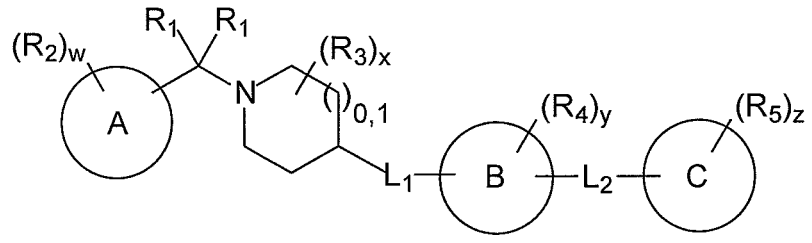
BRIEF SUMMARY

Provided herein are compounds that antagonize muscarinic receptors. In particular embodiments, compounds are provided that selectively antagonize muscarinic receptor 4 (M4). Such compounds are useful in the treatment of a number of diseases and/or disorders, particularly neurological conditions, diseases, and disorders including cognitive disorders such as Alzheimer's Disease, Lewy Body Dementia and the cognitive deficits associated with schizophrenia. In other embodiments, methods are provided for treating or preventing movement disorders which may include Parkinson's Disease, drug induced Parkinsonism, dyskinesias, dystonia, chorea, levodopa induced dyskinesia, cerebral palsy and progressive supranuclear palsy, and Huntington's disease, particularly chorea associate with Huntington's disease.

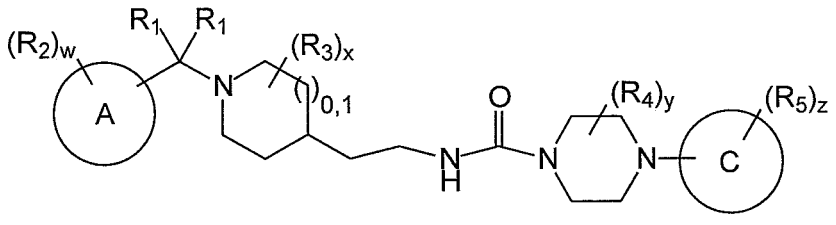
In one embodiment, compounds are provided having the structure of formula (I):



(I)

or a stereoisomer, tautomer, solvate, ester, prodrug, or pharmaceutically acceptable salt thereof, wherein A, B, C, L_1, L_2, R_1, R_2, R_3, R_4, R_5, w, x, y and z are as defined below. More specific embodiments are also described within Tables 1-14, as well as the more specific formulas noted herein below.

In one aspect, there is provided a compound having the structure of the following formula (XII):



(XII)

or a stereoisomer, solvate, or pharmaceutically acceptable salt thereof, wherein:

A and C are each independently a carbocyclyl or heterocyclyl;

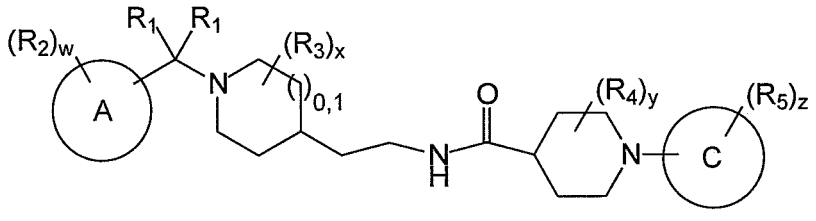
R_1 is, at each occurrence, H, C_{1-4}alkyl, $C(=O)OC_{1-4}$alkyl or aryl;

R_2, R_3, R_4 and R_5 are each independently -OH, $-NH_2$, $-NH(C_{1-4}alkyl)$, $-N(C_{1-4}alkyl)_2$, -C≡N, $-C(=O)NH_2$, halo, C_{1-4}alkyl, C_{1-4}alkyl-OH, C_{1-4}haloalkyl, C_{1-4}alkoxy or C_{1-4}haloalkoxy; and

w, x, y and z are each independently 0, 1, 2 or 3;

or

a compound having the structure of the following formula (XIII):



(XIII)

or a stereoisomer, solvate, or pharmaceutically acceptable salt thereof, wherein:

A and C are each independently a carbocyclyl or heterocyclyl;

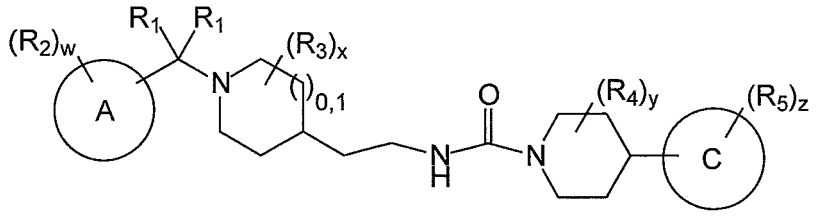
R_1 is, at each occurrence, H, C_{1-4}alkyl, $C(=O)OC_{1-4}$alkyl or aryl;

R_2, R_3, R_4 and R_5 are each independently -OH, $-NH_2$, $-NH(C_{1-4}alkyl)$, $-N(C_{1-4}alkyl)_2$, -C≡N, $-C(=O)NH_2$, halo, C_{1-4}alkyl, C_{1-4}alkyl-OH, C_{1-4}haloalkyl, C_{1-4}alkoxy or C_{1-4}haloalkoxy; and

w, x, y and z are each independently 0, 1, 2 or 3, wherein at least one of y or z is 1, 2 or 3;

or

a compound having the structure of the following formula (XIV):



(XIV)

or a stereoisomer, solvate, or pharmaceutically acceptable salt thereof, wherein:

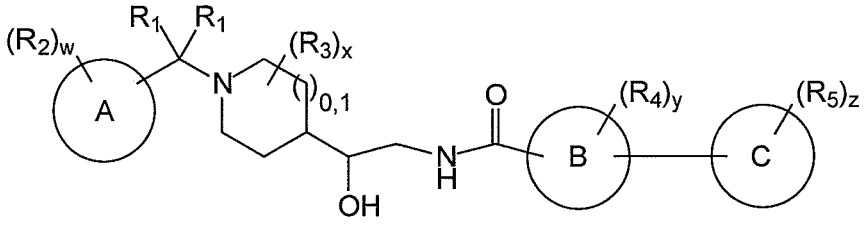
A and C are each independently a carbocyclyl or heterocyclyl;

R_1 is, at each occurrence, H, C_{1-4}alkyl, $C(=O)OC_{1-4}$alkyl or aryl;

R_2, R_3, R_4 and R_5 are each independently -OH, $-NH_2$, $-NH(C_{1-4}alkyl)$, $-N(C_{1-4}alkyl)_2$, $-C\equiv N$, $-C(=O)NH_2$, halo, C_{1-4}alkyl, C_{1-4}alkyl-OH, C_{1-4}haloalkyl, C_{1-4}alkoxy or C_{1-4}haloalkoxy; and

w, x, y and z are each independently 0, 1, 2 or 3.

In another aspect, there is provided a compound having the structure of the following formula (XI):



(XI)

or a stereoisomer, solvate, or pharmaceutically acceptable salt thereof, wherein:

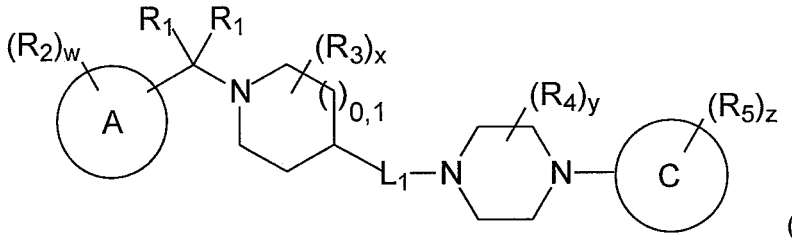
A, B and C are each independently a carbocyclyl or heterocyclyl;

R_1 is, at each occurrence, H, C_{1-4}alkyl, $C(=O)OC_{1-4}$alkyl or aryl;

R_2, R_3, R_4 and R_5 are each independently -OH, $-NH_2$, $-NH(C_{1-4}alkyl)$, $-N(C_{1-4}alkyl)_2$, $-C\equiv N$, $-C(=O)NH_2$, halo, C_{1-4}alkyl, C_{1-4}alkyl-OH, C_{1-4}haloalkyl, C_{1-4}alkoxy or C_{1-4}haloalkoxy; and

w, x, y and z are each independently 0, 1, 2 or 3.

In yet another aspect, there is provided a compound having the structure of the following formula (VII):



(VII)

or a stereoisomer, solvate, or pharmaceutically acceptable salt thereof, wherein:

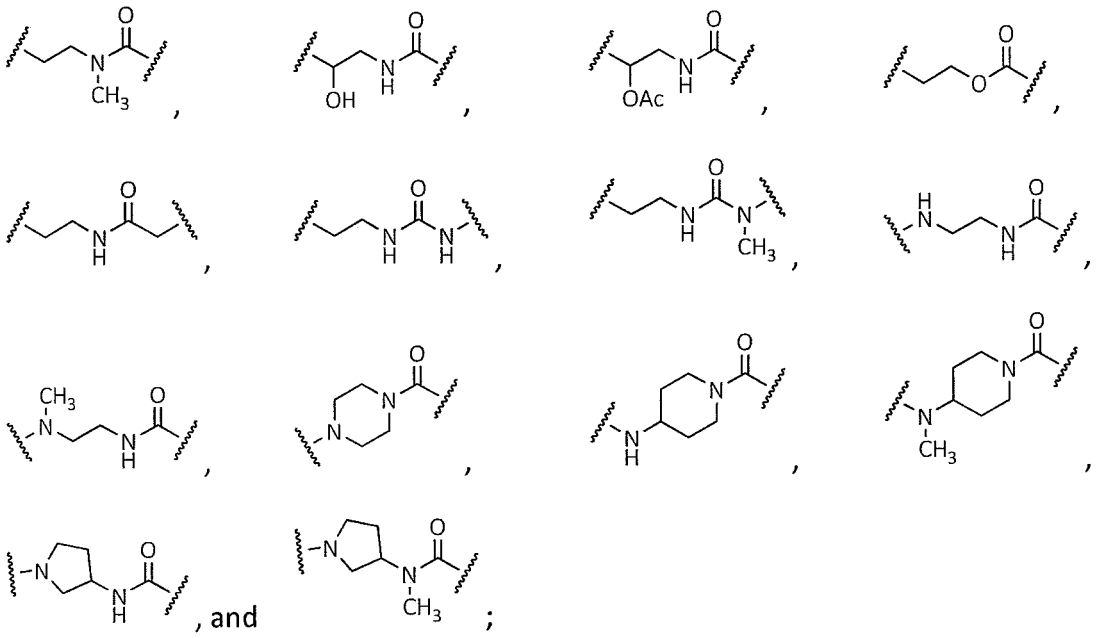
A and C are each independently a carbocyclyl or heterocyclyl;

R_1 is, at each occurrence, H, C_{1-4}alkyl, $C(=O)OC_{1-4}$alkyl or aryl;

R_2, R_3, R_4 and R_5 are each independently -OH, $-NH_2$, $-NH(C_{1-4}alkyl)$, $-N(C_{1-4}alkyl)_2$, -C≡N, $-C(=O)NH_2$, halo, C_{1-4}alkyl, C_{1-4}alkyl-OH, C_{1-4}haloalkyl, C_{1-4}alkoxy or C_{1-4}haloalkoxy;

w, x, y and z are each independently 0, 1, 2 or 3; and

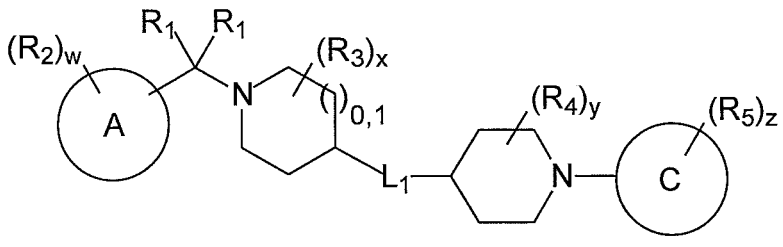
L_1 is one of the following:



; and

or

a compound having the structure of the following formula (VIII):



(VIII)

or a stereoisomer, solvate, or pharmaceutically acceptable salt thereof, wherein:

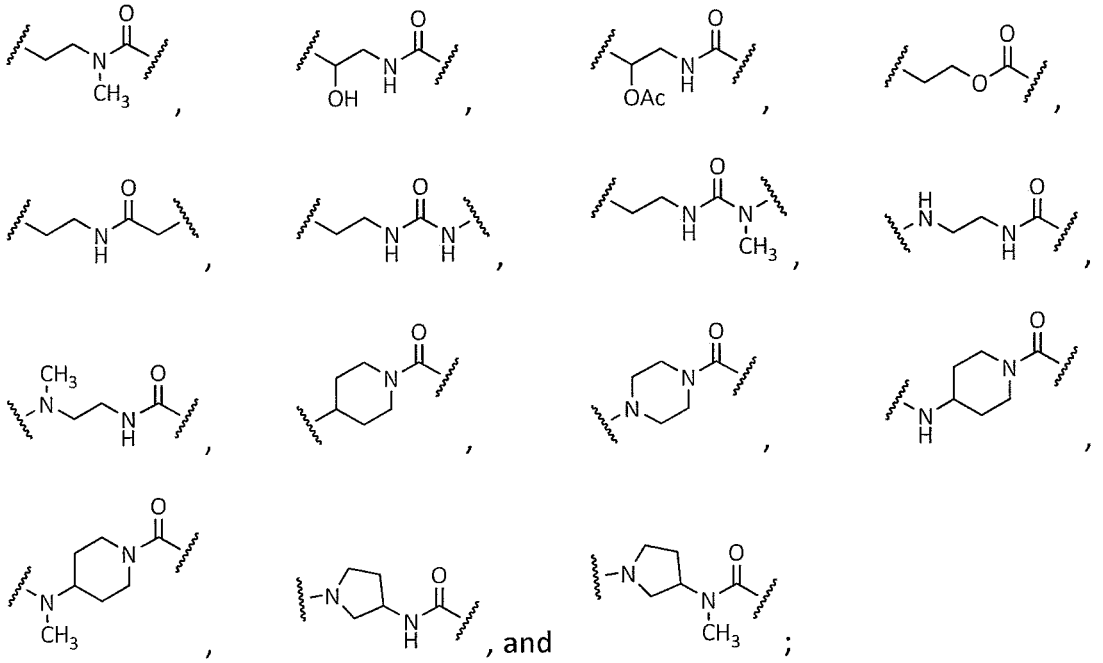
A and C are each independently a carbocyclyl or heterocyclyl;

R_1 is, at each occurrence, H, C_{1-4}alkyl, $C(=O)OC_{1-4}$alkyl or aryl;

R_2, R_3, R_4 and R_5 are each independently -OH, $-NH_2$, $-NH(C_{1-4}alkyl)$, $-N(C_{1-4}alkyl)_2$, $-C\equiv N$, $-C(=O)NH_2$, halo, C_{1-4}alkyl, C_{1-4}alkyl-OH, C_{1-4}haloalkyl, C_{1-4}alkoxy or C_{1-4}haloalkoxy;

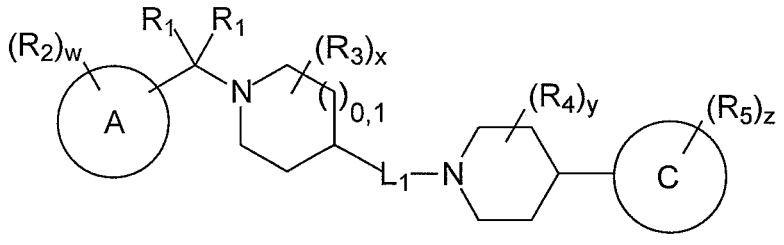
w, x, y and z are each independently 0, 1, 2 or 3; and

L_1 is one of the following:



or

a compound having the structure of the following formula (IX):



(IX)

or a stereoisomer, solvate, or pharmaceutically acceptable salt thereof, wherein:

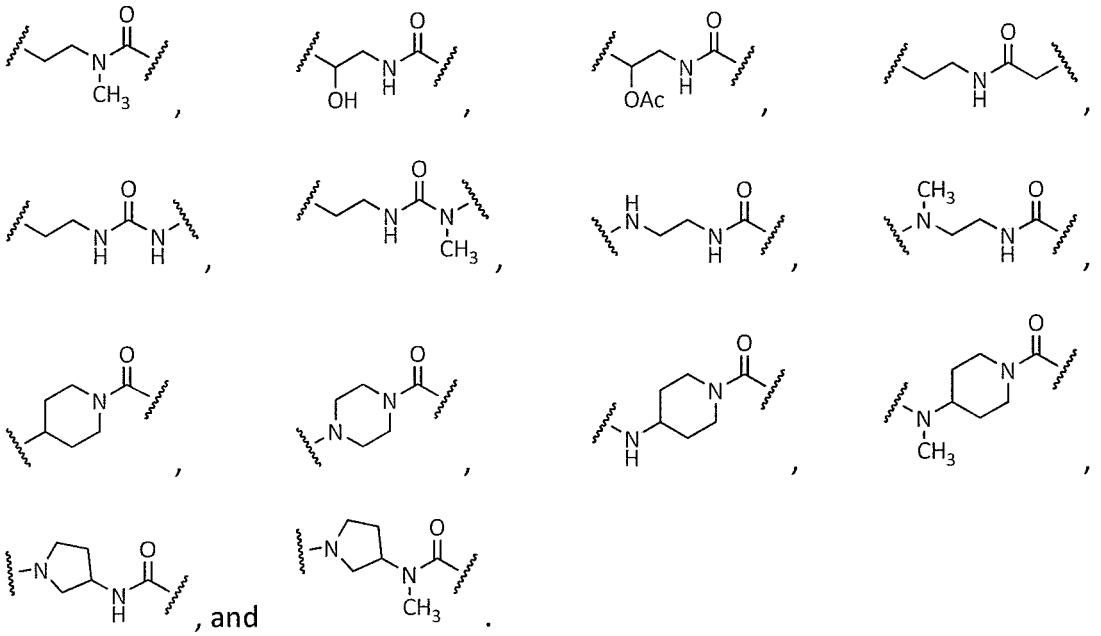
A and C are each independently a carbocyclyl or heterocyclyl;

R_1 is, at each occurrence, H, C_{1-4}alkyl, $C(=O)OC_{1-4}$alkyl or aryl;

R_2, R_3, R_4 and R_5 are each independently -OH, $-NH_2$, $-NH(C_{1-4}alkyl)$, $-N(C_{1-4}alkyl)_2$, -C≡N, $-C(=O)NH_2$, halo, C_{1-4}alkyl, C_{1-4}alkyl-OH, C_{1-4}haloalkyl, C_{1-4}alkoxy or C_{1-4}haloalkoxy;

w, x, y and z are each independently 0, 1, 2 or 3; and

L_1 is one of the following:



In one aspect, there is provided a compound that is (2R,6R)-N-[2-(1-benzylpiperidin-4-yl)ethyl]-2,6-dimethyl-4-[5-(trifluoromethyl)pyrazin-2-yl]piperazine-1-carboxamide or pharmaceutically acceptable salt thereof.

In one aspect, there is provided a compound that is (2S,6R)-N-(2-(1-Benzylpiperidin-4-yl)ethyl)-4-(5-cyanopyrimidin-2-yl)-2,6-dimethylpiperazine-1-carboxamide or pharmaceutically acceptable salt thereof.

In one aspect, there is provided a compound that is (2R,6R)-N-(2-(1-Benzylpiperidin-4-yl)ethyl)-4-(5-cyanopyrimidin-2-yl)-2,6-dimethylpiperazine-1-carboxamide or pharmaceutically acceptable salt thereof.

In one aspect, there is provided a compound that is (2R)-N-[2-(1-Benzylpiperidin-4-yl)ethyl]-2-methyl-4-[5-(trifluoromethyl)pyrimidin-2-yl]piperazine-1-carboxamide or pharmaceutically acceptable salt thereof.

In one aspect, there is provided a compound that is (2R)-N-[2-(1-Benzylpiperidin-4-yl)ethyl]-4-(3-cyano-5-fluorophenyl)-2-methylpiperazine-1-carboxamide or pharmaceutically acceptable salt thereof.

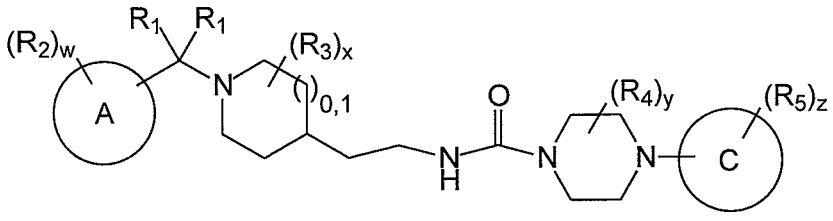
In another embodiment, pharmaceutical compositions are provided comprising a compound of formula (I), including one or more of the specific compounds described herein, and at least one pharmaceutically acceptable excipient. In one aspect, there is provided a composition comprising a compound as described herein, or a stereoisomer, solvate, or pharmaceutically acceptable salt thereof, and at least one pharmaceutically acceptable excipient. The compounds, as well as the pharmaceutical compositions comprising the compounds, may be used for antagonizing a muscarinic receptor, such as muscarinic receptor 4 (M4). In one aspect, there is provided and *in vitro* method for antagonizing a muscarinic receptor of a cell comprising contacting the cell with the compound as described herein, or a stereoisomer, solvate, or pharmaceutically acceptable salt thereof. In another aspect, there is provided use of a compound as described herein, or a stereoisomer, solvate, or pharmaceutically acceptable salt thereof, in the manufacture of a medicament for antagonizing a muscarinic receptor of a cell. In certain embodiments, the compound is a selective M4 antagonist.

In one aspect, there is provided use of a compound as described herein, or a stereoisomer, solvate, or pharmaceutically acceptable salt thereof, or a pharmaceutical composition as described herein, in the manufacture of a medicament for treating or preventing a neurological disease or disorder in a subject in need thereof.

CLAIMS

We claim the following:

1. A compound having the structure of the following formula (XII):



(XII)

or a stereoisomer, solvate, or pharmaceutically acceptable salt thereof, wherein:

A and C are each independently a carbocyclyl or heterocyclyl;

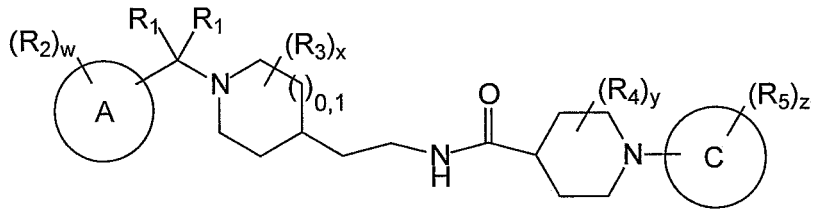
R_1 is, at each occurrence, H, C_{1-4}alkyl, $C(=O)OC_{1-4}$alkyl or aryl;

R_2, R_3, R_4 and R_5 are each independently -OH, $-NH_2$, $-NH(C_{1-4}alkyl)$, $-N(C_{1-4}alkyl)_2$, $-C\equiv N$, $-C(=O)NH_2$, halo, C_{1-4}alkyl, C_{1-4}alkyl-OH, C_{1-4}haloalkyl, C_{1-4}alkoxy or C_{1-4}haloalkoxy; and

w, x, y and z are each independently 0, 1, 2 or 3;

or

a compound having the structure of the following formula (XIII):



(XIII)

or a stereoisomer, solvate, or pharmaceutically acceptable salt thereof, wherein:

A and C are each independently a carbocyclyl or heterocyclyl;

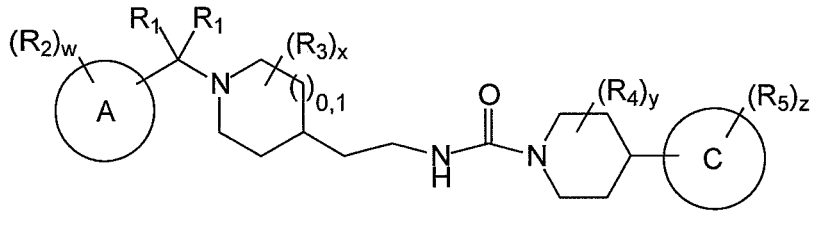
R_1 is, at each occurrence, H, C_{1-4}alkyl, $C(=O)OC_{1-4}$alkyl or aryl;

R_2, R_3, R_4 and R_5 are each independently -OH, $-NH_2$, $-NH(C_{1-4}alkyl)$, $-N(C_{1-4}alkyl)_2$, -C≡N, $-C(=O)NH_2$, halo, C_{1-4}alkyl, C_{1-4}alkyl-OH, C_{1-4}haloalkyl, C_{1-4}alkoxy or C_{1-4}haloalkoxy; and

w, x, y and z are each independently 0, 1, 2 or 3, wherein at least one of y or z is 1, 2 or 3;

or

a compound having the structure of the following formula (XIV):



(XIV)

or a stereoisomer, solvate, or pharmaceutically acceptable salt thereof, wherein:

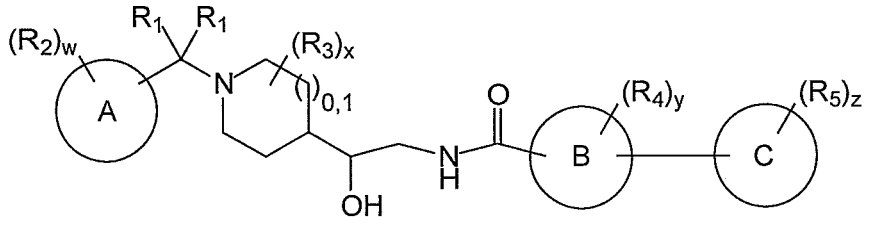
A and C are each independently a carbocyclyl or heterocyclyl;

R_1 is, at each occurrence, H, C_{1-4}alkyl, $C(=O)OC_{1-4}$alkyl or aryl;

R_2, R_3, R_4 and R_5 are each independently -OH, $-NH_2$, $-NH(C_{1-4}alkyl)$, $-N(C_{1-4}alkyl)_2$, -C≡N, $-C(=O)NH_2$, halo, C_{1-4}alkyl, C_{1-4}alkyl-OH, C_{1-4}haloalkyl, C_{1-4}alkoxy or C_{1-4}haloalkoxy; and

w, x, y and z are each independently 0, 1, 2 or 3.

2. A compound having the structure of the following formula (XI):



(XI)

or a stereoisomer, solvate, or pharmaceutically acceptable salt thereof, wherein:

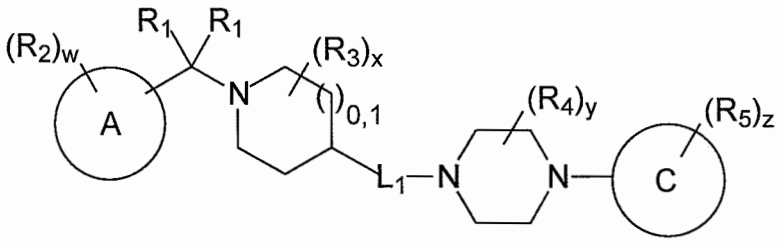
A, B and C are each independently a carbocyclyl or heterocyclyl;

R_1 is, at each occurrence, H, C_{1-4}alkyl, $C(=O)OC_{1-4}$alkyl or aryl;

R_2, R_3, R_4 and R_5 are each independently -OH, $-NH_2$, $-NH(C_{1-4}alkyl)$, $-N(C_{1-4}alkyl)_2$, -C≡N, $-C(=O)NH_2$, halo, C_{1-4}alkyl, C_{1-4}alkyl-OH, C_{1-4}haloalkyl, C_{1-4}alkoxy or C_{1-4}haloalkoxy; and

w, x, y and z are each independently 0, 1, 2 or 3.

3. A compound having the structure of the following formula (VII):



(VII)

or a stereoisomer, solvate, or pharmaceutically acceptable salt thereof, wherein:

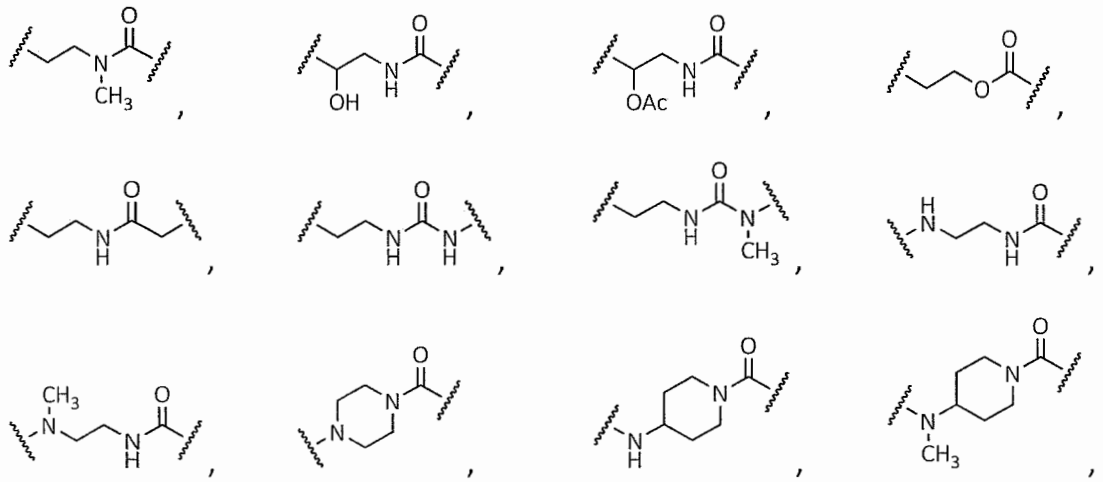
A and C are each independently a carbocyclyl or heterocyclyl;

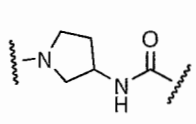
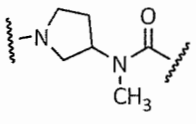
R_1 is, at each occurrence, H, C_{1-4}alkyl, $C(=O)OC_{1-4}$alkyl or aryl;

R_2, R_3, R_4 and R_5 are each independently -OH, $-NH_2$, $-NH(C_{1-4}alkyl)$, $-N(C_{1-4}alkyl)_2$, -C≡N, $-C(=O)NH_2$, halo, C_{1-4}alkyl, C_{1-4}alkyl-OH, C_{1-4}haloalkyl, C_{1-4}alkoxy or C_{1-4}haloalkoxy;

w, x, y and z are each independently 0, 1, 2 or 3; and

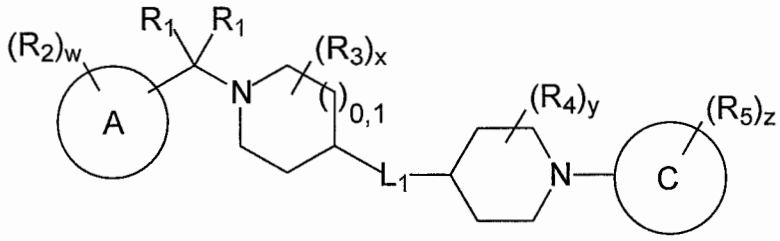
L_1 is one of the following:




, and 
;

or

a compound having the structure of the following formula (VIII):


(VIII)

or a stereoisomer, solvate, or pharmaceutically acceptable salt thereof, wherein:

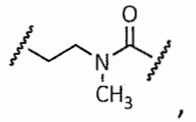
A and C are each independently a carbocyclyl or heterocyclyl;

R_1 is, at each occurrence, H, C_{1-4}alkyl, $C(=O)OC_{1-4}$alkyl or aryl;

R_2, R_3, R_4 and R_5 are each independently -OH, $-NH_2$, $-NH(C_{1-4}alkyl)$, $-N(C_{1-4}alkyl)_2$, -C≡N, $-C(=O)NH_2$, halo, C_{1-4}alkyl, C_{1-4}alkyl-OH, C_{1-4}haloalkyl, C_{1-4}alkoxy or C_{1-4}haloalkoxy;

w, x, y and z are each independently 0, 1, 2 or 3; and

L_1 is one of the following: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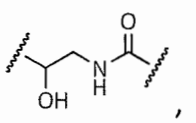
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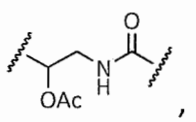
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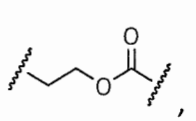
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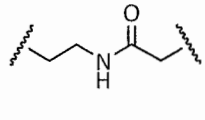
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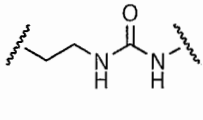
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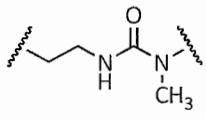
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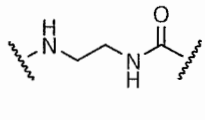
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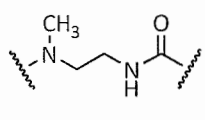
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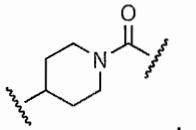
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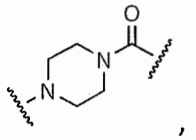
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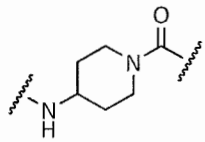
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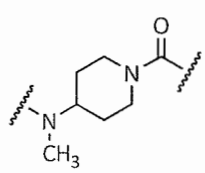
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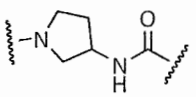
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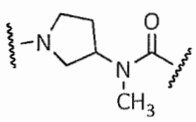
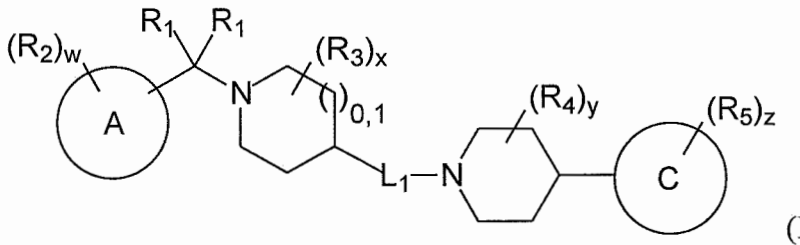

;

or

a compound having the structure of the following formula (IX):



(IX)

or a stereoisomer, solvate, or pharmaceutically acceptable salt thereof, wherein:

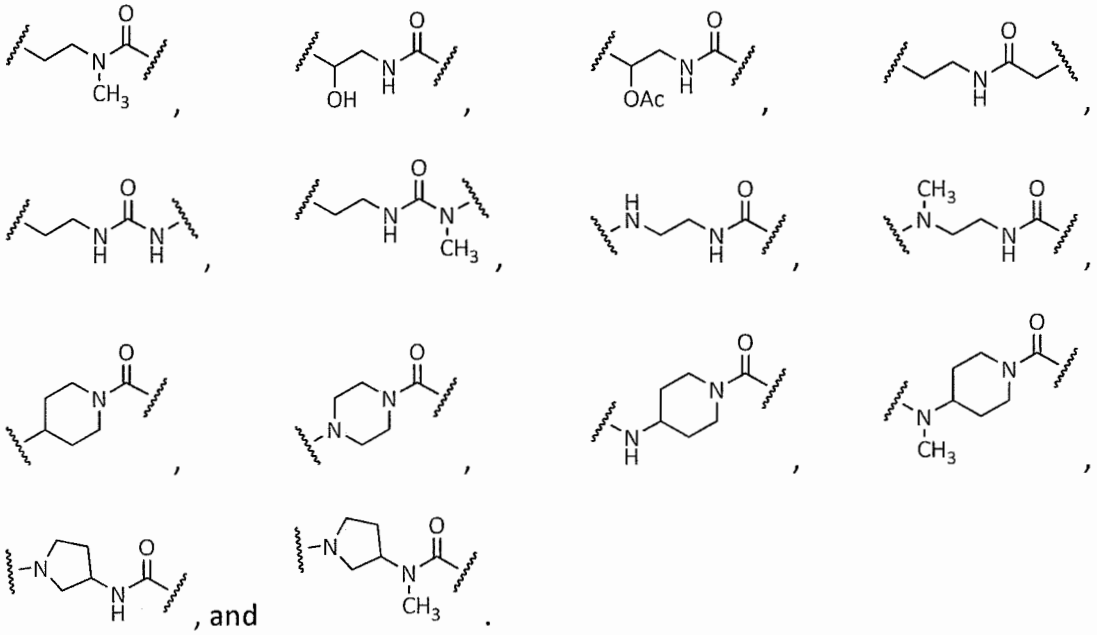
A and C are each independently a carbocyclyl or heterocyclyl;

R_1 is, at each occurrence, H, C_{1-4}alkyl, $C(=O)OC_{1-4}$alkyl or aryl;

R_2, R_3, R_4 and R_5 are each independently -OH, $-NH_2$, $-NH(C_{1-4}alkyl)$, $-N(C_{1-4}alkyl)_2$, -C≡N, $-C(=O)NH_2$, halo, C_{1-4}alkyl, C_{1-4}alkyl-OH, C_{1-4}haloalkyl, C_{1-4}alkoxy or C_{1-4}haloalkoxy;

w, x, y and z are each independently 0, 1, 2 or 3; and

L_1 is one of the following:



4. The compound of any one of claims 1–3, or a stereoisomer, solvate, or pharmaceutically acceptable salt thereof, wherein R_1 is H at both occurrences.

5. The compound of any one of claims 1–3, or a stereoisomer, solvate, or pharmaceutically acceptable salt thereof, wherein one R_1 is H and the other R_1 is methyl.

6. The compound of any one of claims 1–3, or a stereoisomer, solvate, or pharmaceutically acceptable salt thereof, wherein R_1 is methyl at both occurrences.

7. The compound of any one of claims 1–3, or a stereoisomer, solvate, or pharmaceutically acceptable salt thereof, wherein A is a non-aromatic carbocyle.

8. The compound of claim 7, or a stereoisomer, solvate, or pharmaceutically acceptable salt thereof, wherein A is cyclohexyl.

9. The compound of any one of claims 1–3, or a stereoisomer, solvate, or pharmaceutically acceptable salt thereof, wherein A is an aromatic carbocyle.

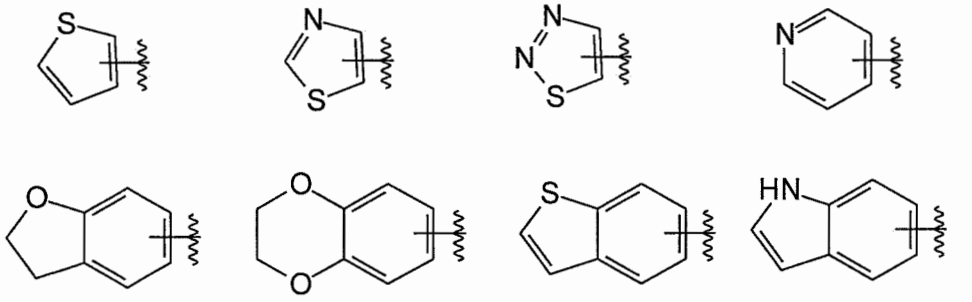
10. The compound of claim 9, or a stereoisomer, solvate, or pharmaceutically acceptable salt thereof, wherein A is aryl.

11. The compound of claim 10, or a stereoisomer, solvate, or pharmaceutically acceptable salt thereof, wherein A is phenyl or naphthyl.

12. The compound of claim 11, or a stereoisomer, solvate, or pharmaceutically acceptable salt thereof, wherein A is phenyl.

13. The compound of any one of claims 1–3, or a stereoisomer, solvate, or pharmaceutically acceptable salt thereof, wherein A is an aromatic heterocycle.

14. The compound of claim 13, or a stereoisomer, solvate, or pharmaceutically acceptable salt thereof, wherein A is one of the following:



15. The compound of any one of claims 1–3, or a stereoisomer, solvate, or pharmaceutically acceptable salt thereof, wherein w is 0 and R_2 is not present.

16. The compound of any one of claims 1–3, or a stereoisomer, solvate, or pharmaceutically acceptable salt thereof, wherein w is 1, 2 or 3, and R_2 is at each occurrence -OH, -C≡N, halo or C_{1-4}alkyl.

17. The compound of any one of claims 1–3, or a stereoisomer, solvate, or pharmaceutically acceptable salt thereof, wherein x is 0 and R_3 is not present.

18. The compound of any one of claims 1–3, or a stereoisomer, solvate, or pharmaceutically acceptable salt thereof, wherein x is 1 or 2 and R_3 is at each occurrence -OH or C_{1-4}alkyl-OH.

19. The compound of claim 2, or a stereoisomer, solvate, or pharmaceutically acceptable salt thereof, wherein B is a non-aromatic carbocyle.

20. The compound of claim 19, or a stereoisomer, solvate, or pharmaceutically acceptable salt thereof, wherein B is cyclohexyl.

21. The compound of claim 2, or a stereoisomer, solvate, or pharmaceutically acceptable salt thereof, wherein B is an aromatic carbocyle.

22. The compound of claim 21, or a stereoisomer, solvate, or pharmaceutically acceptable salt thereof, wherein B is aryl.

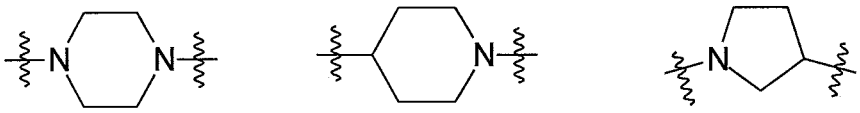
23. The compound of claim 22, or a stereoisomer, solvate, or pharmaceutically acceptable salt thereof, wherein B is phenyl or naphthyl.

24. The compound of claim 23, or a stereoisomer, solvate, or pharmaceutically acceptable salt thereof, wherein B is phenyl.

25. The compound of claim 2, or a stereoisomer, solvate, or pharmaceutically acceptable salt thereof, wherein B is a non-aromatic heterocycle.

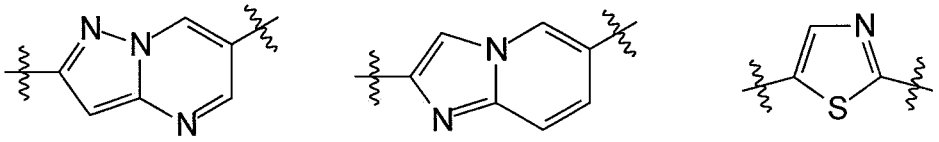
26. The compound of claim 25, or a stereoisomer, solvate, or pharmaceutically acceptable salt thereof, wherein B is piperzinyl, piperdinyl or pyrrolidinyl.

27. The compound of claim 26, or a stereoisomer, solvate, or pharmaceutically acceptable salt thereof, wherein B is one of the following:



28. The compound of claim 2, or a stereoisomer, solvate, or pharmaceutically acceptable salt thereof, wherein B is an aromatic heterocycle.

29. The compound of claim 28, or a stereoisomer, solvate, or pharmaceutically acceptable salt thereof, wherein B is one of the following:



30. The compound of any one of claims 1–3, or a stereoisomer, solvate, or pharmaceutically acceptable salt thereof, wherein y is 0 and R_4 is not present.

31. The compound of any one of claims 1–3, or a stereoisomer, solvate, or pharmaceutically acceptable salt thereof, wherein y is 1 and R_4 is methyl.

32. The compound of any one of claims 1–3, or a stereoisomer, solvate, or pharmaceutically acceptable salt thereof, wherein y is 2 and R_4 at both occurences is methyl.

33. The compound of any one of claims 1–3, or a stereoisomer, solvate, or pharmaceutically acceptable salt thereof, wherein C is an aromatic carbocycle or heterocycle.

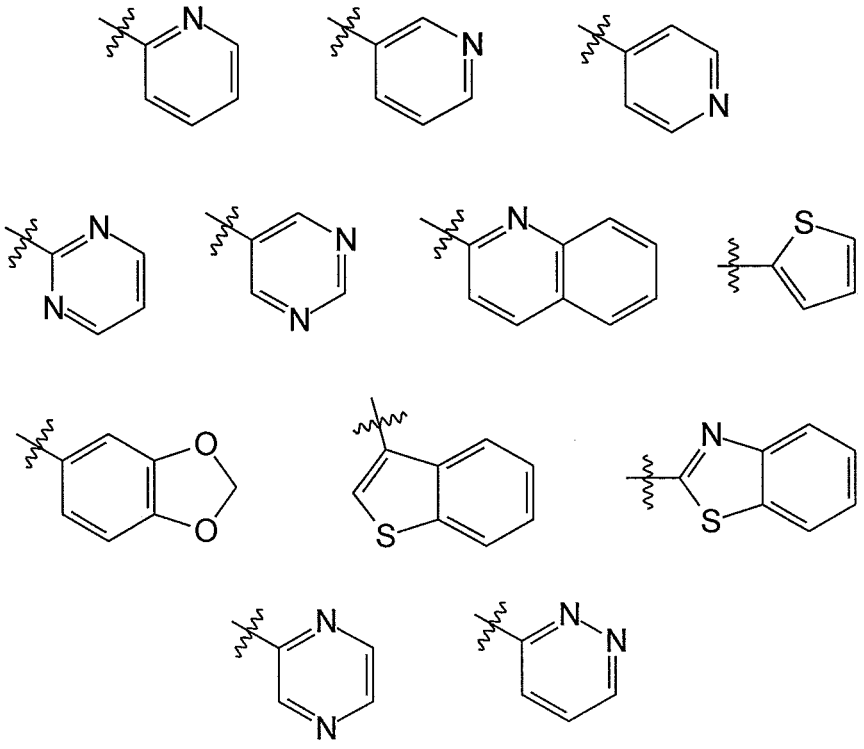
34. The compound of claim 33, or a stereoisomer, solvate, or pharmaceutically acceptable salt thereof, wherein C is an aromatic carbocyle.

35. The compound of claim 34, or a stereoisomer, solvate, or pharmaceutically acceptable salt thereof, wherein C is aryl.

36. The compound of claim 35, or a stereoisomer, solvate, or pharmaceutically acceptable salt thereof, wherein C is phenyl.

37. The compound of any one of claims 1–3, or a stereoisomer, solvate, or pharmaceutically acceptable salt thereof, wherein C is an aromatic heterocycle.

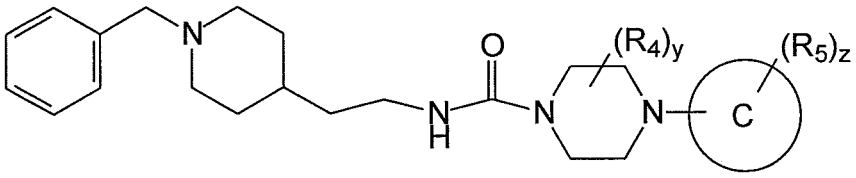
38. The compound of claim 37, or a stereoisomer, solvate, or pharmaceutically acceptable salt thereof, wherein C is one of the following:



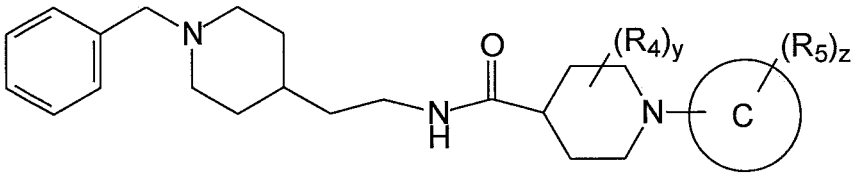
39. The compound of any one of claims 1–3, or a stereoisomer, solvate, or pharmaceutically acceptable salt thereof, wherein z is 0 and R_5 is not present.

40. The compound of any one of claims 1–3, or a stereoisomer, solvate, or pharmaceutically acceptable salt thereof, wherein z is 1, 2 or 3, and each occurrence of R_5 is independently -OH, $-NH_2$, $-NH(C_{1-4}alkyl)$, $-N(C_{1-4}alkyl)_2$, -C≡N, halo, C_{1-4}alkyl, C_{1-4}alkyl-OH, C_{1-4}haloalkyl, C_{1-4}alkoxy or C_{1-4}haloalkoxy.

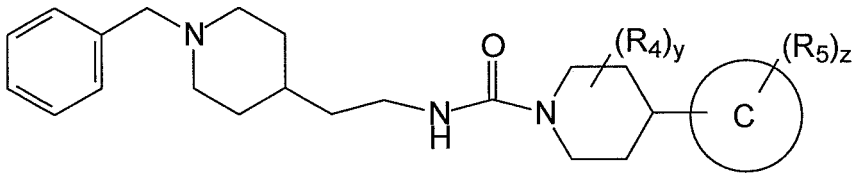
41. The compound of claim 1, or a stereoisomer, solvate, or pharmaceutically acceptable salt thereof, wherein the compound has a structure of one of the following formulas (XV) through (XVII):



(XV)



(XVI)



(XVII).

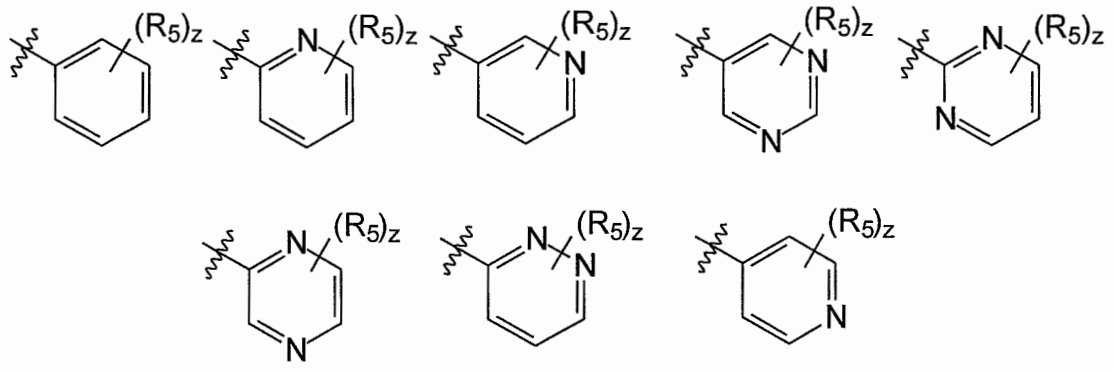
42. The compound of claim 41, or a stereoisomer, solvate, or pharmaceutically acceptable salt thereof, wherein the compound has a structure of formula (XV) or (XVII), wherein y is 0.

43. The compound of claim 41, or a stereoisomer, solvate, or pharmaceutically acceptable salt thereof, wherein the compound has a structure of

formula (XV), (XVI) or (XVII), wherein y is 1 or 2 and R_4 is at each occurrence C_{1-4}alkyl.

44. The compound of claim 41, or a stereoisomer, solvate, or pharmaceutically acceptable salt thereof, wherein the compound has a structure of formula (XV), (XVI) or (XVII), wherein y is 1 or 2 and R_4 is at each occurrence methyl.

45. The compound of claim 41, or a stereoisomer, solvate, or pharmaceutically acceptable salt thereof, wherein the compound has a structure of formula (XV), (XVI) or (XVII), wherein $C(R_5)_z$ is one of the following:



46. The compound of claim 45, or a stereoisomer, solvate, or pharmaceutically acceptable salt thereof, wherein z is 0 and R_5 is not present.

47. The compound of claim 45, or a stereoisomer, solvate, or pharmaceutically acceptable salt thereof, wherein z is 1, 2 or 3, and each occurrence of R_5 is independently -OH, $-NH_2$, $-NH(C_{1-4}alkyl)$, $-N(C_{1-4}alkyl)_2$, -C≡N, halo, C_{1-4}alkyl, C_{1-4}alkyl-OH, C_{1-4}haloalkyl, C_{1-4}alkoxy or C_{1-4}haloalkoxy.

48. The compound of claim 4, or a stereoisomer, solvate, or pharmaceutically acceptable salt thereof, wherein R_1 is ^1H at both occurrences.

49. The compound of claim 4, or a stereoisomer, solvate, or pharmaceutically acceptable salt thereof, wherein R_1 is ^2H at both occurrences.

50. A compound that is (2R,6R)-N-[2-(1-benzylpiperidin-4-yl)ethyl]-2,6-dimethyl-4-[5-(trifluoromethyl)pyrazin-2-yl]piperazine-1-carboxamide or pharmaceutically acceptable salt thereof.

51. A compound that is (2S,6R)-N-(2-(1-Benzylpiperidin-4-yl)ethyl)-4-(5-cyanopyrimidin-2-yl)-2,6-dimethylpiperazine-1-carboxamide or pharmaceutically acceptable salt thereof.

52. A compound that is (2R,6R)-N-(2-(1-Benzylpiperidin-4-yl)ethyl)-4-(5-cyanopyrimidin-2-yl)-2,6-dimethylpiperazine-1-carboxamide or pharmaceutically acceptable salt thereof.

53. A compound that is (2R)-N-[2-(1-Benzylpiperidin-4-yl)ethyl]-2-methyl-4-[5-(trifluoromethyl)pyrimidin-2-yl]piperazine-1-carboxamide or pharmaceutically acceptable salt thereof.

54. A compound that is (2R)-N-[2-(1-Benzylpiperidin-4-yl)ethyl]-4-(3-cyano-5-fluorophenyl)-2-methylpiperazine-1-carboxamide or pharmaceutically acceptable salt thereof.

55. A pharmaceutical composition comprising a compound of any one of claims 1–54, or a stereoisomer, solvate, or pharmaceutically acceptable salt thereof, and at least one pharmaceutically acceptable excipient.

56. An *in vitro* method for antagonizing a muscarinic receptor of a cell comprising contacting the cell with the compound of any one of claims 1–54, or a stereoisomer, solvate, or pharmaceutically acceptable salt thereof.

57. The method of claim 56, wherein the muscarinic receptor is muscarinic receptor 4.

58. The method of claim 57, wherein the compound selectively antagonizes muscarinic receptor 4 (M4).

59. Use of a compound of any one of claims 1-54, or a stereoisomer, solvate, or pharmaceutically acceptable salt thereof, in the manufacture of a medicament for antagonizing a muscarinic receptor of a cell.

60. The use of claim 59, wherein the muscarinic receptor is muscarinic receptor 4.

61. The use of claim 60, wherein the compound selectively antagonizes muscarinic receptor 4 (M4).

62. The use of any one of claims 59-61 wherein the cell is comprised within a subject who is in need of treatment with the compound.

63. The use of claim 62 wherein the subject has a neurological disease or disorder.

64. Use of a compound of any one of claims 1-54, or a stereoisomer, solvate, or pharmaceutically acceptable salt thereof, or a pharmaceutical composition of claim 55, in the manufacture of a medicament for treating or preventing a neurological disease or disorder in a subject in need thereof.

65. The use of claim 64 wherein the neurological disease or disorder is Alzheimer's Disease, Lewy Body Dementia and the cognitive deficits associated with schizophrenia; Parkinson's Disease, drug induced Parkinsonism, dyskinesias, dystonia, chorea, levodopa induced dyskinesia, cerebral palsy, progressive supranuclear palsy, or Huntington's disease.