkenyl, arylalkenyl, cycloalkenyl, arylcycloalkenyl, heteroarylcycloalkenyl, heterocycloalkenyl, arylheterocycloalkenyl, heteroarylheterocycloalkenyl, alkynyl, arylalkynyl, aryl, cycloalkylaryl, heterocycloalkylaryl, cycloalkenylaryl, heterocycloalkenylaryl, heteroaryl, cycloalkylheteroaryl, heterocycloalkylheteroaryl, cycloalkenylheteroaryl, heterocycloalkenylheteroaryl, $-C(O)R^8$, $-C(O)OR^9$, $-S(O)R^{10}$, $-S(O)_2R^{10}$, $-C(O)N(R^{15})(R^{16})$, $-S(O)N(R^{15})(R^{16})$, $-S(O)_2N(R^{15})(R^{16})$ and –CN;

R^{15}, R^{16} and R^{17} are independently selected from the group consisting of H, alkyl, arylalkyl, heteroarylalkyl, cycloalkylalkyl, heterocycloalkylalkyl, arylcycloalkylalkyl, heteroarylcycloalkylalkyl, arylheterocycloalkylalkyl, heteroarylheterocycloalkylalkyl, cycloalkyl, arylcycloalkyl, heteroarylcycloalkyl, heterocycloalkyl, arylheterocycloalkyl, heteroarylheterocycloalkyl, alkenyl, arylalkenyl, cycloalkenyl, arylcycloalkenyl, heteroarylcycloalkenyl, heterocycloalkenyl, arylheterocycloalkenyl, heteroarylheterocycloalkenyl, alkynyl, arylalkynyl, aryl, cycloalkylaryl, heterocycloalkylaryl, cycloalkenylaryl, heterocycloalkenylaryl, heteroaryl, cycloalkylheteroaryl, heterocycloalkylheteroaryl, cycloalkenylheteroaryl, heterocycloalkenylheteroaryl, R^{18}-alkyl, R^{18}-arylalkyl, R^{18}-heteroarylalkyl, R^{18}-cycloalkylalkyl, R^{18}-heterocycloalkylalkyl, R^{18}-arylcycloalkylalkyl, R^{18}-heteroarylcycloalkylalkyl, R^{18}-arylheterocycloalkylalkyl, R^{18}-heteroarylheterocycloalkylalkyl, R^{18}-cycloalkyl, R^{18}-arylcycloalkyl, R^{18}-heteroarylcycloalkyl, R^{18}-heterocycloalkyl, R^{18}-arylheterocycloalkyl, R^{18}-heteroarylheterocycloalkyl, R^{18}-alkenyl, R^{18}-arylalkenyl, R^{18}-cycloalkenyl, R^{18}-arylcycloalkenyl, R^{18}-heteroarylcycloalkenyl, R^{18}-heterocycloalkenyl,

R^{18}-arylheterocycloalkenyl, R^{18}-heteroarylheterocycloalkenyl, R^{18}-alkynyl, R^{18}-arylalkynyl, R^{18}-aryl, R^{18}-cycloalkylaryl, R^{18}-heterocycloalkylaryl, R^{18}-cycloalkenylaryl, R^{18}-heterocycloalkenylaryl, R^{18}-heteroaryl, R^{18}-cycloalkylheteroaryl, R^{18}-heterocycloalkylheteroaryl, R^{18}-cycloalkenylheteroaryl, and R^{18}-heterocycloalkenylheteroaryl; or

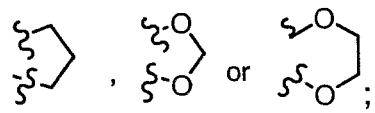
R^{15}, R^{16} and R^{17} are



wherein R^{23} numbers 0 to 5 substituents, m is 0 to 6 and n is 0 to 5;

R^{18} is 1-5 substituents independently selected from the group consisting of alkyl, arylalkyl, heteroarylalkyl, cycloalkylalkyl, heterocycloalkylalkyl, arylcycloalkylalkyl, heteroarylcycloalkylalkyl, arylheterocycloalkylalkyl, heteroarylheterocycloalkylalkyl, cycloalkyl, arylcycloalkyl, heteroarylcycloalkyl, heterocycloalkyl, arylheterocycloalkyl, heteroarylheterocycloalkyl, alkenyl, arylalkenyl, cycloalkenyl, arylcycloalkenyl, heteroarylcycloalkenyl, heterocycloalkenyl, arylheterocycloalkenyl, heteroarylheterocycloalkenyl, alkynyl, arylalkynyl, aryl, cycloalkylaryl, heterocycloalkylaryl, cycloalkenylaryl, heterocycloalkenylaryl, heteroaryl, cycloalkylheteroaryl, heterocycloalkylheteroaryl, cycloalkenylheteroaryl, heterocycloalkenylheteroaryl, $-NO_2$, halo, HO-alkoxyalkyl, $-CF_3$, -CN, alkyl-CN, $-C(O)R^{19}$, -C(O)OH, $-C(O)OR^{19}$, $-C(O)NHR^{20}$, $-C(O)NH_2$, $-C(O)NH_2$-C(O)N(alkyl)$_2$, -C(O)N(alkyl)(aryl), -C(O)N(alkyl)(heteroaryl), $-SR^{19}$, $-S(O)_2R^{20}$, $-S(O)NH_2$, -S(O)NH(alkyl), -S(O)N(alkyl)(alkyl), -S(O)NH(aryl), $-S(O)_2NH_2$, $-S(O)_2NHR^{19}$, $-S(O)_2$NH(heterocycloalkyl), $-S(O)_2$N(alkyl)$_2$, $-S(O)_2$N(alkyl)(aryl), $-OCF_3$, -OH, $-OR^{20}$, -O-heterocycloalkyl, -O-cycloalkylalkyl, -O-heterocycloalkylalkyl, $-NH_2$, $-NHR^{20}$, -N(alkyl)$_2$, -N(arylalkyl)$_2$, -N(arylalkyl)-(heteroarylalkyl), $-NHC(O)R^{20}$, $-NHC(O)NH_2$, -NHC(O)NH(alkyl), -NHC(O)N(alkyl)(alkyl), -N(alkyl)C(O)NH(alkyl), -N(alkyl)C(O)N(alkyl)(alkyl), $-NHS(O)_2R^{20}$, $-NHS(O)_2$NH(alkyl), $-NHS(O)_2$N(alkyl)(alkyl), -N(alkyl)$S(O)_2$NH(alkyl) and –N(alkyl)$S(O)_2$N(alkyl)(alkyl);

or two R^{18} moieties on adjacent carbons are optionally linked together to form



R^{19} is alkyl, arylalkyl, heteroarylalkyl, cycloalkylalkyl, heterocycloalkylalkyl, arylcycloalkylalkyl, heteroarylcycloalkylalkyl, arylheterocycloalkylalkyl, heteroarylheterocycloalkylalkyl, cycloalkyl, arylcycloalkyl, heteroarylcycloalkyl, heterocycloalkyl, arylheterocycloalkyl, heteroarylheterocycloalkyl, alkenyl, arylalkenyl, cycloalkenyl, arylcycloalkenyl, heteroarylcycloalkenyl, heterocycloalkenyl, arylheterocycloalkenyl, heteroarylheterocycloalkenyl, alkynyl, arylalkynyl, aryl, cycloalkylaryl, heterocycloalkylaryl, cycloalkenylaryl, heterocycloalkenylaryl, heteroaryl, cycloalkylheteroaryl, heterocycloalkylheteroaryl, cycloalkenylheteroaryl or heterocycloalkenylheteroaryl;

R^{20} is halo substituted aryl, alkyl, arylalkyl, heteroarylalkyl, cycloalkylalkyl, heterocycloalkylalkyl, arylcycloalkylalkyl, heteroarylcycloalkylalkyl, arylheterocycloalkylalkyl, heteroarylheterocycloalkylalkyl, cycloalkyl, arylcycloalkyl, heteroarylcycloalkyl, heterocycloalkyl, arylheterocycloalkyl, heteroarylheterocycloalkyl, alkenyl, arylalkenyl, cycloalkenyl, arylcycloalkenyl, heteroarylcycloalkenyl, heterocycloalkenyl, arylheterocycloalkenyl, heteroarylheterocycloalkenyl, alkynyl, arylalkynyl, aryl, cycloalkylaryl, heterocycloalkylaryl, cycloalkenylaryl, heterocycloalkenylaryl, heteroaryl, cycloalkylheteroaryl, heterocycloalkylheteroaryl, cycloalkenylheteroaryl or heterocycloalkenylheteroaryl;

and wherein

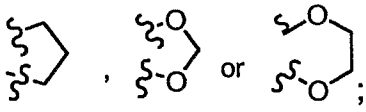
each of the alkyl, arylalkyl, heteroarylalkyl, cycloalkylalkyl, heterocycloalkylalkyl, arylcycloalkylalkyl, heteroarylcycloalkylalkyl, arylheterocycloalkylalkyl, heteroarylheterocycloalkylalkyl, cycloalkyl, arylcycloalkyl, heteroarylcycloalkyl, heterocycloalkyl, arylheterocycloalkyl, heteroarylheterocycloalkyl, alkenyl, arylalkenyl, cycloalkenyl, arylcycloalkenyl, heteroarylcycloalkenyl, heterocycloalkenyl, arylheterocycloalkenyl, heteroarylheterocycloalkenyl, alkynyl, arylalkynyl, aryl, cycloalkylaryl, heterocycloalkylaryl, cycloalkenylaryl, heterocycloalkenylaryl, heteroaryl, cycloalkylheteroaryl, heterocycloalkylheteroaryl, cycloalkenylheteroaryl or heterocycloalkenylheteroaryl in R, R^1, R^2, R^3, R^4, R^5, R^6, R^7 R^8, R^9, R^{10}, R^{11}, R^{12}, R^{13} and R^{14}

are independently unsubstituted or substituted by 1 to 5 R^{21} groups independently selected from the group consisting of alkyl, arylalkyl, heteroarylalkyl, cycloalkylalkyl, heterocycloalkylalkyl, arylcycloalkylalkyl, heteroarylcycloalkylalkyl,

arylheterocycloalkylalkyl, heteroarylheterocycloalkylalkyl, cycloalkyl, arylcycloalkyl, heteroarylcycloalkyl, heterocycloalkyl, arylheterocycloalkyl, heteroarylheterocycloalkyl, alkenyl, arylalkenyl, cycloalkenyl, arylcycloalkenyl, heteroarylcycloalkenyl, heterocycloalkenyl, arylheterocycloalkenyl, heteroarylheterocycloalkenyl, alkynyl, arylalkynyl, aryl, cycloalkylaryl, heterocycloalkylaryl, cycloalkenylaryl, heterocycloalkenylaryl, heteroaryl, cycloalkylheteroaryl, heterocycloalkylheteroaryl, cycloalkenylheteroaryl, heterocycloalkenylheteroaryl, halo, -CN, $-OR^{15}$, $-C(O)R^{15}$, $-C(O)OR^{15}$, $-C(O)N(R^{15})(R^{16})$, $-SR^{15}$, $-S(O)N(R^{15})(R^{16})$, $-CH(R^{15})(R^{16})$, $-S(O)_2N(R^{15})(R^{16})$, $-C(=NOR^{15})R^{16}$, $-P(O)(OR^{15})(OR^{16})$, $-N(R^{15})(R^{16})$, -alkyl-$N(R^{15})(R^{16})$, $-N(R^{15})C(O)R^{16}$, $-CH_2-N(R^{15})C(O)R^{16}$, $-CH_2-N(R^{15})C(O)N(R^{16})(R^{17})$, $-CH_2-R^{15}$; $-CH_2N(R^{15})(R^{16})$, $-N(R^{15})S(O)R^{16}$, $-N(R^{15})S(O)_2R^{16}$, $-CH_2-N(R^{15})S(O)_2R^{16}$, $-N(R^{15})S(O)_2N(R^{16})(R^{17})$, $-N(R^{15})S(O)N(R^{16})(R^{17})$, $-N(R^{15})C(O)N(R^{16})(R^{17})$, $-CH_2-N(R^{15})C(O)N(R^{16})(R^{17})$, $-N(R^{15})C(O)OR^{16}$, $-CH_2-N(R^{15})C(O)OR^{16}$, $-S(O)R^{15}$, $-N_3$, $-NO_2$ and $-S(O)_2R^{15}$;

and wherein each of the alkyl, arylalkyl, heteroarylalkyl, cycloalkylalkyl, heterocycloalkylalkyl, arylcycloalkylalkyl, heteroarylcycloalkylalkyl, arylheterocycloalkylalkyl, heteroarylheterocycloalkylalkyl, cycloalkyl, arylcycloalkyl, heteroarylcycloalkyl, heterocycloalkyl, arylheterocycloalkyl, heteroarylheterocycloalkyl, alkenyl, arylalkenyl, cycloalkenyl, arylcycloalkenyl, heteroarylcycloalkenyl, heterocycloalkenyl, arylheterocycloalkenyl, heteroarylheterocycloalkenyl, alkynyl, arylalkynyl, aryl, cycloalkylaryl, heterocycloalkylaryl, cycloalkenylaryl, heterocycloalkenylaryl, heteroaryl, cycloalkylheteroaryl, heterocycloalkylheteroaryl, cycloalkenylheteroaryl, heterocycloalkenylheteroaryl groups in R^{21} are independently unsubstituted or substituted by 1 to 5 R^{22} groups independently selected from the group consisting of alkyl, arylalkyl, heteroarylalkyl, cycloalkylalkyl, heterocycloalkylalkyl, arylcycloalkylalkyl, heteroarylcycloalkylalkyl, arylheterocycloalkylalkyl, heteroarylheterocycloalkylalkyl, cycloalkyl, arylcycloalkyl, heteroarylcycloalkyl, heterocycloalkyl, arylheterocycloalkyl, heteroarylheterocycloalkyl, alkenyl, arylalkenyl, cycloalkenyl, arylcycloalkenyl, heteroarylcycloalkenyl, heterocycloalkenyl, arylheterocycloalkenyl, heteroarylheterocycloalkenyl, alkynyl, arylalkynyl, aryl, cycloalkylaryl, heterocycloalkylaryl, cycloalkenylaryl, heterocycloalkenylaryl, heteroaryl, cycloalkylheteroaryl, heterocycloalkylheteroaryl, cycloalkenylheteroaryl, heterocycloalkenylheteroaryl, halo, $-CF_3$, -CN, $-OR^{15}$,

$-C(O)R^{15}$, $-C(O)OR^{15}$, -alkyl-$C(O)OR^{15}$, $C(O)N(R^{15})(R^{16})$, $-SR^{15}$, $-S(O)N(R^{15})(R^{16})$, $-S(O)_2N(R^{15})(R^{16})$, $-C(=NOR^{15})R^{16}$, $-P(O)(OR^{15})(OR^{16})$, $-N(R^{15})(R^{16})$, -alkyl-$N(R^{15})(R^{16})$, $-N(R^{15})C(O)R^{16}$, $-CH_2-N(R^{15})C(O)R^{16}$, $-N(R^{15})S(O)R^{16}$, $-N(R^{15})S(O)_2R^{16}$, $-CH_2-N(R^{15})S(O)_2R^{16}$, $-N(R^{15})S(O)_2N(R^{16})(R^{17})$, $-N(R^{15})S(O)N(R^{16})(R^{17})$, $-N(R^{15})C(O)N(R^{16})(R^{17})$, $-CH_2-N(R^{15})C(O)N(R^{16})(R^{17})$, $-N(R^{15})C(O)OR^{16}$, $-CH_2-N(R^{15})C(O)OR^{16}$, $-N_3$, $-NO_2$, $-S(O)R^{15}$ and $-S(O)_2R^{15}$;

or two R^{21} or two R^{22} moieties on adjacent carbons are optionally linked together to form ;

and when R^{21} or R^{22} are selected from the group consisting of $-C(=NOR^{15})R^{16}$, $-N(R^{15})C(O)R^{16}$, $-CH_2-N(R^{15})C(O)R^{16}$, $-N(R^{15})S(O)R^{16}$, $-N(R^{15})S(O)_2R^{16}$, $-CH_2-N(R^{15})S(O)_2R^{16}$, $-N(R^{15})S(O)_2N(R^{16})(R^{17})$, $-N(R^{15})S(O)N(R^{16})(R^{17})$, $-N(R^{15})C(O)N(R^{16})(R^{17})$, $-CH_2-N(R^{15})C(O)N(R^{16})(R^{17})$, $-N(R^{15})C(O)OR^{16}$ and $-CH_2-N(R^{15})C(O)OR^{16}$, R^{15} and R^{16} together are optionally a C_2 to C_4 chain wherein, optionally, one, two or three ring carbons are replaced by –C(O)- or –N(H)- and R^{15} and R^{16}, together with the atoms to which they are attached, form a 5 to 7 membered ring, optionally substituted by R^{23};

R^{23} is 1 to 5 groups independently selected from the group consisting of alkyl, arylalkyl, heteroarylalkyl, cycloalkylalkyl, heterocycloalkylalkyl, arylcycloalkylalkyl, heteroarylcycloalkylalkyl, arylheterocycloalkylalkyl, heteroarylheterocycloalkylalkyl, cycloalkyl, arylcycloalkyl, heteroarylcycloalkyl, heterocycloalkyl, arylheterocycloalkyl, heteroarylheterocycloalkyl, alkenyl, arylalkenyl, cycloalkenyl, arylcycloalkenyl, heteroarylcycloalkenyl, heterocycloalkenyl, arylheterocycloalkenyl, heteroarylheterocycloalkenyl, alkynyl, arylalkynyl, aryl, cycloalkylaryl, heterocycloalkylaryl, cycloalkenylaryl, heterocycloalkenylaryl, heteroaryl, cycloalkylheteroaryl, heterocycloalkylheteroaryl, cycloalkenylheteroaryl, heterocycloalkenylheteroaryl, halo, -CN, $-OR^{24}$, $-C(O)R^{24}$, $-C(O)OR^{24}$, $-C(O)N(R^{24})(R^{25})$, $-SR^{24}$, $-S(O)N(R^{24})(R^{25})$, $-S(O)_2N(R^{24})(R^{25})$, $-C(=NOR^{24})R^{25}$, $-P(O)(OR^{24})(OR^{25})$, $-N(R^{24})(R^{25})$, -alkyl-$N(R^{24})(R^{25})$, $-N(R^{24})C(O)R^{25}$, $-CH_2-N(R^{24})C(O)R^{25}$, $-N(R^{24})S(O)R^{25}$, $-N(R^{24})S(O)_2R^{25}$, $-CH_2-N(R^{24})S(O)_2R^{25}$, $-N(R^{24})S(O)_2N(R^{25})(R^{26})$, $-N(R^{24})S(O)N(R^{25})(R^{26})$, $-N(R^{24})C(O)N(R^{25})(R^{26})$, $-CH_2-N(R^{24})C(O)N(R^{25})(R^{26})$, $-N(R^{24})C(O)OR^{25}$, $-CH_2-N(R^{24})C(O)OR^{25}$, $-S(O)R^{24}$ and $-S(O)_2R^{24}$; and wherein each of the alkyl, arylalkyl, heteroarylalkyl, cycloalkylalkyl,

heterocycloalkylalkyl, arylcycloalkylalkyl, heteroarylcycloalkylalkyl, arylheterocycloalkylalkyl, heteroarylheterocycloalkylalkyl, cycloalkyl, arylcycloalkyl, heteroarylcycloalkyl, heterocycloalkyl, arylheterocycloalkyl, heteroarylheterocycloalkyl, alkenyl, arylalkenyl, cycloalkenyl, arylcycloalkenyl, heteroarylcycloalkenyl, heterocycloalkenyl, arylheterocycloalkenyl, heteroarylheterocycloalkenyl, alkynyl, arylalkynyl, aryl, cycloalkylaryl, heterocycloalkylaryl, cycloalkenylaryl, heterocycloalkenylaryl, heteroaryl, cycloalkylheteroaryl, heterocycloalkylheteroaryl, cycloalkenylheteroaryl and heterocycloalkenylheteroaryl groups in R^{23} are independently unsubstituted or substituted by 1 to 5 R^{27} groups independently selected from the group consisting of alkyl, arylalkyl, heteroarylalkyl, cycloalkylalkyl, heterocycloalkylalkyl, arylcycloalkylalkyl, heteroarylcycloalkylalkyl, arylheterocycloalkylalkyl, heteroarylheterocycloalkylalkyl, cycloalkyl, arylcycloalkyl, heteroarylcycloalkyl, heterocycloalkyl, arylheterocycloalkyl, heteroarylheterocycloalkyl, alkenyl, arylalkenyl, cycloalkenyl, arylcycloalkenyl, heteroarylcycloalkenyl, heterocycloalkenyl, arylheterocycloalkenyl, heteroarylheterocycloalkenyl, alkynyl, arylalkynyl, aryl, cycloalkylaryl, heterocycloalkylaryl, cycloalkenylaryl, heterocycloalkenylaryl, heteroaryl, cycloalkylheteroaryl, heterocycloalkylheteroaryl, cycloalkenylheteroaryl, heterocycloalkenylheteroaryl, halo, $-CF_3$, -CN, $-OR^{24}$, $-C(O)R^{24}$, $-C(O)OR^{24}$, alkyl-$C(O)OR^{24}$, $C(O)N(R^{24})(R^{25})$, $-SR^{24}$, $-S(O)N(R^{24})(R^{25})$, $-S(O)_2N(R^{24})(R^{25})$, $-C(=NOR^{24})R^{25}$, $-P(O)(OR^{24})(OR^{25})$, $-N(R^{24})(R^{25})$, -alkyl-$N(R^{24})(R^{25})$, $-N(R^{24})C(O)R^{25}$, $-CH_2-N(R^{24})C(O)R^{25}$, $-N(R^{24})S(O)R^{25}$, $-N(R^{24})S(O)_2R^{25}$, $-CH_2-N(R^{24})S(O)_2R^{25}$, $-N(R^{24})S(O)_2N(R^{25})(R^{26})$, $-N(R^{24})S(O)N(R^{25})(R^{26})$, $-N(R^{24})C(O)N(R^{25})(R^{26})$, $-CH_2-N(R^{24})C(O)N(R^{25})(R^{26})$, $-N(R^{24})C(O)OR^{25}$, $-CH_2-N(R^{24})C(O)OR^{25}$, $-S(O)R^{24}$ and $-S(O)_2R^{24}$;

R^{24}, R^{25} and R^{26} are independently selected from the group consisting of H, alkyl, arylalkyl, heteroarylalkyl, cycloalkylalkyl, heterocycloalkylalkyl, arylcycloalkylalkyl, heteroarylcycloalkylalkyl, arylheterocycloalkylalkyl, heteroarylheterocycloalkylalkyl, cycloalkyl, arylcycloalkyl, heteroarylcycloalkyl, heterocycloalkyl, arylheterocycloalkyl, heteroarylheterocycloalkyl, alkenyl, arylalkenyl, cycloalkenyl, arylcycloalkenyl, heteroarylcycloalkenyl, heterocycloalkenyl, arylheterocycloalkenyl, heteroarylheterocycloalkenyl, alkynyl, arylalkynyl, aryl, cycloalkylaryl, heterocycloalkylaryl, cycloalkenylaryl, heterocycloalkenylaryl, heteroaryl, cycloalkylheteroaryl, heterocycloalkylheteroaryl, cycloalkenylheteroaryl,

heterocycloalkenylheteroaryl, R^{27}-alkyl, R^{27}-arylalkyl, R^{27}-heteroarylalkyl, R^{27}-cycloalkylalkyl, R^{27}-heterocycloalkylalkyl, R^{27}-arylcycloalkylalkyl, R^{27}-heteroarylcycloalkylalkyl, R^{27}-arylheterocycloalkylalkyl, R^{27}-heteroarylheterocycloalkylalkyl, R^{27}-cycloalkyl, R^{27}-arylcycloalkyl, R^{27}-heteroarylcycloalkyl, R^{27}-heterocycloalkyl, R^{27}-arylheterocycloalkyl, R^{27}-heteroarylheterocycloalkyl, R^{27}-alkenyl, R^{27}-arylalkenyl, R^{27}-cycloalkenyl, R^{27}-arylcycloalkenyl, R^{27}-heteroarylcycloalkenyl, R^{27}-heterocycloalkenyl, R^{27}-arylheterocycloalkenyl, R^{27}-heteroarylheterocycloalkenyl, R^{27}-alkynyl, R^{27}-arylalkynyl, R^{27}-aryl, R^{27}-cycloalkylaryl, R^{27}-heterocycloalkylaryl, R^{27}-cycloalkenylaryl, R^{27}-heterocycloalkenylaryl, R^{27}-heteroaryl, R^{27}-cycloalkylheteroaryl, R^{27}-heterocycloalkylheteroaryl, R^{27}-cycloalkenylheteroaryl and R^{27}-heterocycloalkenylheteroaryl;

R^{27} is 1-5 substituents independently selected from the group consisting of alkyl, arylalkyl, heteroarylalkyl, cycloalkylalkyl, heterocycloalkylalkyl, arylcycloalkylalkyl, heteroarylcycloalkylalkyl, arylheterocycloalkylalkyl, heteroarylheterocycloalkylalkyl, cycloalkyl, arylcycloalkyl, heteroarylcycloalkyl, heterocycloalkyl, arylheterocycloalkyl, heteroarylheterocycloalkyl, alkenyl, arylalkenyl, cycloalkenyl, arylcycloalkenyl, heteroarylcycloalkenyl, heterocycloalkenyl, arylheterocycloalkenyl, heteroarylheterocycloalkenyl, alkynyl, arylalkynyl, aryl, cycloalkylaryl, heterocycloalkylaryl, cycloalkenylaryl, heterocycloalkenylaryl, heteroaryl, cycloalkylheteroaryl, heterocycloalkylheteroaryl, cycloalkenylheteroaryl, heterocycloalkenylheteroaryl, $-NO_2$, halo, $-CF_3$, -CN, alkyl-CN, $-C(O)R^{28}$, -C(O)OH, $-C(O)OR^{28}$, $-C(O)NHR^{29}$, $-C(O)N(alkyl)_2$, -C(O)N(alkyl)(aryl), -C(O)N(alkyl)(heteroaryl), $-SR^{28}$, $-S(O)_2R^{29}$, $-S(O)NH_2$, -S(O)NH(alkyl), -S(O)N(alkyl)(alkyl), -S(O)NH(aryl), $-S(O)_2NH_2$, $-S(O)_2NHR^{28}$, $-S(O)_2NH(aryl)$, $-S(O)_2NH(heterocycloalkyl)$, $-S(O)_2N(alkyl)_2$, $-S(O)_2N(alkyl)(aryl)$, -OH, $-OR^{29}$, -O-heterocycloalkyl, -O-cycloalkylalkyl, -O-heterocycloalkylalkyl, $-NH_2$, $-NHR^{29}$, $-N(alkyl)_2$, $-N(arylalkyl)_2$, -N(arylalkyl)(heteroarylalkyl), $-NHC(O)R^{29}$, $-NHC(O)NH_2$, -NHC(O)NH(alkyl), -NHC(O)N(alkyl)(alkyl), -N(alkyl)C(O)NH(alkyl), -N(alkyl)C(O)N(alkyl)(alkyl), $-NHS(O)_2R^{29}$, $-NHS(O)_2NH(alkyl)$, $-NHS(O)_2N(alkyl)(alkyl)$, $-N(alkyl)S(O)_2NH(alkyl)$ and $-N(alkyl)S(O)_2N(alkyl)(alkyl)$;

R^{28} is alkyl, arylalkyl, heteroarylalkyl, cycloalkylalkyl, heterocycloalkylalkyl, arylcycloalkylalkyl, heteroarylcycloalkylalkyl, arylheterocycloalkylalkyl,

heteroarylheterocycloalkylalkyl, cycloalkyl, arylcycloalkyl, heteroarylcycloalkyl, heterocycloalkyl, arylheterocycloalkyl, heteroarylheterocycloalkyl, alkenyl, arylalkenyl, cycloalkenyl, arylcycloalkenyl, heteroarylcycloalkenyl, heterocycloalkenyl, arylheterocycloalkenyl, heteroarylheterocycloalkenyl, alkynyl, arylalkynyl, aryl, cycloalkylaryl, heterocycloalkylaryl, cycloalkenylaryl, heterocycloalkenylaryl, heteroaryl, cycloalkylheteroaryl, heterocycloalkylheteroaryl, cycloalkenylheteroaryl or heterocycloalkenylheteroaryl;

R^{29} is alkyl, arylalkyl, heteroarylalkyl, cycloalkylalkyl, heterocycloalkylalkyl, arylcycloalkylalkyl, heteroarylcycloalkylalkyl, arylheterocycloalkylalkyl, heteroarylheterocycloalkylalkyl, cycloalkyl, arylcycloalkyl, heteroarylcycloalkyl, heterocycloalkyl, arylheterocycloalkyl, heteroarylheterocycloalkyl, alkenyl, arylalkenyl, cycloalkenyl, arylcycloalkenyl, heteroarylcycloalkenyl, heterocycloalkenyl, arylheterocycloalkenyl, heteroarylheterocycloalkenyl, alkynyl, arylalkynyl, aryl, cycloalkylaryl, heterocycloalkylaryl, cycloalkenylaryl, heterocycloalkenylaryl, heteroaryl, cycloalkylheteroaryl, heterocycloalkylheteroaryl, cycloalkenylheteroaryl or heterocycloalkenylheteroaryl;

R^{30} is alkyl, arylalkyl, heteroarylalkyl, cycloalkylalkyl, heterocycloalkylalkyl, arylcycloalkylalkyl, heteroarylcycloalkylalkyl, arylheterocycloalkylalkyl, heteroarylheterocycloalkylalkyl, cycloalkyl, arylcycloalkyl, heteroarylcycloalkyl, heterocycloalkyl, arylheterocycloalkyl, heteroarylheterocycloalkyl, alkenyl, arylalkenyl, cycloalkenyl, arylcycloalkenyl, heteroarylcycloalkenyl, heterocycloalkenyl, arylheterocycloalkenyl, heteroarylheterocycloalkenyl, alkynyl, arylalkynyl, aryl, cycloalkylaryl, heterocycloalkylaryl, cycloalkenylaryl, heterocycloalkenylaryl, heteroaryl, cycloalkylheteroaryl, heterocycloalkylheteroaryl, cycloalkenylheteroaryl or heterocycloalkenylheteroaryl;

and

R^{31} is alkyl, arylalkyl, heteroarylalkyl, cycloalkylalkyl, heterocycloalkylalkyl, arylcycloalkylalkyl, heteroarylcycloalkylalkyl, arylheterocycloalkylalkyl, heteroarylheterocycloalkylalkyl, cycloalkyl, arylcycloalkyl, heteroarylcycloalkyl, heterocycloalkyl, arylheterocycloalkyl, heteroarylheterocycloalkyl, alkenyl, arylalkenyl, cycloalkenyl, arylcycloalkenyl, heteroarylcycloalkenyl, heterocycloalkenyl, arylheterocycloalkenyl, heteroarylheterocycloalkenyl, alkynyl, arylalkynyl, aryl, cycloalkylaryl, heterocycloalkylaryl, cycloalkenylaryl, heterocycloalkenylaryl,

heteroaryl, cycloalkylheteroaryl, heterocycloalkylheteroaryl, cycloalkenylheteroaryl or heterocycloalkenylheteroaryl.

In another aspect, the invention relates to a pharmaceutical composition comprising at least one compound of formula I and a pharmaceutically acceptable carrier.

In another aspect, the invention comprises the method of inhibiting aspartyl proteases comprising administering at least one compound of formula I to a patient in need of such treatment.

More specifically, the invention comprises: the method of treating a cardiovascular disease such as hypertension, renal failure, congestive heart failure or another disease modulated by renin inhibition; the method of treating Human Immunodeficiency Virus; the method of treating a cognitive or neurodegenerative disease such as Alzheimer's Disease; the method of inhibiting plasmepsins I and II for treatment of malaria; the method of inhibiting Cathepsin D for the treatment of Alzheimer's Disease, breast cancer, and ovarian cancer; and the method of inhibiting protozoal enzymes, for example inhibition of plasmodium falciparnum, for the treatment of fungal infections. Said method of treatment comprise administering at least one compound of formula I to a patient in need of such treatment. In particular, the invention comprises the method of treating Alzheimer's Disease comprising administering at least one compound of formula I to a patient in need of such treatment.

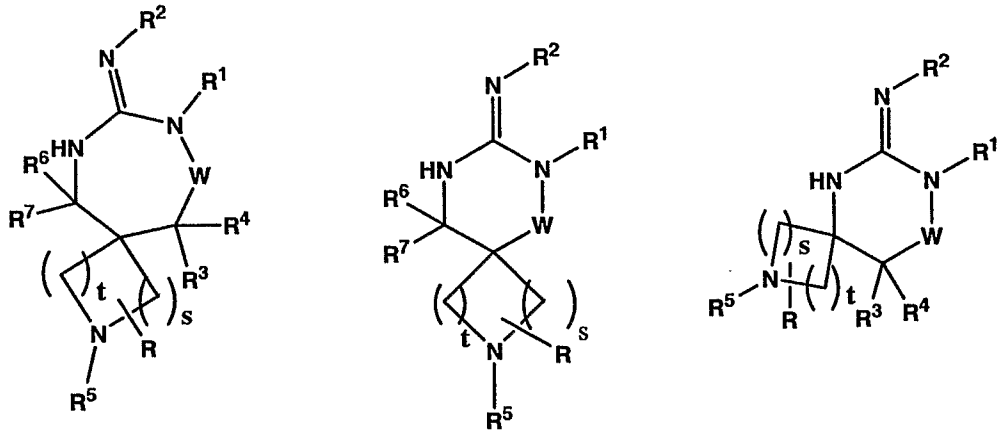
In another aspect, the invention comprises the method of treating Alzheimer's Disease comprising administering to a patient in need of such treatment a combination of at least one compound of formula I and a cholinesterase inhibitor or a muscarinic m_1 agonist or m_2 antagonist.

In a final aspect, the invention relates to a kit comprising in separate containers in a single package pharmaceutical compositions for use in combination, in which one container comprises a compound of formula I in a pharmaceutically acceptable carrier and a second container comprises a cholinesterase inhibitor or a muscarinic m_1 agonist or m_2 antagonist in a pharmaceutically acceptable carrier, the combined quantities being an effective amount to treat a cognitive disease or neurodegenerative disease such as Alzheimer's Disease.

DETAILED DESCRIPTION:

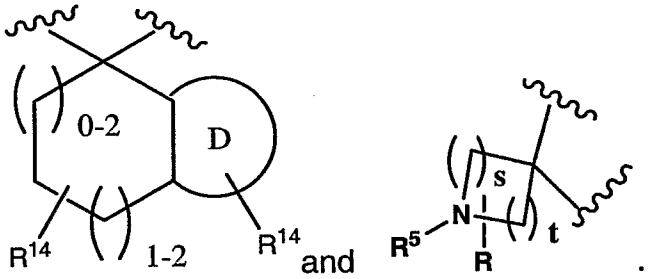
In general, it is understood that divalent groups are to be read left to right.

Preferred compounds of formula I are those compounds with the following structures



wherein s, t, R, R^1, R^2, R^3, R^4, R^5, R^6 and R^7 are defined herein.

Alternatively, another group of preferred compounds of formula I are those compounds wherein R^{6a} and R^{7a} together are selected from the group consisting of :

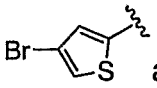
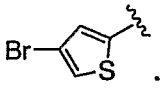

and

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It is also understood that when R^{6a} and R^{7a} together form a carbon chain so that when at least one of the carbons is replaced by –O-, -C(O)-, -S-, -C(S)-, -S(O)-, $-S(O)_2-$ or $-N(R^5)-$, then the number carbons in the R^{6a} and R^{7a} portion of the chain is the sum of s and t, wherein s is 0 to 3 and t is 0 to 3, with the further proviso that s or t cannot both be zero.

Yet another group of preferred compounds of formula I are those compounds wherein U is $-(C(R^6)(R^7))-$ or $-(C(R^6)(R^7))(C(R^6)(R^7))-$, or more preferably, U is $-(C(R^6)(R^7))-$.

Yet another group of preferred compounds of formula I are those compounds wherein R^6 is aryl, heteroaryl, $R-^{21}$ substituted aryl, $R^{21}-$ substituted heteroaryl or alkyl

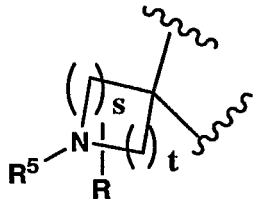
and R^7 is aryl, heteroaryl, R-^{21} substituted aryl, R^{21}- substituted heteroaryl or alkyl, or more preferably, R^6 is methyl or  and R^7 is methyl or .

Yet another group of preferred compounds of formula I are those compounds wherein R^1 is alkyl, or more preferably, R^1 is methyl.

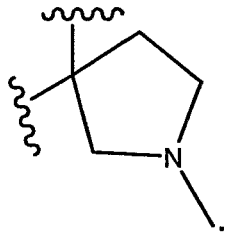
Yet another group of preferred compounds of formula I are those compounds wherein A is a bond.

Yet another group of preferred compounds of formula I are those compounds wherein W is -C(O)-.

Yet another group of preferred compounds of formula I are those compounds wherein R^{6a} and R^{7a} together are:



or more preferably, R^{6a} and R^{7a} together are



Yet another group of preferred compounds of formula I are those compounds wherein U is -(C(R^6)(R^7))-;

R^1 is alkyl;

R^6 is aryl, heteroaryl, R-^{21} substituted aryl, R^{21}- substituted heteroaryl or alkyl;

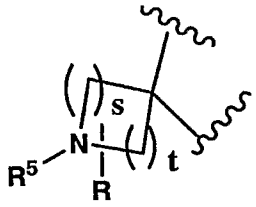
R^7 is aryl, heteroaryl, R-^{21} substituted aryl, R^{21}- substituted heteroaryl or alkyl;

A is a bond;

W is -C(O)-;

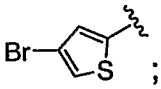
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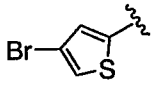
wherein R^{6a} and R^{7a} together are:



Yet another group of preferred compounds of formula I are those compounds wherein U is -(C(R^6)(R^7))-;

R^1 is methyl;

R^6 is methyl or ;

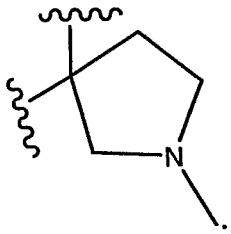
R^7 is methyl or ;

A is a bond;

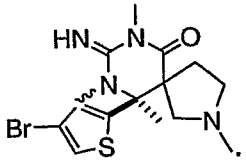
W is -C(O)-;

and

R^{6a} and R^{7a} together are



In another embodiment, the compound of Formula (I) has the following structure:



It is noted that the carbons of formula I may be replaced with 1 to 3 silicon atoms so long as all valency requirements are satisfied.

As used above, and throughout the specification, the following terms, unless otherwise indicated, shall be understood to have the following meanings:

"Patient" includes both human and animals.

"Mammal" means humans and other mammalian animals.

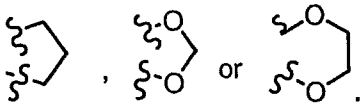
"Alkyl" means an aliphatic hydrocarbon group which may be straight or branched and comprising about 1 to about 20 carbon atoms in the chain. Preferred

alkyl groups contain about 1 to about 12 carbon atoms in the chain. More preferred alkyl groups contain about 1 to about 6 carbon atoms in the chain. Branched means that one or more lower alkyl groups such as methyl, ethyl or propyl, are attached to a linear alkyl chain. "Lower alkyl" means a group having about 1 to about 6 carbon atoms in the chain which may be straight or branched. Non-limiting examples of suitable alkyl groups include methyl, ethyl, n-propyl, isopropyl, n-butyl, t-butyl, n-pentyl, heptyl, nonyl and decyl. R^{21}-substituted alkyl groups include fluoromethyl, trifluoromethyl and cyclopropylmethyl .

"Alkenyl" means an aliphatic hydrocarbon group containing at least one carbon-carbon double bond and which may be straight or branched and comprising about 2 to about 15 carbon atoms in the chain. Preferred alkenyl groups have about 2 to about 12 carbon atoms in the chain; and more preferably about 2 to about 6 carbon atoms in the chain. Branched means that one or more lower alkyl groups such as methyl, ethyl or propyl, are attached to a linear alkenyl chain. "Lower alkenyl" means about 2 to about 6 carbon atoms in the chain which may be straight or branched. Non-limiting examples of suitable alkenyl groups include ethenyl, propenyl, n-butenyl, 3-methylbut-2-enyl, n-pentenyl, octenyl and decenyl.

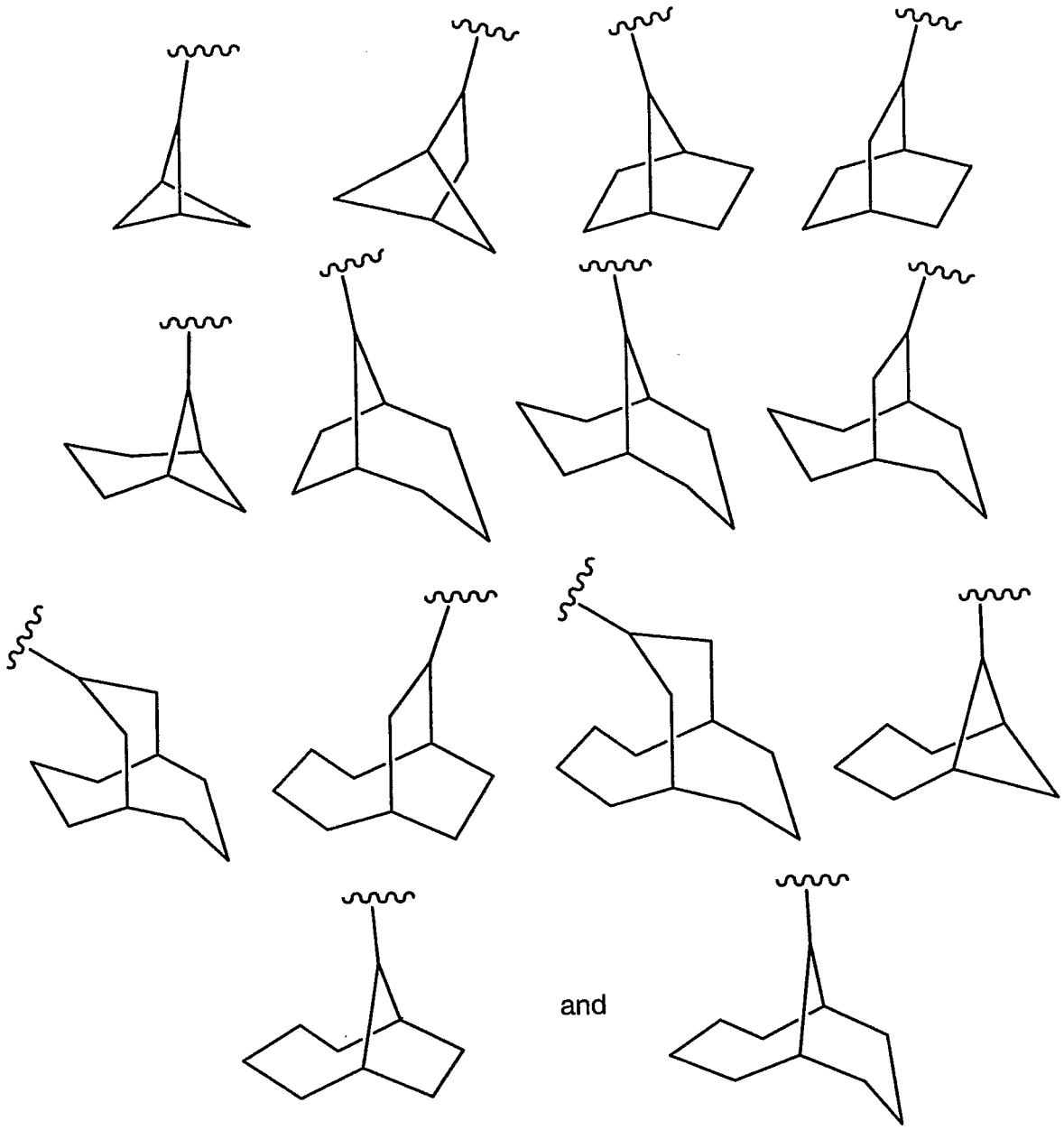
"Alkynyl" means an aliphatic hydrocarbon group containing at least one carbon-carbon triple bond and which may be straight or branched and comprising about 2 to about 15 carbon atoms in the chain. Preferred alkynyl groups have about 2 to about 12 carbon atoms in the chain; and more preferably about 2 to about 4 carbon atoms in the chain. Branched means that one or more lower alkyl groups such as methyl, ethyl or propyl, are attached to a linear alkynyl chain. "Lower alkynyl" means about 2 to about 6 carbon atoms in the chain which may be straight or branched. Non-limiting examples of suitable alkynyl groups include ethynyl, propynyl, 2-butynyl, 3-methylbutynyl, n-pentynyl, and decynyl.

"Aryl" means an aromatic monocyclic or multicyclic ring system comprising about 6 to about 14 carbon atoms, preferably about 6 to about 10 carbon atoms. The aryl group can be optionally substituted with one or more substituents (e.g., R^{18}, R^{21}, R^{22}, etc.) which may be the same or different, and are as defined herein or two substituents on adjacent carbons can be linked together to form

. Non-limiting examples of suitable aryl groups include phenyl and naphthyl.

"Heteroaryl" means an aromatic monocyclic or multicyclic ring system comprising about 5 to about 14 ring atoms, preferably about 5 to about 10 ring atoms, in which one to four of the ring atoms is an element other than carbon, for example nitrogen, oxygen or sulfur, alone or in combination. Preferred heteroaryls contain about 5 to about 6 ring atoms. The "heteroaryl" can be optionally substituted by one or more R^{21} substituents which may be the same or different, and are as defined herein. The prefix aza, oxa or thia before the heteroaryl root name means that at least a nitrogen, oxygen or sulfur atom respectively, is present as a ring atom. A nitrogen atom of a heteroaryl can be optionally oxidized to the corresponding N-oxide. Non-limiting examples of suitable heteroaryls include pyridyl, pyrazinyl, furanyl, thienyl, pyrimidinyl, isoxazolyl, isothiazolyl, oxazolyl, thiazolyl, pyrazolyl, furazanyl, pyrrolyl, pyrazolyl, triazolyl, 1,2,4-thiadiazolyl, pyrazinyl, pyridazinyl, quinoxalinyl, phthalazinyl, imidazo[1,2-a]pyridinyl, imidazo[2,1-b]thiazolyl, benzofurazanyl, indolyl, azaindolyl, benzimidazolyl, benzothienyl, quinolinyl, imidazolyl, thienopyridyl, quinazolinyl, thienopyrimidyl, pyrrolopyridyl, imidazopyridyl, isoquinolinyl, benzoazaindolyl, 1,2,4-triazinyl, benzothiazolyl and the like.

"Cycloalkyl" means a non-aromatic mono- or multicyclic ring system comprising about 3 to about 15 carbon atoms, preferably about 5 to about 10 carbon atoms. Preferred cycloalkyl rings contain about 5 to about 7 ring atoms. The cycloalkyl can be optionally substituted with one or more R^{21} substituents which may be the same or different, and are as defined above. Non-limiting examples of suitable monocyclic cycloalkyls include cyclopropyl, cyclopentyl, cyclohexyl, cycloheptyl and the like. Non-limiting examples of suitable multicyclic cycloalkyls include 1-decalin, norbornyl, adamantyl and the like. Further non-limiting examples of cycloalkyl include the following



and

"Cycloalkylether" means a non-aromatic ring of 3 to 15 atoms comprising an oxygen atom and 2 to 14 carbon atoms. Ring carbon atoms can be substituted, provided that substituents adjacent to the ring oxygen do not include halo or substituents joined to the ring through an oxygen, nitrogen or sulfur atom.

"Cycloalkenyl" means a non-aromatic mono or multicyclic ring system comprising about 3 to about 15 carbon atoms, preferably about 5 to about 10 carbon atoms which contains at least one carbon-carbon double bond. The cycloalkenyl ring can be optionally substituted with one or more R^{21} substituents which may be the same or different, and are as defined above. Preferred cycloalkenyl rings contain about 5 to about 7 ring atoms. Non-limiting examples of suitable monocyclic

cycloalkenyls include cyclopentenyl, cyclohexenyl, cycloheptenyl, and the like. Non-limiting example of a suitable multicyclic cycloalkenyl is norbornylenyl.

"Heterocyclenyl" (or "heterocycloalkenyl") means a non-aromatic monocyclic or multicyclic ring system comprising about 3 to about 10 ring atoms, preferably about 5 to about 10 ring atoms, in which one or more of the atoms in the ring system is an element other than carbon, for example nitrogen, oxygen or sulfur atom, alone or in combination, and which contains at least one carbon-carbon double bond or carbon-nitrogen double bond. There are no adjacent oxygen and/or sulfur atoms present in the ring system. Preferred heterocyclenyl rings contain about 5 to about 6 ring atoms. The prefix aza, oxa or thia before the heterocyclenyl root name means that at least a nitrogen, oxygen or sulfur atom respectively is present as a ring atom. The heterocyclenyl can be optionally substituted by one or more ring system substituents, wherein "ring system substituent" is as defined above. The nitrogen or sulfur atom of the heterocyclenyl can be optionally oxidized to the corresponding N-oxide, S-oxide or S,S-dioxide. Non-limiting examples of suitable monocyclic azaheterocyclenyl groups include 1,2,3,4- tetrahydropyridyl, 1,2-dihydropyridyl, 1,4-dihydropyridyl, 1,2,3,6-tetrahydropyridyl, 1,4,5,6-tetrahydropyrimidyl, 2-pyrrolinyl, 3-pyrrolinyl, 2-imidazolinyl, 2-pyrazolinyl, and the like. Non-limiting examples of suitable oxaheterocyclenyl groups include 3,4-dihydro-2H-pyran, dihydrofuranyl, fluorodihydrofuranyl, and the like. Non-limiting example of a suitable multicyclic oxaheterocyclenyl group is 7-oxabicyclo[2.2.1]heptenyl. Non-limiting examples of suitable monocyclic thiaheterocyclenyl rings include dihydrothiophenyl, dihydrothiopyranyl, and the like.

"Halo" means fluoro, chloro, bromo, or iodo groups. Preferred are fluoro, chloro or bromo, and more preferred are fluoro and chloro.

"Haloalkyl" means an alkyl as defined above wherein one or more hydrogen atoms on the alkyl is replaced by a halo group defined above.

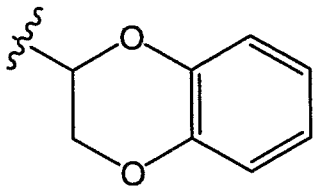
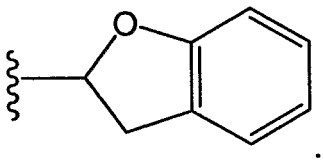
"Heterocyclyl" (or heterocycloalkyl) means a non-aromatic saturated monocyclic or multicyclic ring system comprising about 3 to about 10 ring atoms, preferably about 5 to about 10 ring atoms, in which 1-3, preferably 1 or 2 of the atoms in the ring system is an element other than carbon, for example nitrogen, oxygen or sulfur, alone or in combination. There are no adjacent oxygen and/or sulfur atoms present in the ring system. Preferred heterocyclyls contain about 5 to about 6 ring atoms. The prefix aza, oxa or thia before the heterocyclyl root name means that at

least a nitrogen, oxygen or sulfur atom respectively is present as a ring atom. The heterocyclyl can be optionally substituted by one or more R^{21} substituents which may be the same or different, and are as defined herein. The nitrogen or sulfur atom of the heterocyclyl can be optionally oxidized to the corresponding N-oxide, S-oxide or S,S-dioxide. Non-limiting examples of suitable monocyclic heterocyclyl rings include piperidyl, pyrrolidinyl, piperazinyl, morpholinyl, thiomorpholinyl, thiazolidinyl, 1,3-dioxolanyl, 1,4-dioxanyl, tetrahydrofuranyl, tetrahydrothiophenyl, tetrahydrothiopyranyl, and the like.

"Arylalkyl" means an aryl-alkyl- group in which the aryl and alkyl are as previously described. Preferred aralkyls comprise a lower alkyl group. Non-limiting examples of suitable aralkyl groups include benzyl, 2-phenethyl and naphthalenylmethyl. The bond to the parent moiety is through the alkyl.

"Arylcycloalkyl" means a group derived from a fused aryl and cycloalkyl as defined herein. Preferred arylcycloalkyls are those wherein aryl is phenyl and cycloalkyl consists of about 5 to about 6 ring atoms. The arylcycloalkyl can be optionally substituted by 1-5 R^{21} substituents. Non-limiting examples of suitable arylcycloalkyls include indanyl and 1,2,3,4-tetrahydronaphthyl and the like. The bond to the parent moiety is through a non-aromatic carbon atom.

"Arylheterocycloalkyl" means a group derived from a fused aryl and heterocycloalkyl as defined herein. Preferred arylcycloalkyls are those wherein aryl is phenyl and heterocycloalkyl consists of about 5 to about 6 ring atoms. The arylheterocycloalkyl can be optionally substituted by 1-5 R^{21} substituents. Non-limiting examples of suitable arylheterocycloalkyls include


and


The bond to the parent moiety is through a non-aromatic carbon atom.

Similarly, "heteroarylalkyl" "cycloalkylalkyl" and "heterocycloalkylalkyl" mean a heteroaryl-, cycloalkyl- or heterocycloalkyl-alkyl- group in which the heteroaryl, cycloalkyl, heterocycloalkyl and alkyl are as previously described. It is also understood that the terms "arylcycloalkylalkyl", "heteroarylcycloalkylalkyl", "arylheterocycloalkylalkyl", "heteroarylheterocycloalkylalkyl", "heteroarylcycloalkyl", "heteroarylheterocycloalkyl", "arylcycloalkenyl", "heteroarylcycloalkenyl",

"heterocycloalkenyl", "arylheterocycloalkenyl", "heteroarylheterocycloalkenyl", "cycloalkylaryl", "heterocycloalkylaryl", "heterocycloalkenylaryl", "heterocycloalkylheteroaryl", "cycloalkenylaryl", "cycloalkenylheteroaryl", "heterocycloalkenylheteroaryl" and "heterocycloalkenylaryl" similarly represented by the combination of the groups aryl-, cycloalkyl-, alkyl-, heteroaryl-, heterocycloalkyl-, cycloalkenyl- and heterocycloalkenyl- as previously described. Preferred groups contain a lower alkyl group. The bond to the parent moiety is through the alkyl.

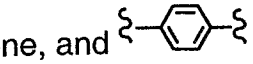
"Acyl" means an H-C(O)-, alkyl-C(O)-, alkenyl-C(O)-, alkynyl-C(O)- or cycloalkyl-C(O)- group in which the various groups are as previously described. The bond to the parent moiety is through the carbonyl. Preferred acyls contain a lower alkyl. Non-limiting examples of suitable acyl groups include formyl, acetyl, propanoyl, 2-methylpropanoyl, butanoyl and cyclohexanoyl.

"Alkoxy" means an alkyl-O- group in which the alkyl group is as previously described. Non-limiting examples of suitable alkoxy groups include methoxy, ethoxy, n-propoxy, isopropoxy, n-butoxy and heptoxy. The bond to the parent moiety is through the ether oxygen.

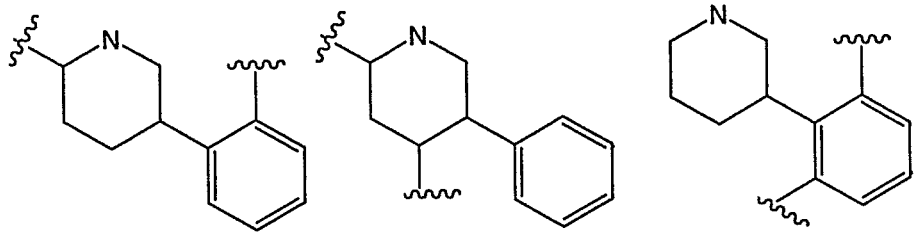
"Alkoxyalkyl" means a group derived from an alkoxy and alkyl as defined herein. The bond to the parent moiety is through the alkyl.

"Arylalkenyl" means a group derived from aryl and alkenyl as defined herein. Preferred arylalkenyls are those wherein aryl is phenyl and the alkenyl consists of about 3 to about 6 atoms. The arylalkenyl can be optionally substituted by one or more R^{27} substituents. The bond to the parent moiety is through a non-aromatic carbon atom.

"Arylalkynyl" means a group derived from aryl and alkynyl as defined herein. Preferred arylalkynyls are those wherein aryl is phenyl and the alkynyl consists of about 3 to about 6 atoms. The arylalkynyl can be optionally substituted by one or more R^{27} substituents. The bond to the parent moiety is through a non-aromatic carbon atom.

The suffix "ene" on alkyl, aryl, hetercycloalkyl, etc. indicates a divalent moiety, e.g., $-CH_2CH_2-$ is ethylene, and  is para-phenylene.

It is understood that multicyclic divalent groups, for example, arylheterocycloalkylene, can be attached to other groups via bonds that are formed on either ring of said group. For example,



The term "optionally substituted" means optional substitution with the specified groups, radicals or moieties, in available position or positions.

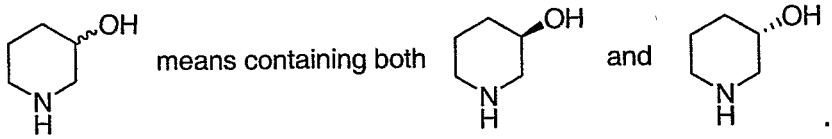
Substitution on a cycloalkylalkyl, heterocycloalkylalkyl, arylalkyl, or heteroarylalkyl moiety includes substitution on the ring portion and/or on the alkyl portion of the group.

When a variable appears more than once in a group, e.g., R^8 in $-N=C(R^8)_2$, or a variable appears more than once in the structure of formula I, e.g., R^{15} may appear in both R^1 and R^3, the variables can be the same or different.

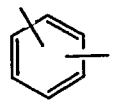
With reference to the number of moieties (e.g., substituents, groups or rings) in a compound, unless otherwise defined, the phrases "one or more" and "at least one" mean that there can be as many moieties as chemically permitted, and the determination of the maximum number of such moieties is well within the knowledge of those skilled in the art. With respect to the compositions and methods comprising the use of "at least one compound of formula I," one to three compounds of formula I can be administered at the same time, preferably one.

As used herein, the term "composition" is intended to encompass a product comprising the specified ingredients in the specified amounts, as well as any product which results, directly or indirectly, from combination of the specified ingredients in the specified amounts.

The wavy line ∿∿∿ as a bond generally indicates a mixture of, or either of, the possible isomers, e.g., containing (R)- and (S)- stereochemistry. For example,

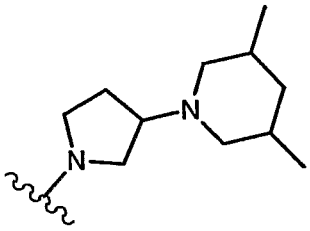


Lines drawn into the ring systems, such as, for example:

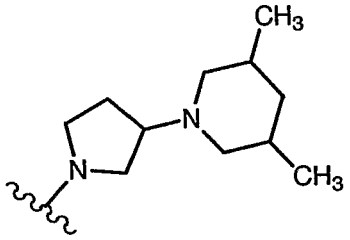


indicate that the indicated line (bond) may be attached to any of the substitutable ring carbon atoms.

As well known in the art, a bond drawn from a particular atom wherein no moiety is depicted at the terminal end of the bond indicates a methyl group bound through that bond to the atom, unless stated otherwise. For example:



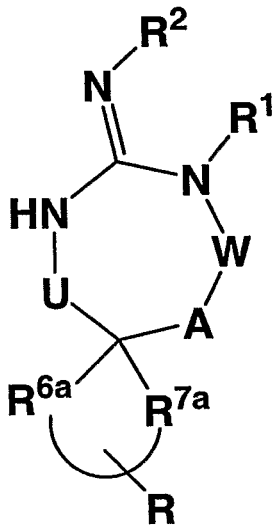
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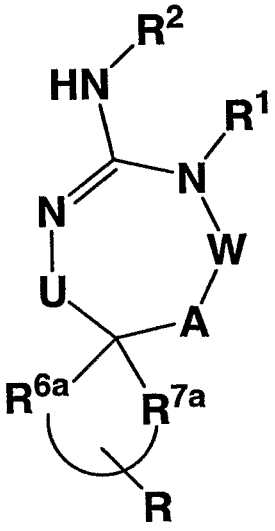
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It should also be noted that any heteroatom with unsatisfied valences in the text, schemes, examples, structural formulae, and any Tables herein is assumed to have the hydrogen atom or atoms to satisfy the valences.

Those skilled in the art will recognize that certain compounds of formula I are tautomeric, and all such tautomeric forms are contemplated herein as part of the present invention.

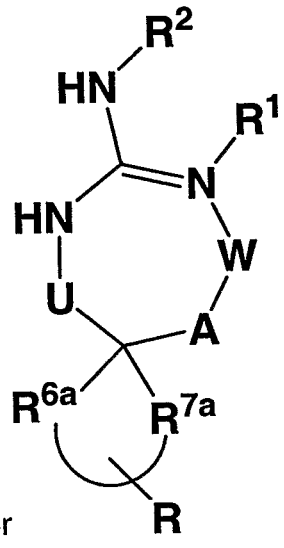


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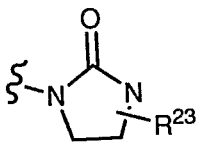
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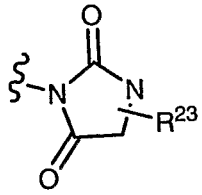
I

.

When, R^8, for example is, $-N(R^{15})S(O)_2N(R^{16})(R^{17})$, and R^{16} and R^{17} form a ring, the moiety formed, is, for example



or



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Prodrugs and solvates of the compounds of the invention are also contemplated herein. A discussion of prodrugs is provided in T. Higuchi and V. Stella, *Pro-drugs as Novel Delivery Systems* (1987) 14 of the A.C.S. Symposium Series, and in *Bioreversible Carriers in Drug Design,* (1987) Edward B. Roche, ed., American Pharmaceutical Association and Pergamon Press. The term "prodrug" means a compound (e.g, a drug precursor) that is transformed *in vivo* to yield a compound of Formula (I) or a pharmaceutically acceptable salt, hydrate or solvate of the compound. The transformation may occur by various mechanisms (e.g., by metabolic or chemical processes), such as, for example, through hydrolysis in blood. A discussion of the use of prodrugs is provided by T. Higuchi and W. Stella, "Pro-drugs as Novel Delivery Systems," Vol. 14 of the A.C.S. Symposium Series, and in Bioreversible Carriers in Drug Design, ed. Edward B. Roche, American Pharmaceutical Association and Pergamon Press, 1987.

For example, if a compound of Formula (I) or a pharmaceutically acceptable salt, hydrate or solvate of the compound contains a carboxylic acid functional group, a prodrug can comprise an ester formed by the replacement of the hydrogen atom of the acid group with a group such as, for example, $(C_1–C_8)$alkyl, $(C_2$-$C_{12})$alkanoyloxymethyl, 1-(alkanoyloxy)ethyl having from 4 to 9 carbon atoms, 1-methyl-1-(alkanoyloxy)-ethyl having from 5 to 10 carbon atoms, alkoxycarbonyloxymethyl having from 3 to 6 carbon atoms, 1-(alkoxycarbonyloxy)ethyl having from 4 to 7 carbon atoms, 1-methyl-1-(alkoxycarbonyloxy)ethyl having from 5 to 8 carbon atoms, N-(alkoxycarbonyl)aminomethyl having from 3 to 9 carbon atoms, 1-(N-(alkoxycarbonyl)amino)ethyl having from 4 to 10 carbon atoms, 3-phthalidyl, 4-crotonolactonyl, gamma-butyrolacton-4-yl, di-N,N-$(C_1$-$C_2)$alkylamino$(C_2$-$C_3)$alkyl (such as β-dimethylaminoethyl), carbamoyl-$(C_1$-$C_2)$alkyl, N,N-di $(C_1$-$C_2)$alkylcarbamoyl-(C1-C2)alkyl and piperidino-, pyrrolidino- or morpholino$(C_2$-$C_3)$alkyl, and the like.

Similarly, if a compound of Formula (I) contains an alcohol functional group, a prodrug can be formed by the replacement of the hydrogen atom of the alcohol group with a group such as, for example, (C_1-C_6)alkanoyloxymethyl, 1-((C_1-C_6)alkanoyloxy)ethyl, 1-methyl-1-((C_1-C_6)alkanoyloxy)ethyl, (C_1-C_6)alkoxycarbonyloxymethyl, N-(C_1-C_6)alkoxycarbonylaminomethyl, succinoyl, (C_1-C_6)alkanoyl, α-amino(C_1-C_4)alkanyl, arylacyl and α-aminoacyl, or α-aminoacyl-α-aminoacyl, where each α-aminoacyl group is independently selected from the naturally occurring L-amino acids, $P(O)(OH)_2$, $-P(O)(O(C_1-C_6)alkyl)_2$ or glycosyl (the radical resulting from the removal of a hydroxyl group of the hemiacetal form of a carbohydrate), and the like.

If a compound of Formula (I) incorporates an amine functional group, a prodrug can be formed by the replacement of a hydrogen atom in the amine group with a group such as, for example, R-carbonyl, RO-carbonyl, NRR'-carbonyl where R and R' are each independently (C_1-C_{10})alkyl, (C_3-C_7) cycloalkyl, benzyl, or R-carbonyl is a natural α-aminoacyl or natural α-aminoacyl, —C(OH)C(O)OY^1 wherein Y^1 is H, (C_1-C_6)alkyl or benzyl, —$C(OY^2)Y^3$ wherein Y^2 is (C_1-C_4) alkyl and Y^3 is (C_1-C_6)alkyl, carboxy (C_1-C_6)alkyl, amino(C_1-C_4)alkyl or mono-N—or di-N,N-(C_1-C_6)alkylaminoalkyl, —$C(Y^4)Y^5$ wherein Y^4 is H or methyl and Y^5 is mono-N— or di-N,N-(C_1-C_6)alkylamino morpholino, piperidin-1-yl or pyrrolidin-1-yl, and the like.

"Solvate" means a physical association of a compound of this invention with one or more solvent molecules. This physical association involves varying degrees of ionic and covalent bonding, including hydrogen bonding. In certain instances the solvate will be capable of isolation, for example when one or more solvent molecules are incorporated in the crystal lattice of the crystalline solid. "Solvate" encompasses both solution-phase and isolatable solvates. Non-limiting examples of suitable solvates include ethanolates, methanolates, and the like. "Hydrate" is a solvate wherein the solvent molecule is H_2O.

"Effective amount" or "therapeutically effective amount" is meant to describe an amount of compound or a composition of the present invention effective in inhibiting aspartyl protease and/or inhibiting BACE-1 and thus producing the desired therapeutic effect in a suitable patient.

The compounds of formula I form salts which are also within the scope of this invention. Reference to a compound of formula I herein is understood to include

reference to salts thereof, unless otherwise indicated. The term "salt(s)", as employed herein, denotes acidic salts formed with inorganic and/or organic acids, as well as basic salts formed with inorganic and/or organic bases. In addition, when a compound of formula I contains both a basic moiety, such as, but not limited to a pyridine or imidazole, and an acidic moiety, such as, but not limited to a carboxylic acid, zwitterions ("inner salts") may be formed and are included within the term "salt(s)" as used herein. Pharmaceutically acceptable (i.e., non-toxic, physiologically acceptable) salts are preferred, although other salts are also useful. Salts of the compounds of the formula I may be formed, for example, by reacting a compound of formula I with an amount of acid or base, such as an equivalent amount, in a medium such as one in which the salt precipitates or in an aqueous medium followed by lyophilization. Acids (and bases) which are generally considered suitable for the formation of pharmaceutically useful salts from basic (or acidic) pharmaceutical compounds are discussed, for example, by S. Berge *et al, Journal of Pharmaceutical Sciences* (1977) 66(1) 1-19; P. Gould, *International J. of Pharmaceutics* (1986) 33 201-217; Anderson *et al, The Practice of Medicinal Chemistry* (1996), Academic Press, New York; in *The Orange Book* (Food & Drug Administration, Washington, D.C. on their website); and P. Heinrich Stahl, Camille G. Wermuth (Eds.), *Handbook of Pharmaceutical Salts: Properties, Selection, and Use*, (2002) Int'l. Union of Pure and Applied Chemistry, pp. 330-331. These disclosures are incorporated herein by reference thereto.

Exemplary acid addition salts include acetates, adipates, alginates, ascorbates, aspartates, benzoates, benzenesulfonates, bisulfates, borates, butyrates, citrates, camphorates, camphorsulfonates, cyclopentanepropionates, digluconates, dodecylsulfates, ethanesulfonates, fumarates, glucoheptanoates, glycerophosphates, hemisulfates, heptanoates, hexanoates, hydrochlorides, hydrobromides, hydroiodides, 2-hydroxyethanesulfonates, lactates, maleates, methanesulfonates, methyl sulfates, 2-naphthalenesulfonates, nicotinates, nitrates, oxalates, pamoates, pectinates, persulfates, 3-phenylpropionates, phosphates, picrates, pivalates, propionates, salicylates, succinates, bisulfates, sulfates, sulfonates (such as those mentioned herein), tartarates, thiocyanates, toluenesulfonates (also known as tosylates,) undecanoates, and the like.

Exemplary basic salts include ammonium salts, alkali metal salts such as sodium, lithium, and potassium salts, alkaline earth metal salts such as calcium and magnesium salts, aluminum salts, zinc salts, salts with organic bases (for example, organic amines) such as benzathines, diethylamine, dicyclohexylamines, hydrabamines (formed with N,N-bis(dehydroabietyl)ethylenediamine), N-methyl-D-glucamines, N-methyl-D-glucamides, t-butyl amines, piperazine, phenylcyclohexylamine, choline, tromethamine, and salts with amino acids such as arginine, lysine and the like. Basic nitrogen-containing groups may be quarternized with agents such as lower alkyl halides (e.g. methyl, ethyl, propyl, and butyl chlorides, bromides and iodides), dialkyl sulfates (e.g. dimethyl, diethyl, dibutyl, and diamyl sulfates), long chain halides (e.g. decyl, lauryl, myristyl and stearyl chlorides, bromides and iodides), aralkyl halides (e.g. benzyl and phenethyl bromides), and others.

All such acid salts and base salts are intended to be pharmaceutically acceptable salts within the scope of the invention and all acid and base salts are considered equivalent to the free forms of the corresponding compounds for purposes of the invention.

All stereoisomers (for example, geometric isomers, optical isomers and the like) of the present compounds (including those of the salts, solvates and prodrugs of the compounds as well as the salts and solvates of the prodrugs), such as those which may exist due to asymmetric carbons on various substituents, including enantiomeric forms (which may exist even in the absence of asymmetric carbons), rotameric forms, atropisomers, and diastereomeric forms, are contemplated within the scope of this invention. Individual stereoisomers of the compounds of the invention may, for example, be substantially free of other isomers, or may be admixed, for example, as racemates or with all other, or other selected, stereoisomers. The chiral centers of the present invention can have the S or R configuration as defined by the *IUPAC* 1974 Recommendations. The use of the terms "salt", "solvate", "prodrug" and the like, is intended to equally apply to the salt, solvate and prodrug of enantiomers, stereoisomers, rotamers, tautomers, racemates or prodrugs of the inventive compounds.

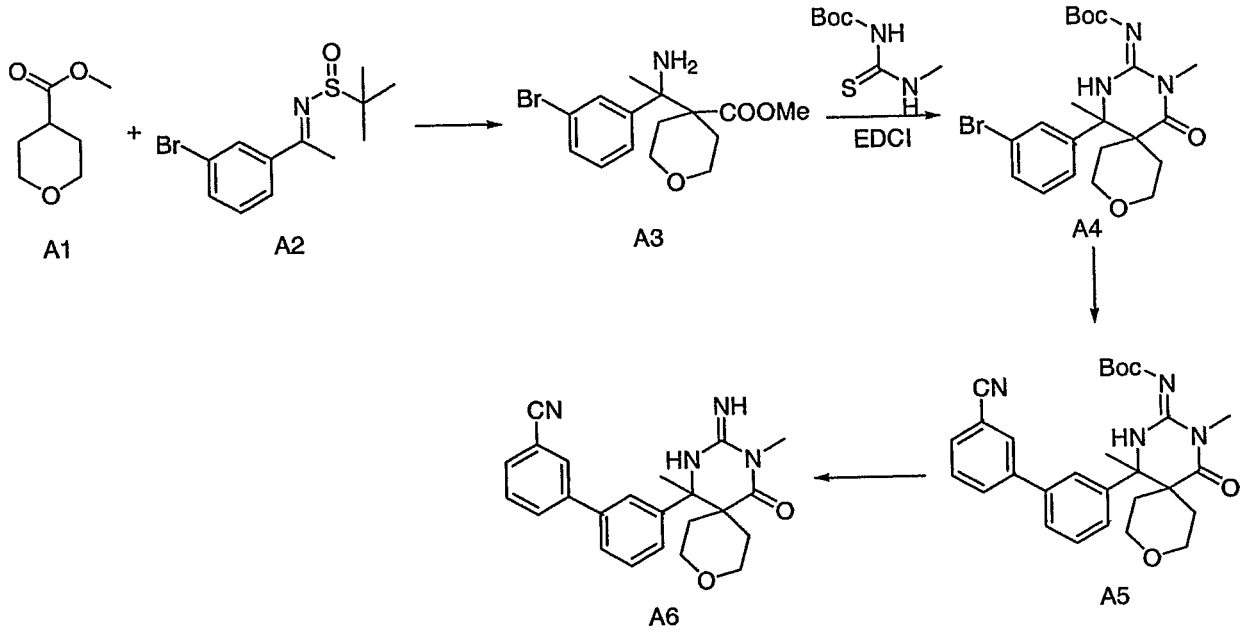
Polymorphic forms of the compounds of formula I, and of the salts, solvates and prodrugs of the compounds of formula I, are intended to be included in the present invention

Compounds of formula I can be made using procedures known in the art. The following reaction schemes show typical procedures, but those skilled in the art will recognize that other procedures can also be suitable.

In the Schemes and in the Example below, the following abbreviations are used:

high pressure liquid chromatography: HPLC
reverse-phase HPLC: RP-HPLC
liquid chromatography mass spectrometry: LCMS
mass spectrometry: MS
polytetrafluoroethylene: PTFE
hour: h
minute: min
retention time: tR
room temperature: r.t.
DMF; dimethylformamide
Et; ethyl
DIEA; diisopropylethylamine
EtOAc; ethylacetate
TEOC; trimethylsilylethoxycarbonyl
TBAF; tetrabutylammonium fluoride
TFA; trifluoroacetic acid
THF; tetrahydrofuran
LDA; lithium diisopropylamide

Method A



Method A, Step 1;

A literature procedure is adapted (Tang, T. et.al Journal of Organic Chemistry (2002), 67(22), 7819-7832).

To a solution of (R)-(+)-2-methyl-2-propane sulfinamide (1.0 g, 8.3 mmol, 1 eq) and m-bromoacetophenone (9.1 mmol) in anhydrous THF (30 mL) at room temperature is added $Ti(OEt)_4$ (7 mL, 17 mmol, 2 eq). The mixture is heated at 70 °C for 24 h. After cooling to room temperature, the mixture is poured into 30 mL of brine under vigourous stirring. The resulting suspension is filtered through a pad of Celite and the solid is washed with EtOAc (2 x 20 mL). The filtrate is washed with brine (30 mL), dried (Na_2SO_4), and concentrated in vacuo. The residue is chromatographed on silica by eluting with hexane/Et_2O (5:1) to give A2.

To a solution of methyl 4-tetrahydropyranylcarboxylate (6.9 mmol, 2 eq) in THF (5 mL), LDA (2M in heptane/THF, 3.4 mL, 6.9 mmol, 2 eq) is added dropwise via a syringe at -78 °C. After stirring at -78 °C for 30 min, a solution of $ClTi(Oi\text{-}Pr)_3$ (1.8 mL, 7.6 mmol, 2.2 eq) in THF (5 mL) is added dropwise. After stirring for another 30 min, a solution of A2 (3.4 mmol, 1 eq) in THF (2 mL) is added dropwise via a syringe. The mixture is stirred at -78 °C for 3 h. A saturated aqueous solution of NH_4Cl (10 eq) is added and the suspension is warmed to room temperature. The mixture is diluted with H_2O (50 mL) and

stirred for 10 min. The mixture is then partitioned between H_2O (50 mL) and EtOAc (50 mL). The organic layer is separated and the aqueous layer is extracted with EtOAc (3 x 50 mL). The combined organic layers are washed with brine, dried ($MgSO_4$) and concentrated to give a brown oil. Chromatography on silica gel using 50% EtOAc/hexanes as eluent give a product which is dissolved in 12 mL of MeOH followed by addition of 16 mL of 4N HCl/dioxane. After stirring for 30 min, the volatiles are removed in vacuo. The residue is re-dissolved in MeOH (6 mL), stirred for 5 min, and evaporated again to afford A3.

Method A, Step 2:

To a solution of an HCl salt of A3 in DMF (2 mL) at RT and N-methyl-N'-Boc-thiourea is added DIEA (4 eq) and 1-[3-(dimethylamino)propyl]-3-ethylcarbodiimide HCl (EDCI, 1.4 eq). After stirring at RT for 16 h, the mixture is diluted with EtOAc (10 mL), washed with brine, dried ($MgSO_4$), and filtered. The filtrate is evaporated under reduced pressure to afford a crude product which is purified using silica gel chromatography by eluting with 20% EtOAc/hexanes to give A4.

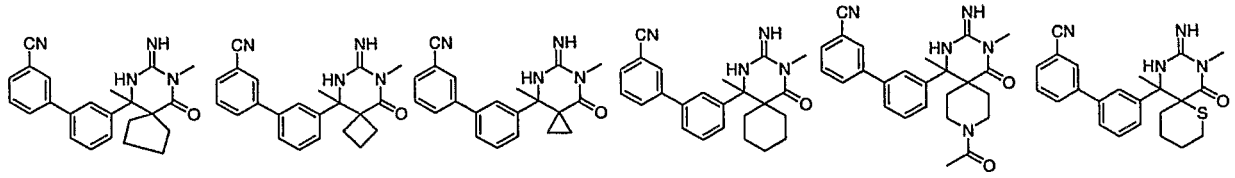
Method A, Step 3.

A mixture of A4, 3-Cyanophenylboronic acid, Fibrecat (4.26% of Pd, 0.7 g) and 1N aq. K_2CO_3 (0.5 mL) in tert-butanol (10 mL) is heated in an microwave oven at 110 °C for 15 min. After cooling, the reaction mixture is transferred to a pre-packed Si-Carbonate column and eluted with MeOH/CH_2Cl_2 (1:1). The eluant is collected and concentrated under reduced pressure to give B5 as a crude product which is purified by silica gel chromatography (20-50% EtOAc/hexanes gradient) to give A5.

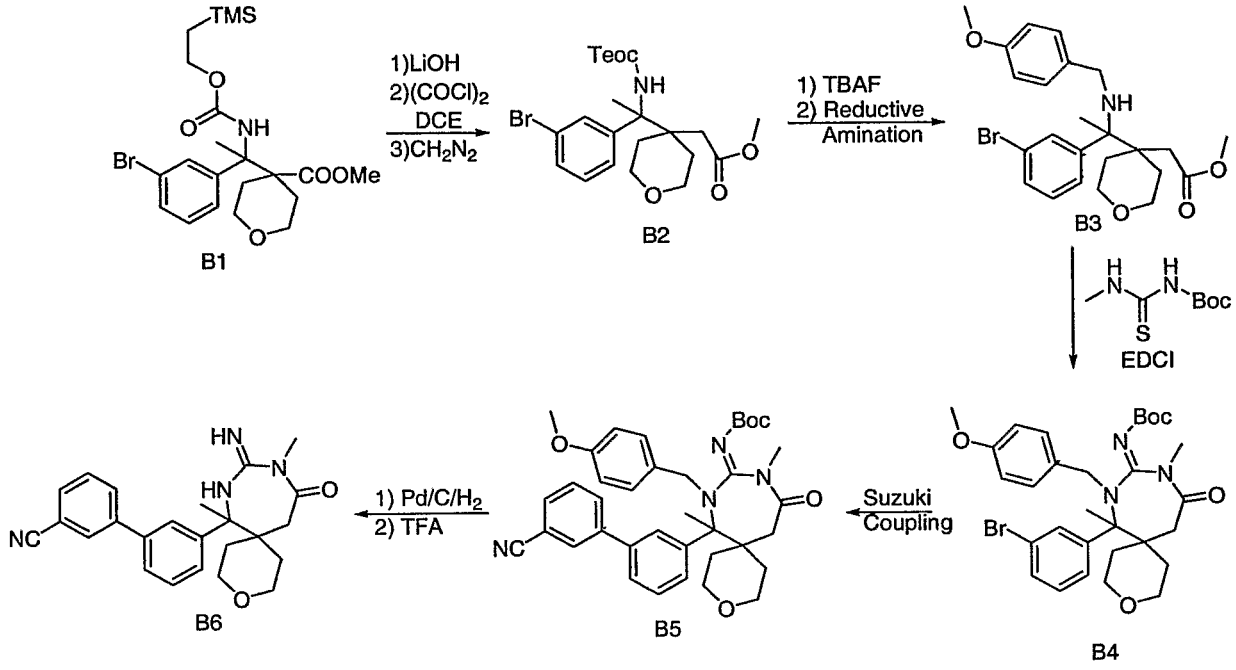
Method A, Step 4.

A5 is treated with 1 mL of 30%TFA/CH_2Cl_2 at RT for 30 min. The volatiles are removed in vacuo. The residue is redissolved in acetonitrile (5 mL) and evaporated again to afford the crude product. The crude product is purified via reverse phase HPLC to provide A6.

The following compounds can be made using procedures similar to Method A.



Method B.



Method B, Step 1.

Compound B1, which is obtained using a similar method as in Method A step 1 after TEOC protection of the aminogroup, is hydrolyzed to the corresponding carboxylic acid which is subsequently converted to acid chloride. Treatment of the acid chloride with diazomethane lead to compound B2 after rearrangement and reaction with MeOH.

Method B, Step 2;

Compound B2 is deprotected using 1 M TBAF in THF followed by reductive amination using p-methoxybenzaldehyde to give B3.

Method B, Step 3;

Compound B4 is obtained using a procedure similar to Method A step 2 using B3 as the starting material.

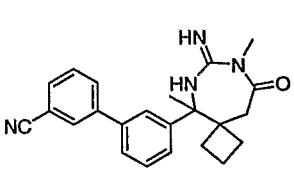
Method B, Step 4.

Compound B5 can be obtained using a procedure similar to Method A step 3 using B4 as the starting material

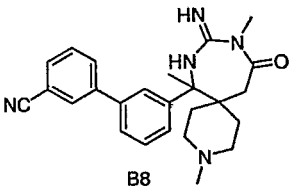
Method B, Step 5.

Compound B6 can be obtained through debenzylation of B5 using a Pd/C hydrogenation condition following by TFA treatment to remove the boc group.

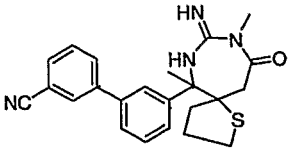
The following compounds can be synthesized using similar procedures



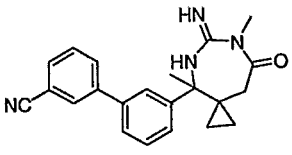
B7



B8

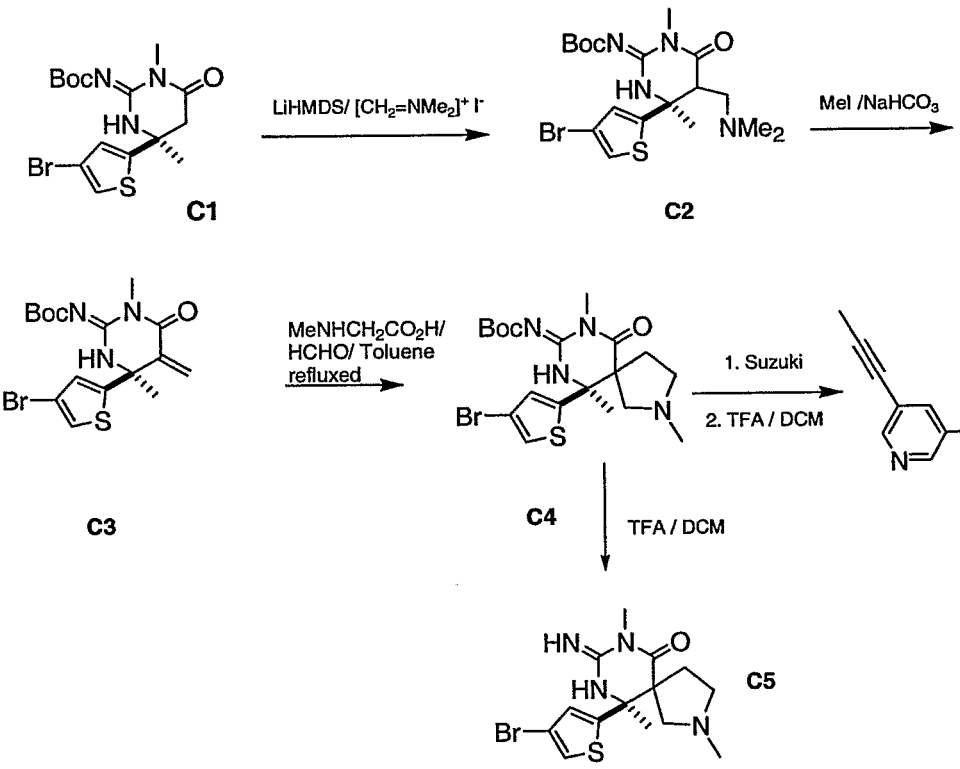


B9



B10

Method C.



Method C, Step 1 and 2,

The synthesis was adapted from the synthetic procedure by Pedregal *et. al.Tetrahedron: Asymmetry* **1994**, *5*, 921-926. Thus, to a solution of (S)-tert-butyl 4-(4-bromothiophen-2-yl)-1,4-dimethyl-6-oxo-tetrahydropyrimidin-2(1H)-ylidenecarbamate (**C1,** 1.0 g, 2.48 mmol) in anhydrous THF (7 mL) at -70 °C was added dropwise a solution of LiHMDS (1M, 5 mL, 2 eq, 4.96 mmol) in THF. After stirring at -78 °C for 40 min, N, N-dimethylmethylene iminium iodide (Eschenmoser's

salt, 0.92 g, 4.96 mmol) was added. The reaction mixture was allowed to warm up to rt and stirred for 16 h. The resulting reaction mixture was diluted with water (15 mL) and extracted with ethyl acetate (3 X 50 mL). The organic layers were combined, washed with brine, dried ($MgSO_4$), and concentrated *in vacuo* to give a crude product mixture containing **C2** which was dissolved in methanol (8.0 mL), followed by addition of MeI (5.7 mL). The reaction mixture was stirred at rt for 16 h followed by evaporation of solvent. The residue was partitioned between saturated $NaHCO_3$ (10 mL) and EtOAc (15 mL) and the organic layer was separated, washed with brine, dried ($MgSO_4$). The solution was concentrated to give a yellow oil which was purified by column chromatography using 1:1 EtOAc/Hexane as eluent to give 0.88 g (85%) of (S)-tert-butyl 4-(4-bromothiophen-2-yl)-1,4-dimethyl-5-methylene-6-oxo-tetrahydropyrimidin-2(1H)-ylidenecarbamate **C3** as a yellow oil. ^{1}HNMR ($CDCl_3$, 300 MHz): δ 7.14 (s, 1H), 6.8 (s, 1H), 6.49 (s, 1H), 5.73 (s, 1H), 3.29 (s, 3H), 1.86 (s, 3H), 1.52 (br s, 9H). MS (ESI): MH^+ = 415.6; MH^++1 = 416.6; M^+ - 55 = 359.9;

Method C, Step 3,

The synthesis was adapted from the synthetic procedure by Raghunathan *et. al.Synthesis Communication* **2003**, *33*, 1131-1139. Thus, to a flask fitted with reflux condenser and Deans-Stark trap, a solution of sarcosine (0.21, 2.8 mmol, 2.7 eq), paraformaldehyde (0.42 g, 7.1 mmol, 6.7 eq), and (S)-tert-butyl 4-(4-bromothiophen-2-yl)-1,4-dimethyl-5-methylene-6-oxo-tetrahydropyrimidin-2(1H)-ylidenecarbamate **C3** (0.6 g, 1.45 mmol, 1 eq) was heated under reflux in anhydrous Toluene (50 mL) for 24h. The solvent was evaporated and the residue purified by column chromatography using gradient of 1:2 EtOAc/Hexane to EtOAc/MeOH 9:1 as eluent to give 0.23 g (47%) of (R)-4-(3-bromo thiophen-2-yl)-2-tert-butyloxycarbamimino-1,4-dimethyl-6-oxo-1,3,8-diazaspiro[5.5]decane-8-methyl **C4** as a yellow oil. ^{1}HNMR ($CDCl_3$, 300 MHz): δ 7.48 (m, 2H), 7.23 (m, 1H), 6.88 (m, 1H), 3.4-3.12 (m, 5H), 3.07 (m, 1H), 2.75 (m, 1H), 2.58-2.52 (m2H), 2.49-2.44 (m, 5H), 2.14-1.82 (m, 9H). MS (ESI): MH^+= 473.9.

Method C, Step 4,

(R)-4-(3-bromo thiophen-2-yl)-2-tert-butyloxycarbamimino-1,4-dimethyl-6-oxo-1,3,8-triazaspiro[5.5]decane (**C4,** 0.045 g, 0.095 mmol) was treated with 1 mL of 30%

TFA/CH_2Cl_2 at room temperature for 3h. The solvent was evaporated and the residue was purified by reverse phase preparative HPLC to give 0.008 g (25%) of (R)-4-(3-bromo thiophen-2-yl)-2-imino-1,4-dimethyl-6-oxo-1,3,8-triazaspiro[5.5]decane **C5** as a white solid. ^{1}HNMR ($CDCl_3$, 300 MHz): δ 7.4 (m, 1H), 7.03 (m, 1H), 4.17 (m, 1H), 3.80-3.49 (m, 3H), 3.47 (s, 3H), 3.32 (m, 1H), 2.98 (br s, 3H), 2.66-2.60 (m, 1H), 2.56-2.49 (m,1H), 1.90 (s, 3H). MS (ESI): MH^+= 373.1. HPLC (A) t_R = 4.13 min.

Method C, Step 5,

A mixture of (R)-4-(3-bromophenyl)-2-tert-butyloxycarbamimino-1,4-dimethyl-6-oxo-1,3,8-triazaspiro[5.5]decane (**C4,** 0.05 g, 0.11 mmol) in t-butanol (1 mL), 5-(prop-1-ynyl)pyridin-3-ylboronic acid (0.033 g, 0.021 mmol), Pd $(PPh_3)_4$ (0.011 g, 8 mol%), and K_2CO_3 (1M in H_2O, 0.28 mL, 0.28 mmol) was heated in a microwave synthesizer at 110 °C for 15 min. The solvent was evaporated and the brown residue was treated with 2 mL of 30% TFA/CH_2Cl_2 at room temperature for 3h. The solvent was evaporated and the crude product was purified by reverse phase preparative HPLC to yield 0.012 g (25%) (R)-4-(5-(prop-1-ynyl)pyridin-3-yl)thiophen-2-yl)-2-imino-1,4-dimethyl-6-oxo-1,3,8-triazaspiro[5.5]decane-8-methyl (**C6**) as a white solid. ^{1}HNMR ($CDCl_3$, 300 MHz): δ 8.9 (br s, 1H), 8.53 (br s, 1H), 8.23 (s, 1H), 7.77(br s, 1H), 7.54 (br s, 1H), 3.93 (m, 2H), 3.61 (m, 2H), 3.40 (s, 3H), 3.33 (m, 1H), 3.17 (m, 1H), 2.87 (br s, 3H), 2.71-2.69 (m, 1H), 2.48-2.44 (m, 1H), 2.09 (br s, 3H), 1.85 (br s, 3H). MS (ESI): MH^+= 408.2.

t.

Human Cathepsin D FRET assay.

The substrate used below has been described **(Y.Yasuda et al., J. Biochem. , 125, 1137 (1999))**. Substrate and enzyme are commercially available.

The assay can be run in a 30 µl final volume using a 384 well Nunc black plate. 8 concentrations of compound can be pre-incubated with enzyme for 30 mins at 37° C followed by addition of substrate with continued incubation at 37° C for 45 mins. The rate of increase in fluorescence is linear for over 1h and is measured at the end of the incubation period using a Molecular Devices FLEX station plate reader. Kis are interpolated from the IC_{50}s using a Km value of 4 µM and the substrate concentration of 2.5 µM.

Reagents

Na-Acetate pH 5

1% Brij-35 from 10% stock (Calbiochem)

DMSO

Purified (>95%) human liver Cathepsin D (Athens Research & Technology Cat# 16-12-030104)

Peptide substrate(Km=4uM) Mca-Gly-Lys-Pro-Ile-Leu-Phe-Phe-Arg-Leu-Lys(Dnp)-D-Arg-NH_2 Bachem Cat # M-2455

Pepstatin is used as a control inhibitor (Ki~0.5 nM) and is available from Sigma.

Nunc 384 well black plates

Final Assay buffer conditions

100 mM Na Acetate pH 5.0

0.02% Brij-35

1% DMSO

Compound can be diluted to 3x final concentration in assay buffer containing 3% DMSO. 10 µl of compound will be added to 10 µl of 2.25 nM enzyme (3x) diluted in assay buffer without DMSO, mixed briefly, spun, and can be incubated at 37° C for 30 mins. 3x substrate (7.5 µM) is prepared in 1x assay buffer without DMSO. 10 µl of substrate will be added to each well mixed and spun briefly to initiate the reaction. Assay plates can be incubated at 37 C for 45 mins and read on 384 compatible fluorescence plate reader using a 328 nm Ex and 393 nm Em.

BACE-1 Cloning, Protein Expression and Purification.

A predicted soluble form of human BACE1 (sBACE1, corresponding to amino acids 1-454) can be generated from the full length BACE1 cDNA (full length human BACE1 cDNA in pCDNA4/mycHisA construct; University of Toronto) by PCR using the advantage-GC cDNA PCR kit (Clontech, Palo Alto, CA). A HindIII/PmeI fragment from pCDNA4-sBACE1myc/His can be blunt ended using Klenow and subcloned into the Stu I site of pFASTBACI(A) (Invitrogen). A sBACE1mycHis recombinant bacmid can be generated by transposition in DH10Bac cells(GIBCO/BRL). Subsequently, the

sBACE1mycHis bacmid construct can be transfected into sf9 cells using CellFectin (Invitrogen, San Diego, CA) in order to generate recombinant baculovirus. Sf9 cells are grown in SF 900-II medium (Invitrogen) supplemented with 3% heat inactivated FBS and 0.5X penicillin/streptomycin solution (Invitrogen). Five milliliters of high titer plaque purified sBACEmyc/His virus is used to infect 1L of logarithmically growing sf9 cells for 72 hours. Intact cells are pelleted by centrifugation at 3000xg for 15 minutes. The supernatant, containing secreted sBACE1, is collected and diluted 50% v/v with 100 mM HEPES, pH 8.0. The diluted medium is loaded onto a Q-sepharose column. The Q-sepharose column is washed with Buffer A (20 mM HEPES, pH 8.0, 50 mM NaCl).

Proteins, can be eluted from the Q-sepharose column with Buffer B (20 mM HEPES, pH 8.0, 500 mM NaCl). The protein peaks from the Q-sepharose column are pooled and loaded onto a Ni-NTA agarose column. The Ni-NTA column can be then washed with Buffer C (20 mM HEPES, pH 8.0, 500 mM NaCl). Bound proteins are then eluted with Buffer D (Buffer C+250 mM imidazole). Peak protein fractions as determined by the Bradford Assay (Biorad, CA) are concentrated using a Centricon 30 concentrator (Millipore). sBACE1 purity is estimated to be ~90% as assessed by SDS-PAGE and Commassie Blue staining. N-terminal sequencing indicates that greater than 90% of the purified sBACE1 contained the prodomain; hence this protein is referred to as sproBACE1.

Peptide Hydrolysis Assay.

The inhibitor, 25 nM EuK-biotin labeled APPsw substrate (EuK-KTEEISEVNLDAEFRHDKC-biotin; CIS-Bio International, France), 5 μM unlabeled APPsw peptide (KTEEISEVNLDAEFRHDK; American Peptide Company, Sunnyvale, CA), 7 nM sproBACE1, 20 mM PIPES pH 5.0, 0.1%Brij-35 (protein grade, Calbiochem, San Diego, CA), and 10% glycerol are preincubated for 30 min at 30° C. Reactions are initiated by addition of substrate in a 5 μl aliquot resulting in a total volume of 25 μl. After 3 hr at 30° C reactions are terminated by addition of an equal volume of 2x stop buffer containing 50 mM Tris-HCl pH 8.0, 0.5 M KF, 0.001% Brij-35, 20 μg/ml SA-XL665 (cross-linked allophycocyanin protein coupled to streptavidin; CIS-Bio International, France) (0.5 μg/well). Plates are shaken briefly and spun at 1200xg for 10 seconds to pellet all liquid to the bottom of the plate before the

incubation. HTRF measurements are made on a Packard Discovery® HTRF plate reader using 337 nm laser light to excite the sample followed by a 50 μs delay and simultaneous measurements of both 620 nm and 665 nm emissions for 400 μs.

IC_{50} determinations for inhibitors, (*I*), are determined by measuring the percent change of the relative fluorescence at 665 nm divided by the relative fluorescence at 620 nm, (665/620 ratio), in the presence of varying concentrations of *I* and a fixed concentration of enzyme and substrate. Nonlinear regression analysis of this data can be performed using GraphPad Prism 3.0 software selecting four parameter logistic equation, that allows for a variable slope. Y=Bottom + (Top-Bottom)/ (1+10^((LogEC50-X)*Hill Slope)); X is the logarithm of concentration of I, Y is the percent change in ratio and Y starts at bottom and goes to top with a sigmoid shape.

Human mature Renin enzyme assay:

Human Renin can be cloned from a human kidney cDNA library and C-terminally epitope-tagged with the V5-6His sequence into pCDNA3.1. pCNDA3.1-Renin-V5-6His is stably expressed in HEK293 cells and purified to >80% using standard Ni-Affinity chromatography. The prodomain of the recombinant human renin-V5-6His can be removed by limited proteolysis using immobilized TPCK-trypsin to give mature-human renin. Renin enzymatic activity can be monitored using a commercially available fluorescence resonance energy transfer (FRET) peptide substrate, RS-1 (Molecular Probes, Eugene, OR) in 50 mM Tris-HCl pH 8.0, 100 mM NaCl, 0.1%Brij-35 and 5% DMSO buffer for 40 mins at 30 °celsius in the presence or absence of different concentrations of test compounds. Mature human Renin is present at approximately 200 nM. Inhibitory activity is defined as the percent decrease in renin induced fluorescence at the end of the 40 min incubation compared to vehicle controls and samples lacking enzyme.

In the aspect of the invention relating to a combination of at least one compound of formula I with at least one cholinesterase inhibitor, acetyl- and/or butyrylcholinesterase inhibitors can be used. Examples of cholinesterase inhibitors are tacrine, donepezil, rivastigmine, galantamine, pyridostigmine and neostigmine, with tacrine, donepezil, rivastigmine and galantamine being preferred. Preferably, these combinations are directed to the treatment of Alzheimer's Disease.

In one aspect of the invention, a combination of at least one compound of formula I with at least one muscarinic m_1 agonist or m_2 antagonist can be used. Examples of m_1 agonists are known in the art. Examples of m_2 antagonists are also known in the art; in particular, m_2 antagonists are disclosed in US patents 5,883,096; 6,037,352; 5,889,006; 6,043,255; 5,952,349; 5,935,958; 6,066,636; 5,977,138; 6,294,554; 6,043,255; and 6,458,812; and in WO 03/031412, all of which are incorporated herein by reference.

In other aspects of the invention relating to a combination of at least one compound of formula I and at least one other agent, for example a beta secretase inhibitor; a gamma secretase inhibitor; an HMG-CoA reductase inhibitor such as atorvastatin, lovastatin, simvastatin, pravastatin, fluvastatin and rosuvastatin; non-steroidal anti-inflammatory agents such as, but not necessarily limited to ibuprofen, relafen or naproxen; N-methyl-D-aspartate receptor antagonists such as memantine; anti-amyloid antibodies including humanized monoclonal antibodies; vitamin E; nicotinic acetylcholine receptor agonists; CB1 receptor inverse agonists or CB1 receptor antagonists; antibiotics such as doxycycline; growth hormone secretagogues; histamine H3 antagonists; AMPA agonists; PDE4 inhibitors; $GABA_A$ inverse agonists; inhibitors of amyloid aggregation; glycogen synthase kinase beta inhibitors; promoters of alpha secretase activity. Preferably, these combinations are directed to the treatment of Alzheimer's Disease.

For preparing pharmaceutical compositions from the compounds described by this invention, inert, pharmaceutically acceptable carriers can be either solid or liquid. Solid form preparations include powders, tablets, dispersible granules, capsules, cachets and suppositories. The powders and tablets may be comprised of from about 5 to about 95 percent active ingredient. Suitable solid carriers are known in the art, e.g. magnesium carbonate, magnesium stearate, talc, sugar or lactose. Tablets, powders, cachets and capsules can be used as solid dosage forms suitable for oral administration. Examples of pharmaceutically acceptable carriers and methods of manufacture for various compositions may be found in A. Gennaro (ed.), Remington's Pharmaceutical Sciences, 18th Edition, (1990), Mack Publishing Co., Easton, Pennsylvania.

Liquid form preparations include solutions, suspensions and emulsions. As an example may be mentioned water or water-propylene glycol solutions for parenteral

injection or addition of sweeteners and opacifiers for oral solutions, suspensions and emulsions. Liquid form preparations may also include solutions for intranasal administration.

Aerosol preparations suitable for inhalation may include solutions and solids in powder form, which may be in combination with a pharmaceutically acceptable carrier, such as an inert compressed gas, e.g. nitrogen.

Also included are solid form preparations which are intended to be converted, shortly before use, to liquid form preparations for either oral or parenteral administration. Such liquid forms include solutions, suspensions and emulsions.

The compounds of the invention may also be deliverable transdermally. The transdermal compositions can take the form of creams, lotions, aerosols and/or emulsions and can be included in a transdermal patch of the matrix or reservoir type as are conventional in the art for this purpose.

Preferably the compound is administered orally.

Preferably, the pharmaceutical preparation is in a unit dosage form. In such form, the preparation is subdivided into suitably sized unit doses containing appropriate quantities of the active component, e.g., an effective amount to achieve the desired purpose.

The quantity of active compound in a unit dose of preparation may be varied or adjusted from about 1 mg to about 100 mg, preferably from about 1 mg to about 50 mg, more preferably from about 1 mg to about 25 mg, according to the particular application.

The actual dosage employed may be varied depending upon the requirements of the patient and the severity of the condition being treated. Determination of the proper dosage regimen for a particular situation is within the skill of the art. For convenience, the total daily dosage may be divided and administered in portions during the day as required.

The amount and frequency of administration of the compounds of the invention and/or the pharmaceutically acceptable salts thereof will be regulated according to the judgment of the attending clinician considering such factors as age, condition and size of the patient as well as severity of the symptoms being treated. A typical recommended daily dosage regimen for oral administration can range from about 1

mg/day to about 300 mg/day, preferably 1 mg/day to 50 mg/day, in two to four divided doses.

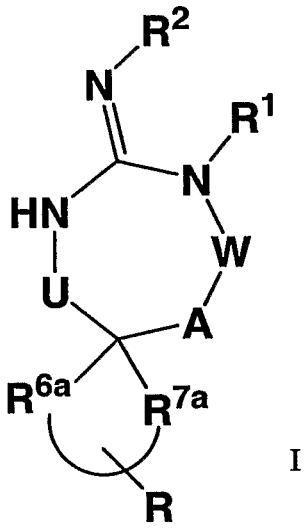
When a compound of formula I is used in combination with a cholinesterase inhibitor to treat cognitive disorders, these two active components may be co-administered simultaneously or sequentially, or a single pharmaceutical composition comprising a compound of formula I and a cholinesterase inhibitor in a pharmaceutically acceptable carrier can be administered. The components of the combination can be administered individually or together in any conventional oral or parenteral dosage form such as capsule, tablet, powder, cachet, suspension, solution, suppository, nasal spray, etc. The dosage of the cholinesterase inhibitor can be determined from published material, and may range from 0.001 to 100 mg/kg body weight.

When separate pharmaceutical compositions of a compound of formula I and a cholinesterase inhibitor are to be administered, they can be provided in a kit comprising in a single package, one container comprising a compound of formula I in a pharmaceutically acceptable carrier, and a separate container comprising a cholinesterase inhibitor in a pharmaceutically acceptable carrier, with the compound of formula I and the cholinesterase inhibitor being present in amounts such that the combination is therapeutically effective. A kit is advantageous for administering a combination when, for example, the components must be administered at different time intervals or when they are in different dosage forms.

While the present invention has been described in conjunction with the specific embodiments set forth above, many alternatives, modifications and variations thereof will be apparent to those of ordinary skill in the art. All such alternatives, modifications and variations are intended to fall within the spirit and scope of the present invention.

We claim:

1. A compound having the structural formula



I

or a pharmaceutically acceptable salt or solvate thereof, wherein

W is a bond, -C(=S)-, –S(O)-, -S(O)$_2$-, -C(=O)-, -O-, -C(R^6)(R^7)-, -N(R^5)- or –C(=N(R^5))-;

U is a bond, -N(R^5)-, -(C(R^6)(R^7))- or -(C(R^6)(R^7))(C(R^6)(R^7))-;

A is a bond or -(C(R^3)(R^4))-;

R is 1-5 substituents independently selected from the group consisting of H, alkyl, arylalkyl, heteroarylalkyl, cycloalkylalkyl, heterocycloalkylalkyl, arylcycloalkylalkyl, heteroarylcycloalkylalkyl, arylheterocycloalkylalkyl, heteroarylheterocycloalkylalkyl, cycloalkyl, arylcycloalkyl, heteroarylcycloalkyl, heterocycloalkyl, arylheterocycloalkyl, heteroarylheterocycloalkyl, alkenyl, arylalkenyl, cycloalkenyl, arylcycloalkenyl, heteroarylcycloalkenyl, heterocycloalkenyl, arylheterocycloalkenyl, heteroarylheterocycloalkenyl, alkynyl, arylalkynyl, aryl, cycloalkylaryl, heterocycloalkylaryl, cycloalkenylaryl, heterocycloalkenylaryl, heteroaryl, cycloalkylheteroaryl, heterocycloalkylheteroaryl, cycloalkenylheteroaryl, heterocycloalkenylheteroaryl, -NO$_2$, halo, HO-alkoxyalkyl, -CF$_3$, -CN, alkyl-CN, -C(O)R^{30}, -C(O)OH, -C(O)OR^{30}, -C(O)NHR^{31}, -C(O)NH$_2$, -C(O)NH$_2$-C(O)N(alkyl)$_2$, -C(O)N(alkyl)(aryl), -C(O)N(alkyl)(heteroaryl), -SR^{30}, -S(O)R^{31}, -S(O)$_2$R^{31}, -S(O)NH$_2$,

-S(O)NH(alkyl), -S(O)N(alkyl)(alkyl), -S(O)NH(aryl), $-S(O)_2NH_2$, $-S(O)_2NHR^{30}$, $-S(O)_2NH$(heterocycloalkyl), $-S(O)_2N(alkyl)_2$, $-S(O)_2N$(alkyl)(aryl), $-OCF_3$, -OH, $-OR^{31}$, -O-heterocycloalkyl, -O-cycloalkylalkyl, -O-heterocycloalkylalkyl, $-NH_2$, $-NHR^{31}$, $-N(alkyl)_2$, $-N(arylalkyl)_2$, -N(arylalkyl)-(heteroarylalkyl), $-NHC(O)R^{31}$, $-NHC(O)NH_2$, -NHC(O)NH(alkyl), -NHC(O)N(alkyl)(alkyl), -N(alkyl)C(O)NH(alkyl), -N(alkyl)C(O)N(alkyl)(alkyl), $-NHS(O)_2R^{31}$, $-NHS(O)_2NH$(alkyl), $-NHS(O)_2N$(alkyl)(alkyl), -N(alkyl)$S(O)_2NH$(alkyl) and $-N(alkyl)S(O)_2N$(alkyl)(alkyl);

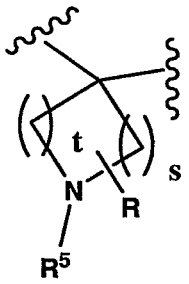
R^1, R^2 and R^5 are independently selected from the group consisting of H, alkyl, arylalkyl, heteroarylalkyl, cycloalkylalkyl, heterocycloalkylalkyl, arylcycloalkylalkyl, heteroarylcycloalkylalkyl, arylheterocycloalkylalkyl, heteroarylheterocycloalkylalkyl, cycloalkyl, arylcycloalkyl, heteroarylcycloalkyl, heterocycloalkyl, arylheterocycloalkyl, heteroarylheterocycloalkyl, alkenyl, arylalkenyl, cycloalkenyl, arylcycloalkenyl, heteroarylcycloalkenyl, heterocycloalkenyl, arylheterocycloalkenyl, heteroarylheterocycloalkenyl, alkynyl, arylalkynyl, aryl, cycloalkylaryl, heterocycloalkylaryl, cycloalkenylaryl, heterocycloalkenylaryl, heteroaryl, cycloalkylheteroaryl, heterocycloalkylheteroaryl, cycloalkenylheteroaryl, heterocycloalkenylheteroaryl, $-OR^{15}$, -CN, $-C(O)R^8$, $-C(O)OR^9$, $-S(O)R^{10}$, $-S(O)_2R^{10}$, $-C(O)N(R^{11})(R^{12})$, $-S(O)N(R^{11})(R^{12})$, $-S(O)_2N(R^{11})(R^{12})$, $-NO_2$, $-N=C(R^8)_2$ and $-N(R^{11})(R^{12})$, provided that R^1 and R^5 are not both selected from $-NO_2$, $-N=C(R^8)_2$ and $-N(R^{11})(R^{12})$;

R^3, R^4, R^6 and R^7 are independently selected from the group consisting of H, alkyl, arylalkyl, heteroarylalkyl, cycloalkylalkyl, heterocycloalkylalkyl, arylcycloalkylalkyl, heteroarylcycloalkylalkyl, arylheterocycloalkylalkyl, heteroarylheterocycloalkylalkyl, cycloalkyl, arylcycloalkyl, heteroarylcycloalkyl, heterocycloalkyl, arylheterocycloalkyl, heteroarylheterocycloalkyl, alkenyl, arylalkenyl, cycloalkenyl, arylcycloalkenyl, heteroarylcycloalkenyl, heterocycloalkenyl, arylheterocycloalkenyl, heteroarylheterocycloalkenyl, alkynyl, arylalkynyl, aryl, cycloalkylaryl, heterocycloalkylaryl, cycloalkenylaryl, heterocycloalkenylaryl, heteroaryl, cycloalkylheteroaryl, heterocycloalkylheteroaryl, cycloalkenylheteroaryl, heterocycloalkenylheteroaryl, halo, $-CH_2-O-Si(R^9)(R^{10})(R^{19})$, -SH, -CN, $-OR^9$, $-C(O)R^8$, $-C(O)OR^9$, $-C(O)N(R^{11})(R^{12})$, $-SR^{19}$, $-S(O)N(R^{11})(R^{12})$, $-S(O)_2N(R^{11})(R^{12})$, $-N(R^{11})(R^{12})$, $-N(R^{11})C(O)R^8$, $-N(R^{11})S(O)R^{10}$, $-N(R^{11})S(O)_2R^{10}$, $-N(R^{11})C(O)N(R^{12})(R^{13})$, $-N(R^{11})C(O)OR^9$ and $-C(=NOH)R^8$;

R^{6a} and R^{7a} are independently selected from the group consisting of alkylene, arylalkylene, heteroarylalkylene, cycloalkylalkylene, heterocycloalkylalkylene, arylcycloalkylalkylene, heteroarylcycloalkylalkylene, arylheterocycloalkylalkylene, heteroarylheterocycloalkylalkylene, cycloalkylene, arylcycloalkylene, heteroarylcycloalkylene, heterocycloalkylene, arylheterocycloalkylene, heteroarylheterocycloalkylene, alkenylene, arylalkenylene, cycloalkenylene, arylcycloalkenylene, heteroarylcycloalkenylene, heterocycloalkenylene, arylheterocycloalkenylene, heteroarylheterocycloalkenylene, alkynylene, arylalkynylene, arylene, cycloalkylarylene, heterocycloalkylarylene, cycloalkyenylarylene, cycloalkenylarylene, heterocycloalkenylarylene, heteroarylene, cycloalkylheteroarylene, heterocycloalkylheteroarylene, cycloalkenylheteroarylene and heterocycloalkenylheteroarylene, or

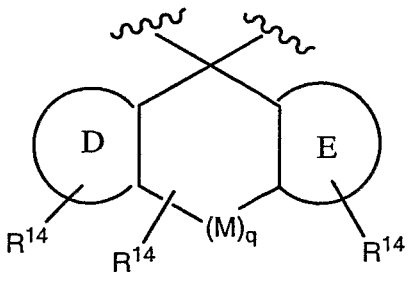
R^{6a} and R^{7a} together are optionally a C_2 to C_7 carbon chain, wherein, one, two or three ring carbons are optionally replaced by –O-, -C(O)-, -S-, -C(S)-, -S(O)-, $-S(O)_2-$ or $-N(R^5)-$, and R^{6a} and R^{7a} together with the carbon atoms to which they are attached, form a 3 to 8 membered ring, optionally substituted by R;
provided that when only one ring carbon is replaced with –O-, -C(O)-, -C(S)-, -S-, -S(O)- ,$-S(O)_2-$or $-N(R^5)-$, R^4 and R^{7a} cannot form a cycloalkylether;

or R^{6a} and R^{7a} together are



wherein s is 0 to 3 and t is 0 to 3, with the proviso that s or t cannot both be zero;

or R^{6a}, R^{7a}, D and E together are



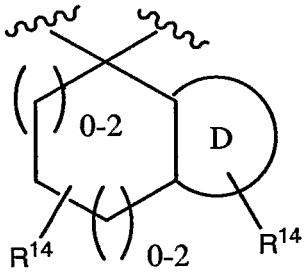
wherein D or E is cycloalkenylene, heterocycloalkenylene, cycloalkylene, heterocycloalkylene, arylene or heteroarylene,

M is –O-, -C(O)-, -S-, $-CH_2-$, -C(S)-, -S(O)-, $-S(O)_2-$ or $-N(R^5)-$;

q is 0, 1 or 2;

wherein, one to five ring carbons is replaced by –O-, -C(O)-, -S-, -C(S)-, -S(O)-, $-S(O)_2-$ or $-N(R^5)-$;

or R^{6a}, R^{7a} and D together are

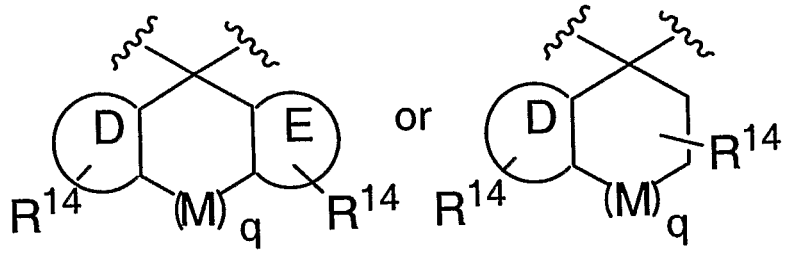


wherein D is cycloalkenylene, heterocycloalkenylene, cycloalkylene, heterocycloalkylene, arylene or heteroarylene,

wherein, one to five ring carbons is replaced by –O-, -C(O)-, -S-, -C(S)-, -S(O)-, $-S(O)_2-$ or $-N(R^5)-$;

R^{14} is 1-5 substituents independently selected from the group consisting of alkyl, arylalkyl, heteroarylalkyl, cycloalkylalkyl, heterocycloalkylalkyl, arylcycloalkylalkyl, heteroarylcycloalkylalkyl, arylheterocycloalkylalkyl, heteroarylheterocycloalkylalkyl, cycloalkyl, arylcycloalkyl, heteroarylcycloalkyl, heterocycloalkyl, arylheterocycloalkyl, heteroarylheterocycloalkyl, alkenyl, arylalkenyl, cycloalkenyl, arylcycloalkenyl, heteroarylcycloalkenyl, heterocycloalkenyl, arylheterocycloalkenyl, heteroarylheterocycloalkenyl, alkynyl, arylalkynyl, aryl, cycloalkylaryl, heterocycloalkylaryl, cycloalkenylaryl, heterocycloalkenylaryl, heteroaryl, cycloalkylheteroaryl, heterocycloalkylheteroaryl, cycloalkenylheteroaryl, heterocycloalkenylheteroaryl, halo, -CN, $-OR^{15}$, $-C(O)R^{15}$, $-C(O)OR^{15}$, $-C(O)N(R^{15})(R^{16})$, $-SR^{15}$, $-S(O)N(R^{15})(R^{16})$, $-S(O)_2N(R^{15})(R^{16})$, $-C(=NOR^{15})R^{16}$, $-P(O)(OR^{15})(OR^{16})$, $-N(R^{15})(R^{16})$, $-N(R^{15})C(O)R^{16}$, $-N(R^{15})S(O)R^{16}$, $-N(R^{15})S(O)_2R^{16}$, $-N(R^{15})S(O)_2N(R^{16})(R^{17})$, $-N(R^{15})S(O)N(R^{16})(R^{17})$, $-N(R^{15})C(O)N(R^{16})(R^{17})$ and $-N(R^{15})C(O)OR^{16}$;

with the following provisos that R^{6a} and R^{7a} cannot be combined to form said multicyclic groups



wherein

M is $-CH_2-$, -S-, $-N(R^{19})-$, or –O-;

D and E are independently arylene or heteroarylene;

and q is 0, 1 or 2 provided that when q is 2, one M must be a carbon atom and when q is 2, M is optionally a double bond;

and provided that when there are at least two heteroatoms present, there cannot be any adjacent oxygen and/or sulfur atoms present in the above-described ring systems.

R^8 is independently selected from the group consisting of H, alkyl, arylalkyl, heteroarylalkyl, cycloalkylalkyl, heterocycloalkylalkyl, arylcycloalkylalkyl, heteroarylcycloalkylalkyl, arylheterocycloalkylalkyl, heteroarylheterocycloalkylalkyl, cycloalkyl, arylcycloalkyl, heteroarylcycloalkyl, heterocycloalkyl, arylheterocycloalkyl, heteroarylheterocycloalkyl, alkenyl, arylalkenyl, cycloalkenyl, arylcycloalkenyl, heteroarylcycloalkenyl, heterocycloalkenyl, arylheterocycloalkenyl, heteroarylheterocycloalkenyl, alkynyl, arylalkynyl, aryl, cycloalkylaryl, heterocycloalkylaryl, cycloalkenylaryl, heterocycloalkenylaryl, heteroaryl, cycloalkylheteroaryl, heterocycloalkylheteroaryl, cycloalkenylheteroaryl, heterocycloalkenylheteroaryl, $-OR^{15}$, $-N(R^{15})(R^{16})$, $-N(R^{15})C(O)R^{16}$, $-N(R^{15})S(O)R^{16}$, $-N(R^{15})S(O)_2R^{16}$, $-N(R^{15})S(O)_2N(R^{16})(R^{17})$, $-N(R^{15})S(O)N(R^{16})(R^{17})$, $-N(R^{15})C(O)N(R^{16})(R^{17})$ and $-N(R^{15})C(O)OR^{16}$;

R^9 is independently selected from the group consisting of H, alkyl, arylalkyl, heteroarylalkyl, cycloalkylalkyl, heterocycloalkylalkyl, arylcycloalkylalkyl, heteroarylcycloalkylalkyl, arylheterocycloalkylalkyl, heteroarylheterocycloalkylalkyl, cycloalkyl, arylcycloalkyl, heteroarylcycloalkyl, heterocycloalkyl, arylheterocycloalkyl, heteroarylheterocycloalkyl, alkenyl, arylalkenyl, cycloalkenyl, arylcycloalkenyl, heteroarylcycloalkenyl, heterocycloalkenyl, arylheterocycloalkenyl, heteroarylheterocycloalkenyl, alkynyl, arylalkynyl, aryl, cycloalkylaryl, heterocycloalkylaryl, cycloalkenylaryl, heterocycloalkenylaryl, heteroaryl,

cycloalkylheteroaryl, heterocycloalkylheteroaryl, cycloalkenylheteroaryl and heterocycloalkenylheteroaryl;

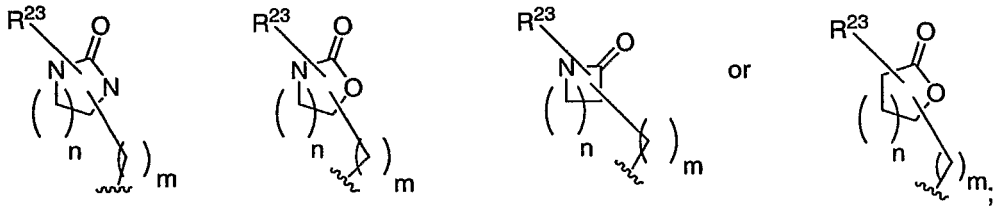
R^{10} is independently selected from the group consisting of H, alkyl, arylalkyl, heteroarylalkyl, cycloalkylalkyl, heterocycloalkylalkyl, arylcycloalkylalkyl, heteroarylcycloalkylalkyl, arylheterocycloalkylalkyl, heteroarylheterocycloalkylalkyl, cycloalkyl, arylcycloalkyl, heteroarylcycloalkyl, heterocycloalkyl, arylheterocycloalkyl, heteroarylheterocycloalkyl, alkenyl, arylalkenyl, cycloalkenyl, arylcycloalkenyl, heteroarylcycloalkenyl, heterocycloalkenyl, arylheterocycloalkenyl, heteroarylheterocycloalkenyl, alkynyl, arylalkynyl, aryl, cycloalkylaryl, heterocycloalkylaryl, cycloalkenylaryl, heterocycloalkenylaryl, heteroaryl, cycloalkylheteroaryl, heterocycloalkylheteroaryl, cycloalkenylheteroaryl, heterocycloalkenylheteroaryl and $-N(R^{15})(R^{16})$;

R^{11}, R^{12} and R^{13} are independently selected from the group consisting of H, alkyl, arylalkyl, heteroarylalkyl, cycloalkylalkyl, heterocycloalkylalkyl, arylcycloalkylalkyl, heteroarylcycloalkylalkyl, arylheterocycloalkylalkyl, heteroarylheterocycloalkylalkyl, cycloalkyl, arylcycloalkyl, heteroarylcycloalkyl, heterocycloalkyl, arylheterocycloalkyl, heteroarylheterocycloalkyl, alkenyl, arylalkenyl, cycloalkenyl, arylcycloalkenyl, heteroarylcycloalkenyl, heterocycloalkenyl, arylheterocycloalkenyl, heteroarylheterocycloalkenyl, alkynyl, arylalkynyl, aryl, cycloalkylaryl, heterocycloalkylaryl, cycloalkenylaryl, heterocycloalkenylaryl, heteroaryl, cycloalkylheteroaryl, heterocycloalkylheteroaryl, cycloalkenylheteroaryl, heterocycloalkenylheteroaryl, $-C(O)R^8$, $-C(O)OR^9$, $-S(O)R^{10}$, $-S(O)_2R^{10}$, $-C(O)N(R^{15})(R^{16})$, $-S(O)N(R^{15})(R^{16})$, $-S(O)_2N(R^{15})(R^{16})$ and –CN;

R^{15}, R^{16} and R^{17} are independently selected from the group consisting of H, alkyl, arylalkyl, heteroarylalkyl, cycloalkylalkyl, heterocycloalkylalkyl, arylcycloalkylalkyl, heteroarylcycloalkylalkyl, arylheterocycloalkylalkyl, heteroarylheterocycloalkylalkyl, cycloalkyl, arylcycloalkyl, heteroarylcycloalkyl, heterocycloalkyl, arylheterocycloalkyl, heteroarylheterocycloalkyl, alkenyl, arylalkenyl, cycloalkenyl, arylcycloalkenyl, heteroarylcycloalkenyl, heterocycloalkenyl, arylheterocycloalkenyl, heteroarylheterocycloalkenyl, alkynyl, arylalkynyl, aryl, cycloalkylaryl, heterocycloalkylaryl, cycloalkenylaryl, heterocycloalkenylaryl, heteroaryl, cycloalkylheteroaryl, heterocycloalkylheteroaryl, cycloalkenylheteroaryl, heterocycloalkenylheteroaryl, R^{18}-alkyl, R^{18}-arylalkyl, R^{18}-heteroarylalkyl,

R^{18}-cycloalkylalkyl, R^{18}-heterocycloalkylalkyl, R^{18}-arylcycloalkylalkyl, R^{18}-heteroarylcycloalkylalkyl, R^{18}-arylheterocycloalkylalkyl, R^{18}-heteroarylheterocycloalkylalkyl, R^{18}-cycloalkyl, R^{18}-arylcycloalkyl, R^{18}-heteroarylcycloalkyl, R^{18}-heterocycloalkyl, R^{18}-arylheterocycloalkyl, R^{18}-heteroarylheterocycloalkyl, R^{18}-alkenyl, R^{18}-arylalkenyl, R^{18}-cycloalkenyl, R^{18}-arylcycloalkenyl, R^{18}-heteroarylcycloalkenyl, R^{18}-heterocycloalkenyl, R^{18}-arylheterocycloalkenyl, R^{18}-heteroarylheterocycloalkenyl, R^{18}-alkynyl, R^{18}-arylalkynyl, R^{18}-aryl, R^{18}-cycloalkylaryl, R^{18}-heterocycloalkylaryl, R^{18}-cycloalkenylaryl, R^{18}-heterocycloalkenylaryl, R^{18}-heteroaryl, R^{18}-cycloalkylheteroaryl, R^{18}-heterocycloalkylheteroaryl, R^{18}-cycloalkenylheteroaryl, and R^{18}-heterocycloalkenylheteroaryl; or

R^{15}, R^{16} and R^{17} are

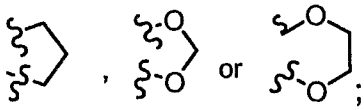


wherein R^{23} numbers 0 to 5 substituents, m is 0 to 6 and n is 0 to 5;

R^{18} is 1-5 substituents independently selected from the group consisting of alkyl, arylalkyl, heteroarylalkyl, cycloalkylalkyl, heterocycloalkylalkyl, arylcycloalkylalkyl, heteroarylcycloalkylalkyl, arylheterocycloalkylalkyl, heteroarylheterocycloalkylalkyl, cycloalkyl, arylcycloalkyl, heteroarylcycloalkyl, heterocycloalkyl, arylheterocycloalkyl, heteroarylheterocycloalkyl, alkenyl, arylalkenyl, cycloalkenyl, arylcycloalkenyl, heteroarylcycloalkenyl, heterocycloalkenyl, arylheterocycloalkenyl, heteroarylheterocycloalkenyl, alkynyl, arylalkynyl, aryl, cycloalkylaryl, heterocycloalkylaryl, cycloalkenylaryl, heterocycloalkenylaryl, heteroaryl, cycloalkylheteroaryl, heterocycloalkylheteroaryl, cycloalkenylheteroaryl, heterocycloalkenylheteroaryl, $-NO_2$, halo, HO-alkoxyalkyl, $-CF_3$, -CN, alkyl-CN, $-C(O)R^{19}$, -C(O)OH, $-C(O)OR^{19}$, $-C(O)NHR^{20}$, $-C(O)NH_2$, $-C(O)NH_2$-$C(O)N(alkyl)_2$, -C(O)N(alkyl)(aryl), -C(O)N(alkyl)(heteroaryl), $-SR^{19}$, $-S(O)_2R^{20}$, $-S(O)NH_2$, -S(O)NH(alkyl), -S(O)N(alkyl)(alkyl), -S(O)NH(aryl), $-S(O)_2NH_2$, $-S(O)_2NHR^{19}$, $-S(O)_2NH$(heterocycloalkyl), $-S(O)_2N(alkyl)_2$, $-S(O)_2N$(alkyl)(aryl), $-OCF_3$, -OH, $-OR^{20}$, -O-heterocycloalkyl, -O-cycloalkylalkyl, -O-heterocycloalkylalkyl, $-NH_2$, $-NHR^{20}$, $-N(alkyl)_2$, $-N(arylalkyl)_2$, -N(arylalkyl)-(heteroarylalkyl), $-NHC(O)R^{20}$, $-NHC(O)NH_2$,

-NHC(O)NH(alkyl), -NHC(O)N(alkyl)(alkyl), -N(alkyl)C(O)NH(alkyl), -N(alkyl)C(O)N(alkyl)(alkyl), $-NHS(O)_2R^{20}$, $-NHS(O)_2NH(alkyl)$, $-NHS(O)_2N(alkyl)(alkyl)$, $-N(alkyl)S(O)_2NH(alkyl)$ and $-N(alkyl)S(O)_2N(alkyl)(alkyl)$;

or two R^{18} moieties on adjacent carbons are optionally linked together to form



;

R^{19} is alkyl, arylalkyl, heteroarylalkyl, cycloalkylalkyl, heterocycloalkylalkyl, arylcycloalkylalkyl, heteroarylcycloalkylalkyl, arylheterocycloalkylalkyl, heteroarylheterocycloalkylalkyl, cycloalkyl, arylcycloalkyl, heteroarylcycloalkyl, heterocycloalkyl, arylheterocycloalkyl, heteroarylheterocycloalkyl, alkenyl, arylalkenyl, cycloalkenyl, arylcycloalkenyl, heteroarylcycloalkenyl, heterocycloalkenyl, arylheterocycloalkenyl, heteroarylheterocycloalkenyl, alkynyl, arylalkynyl, aryl, cycloalkylaryl, heterocycloalkylaryl, cycloalkenylaryl, heterocycloalkenylaryl, heteroaryl, cycloalkylheteroaryl, heterocycloalkylheteroaryl, cycloalkenylheteroaryl or heterocycloalkenylheteroaryl;

R^{20} is halo substituted aryl, alkyl, arylalkyl, heteroarylalkyl, cycloalkylalkyl, heterocycloalkylalkyl, arylcycloalkylalkyl, heteroarylcycloalkylalkyl, arylheterocycloalkylalkyl, heteroarylheterocycloalkylalkyl, cycloalkyl, arylcycloalkyl, heteroarylcycloalkyl, heterocycloalkyl, arylheterocycloalkyl, heteroarylheterocycloalkyl, alkenyl, arylalkenyl, cycloalkenyl, arylcycloalkenyl, heteroarylcycloalkenyl, heterocycloalkenyl, arylheterocycloalkenyl, heteroarylheterocycloalkenyl, alkynyl, arylalkynyl, aryl, cycloalkylaryl, heterocycloalkylaryl, cycloalkenylaryl, heterocycloalkenylaryl, heteroaryl, cycloalkylheteroaryl, heterocycloalkylheteroaryl, cycloalkenylheteroaryl or heterocycloalkenylheteroaryl;

and wherein

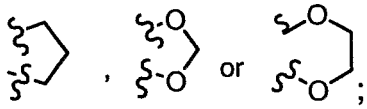
each of the alkyl, arylalkyl, heteroarylalkyl, cycloalkylalkyl, heterocycloalkylalkyl, arylcycloalkylalkyl, heteroarylcycloalkylalkyl, arylheterocycloalkylalkyl, heteroarylheterocycloalkylalkyl, cycloalkyl, arylcycloalkyl, heteroarylcycloalkyl, heterocycloalkyl, arylheterocycloalkyl, heteroarylheterocycloalkyl, alkenyl, arylalkenyl, cycloalkenyl, arylcycloalkenyl, heteroarylcycloalkenyl, heterocycloalkenyl, arylheterocycloalkenyl, heteroarylheterocycloalkenyl, alkynyl, arylalkynyl, aryl, cycloalkylaryl, heterocycloalkylaryl, cycloalkenylaryl, heterocycloalkenylaryl, heteroaryl,

cycloalkylheteroaryl, heterocycloalkylheteroaryl, cycloalkenylheteroaryl or heterocycloalkenylheteroaryl in R, R^1, R^2, R^3, R^4, R^5, R^6, R^7 R^8, R^9, R^{10}, R^{11}, R^{12} , R^{13} and R^{14}

are independently unsubstituted or substituted by 1 to 5 R^{21} groups independently selected from the group consisting of alkyl, arylalkyl, heteroarylalkyl, cycloalkylalkyl, heterocycloalkylalkyl, arylcycloalkylalkyl, heteroarylcycloalkylalkyl, arylheterocycloalkylalkyl, heteroarylheterocycloalkylalkyl, cycloalkyl, arylcycloalkyl, heteroarylcycloalkyl, heterocycloalkyl, arylheterocycloalkyl, heteroarylheterocycloalkyl, alkenyl, arylalkenyl, cycloalkenyl, arylcycloalkenyl, heteroarylcycloalkenyl, heterocycloalkenyl, arylheterocycloalkenyl, heteroarylheterocycloalkenyl, alkynyl, arylalkynyl, aryl, cycloalkylaryl, heterocycloalkylaryl, cycloalkenylaryl, heterocycloalkenylaryl, heteroaryl, cycloalkylheteroaryl, heterocycloalkylheteroaryl, cycloalkenylheteroaryl, heterocycloalkenylheteroaryl, halo, -CN, $-OR^{15}$, $-C(O)R^{15}$, $-C(O)OR^{15}$, $-C(O)N(R^{15})(R^{16})$, $-SR^{15}$, $-S(O)N(R^{15})(R^{16})$, $-CH(R^{15})(R^{16})$, $-S(O)_2N(R^{15})(R^{16})$, $-C(=NOR^{15})R^{16}$, $-P(O)(OR^{15})(OR^{16})$, $-N(R^{15})(R^{16})$, -alkyl-$N(R^{15})(R^{16})$, $-N(R^{15})C(O)R^{16}$, $-CH_2-N(R^{15})C(O)R^{16}$, $-CH_2-N(R^{15})C(O)N(R^{16})(R^{17})$, $-CH_2-R^{15}$; $-CH_2N(R^{15})(R^{16})$, $-N(R^{15})S(O)R^{16}$, $-N(R^{15})S(O)_2R^{16}$, $-CH_2-N(R^{15})S(O)_2R^{16}$, $-N(R^{15})S(O)_2N(R^{16})(R^{17})$, $-N(R^{15})S(O)N(R^{16})(R^{17})$, $-N(R^{15})C(O)N(R^{16})(R^{17})$, $-CH_2-N(R^{15})C(O)N(R^{16})(R^{17})$, $-N(R^{15})C(O)OR^{16}$, $-CH_2-N(R^{15})C(O)OR^{16}$, $-S(O)R^{15}$, $-N_3$, $-NO_2$ and $-S(O)_2R^{15}$;

and wherein each of the alkyl, arylalkyl, heteroarylalkyl, cycloalkylalkyl, heterocycloalkylalkyl, arylcycloalkylalkyl, heteroarylcycloalkylalkyl, arylheterocycloalkylalkyl, heteroarylheterocycloalkylalkyl, cycloalkyl, arylcycloalkyl, heteroarylcycloalkyl, heterocycloalkyl, arylheterocycloalkyl, heteroarylheterocycloalkyl, alkenyl, arylalkenyl, cycloalkenyl, arylcycloalkenyl, heteroarylcycloalkenyl, heterocycloalkenyl, arylheterocycloalkenyl, heteroarylheterocycloalkenyl, alkynyl, arylalkynyl, aryl, cycloalkylaryl, heterocycloalkylaryl, cycloalkenylaryl, heterocycloalkenylaryl, heteroaryl, cycloalkylheteroaryl, heterocycloalkylheteroaryl, cycloalkenylheteroaryl, heterocycloalkenylheteroaryl groups in R^{21} are independently unsubstituted or substituted by 1 to 5 R^{22} groups independently selected from the group consisting of alkyl, arylalkyl, heteroarylalkyl, cycloalkylalkyl, heterocycloalkylalkyl, arylcycloalkylalkyl, heteroarylcycloalkylalkyl, arylheterocycloalkylalkyl, heteroarylheterocycloalkylalkyl, cycloalkyl, arylcycloalkyl,

heteroarylcycloalkyl, heterocycloalkyl, arylheterocycloalkyl, heteroarylheterocycloalkyl, alkenyl, arylalkenyl, cycloalkenyl, arylcycloalkenyl, heteroarylcycloalkenyl, heterocycloalkenyl, arylheterocycloalkenyl, heteroarylheterocycloalkenyl, alkynyl, arylalkynyl, aryl, cycloalkylaryl, heterocycloalkylaryl, cycloalkenylaryl, heterocycloalkenylaryl, heteroaryl, cycloalkylheteroaryl, heterocycloalkylheteroaryl, cycloalkenylheteroaryl, heterocycloalkenylheteroaryl, halo, $-CF_3$, -CN, $-OR^{15}$, $-C(O)R^{15}$, $-C(O)OR^{15}$, -alkyl-$C(O)OR^{15}$, $C(O)N(R^{15})(R^{16})$, $-SR^{15}$, $-S(O)N(R^{15})(R^{16})$, $-S(O)_2N(R^{15})(R^{16})$, $-C(=NOR^{15})R^{16}$, $-P(O)(OR^{15})(OR^{16})$, $-N(R^{15})(R^{16})$, -alkyl-$N(R^{15})(R^{16})$, $-N(R^{15})C(O)R^{16}$, $-CH_2-N(R^{15})C(O)R^{16}$, $-N(R^{15})S(O)R^{16}$, $-N(R^{15})S(O)_2R^{16}$, $-CH_2-N(R^{15})S(O)_2R^{16}$, $-N(R^{15})S(O)_2N(R^{16})(R^{17})$, $-N(R^{15})S(O)N(R^{16})(R^{17})$, $-N(R^{15})C(O)N(R^{16})(R^{17})$, $-CH_2-N(R^{15})C(O)N(R^{16})(R^{17})$, $-N(R^{15})C(O)OR^{16}$, $-CH_2-N(R^{15})C(O)OR^{16}$, $-N_3$, $-NO_2$, $-S(O)R^{15}$ and $-S(O)_2R^{15}$;

or two R^{21} or two R^{22} moieties on adjacent carbons are optionally linked together to form ;

and when R^{21} or R^{22} are selected from the group consisting of $-C(=NOR^{15})R^{16}$, $-N(R^{15})C(O)R^{16}$, $-CH_2-N(R^{15})C(O)R^{16}$, $-N(R^{15})S(O)R^{16}$, $-N(R^{15})S(O)_2R^{16}$, $-CH_2-N(R^{15})S(O)_2R^{16}$, $-N(R^{15})S(O)_2N(R^{16})(R^{17})$, $-N(R^{15})S(O)N(R^{16})(R^{17})$, $-N(R^{15})C(O)N(R^{16})(R^{17})$, $-CH_2-N(R^{15})C(O)N(R^{16})(R^{17})$, $-N(R^{15})C(O)OR^{16}$ and $-CH_2-N(R^{15})C(O)OR^{16}$, R^{15} and R^{16} together are optionally a C_2 to C_4 chain wherein, optionally, one, two or three ring carbons are replaced by –C(O)- or –N(H)- and R^{15} and R^{16}, together with the atoms to which they are attached, form a 5 to 7 membered ring, optionally substituted by R^{23};

R^{23} is 1 to 5 groups independently selected from the group consisting of alkyl, arylalkyl, heteroarylalkyl, cycloalkylalkyl, heterocycloalkylalkyl, arylcycloalkylalkyl, heteroarylcycloalkylalkyl, arylheterocycloalkylalkyl, heteroarylheterocycloalkylalkyl, cycloalkyl, arylcycloalkyl, heteroarylcycloalkyl, heterocycloalkyl, arylheterocycloalkyl, heteroarylheterocycloalkyl, alkenyl, arylalkenyl, cycloalkenyl, arylcycloalkenyl, heteroarylcycloalkenyl, heterocycloalkenyl, arylheterocycloalkenyl, heteroarylheterocycloalkenyl, alkynyl, arylalkynyl, aryl, cycloalkylaryl, heterocycloalkylaryl, cycloalkenylaryl, heterocycloalkenylaryl, heteroaryl, cycloalkylheteroaryl, heterocycloalkylheteroaryl, cycloalkenylheteroaryl, heterocycloalkenylheteroaryl, halo, -CN, $-OR^{24}$, $-C(O)R^{24}$, $-C(O)OR^{24}$,

$-C(O)N(R^{24})(R^{25})$, $-SR^{24}$, $-S(O)N(R^{24})(R^{25})$, $-S(O)_2N(R^{24})(R^{25})$, $-C(=NOR^{24})R^{25}$, $-P(O)(OR^{24})(OR^{25})$, $-N(R^{24})(R^{25})$, -alkyl-$N(R^{24})(R^{25})$, $-N(R^{24})C(O)R^{25}$, $-CH_2-N(R^{24})C(O)R^{25}$, $-N(R^{24})S(O)R^{25}$, $-N(R^{24})S(O)_2R^{25}$, $-CH_2-N(R^{24})S(O)_2R^{25}$, $-N(R^{24})S(O)_2N(R^{25})(R^{26})$, $-N(R^{24})S(O)N(R^{25})(R^{26})$, $-N(R^{24})C(O)N(R^{25})(R^{26})$, $-CH_2-N(R^{24})C(O)N(R^{25})(R^{26})$, $-N(R^{24})C(O)OR^{25}$, $-CH_2-N(R^{24})C(O)OR^{25}$, $-S(O)R^{24}$ and $-S(O)_2R^{24}$; and wherein each of the alkyl, arylalkyl, heteroarylalkyl, cycloalkylalkyl, heterocycloalkylalkyl, arylcycloalkylalkyl, heteroarylcycloalkylalkyl, arylheterocycloalkylalkyl, heteroarylheterocycloalkylalkyl, cycloalkyl, arylcycloalkyl, heteroarylcycloalkyl, heterocycloalkyl, arylheterocycloalkyl, heteroarylheterocycloalkyl, alkenyl, arylalkenyl, cycloalkenyl, arylcycloalkenyl, heteroarylcycloalkenyl, heterocycloalkenyl, arylheterocycloalkenyl, heteroarylheterocycloalkenyl, alkynyl, arylalkynyl, aryl, cycloalkylaryl, heterocycloalkylaryl, cycloalkenylaryl, heterocycloalkenylaryl, heteroaryl, cycloalkylheteroaryl, heterocycloalkylheteroaryl, cycloalkenylheteroaryl and heterocycloalkenylheteroaryl groups in R^{23} are independently unsubstituted or substituted by 1 to 5 R^{27} groups independently selected from the group consisting of alkyl, arylalkyl, heteroarylalkyl, cycloalkylalkyl, heterocycloalkylalkyl, arylcycloalkylalkyl, heteroarylcycloalkylalkyl, arylheterocycloalkylalkyl, heteroarylheterocycloalkylalkyl, cycloalkyl, arylcycloalkyl, heteroarylcycloalkyl, heterocycloalkyl, arylheterocycloalkyl, heteroarylheterocycloalkyl, alkenyl, arylalkenyl, cycloalkenyl, arylcycloalkenyl, heteroarylcycloalkenyl, heterocycloalkenyl, arylheterocycloalkenyl, heteroarylheterocycloalkenyl, alkynyl, arylalkynyl, aryl, cycloalkylaryl, heterocycloalkylaryl, cycloalkenylaryl, heterocycloalkenylaryl, heteroaryl, cycloalkylheteroaryl, heterocycloalkylheteroaryl, cycloalkenylheteroaryl, heterocycloalkenylheteroaryl, halo, $-CF_3$, $-CN$, $-OR^{24}$, $-C(O)R^{24}$, $-C(O)OR^{24}$, alkyl-$C(O)OR^{24}$, $C(O)N(R^{24})(R^{25})$, $-SR^{24}$, $-S(O)N(R^{24})(R^{25})$, $-S(O)_2N(R^{24})(R^{25})$, $-C(=NOR^{24})R^{25}$, $-P(O)(OR^{24})(OR^{25})$, $-N(R^{24})(R^{25})$, -alkyl-$N(R^{24})(R^{25})$, $-N(R^{24})C(O)R^{25}$, $-CH_2-N(R^{24})C(O)R^{25}$, $-N(R^{24})S(O)R^{25}$, $-N(R^{24})S(O)_2R^{25}$, $-CH_2-N(R^{24})S(O)_2R^{25}$, $-N(R^{24})S(O)_2N(R^{25})(R^{26})$, $-N(R^{24})S(O)N(R^{25})(R^{26})$, $-N(R^{24})C(O)N(R^{25})(R^{26})$, $-CH_2-N(R^{24})C(O)N(R^{25})(R^{26})$, $-N(R^{24})C(O)OR^{25}$, $-CH_2-N(R^{24})C(O)OR^{25}$, $-S(O)R^{24}$ and $-S(O)_2R^{24}$;

R^{24}, R^{25} and R^{26} are independently selected from the group consisting of H, alkyl, arylalkyl, heteroarylalkyl, cycloalkylalkyl, heterocycloalkylalkyl, arylcycloalkylalkyl, heteroarylcycloalkylalkyl, arylheterocycloalkylalkyl,

heteroarylheterocycloalkylalkyl, cycloalkyl, arylcycloalkyl, heteroarylcycloalkyl, heterocycloalkyl, arylheterocycloalkyl, heteroarylheterocycloalkyl, alkenyl, arylalkenyl, cycloalkenyl, arylcycloalkenyl, heteroarylcycloalkenyl, heterocycloalkenyl, arylheterocycloalkenyl, heteroarylheterocycloalkenyl, alkynyl, arylalkynyl, aryl, cycloalkylaryl, heterocycloalkylaryl, cycloalkenylaryl, heterocycloalkenylaryl, heteroaryl, cycloalkylheteroaryl, heterocycloalkylheteroaryl, cycloalkenylheteroaryl, heterocycloalkenylheteroaryl, R^{27}-alkyl, R^{27}-arylalkyl, R^{27}-heteroarylalkyl, R^{27}-cycloalkylalkyl, R^{27}-heterocycloalkylalkyl, R^{27}-arylcycloalkylalkyl, R^{27}-heteroarylcycloalkylalkyl, R^{27}-arylheterocycloalkylalkyl, R^{27}-heteroarylheterocycloalkylalkyl, R^{27}-cycloalkyl, R^{27}-arylcycloalkyl, R^{27}-heteroarylcycloalkyl, R^{27}-heterocycloalkyl, R^{27}-arylheterocycloalkyl, R^{27}-heteroarylheterocycloalkyl, R^{27}-alkenyl, R^{27}-arylalkenyl, R^{27}-cycloalkenyl, R^{27}-arylcycloalkenyl, R^{27}-heteroarylcycloalkenyl, R^{27}-heterocycloalkenyl, R^{27}-arylheterocycloalkenyl, R^{27}-heteroarylheterocycloalkenyl, R^{27}-alkynyl, R^{27}-arylalkynyl, R^{27}-aryl, R^{27}-cycloalkylaryl, R^{27}-heterocycloalkylaryl, R^{27}-cycloalkenylaryl, R^{27}-heterocycloalkenylaryl, R^{27}-heteroaryl, R^{27}-cycloalkylheteroaryl, R^{27}-heterocycloalkylheteroaryl, R^{27}-cycloalkenylheteroaryl and R^{27}-heterocycloalkenylheteroaryl;

R^{27} is 1-5 substituents independently selected from the group consisting of alkyl, arylalkyl, heteroarylalkyl, cycloalkylalkyl, heterocycloalkylalkyl, arylcycloalkylalkyl, heteroarylcycloalkylalkyl, arylheterocycloalkylalkyl, heteroarylheterocycloalkylalkyl, cycloalkyl, arylcycloalkyl, heteroarylcycloalkyl, heterocycloalkyl, arylheterocycloalkyl, heteroarylheterocycloalkyl, alkenyl, arylalkenyl, cycloalkenyl, arylcycloalkenyl, heteroarylcycloalkenyl, heterocycloalkenyl, arylheterocycloalkenyl, heteroarylheterocycloalkenyl, alkynyl, arylalkynyl, aryl, cycloalkylaryl, heterocycloalkylaryl, cycloalkenylaryl, heterocycloalkenylaryl, heteroaryl, cycloalkylheteroaryl, heterocycloalkylheteroaryl, cycloalkenylheteroaryl, heterocycloalkenylheteroaryl, $-NO_2$, halo, $-CF_3$, -CN, alkyl-CN, $-C(O)R^{28}$, -C(O)OH, $-C(O)OR^{28}$, $-C(O)NHR^{29}$, $-C(O)N(alkyl)_2$, -C(O)N(alkyl)(aryl), -C(O)N(alkyl)(heteroaryl), $-SR^{28}$, $-S(O)_2R^{29}$, $-S(O)NH_2$, -S(O)NH(alkyl), -S(O)N(alkyl)(alkyl), -S(O)NH(aryl), $-S(O)_2NH_2$, $-S(O)_2NHR^{28}$, $-S(O)_2NH(aryl)$, $-S(O)_2NH(heterocycloalkyl)$, $-S(O)_2N(alkyl)_2$, $-S(O)_2N(alkyl)(aryl)$, -OH, $-OR^{29}$, -O-heterocycloalkyl, -O-cycloalkylalkyl, -O-heterocycloalkylalkyl, $-NH_2$, $-NHR^{29}$,

$-N(alkyl)_2$, $-N(arylalkyl)_2$, -N(arylalkyl)(heteroarylalkyl), $-NHC(O)R^{29}$, $-NHC(O)NH_2$, -NHC(O)NH(alkyl), -NHC(O)N(alkyl)(alkyl), -N(alkyl)C(O)NH(alkyl), -N(alkyl)C(O)N(alkyl)(alkyl), $-NHS(O)_2R^{29}$, $-NHS(O)_2NH(alkyl)$, $-NHS(O)_2N(alkyl)(alkyl)$, -N(alkyl)$S(O)_2$NH(alkyl) and –N(alkyl)$S(O)_2$N(alkyl)(alkyl);

R^{28} is alkyl, arylalkyl, heteroarylalkyl, cycloalkylalkyl, heterocycloalkylalkyl, arylcycloalkylalkyl, heteroarylcycloalkylalkyl, arylheterocycloalkylalkyl, heteroarylheterocycloalkylalkyl, cycloalkyl, arylcycloalkyl, heteroarylcycloalkyl, heterocycloalkyl, arylheterocycloalkyl, heteroarylheterocycloalkyl, alkenyl, arylalkenyl, cycloalkenyl, arylcycloalkenyl, heteroarylcycloalkenyl, heterocycloalkenyl, arylheterocycloalkenyl, heteroarylheterocycloalkenyl, alkynyl, arylalkynyl, aryl, cycloalkylaryl, heterocycloalkylaryl, cycloalkenylaryl, heterocycloalkenylaryl, heteroaryl, cycloalkylheteroaryl, heterocycloalkylheteroaryl, cycloalkenylheteroaryl or heterocycloalkenylheteroaryl;

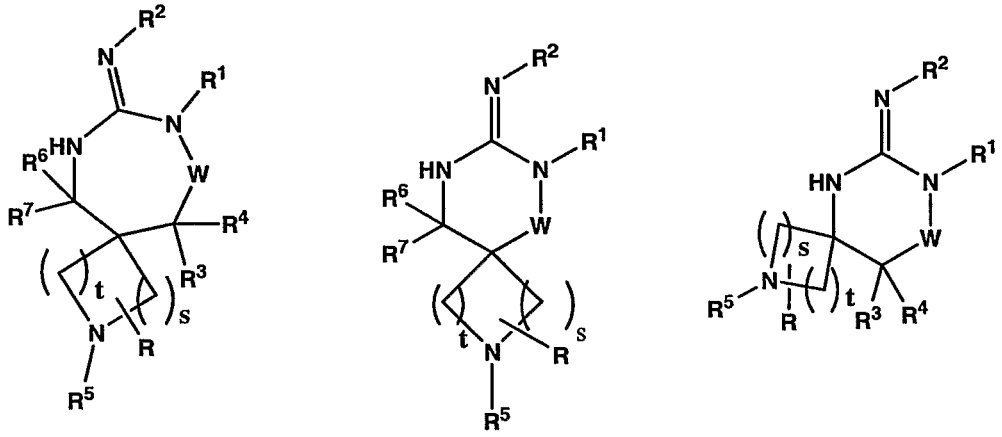
R^{29} is alkyl, arylalkyl, heteroarylalkyl, cycloalkylalkyl, heterocycloalkylalkyl, arylcycloalkylalkyl, heteroarylcycloalkylalkyl, arylheterocycloalkylalkyl, heteroarylheterocycloalkylalkyl, cycloalkyl, arylcycloalkyl, heteroarylcycloalkyl, heterocycloalkyl, arylheterocycloalkyl, heteroarylheterocycloalkyl, alkenyl, arylalkenyl, cycloalkenyl, arylcycloalkenyl, heteroarylcycloalkenyl, heterocycloalkenyl, arylheterocycloalkenyl, heteroarylheterocycloalkenyl, alkynyl, arylalkynyl, aryl, cycloalkylaryl, heterocycloalkylaryl, cycloalkenylaryl, heterocycloalkenylaryl, heteroaryl, cycloalkylheteroaryl, heterocycloalkylheteroaryl, cycloalkenylheteroaryl or heterocycloalkenylheteroaryl;

R^{30} is alkyl, arylalkyl, heteroarylalkyl, cycloalkylalkyl, heterocycloalkylalkyl, arylcycloalkylalkyl, heteroarylcycloalkylalkyl, arylheterocycloalkylalkyl, heteroarylheterocycloalkylalkyl, cycloalkyl, arylcycloalkyl, heteroarylcycloalkyl, heterocycloalkyl, arylheterocycloalkyl, heteroarylheterocycloalkyl, alkenyl, arylalkenyl, cycloalkenyl, arylcycloalkenyl, heteroarylcycloalkenyl, heterocycloalkenyl, arylheterocycloalkenyl, heteroarylheterocycloalkenyl, alkynyl, arylalkynyl, aryl, cycloalkylaryl, heterocycloalkylaryl, cycloalkenylaryl, heterocycloalkenylaryl, heteroaryl, cycloalkylheteroaryl, heterocycloalkylheteroaryl, cycloalkenylheteroaryl or heterocycloalkenylheteroaryl;

and

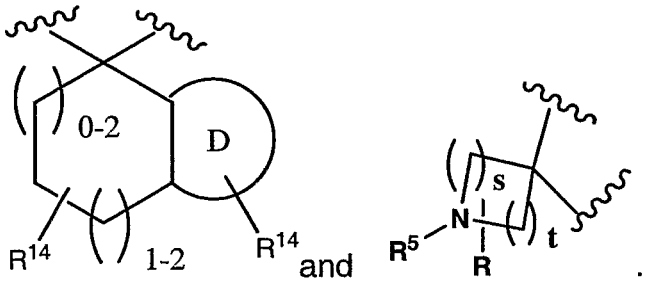
R^{31} is alkyl, arylalkyl, heteroarylalkyl, cycloalkylalkyl, heterocycloalkylalkyl, arylcycloalkylalkyl, heteroarylcycloalkylalkyl, arylheterocycloalkylalkyl, heteroarylheterocycloalkylalkyl, cycloalkyl, arylcycloalkyl, heteroarylcycloalkyl, heterocycloalkyl, arylheterocycloalkyl, heteroarylheterocycloalkyl, alkenyl, arylalkenyl, cycloalkenyl, arylcycloalkenyl, heteroarylcycloalkenyl, heterocycloalkenyl, arylheterocycloalkenyl, heteroarylheterocycloalkenyl, alkynyl, arylalkynyl, aryl, cycloalkylaryl, heterocycloalkylaryl, cycloalkenylaryl, heterocycloalkenylaryl, heteroaryl, cycloalkylheteroaryl, heterocycloalkylheteroaryl, cycloalkenylheteroaryl or heterocycloalkenylheteroaryl.

2. The compound of claim 1 with the following structures:



wherein s, t, R, R^1, R^2, R^3, R^4, R^5, R^6 and R^7 are defined herein.

3. The compound of claim 1 wherein R^{6a} and R^{7a} together are selected from the group consisting of :



and

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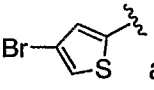
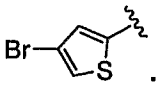
4. A compound of claim 3 wherein U is $-(C(R^6)(R^7))-$ or $-(C(R^6)(R^7))(C(R^6)(R^7))-$.

5. A compound of claim 4 wherein U is $-(C(R^6)(R^7))-$.

6. A compound of claim 4 wherein R^6 is aryl, heteroaryl, R-^{21} substituted aryl, R^{21}-substituted heteroaryl or alkyl

and

R^7 is aryl, heteroaryl, R-^{21} substituted aryl, R^{21}- substituted heteroaryl or alkyl.

7. A compound of claim 6 wherein R^6 is methyl or  and R^7 is methyl or .

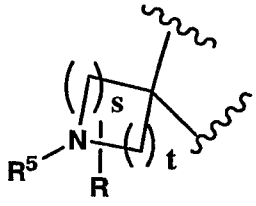
8. A compound of claim 1 wherein R^1 is alkyl.

9. A compound of claim 1 wherein R^1 is methyl.

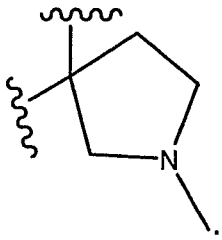
10. A compound of claim 1 wherein A is a bond.

11. A compound of claim 1 wherein W is -C(O)-.

12. A compound of claim 1 wherein R^{6a} and R^{7a} together are:



13. A compound of claim 12 wherein R^{6a} and R^{7a} together are



14. A compound of claim 1 wherein

U is -(C(R^6)(R^7))-;

R^1 is alkyl;

R^6 is aryl, heteroaryl, R-^{21} substituted aryl, R^{21}- substituted heteroaryl or alkyl;

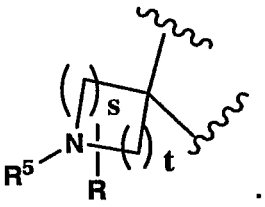
R^7 is aryl, heteroaryl, R-^{21} substituted aryl, R^{21}- substituted heteroaryl or alkyl;

A is a bond;

W is -C(O)-;

and

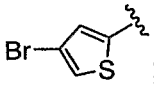
wherein R^{6a} and R^{7a} together are:



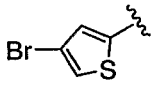
15. A compound of claim 1 wherein

U is -(C(R^6)(R^7))-;

R^1 is methyl;

R^6 is methyl or 

;

R^7 is methyl or 

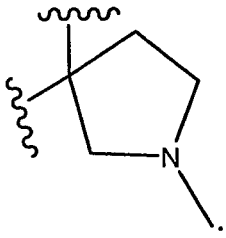
;

A is a bond;

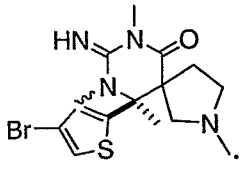
W is -C(O)-;

and

R^{6a} and R^{7a} together are



16. A compound of claim 3 wherein which is



17. A pharmaceutical composition comprising an effective amount of a compound of claim 1 and a pharmaceutically effective carrier.

18. A pharmaceutical composition comprising an effective amount of a compound of claim 16 and a pharmaceutically effective carrier.

19. A method of inhibiting aspartyl protease comprising administering to a patient in need of such treatment an effective amount of a compound of claim 1.

20. A method of inhibiting aspartyl protease comprising administering to a patient in need of such treatment an effective amount of a compound of claim 16.

21. A method of treating cardiovascular diseases, cognitive and neurodegenerative diseases, and the methods of inhibiting of Human Immunodeficiency Virus, plasmepsins, cathepsin D and protozoal enzymes comprising administering to a patient in need of such treatment an effective amount of a compound of claim 1.

22. A method of treating cardiovascular diseases, cognitive and neurodegenerative diseases, and the methods of inhibiting of Human Immunodeficiency Virus, plasmepsins, cathepsin D and protozoal enzymes comprising administering to a patient in need of such treatment an effective amount of a compound of claim 16.

23. The method of claim 21 wherein a cognitive or neurodegenerative disease is treated.

24. The method of claim 22 wherein a cognitive or neurodegenerative disease is treated.

25. The method of claim 23 wherein Alzheimer's Disease is treated.

26. The method of claim 24 wherein Alzheimer's Disease is treated.

27. A pharmaceutical composition comprising an effective amount of a compound of claim 1, and an effective amount of a cholinesterase inhibitor or a muscarinic m_1 agonist or m_2 antagonist in a pharmaceutically effective carrier.

28. A pharmaceutical composition comprising an effective amount of a compound of claim 16, and an effective amount of a cholinesterase inhibitor or a muscarinic m_1 agonist or m_2 antagonist in a pharmaceutically effective carrier.

29. A method of treating a cognitive or neurodegenerative disease comprising administering to a patient in need of such treatment an effective amount of a compound of claim 1 in combination with an effective amount of a cholinesterase inhibitor.

30. A method of treating a cognitive or neurodegenerative disease comprising administering to a patient in need of such treatment an effective amount of a compound of claim 16 in combination with an effective amount of a cholinesterase inhibitor.

31. The method of claim 29 wherein Alzheimer's Disease is treated.

32. The method of claim 30 wherein Alzheimer's Disease is treated.

33. A method of treating a cognitive or neurodegenerative disease comprising administering to a patient in need of such treatment an effective amount of a compound of claim 1 in combination with an effective amount of a gamma secretase inhibitor, an HMG-CoA reductase inhibitor or non-steroidal anti-inflammatory agent.

34. A method of treating a cognitive or neurodegenerative disease comprising administering to a patient in need of such treatment an effective amount of a compound of claim 16 in combination with an effective amount of a gamma secretase inhibitor, an HMG-CoA reductase inhibitor or non-steroidal anti-inflammatory agent.

35. The method of claim 33 wherein Alzheimer's Disease is treated.

36. The method of claim 34 wherein Alzheimer's Disease is treated.

37. The method of claim 33 wherein said HMG-CoA reductase inhibitor is atorvastatin, lovastatin, simvastatin, pravastatin, fluvastatin or rosuvastatin.

38. The method of claim 34 wherein said HMG-CoA reductase inhibitor is atorvastatin, lovastatin, simvastatin, pravastatin, fluvastatin or rosuvastatin.

39. The method of claim 33 wherein said non-steroidal anti-inflammatory agent is ibuprofen, relafen or naproxen.

40. The method of claim 34 wherein said non-steroidal anti-inflammatory agent is ibuprofen, relafen or naproxen.

41. A pharmaceutical composition comprising an effective amount of a compound of claim 1, and an effective amount of a gamma secretase inhibitor; an HMG-CoA reductase inhibitor or a non-steroidal anti-inflammatory agent.

42. A pharmaceutical composition comprising an effective amount of a compound of claim 16 and an effective amount of a gamma secretase inhibitor; an HMG-CoA reductase inhibitor or a non-steroidal anti-inflammatory agent.

43. A method of treating a cognitive or neurodegenerative disease comprising administering to a patient in need of such treatment an effective amount of at least one compound of claim 1 in combination with an effective amount of one or more compounds selected from the group consisting of a cholinesterase inhibitor, muscarinic m_1 agonist or m_2 antagonist, gamma secretase inhibitor, an HMG-CoA reductase inhibitor and non-steroidal anti-inflammatory agent.

44. A method of treating a cognitive or neurodegenerative disease comprising administering to a patient in need of such treatment an effective amount of at least one compound of claim 16 in combination with an effective amount of one or more compounds selected from the group consisting of a cholinesterase inhibitor, muscarinic m_1 agonist or m_2 antagonist, gamma secretase inhibitor, an HMG-CoA reductase inhibitor and non-steroidal anti-inflammatory agent.