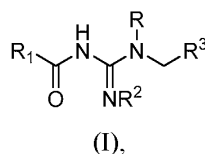


What is claimed is:

1. A compound of Formula (I):



or a pharmaceutically acceptable salt or solvate thereof; wherein:

R is -CH₃, -CH₂D, -CHD₂, or -CD₃;

R¹ is linear or branched alkyl, linear or branched alkenyl, aryl or heteroaryl, wherein R¹ is optionally substituted with R⁴;

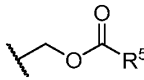
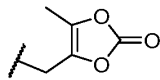
R² is hydrogen, -C(O)NHR⁵, -C(O)R¹ or -C(O)OR⁵;

R³ is -C(O)OR⁶, or -alkyl(OH);

or alternatively, R² and R³ together is an alkylene group which with the atoms which they are each bonded to, forms a 5 to 6 membered ring wherein the 5 to 6 membered ring is optionally substituted with oxo;

R⁴ is halogen, -OH, -OR⁵, oxo, -NH₂, -NHR⁵, -N(R⁵)₂, -NO₂, -CF₃, -C₁-C₆ alkyl, or -C₁-C₆ haloalkyl;

R⁵ is linear or branched alkyl;

R⁶ is H, linear or branched alkyl, , or ;

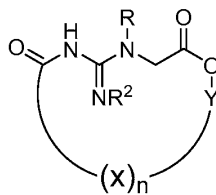
or alternatively, R⁶ and R¹ together is an alkylene group or an alkenylene group which with the atoms which they are each bonded to, forms a 12 to 25 membered ring, wherein 1, 2, 3, or 4 -CH₂- units making up the alkylene group or the alkenylene group is optionally replaced with a heteroatom selected from -O-, -S-, or -N-, provided that no adjacent -CH₂- is replaced; wherein the alkylene group or the alkenylene group is optionally substituted with one or more R⁴; and

wherein, two R⁴ on the same or adjacent carbon can form a 3 to 6 membered fused or spiro cycloalkyl ring or a 3 to 6 membered fused or spiro heterocyclic ring.

2. The compound of claim 1, wherein R is -CH₃ or -CD₃.

3. The compound of claim 1 or 2, wherein R¹ is -C₆-C₂₀ alkyl or -C₆-C₂₀ alkenyl.

4. The compound of any one of claims 1-3, wherein R¹ is -C₆-C₁₈ alkyl or -C₆-C₁₈ alkenyl.
5. The compound of claim 1 or 2, wherein R¹ is pyridyl.
6. The compound of any one of claims 1-5, wherein R² is hydrogen.
7. The compound of any one of claims 1-8, wherein R² is -C(O)OR⁵.
8. The compound of claim 7, wherein R⁵ is linear or branched -C₁-C₆ alkyl.
9. The compound of any one of claims 1-8, wherein R³ is -C(O)OR⁶.
10. The compound of claim 9, wherein R⁶ is H or linear or branched -C₁-C₈ alkyl.
11. The compound of claim 1 or 2, wherein R⁶ and R¹ together is an alkylene group or an alkenylene group which with the atoms which they are each bonded to, forms a 12 to 25 membered ring, wherein 1, 2, 3, or 4 -CH₂- units making up the alkylene group or the alkenylene group is optionally replaced with a heteroatom selected from -O-, -S-, or -N-, provided that no adjacent -CH₂- is replaced; wherein the alkylene group or the alkenylene group is optionally substituted with one or more R⁴.
12. The compound of claim 11, wherein R⁶ and R¹ together is an unsubstituted alkylene group or an unsubstituted alkenylene group which forms a 13 to 24 membered ring with the atoms which they are each bonded to.
13. The compound of any one of claims 1-12, wherein the compound is a pharmaceutically acceptable salt selected from sodium salt, potassium salt, lithium salt, Na₂PO₄H salt, hydrochloric acid salt, formic acid salt, trifluoroacetic acid salt, acetic acid salt or trichloroacetic acid/2 lithium salt.
14. The compound of claim 1, wherein the compound has the structure of Formula (II):



(II),

or a pharmaceutically acceptable salt or solvate thereof; wherein:

R is $-\text{CH}_3$, $-\text{CH}_2\text{D}$, $-\text{CHD}_2$, $-\text{CD}_3$;

R^2 is hydrogen, $-\text{C}(\text{O})\text{NHR}^5$, $-\text{C}(\text{O})\text{R}^1$ or $-\text{C}(\text{O})\text{OR}^5$;

R^1 is linear or branched alkyl, or linear or branched alkenyl, wherein R^1 is optionally substituted with R^4 ;

R^4 is halogen, $-\text{OH}$, $-\text{OR}^5$, oxo, $-\text{NH}_2$, $-\text{NHR}^5$, $-\text{N}(\text{R}^5)_2$, $-\text{NO}_2$, $-\text{CF}_3$, $-\text{C}_1\text{-C}_6$ alkyl, or $-\text{C}_1\text{-C}_6$ haloalkyl;

X at each occurrence is independently $-\text{C}(\text{R}^{5a})_2\text{-C}(\text{R}^{5a})_2-$, $-\text{CH}(\text{R}^{5a})\text{-CH}(\text{R}^{5a})-$, $-\text{C}(\text{R}^{5a})=\text{C}(\text{R}^{5a})-$, $-\text{O-C}(\text{R}^{5a})_2-$, $-\text{O-CH}(\text{R}^{5a})-$, $-\text{C}(\text{R}^{5a})_2\text{-O-}$, or $-\text{CH}(\text{R}^{5a})\text{-O-}$;

Y is $-\text{C}(\text{R}^{5a})_2-$, $-\text{CH}(\text{R}^{5a})-$, $-\text{C}(\text{R}^{5a})_2\text{-C}(\text{R}^{5a})_2-$, $-\text{CH}(\text{R}^{5a})\text{-CH}(\text{R}^{5a})-$, $-\text{C}(\text{R}^{5a})=\text{C}(\text{R}^{5a})-$, $-\text{C}(\text{R}^{5a})_2\text{-O-}$, or $-\text{CH}(\text{R}^{5a})\text{-O-}$;

n is 2, 3, 4, 5, 6, 7, or 8, wherein when n is 2, Y is $\text{C}(\text{R}^{5a})_2\text{-C}(\text{R}^{5a})_2-$, $-\text{CH}(\text{R}^{5a})\text{-CH}(\text{R}^{5a})-$, $-\text{C}(\text{R}^{5a})=\text{C}(\text{R}^{5a})-$, $-\text{C}(\text{R}^{5a})_2\text{-O-}$, or $-\text{CH}(\text{R}^{5a})\text{-O-}$;

R^5 is H or linear or branched alkyl;

R^{5a} is H, halogen, $-\text{OH}$, $-\text{OR}^5$, $-\text{NH}_2$, $-\text{NHR}^5$, $-\text{N}(\text{R}^5)_2$, $-\text{NO}_2$, $-\text{CF}_3$, $-\text{C}_1\text{-C}_6$ alkyl, or $-\text{C}_1\text{-C}_6$ haloalkyl; and

wherein, two R^{5a} on the same or adjacent carbon can form a 3 to 6 membered fused or spiro cycloalkyl ring or a 3 to 6 membered fused or spiro heterocyclic ring.

15. The compound of claim 14, wherein at least one of X is $-\text{C}(\text{R}^{5a})_2\text{-C}(\text{R}^{5a})_2-$, $-\text{CH}(\text{R}^{5a})\text{-CH}(\text{R}^{5a})-$, or $-\text{C}(\text{R}^{5a})=\text{C}(\text{R}^{5a})-$, wherein R^{5a} is H or $-\text{C}_1\text{-C}_6$ alkyl; and

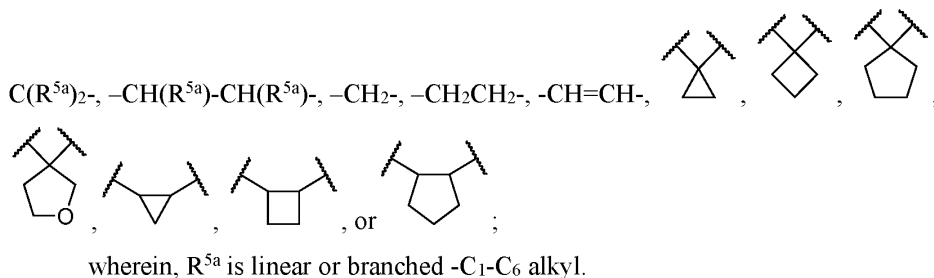
wherein, two R^{5a} on the same or adjacent carbon can form a 3 to 6 membered fused or spiro cycloalkyl ring or a 3 to 6 membered fused or spiro heterocyclic ring.

16. The compound of claim 14, wherein X is $-\text{CH}_2\text{CH}_2-$, $-\text{CH}=\text{CH}-$, $-\text{O-CH}_2-$, or $-\text{CH}_2\text{-O-}$.

17. The compound of any one of claims 14-16, wherein Y is $-\text{C}(\text{R}^{5a})_2-$, $-\text{CH}(\text{R}^{5a})-$, $-\text{C}(\text{R}^{5a})_2\text{-C}(\text{R}^{5a})_2-$, $-\text{CH}(\text{R}^{5a})\text{-CH}(\text{R}^{5a})-$, or $-\text{C}(\text{R}^{5a})=\text{C}(\text{R}^{5a})-$, wherein R^{5a} is H or $-\text{C}_1\text{-C}_6$ alkyl; and

wherein, two R^{5a} on the same or adjacent carbon can form a 3 to 6 membered fused or spiro cycloalkyl ring or a 3 to 6 membered fused or spiro heterocyclic ring.

18. The compound of any one of claims 14-16, wherein Y is -C(R^{5a})₂-, -CH(R^{5a})-, -C(R^{5a})₂-

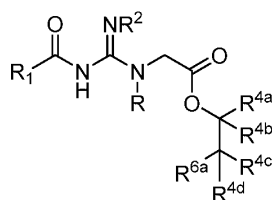


19. The compound of any one of claims 14-18, wherein R is -CH₃ or -CD₃.

20. The compound of any one of claims 14-19, wherein R² is hydrogen.

21. The compound of any one of claims 14-20, wherein the compound is a pharmaceutically acceptable salt selected from sodium salt, potassium salt, lithium salt, Na₂PO₄H salt, hydrochloric acid salt, formic acid salt, trifluoroacetic acid salt, acetic acid salt or trichloroacetic acid/2 lithium salt.

22. The compound of claim 1, wherein the compound has the structure of Formula (I-A):



(I-A),

or a pharmaceutically acceptable salt or solvate thereof; wherein:

R is -CH₃, -CH₂D, -CHD₂, or -CD₃;

R² is hydrogen, -C(O)NHR⁵, -C(O)R¹ or -C(O)OR⁵;

R³ is -C(O)OR⁶, or -alkyl(OH);

or alternatively, R² and R³ together is an alkylene group which with the atoms which they are each bonded to, forms a 5 to 6 membered ring wherein the 5 to 6 membered ring is optionally substituted with oxo;

R⁴ is halogen, -OH, -OR⁵, oxo, -NH₂, -NHR⁵, -N(R⁵)₂, -NO₂, -CF₃, -C₁-C₆ alkyl, or -C₁-C₆ haloalkyl;

R^{4a}, R^{4b}, R^{4c}, and R^{4d}, each independently, is H, halogen, -OH, -OR⁵, oxo, -NH₂, -NHR⁵, -N(R⁵)₂, -NO₂, -CF₃, -C₁-C₆ alkyl, or -C₁-C₆ haloalkyl;

R⁵ is linear or branched alkyl;

R^{6a} and R¹ together is an alkylene group or an alkenylene group which with the atoms which they are each bonded to, forms a 12 to 25 membered ring, wherein 1, 2, 3, or 4 -CH₂- units making up the alkylene group or the alkenylene group is optionally replaced with a heteroatom selected from -O-, -S-, or -N-, provided that no adjacent -CH₂- is replaced; wherein the alkylene group or the alkenylene group is optionally substituted with one or more R⁴; and

wherein, R^{4a} and R^{4b} or R^{4c} and R^{4d} together can form a 3 to 6 membered spiro cycloalkyl ring or a 3 to 6 membered spiro heterocyclic ring; or

wherein R^{4b} and R^{4c} together can form a 3 to 6 membered fused cycloalkyl ring or a 3 to 6 membered fused heterocyclic ring.

23. The compound of claim 22, wherein R^{4a} is -C₁-C₆ alkyl.

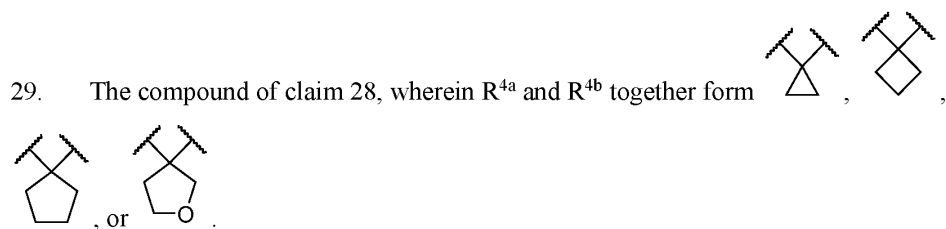
24. The compound of claim 23, wherein R^{4b} is -C₁-C₆ alkyl.

25. The compound of claim 22 or 23, wherein R^{4c} is -C₁-C₆ alkyl.

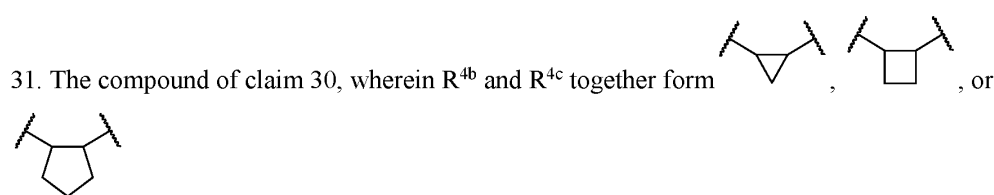
26. The compound of claim 22 or 23, wherein R^{4b}, R^{4c}, and R^{4d} is H.

27. The compound of claim 22 or 25, wherein R^{4b} and R^{4d} is H.

28. The compound of claim 22, wherein R^{4a} and R^{4b} together form a 3 to 6 membered spiro cycloalkyl ring or a 3 to 6 membered spiro heterocyclic ring.



30. The compound of claim 22, wherein R^{4b} and R^{4c} together form a 3 to 6 membered fused cycloalkyl ring or a 3 to 6 membered fused heterocyclic ring.

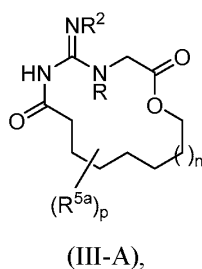


32. The compound of any one of claims 22-31, wherein R is $-\text{CH}_3$ or $-\text{CD}_3$.

33. The compound of any one of claims 22-32, wherein R^2 is hydrogen.

34. The compound of any one of claims 22-33, wherein the compound is a pharmaceutically acceptable salt selected from sodium salt, potassium salt, lithium salt, $\text{Na}_2\text{PO}_4\text{H}$ salt, hydrochloric acid salt, formic acid salt, trifluoroacetic acid salt, acetic acid salt or trichloroacetic acid/2 lithium salt.

35. The compound of claim 1, wherein the compound has the structure of Formula (III-A):



or a pharmaceutically acceptable salt or solvate thereof; wherein:

R is $-\text{CH}_3$, $-\text{CH}_2\text{D}$, $-\text{CHD}_2$, $-\text{CD}_3$;

R^1 is linear or branched alkyl, or linear or branched alkenyl;

R^2 is hydrogen, $-C(O)NHR^5$, $-C(O)R^1$ or $-C(O)OR^5$;

R^5 is H or linear or branched alkyl;

R^{5a} is halogen, $-OH$, $-OR^5$, oxo, $-NH_2$, $-NHR^5$, $-N(R^5)_2$, $-NO_2$, $-CF_3$, $-C_1-C_6$ alkyl, or $-C_1-C_6$ haloalkyl;

wherein, two R^{5a} on the same or adjacent carbon can form a 3 to 6 membered fused or spiro cycloalkyl ring or a 3 to 6 membered fused or spiral heterocyclic ring;

n is 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, or 11; and

p is 0, 1, 2, 3, 4, 5, 6, 7, or 8.

36. The compound of claim 35, wherein R is $-CH_3$ or $-CD_3$.

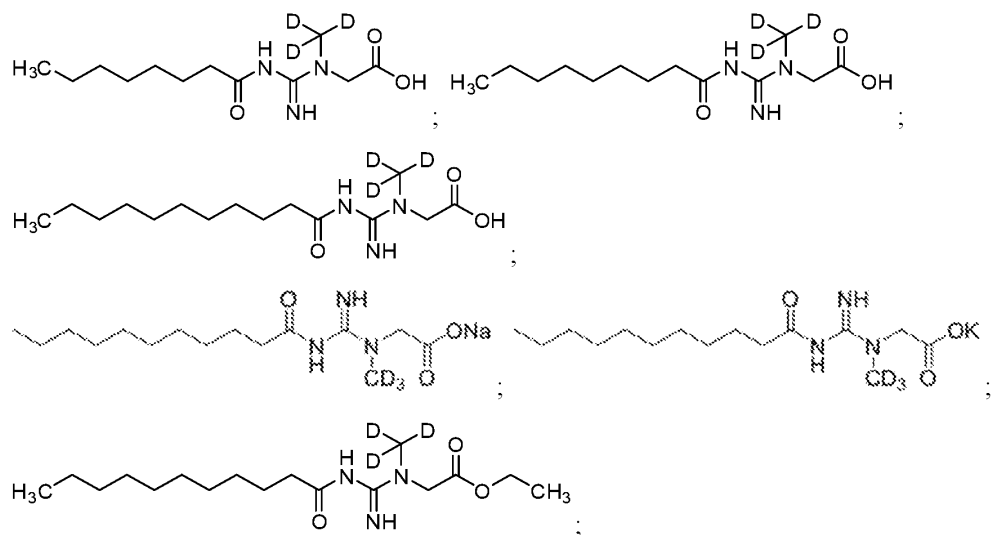
37. The compound of claim 35 or 36, wherein R^2 is H.

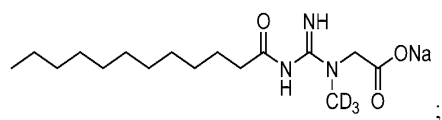
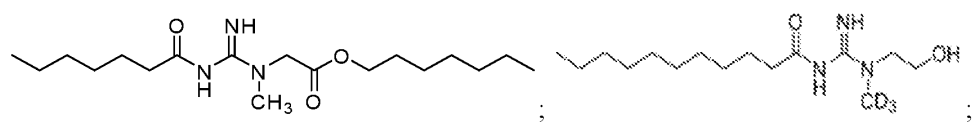
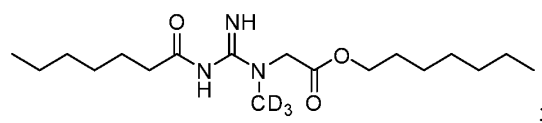
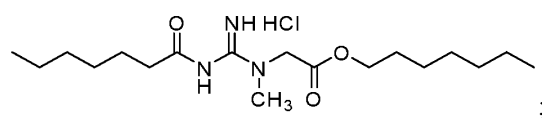
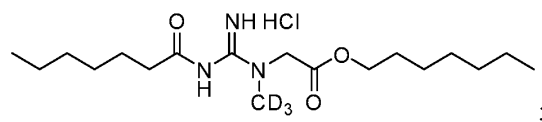
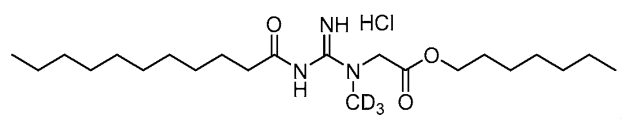
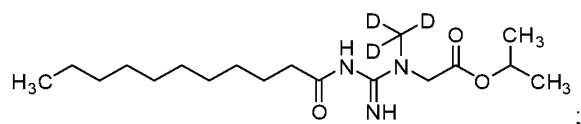
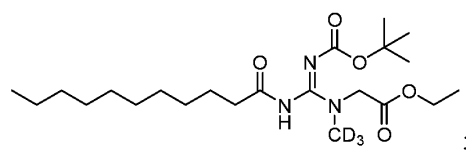
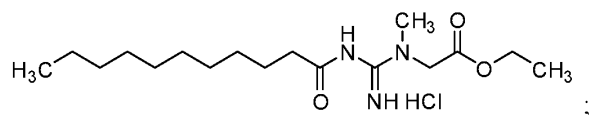
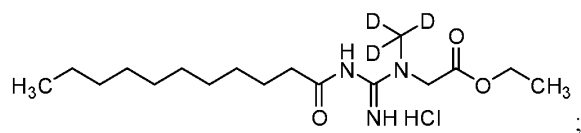
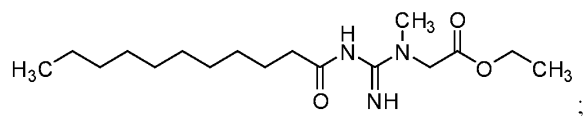
38. The compound of any one of claims 35-37, wherein n is 0, 1, 2, 3, 4, 5, 6, or 7.

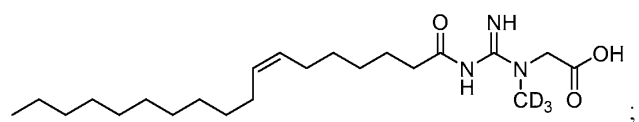
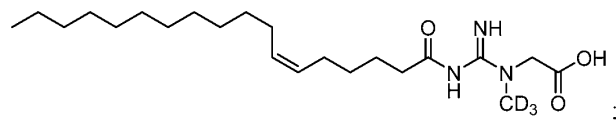
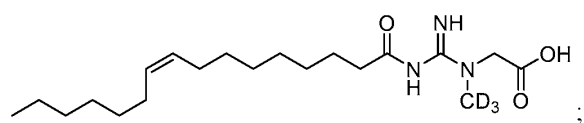
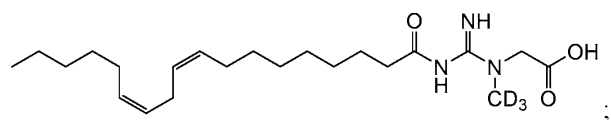
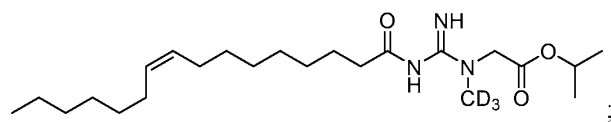
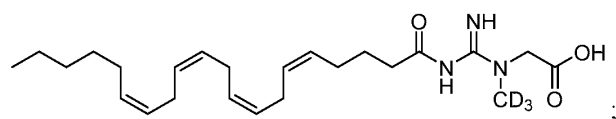
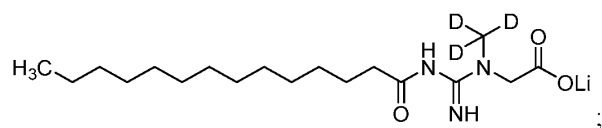
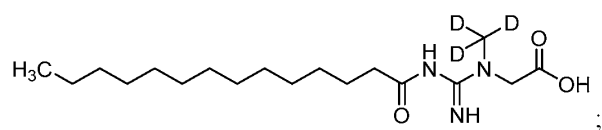
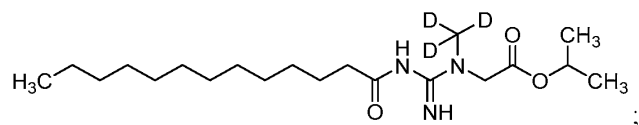
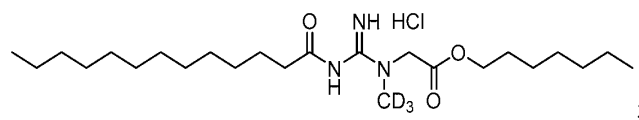
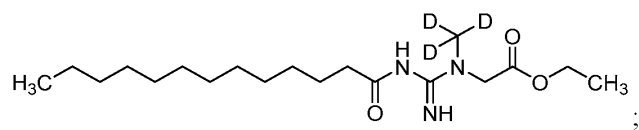
39. The compound of any one of claims 35-38, wherein p is 0, 1, or 2.

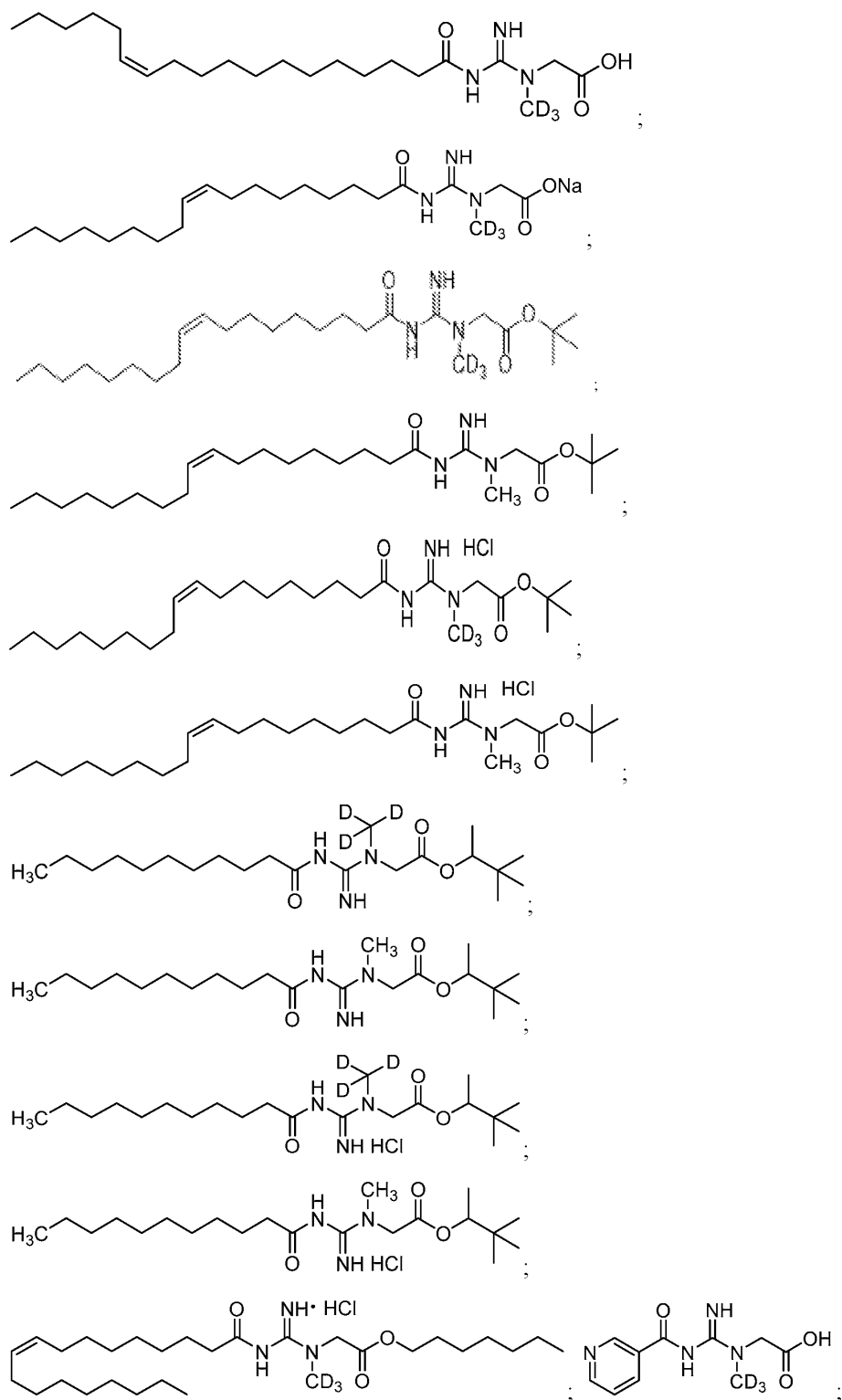
40. The compound of any one of claims 35-39, wherein R^{5a} is $-C_1-C_6$ alkyl.

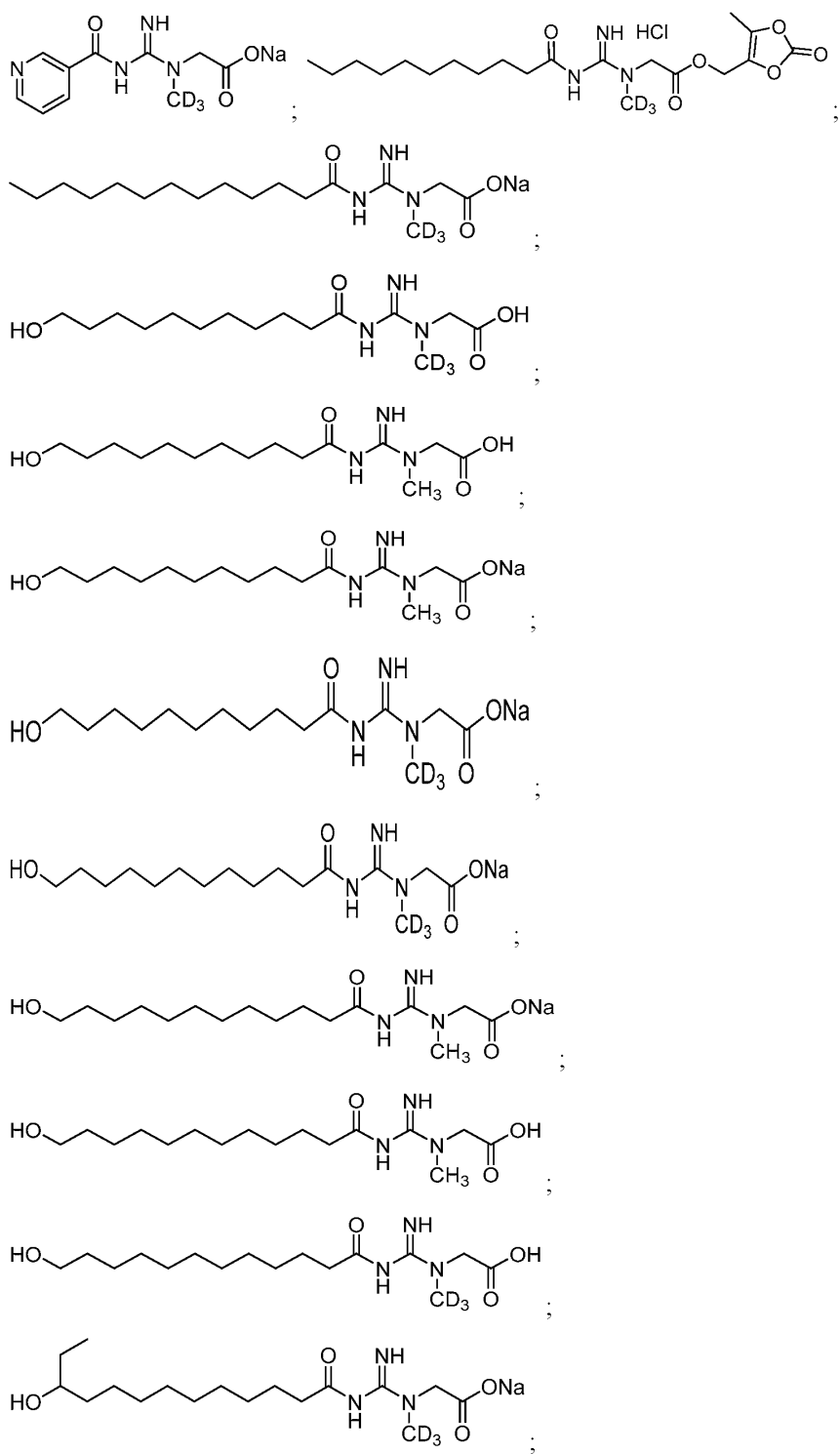
41. The compound of claim 1, selected from:

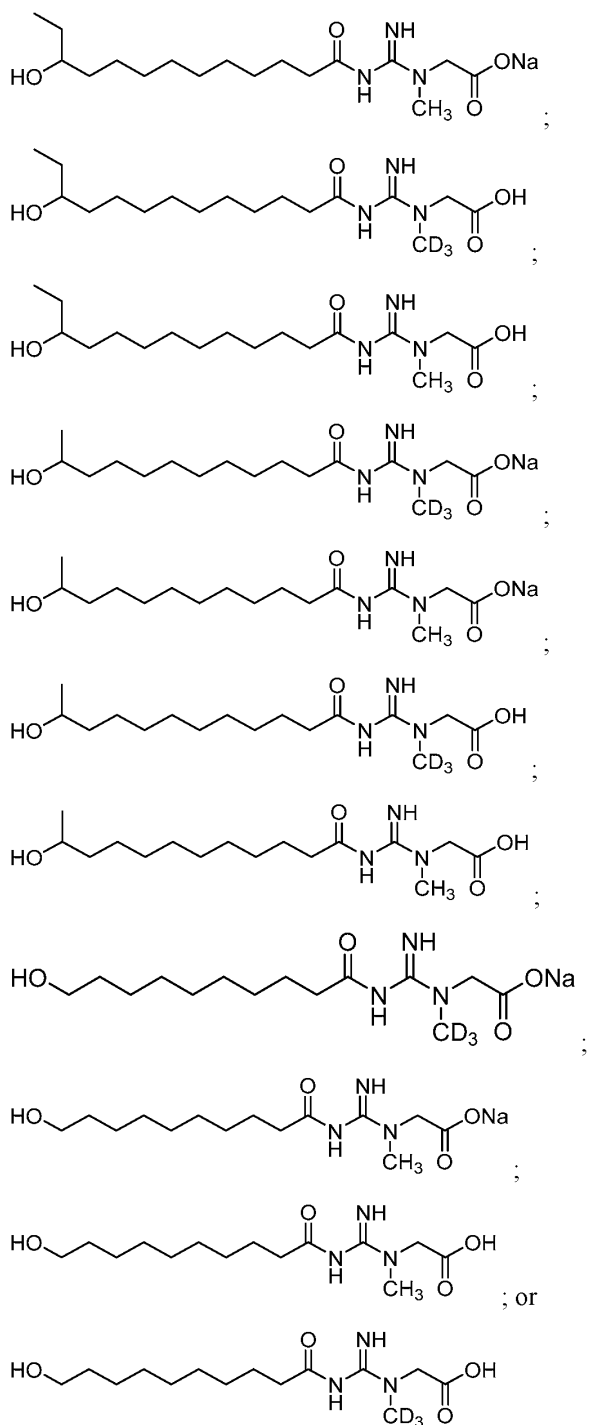




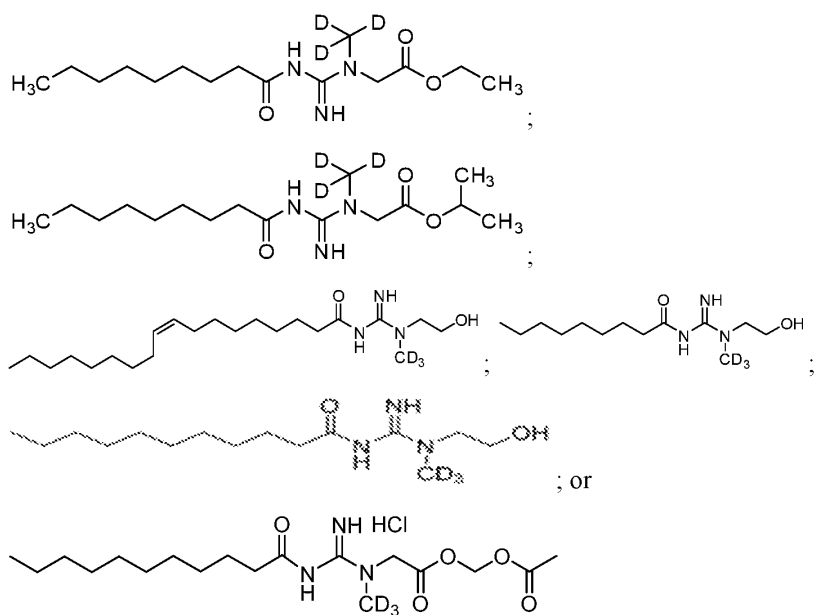




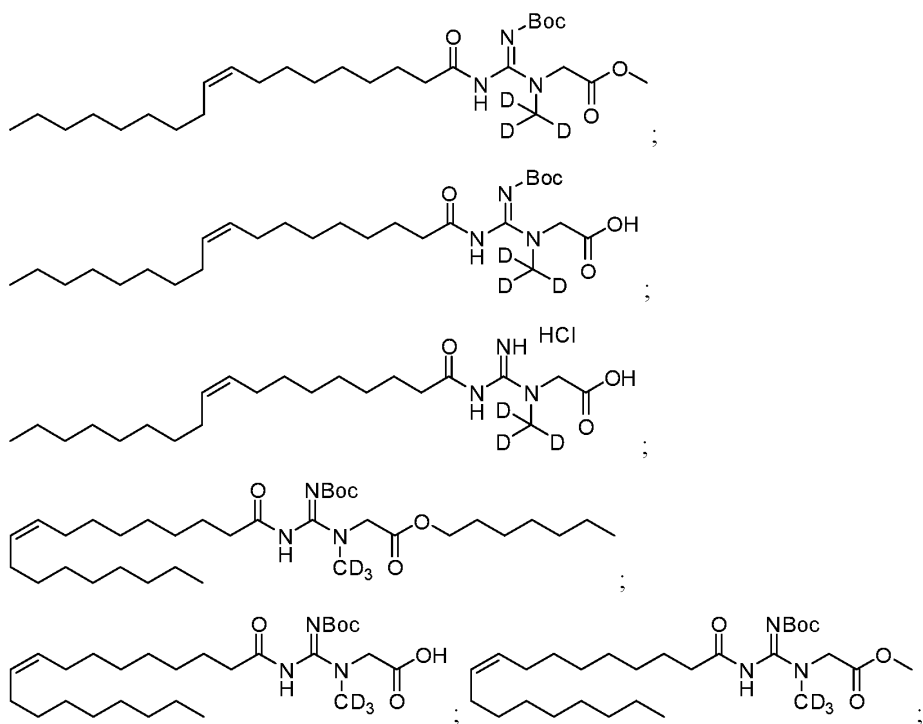


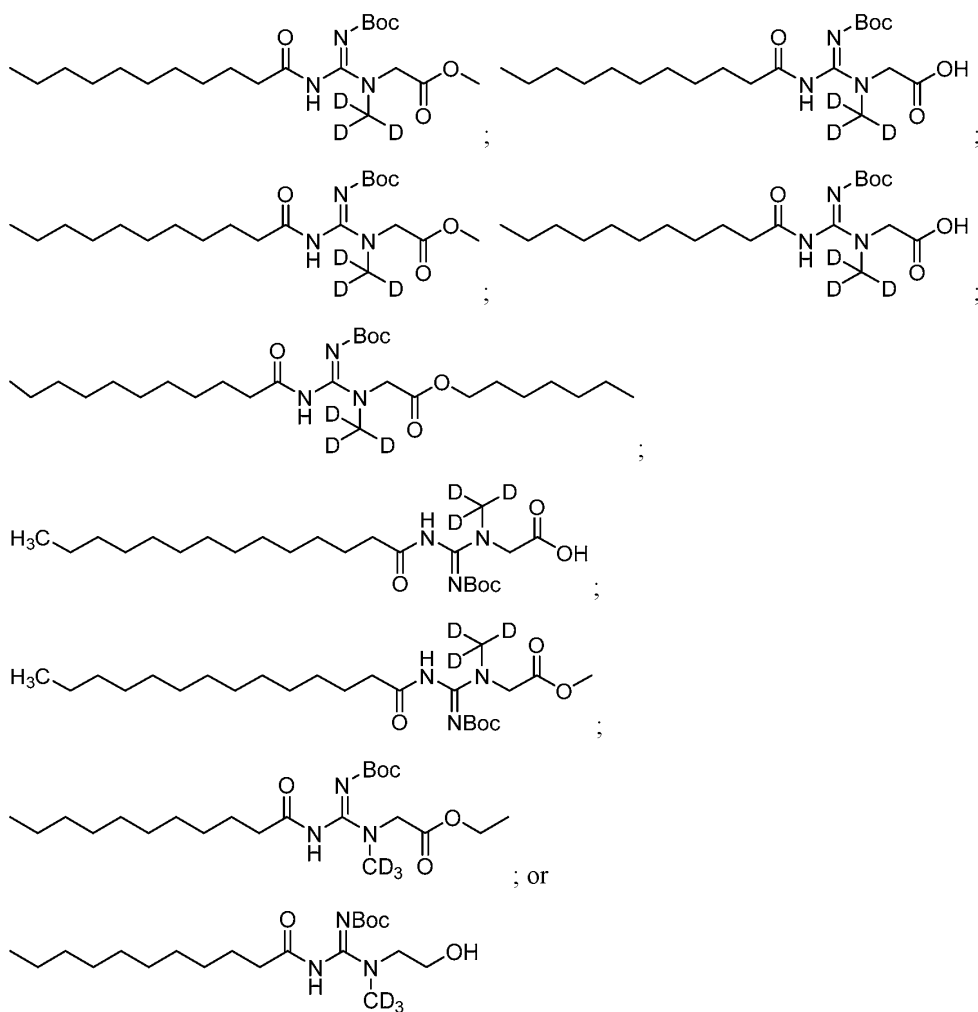


42. The compound of claim 1, selected from:

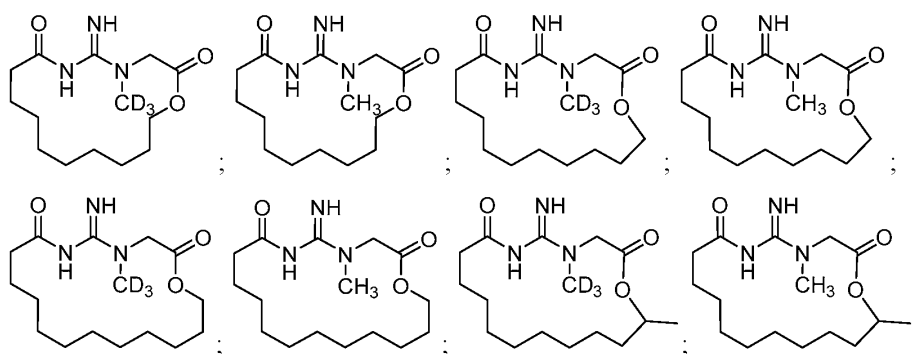


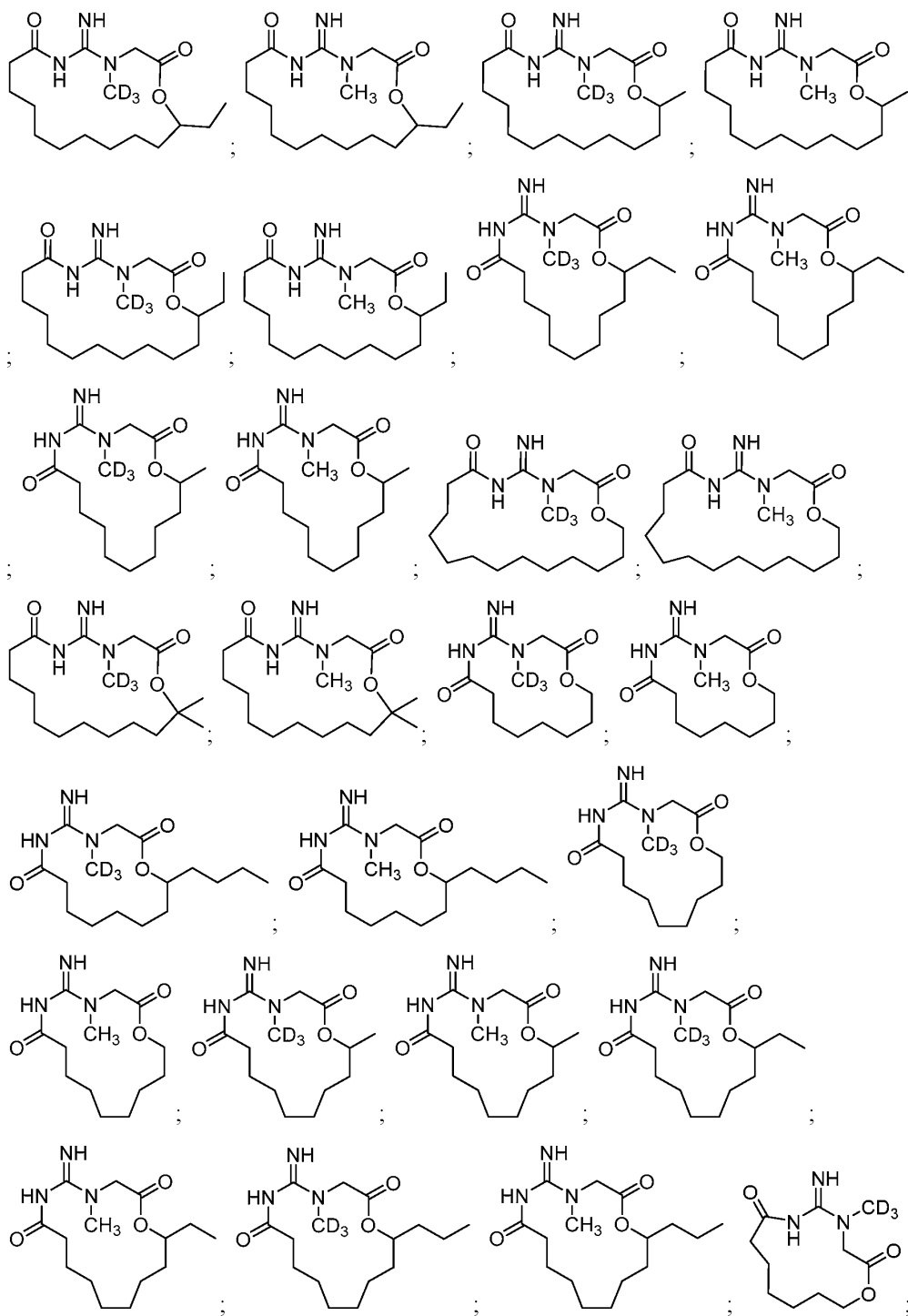
43. The compound of claim 1, selected from:

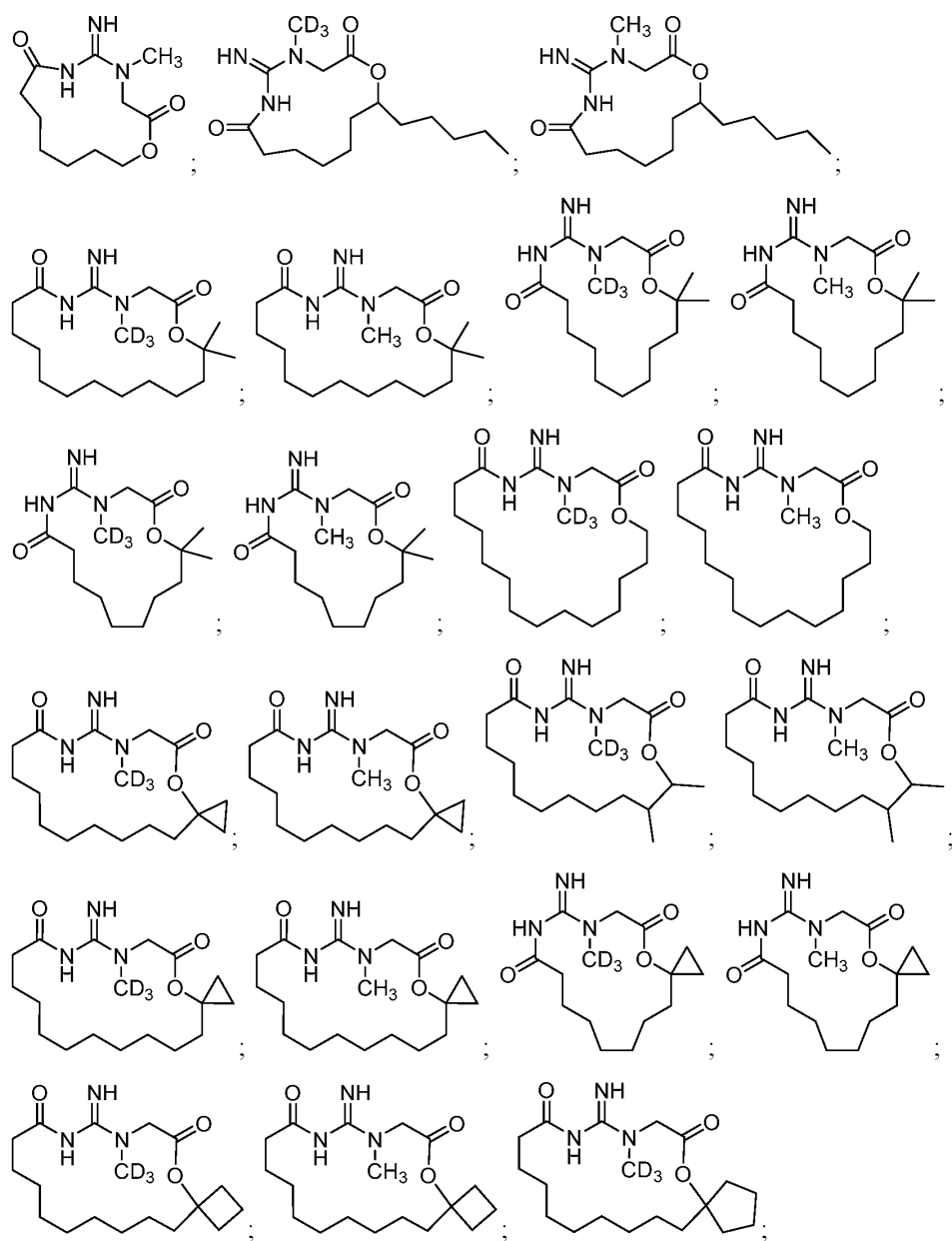


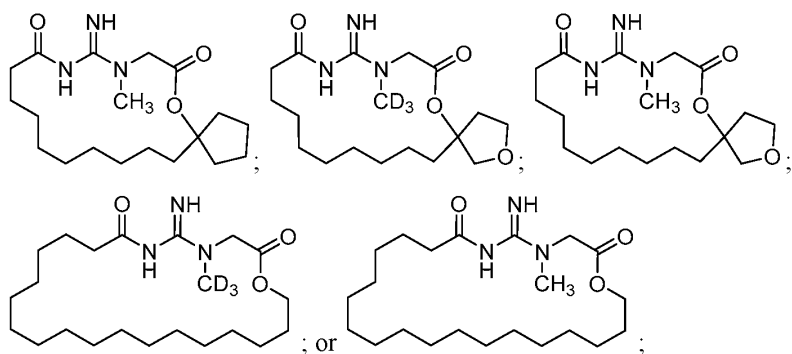


44. The compound of claim 1, selected from:



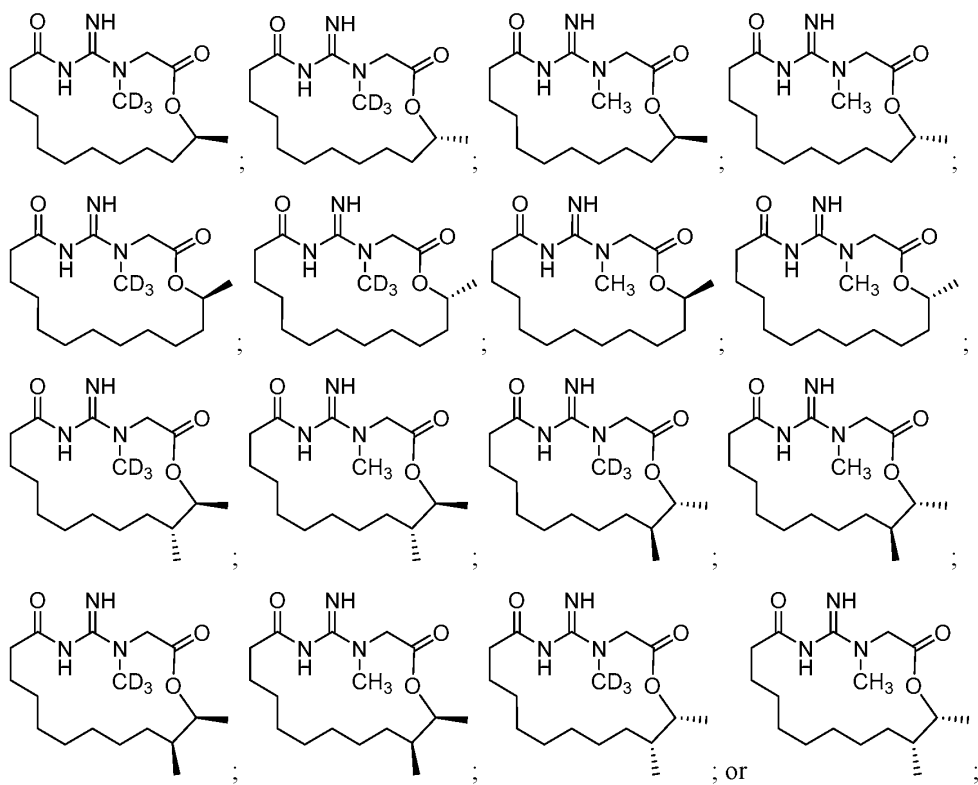






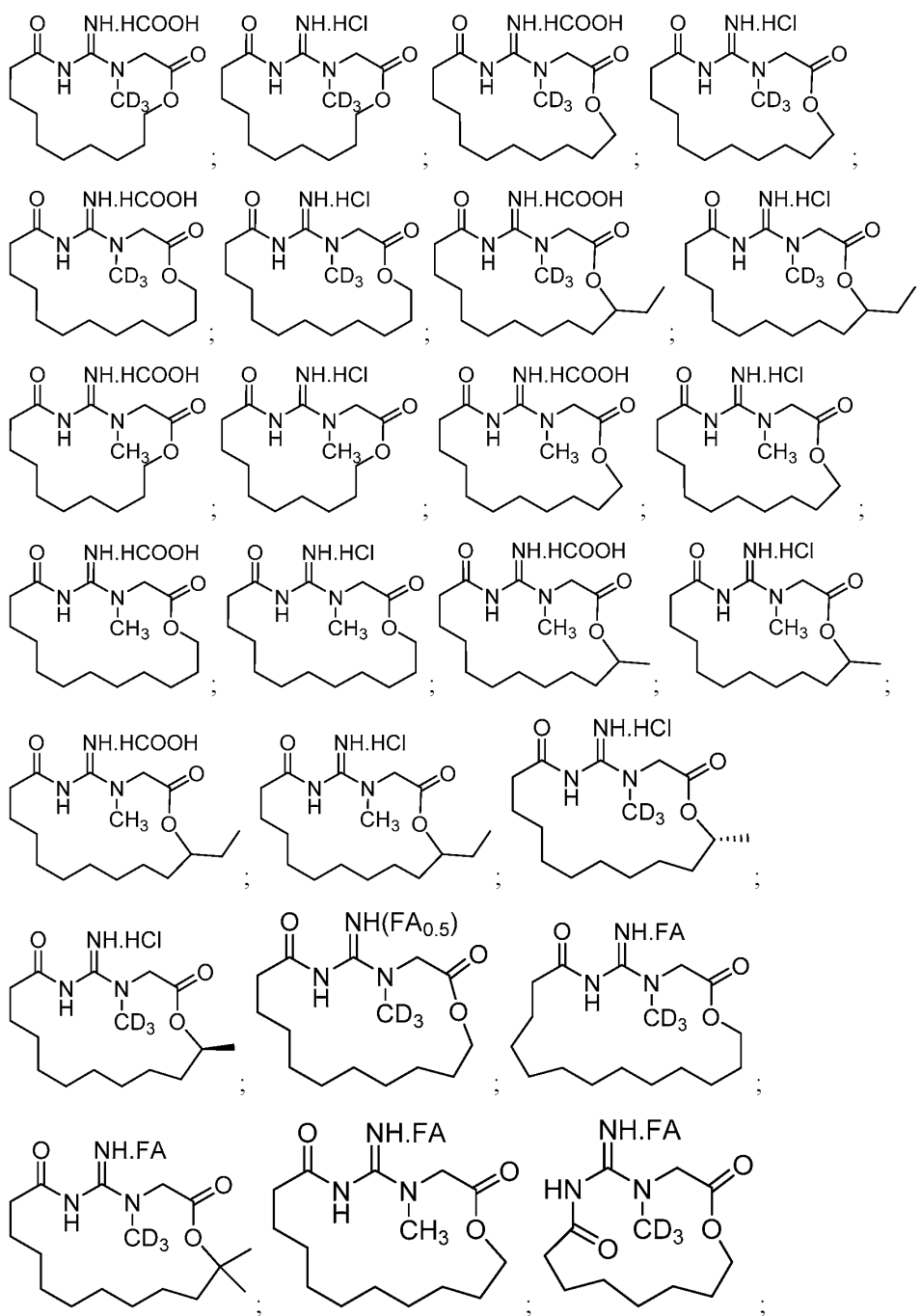
or a pharmaceutically acceptable salt thereof.

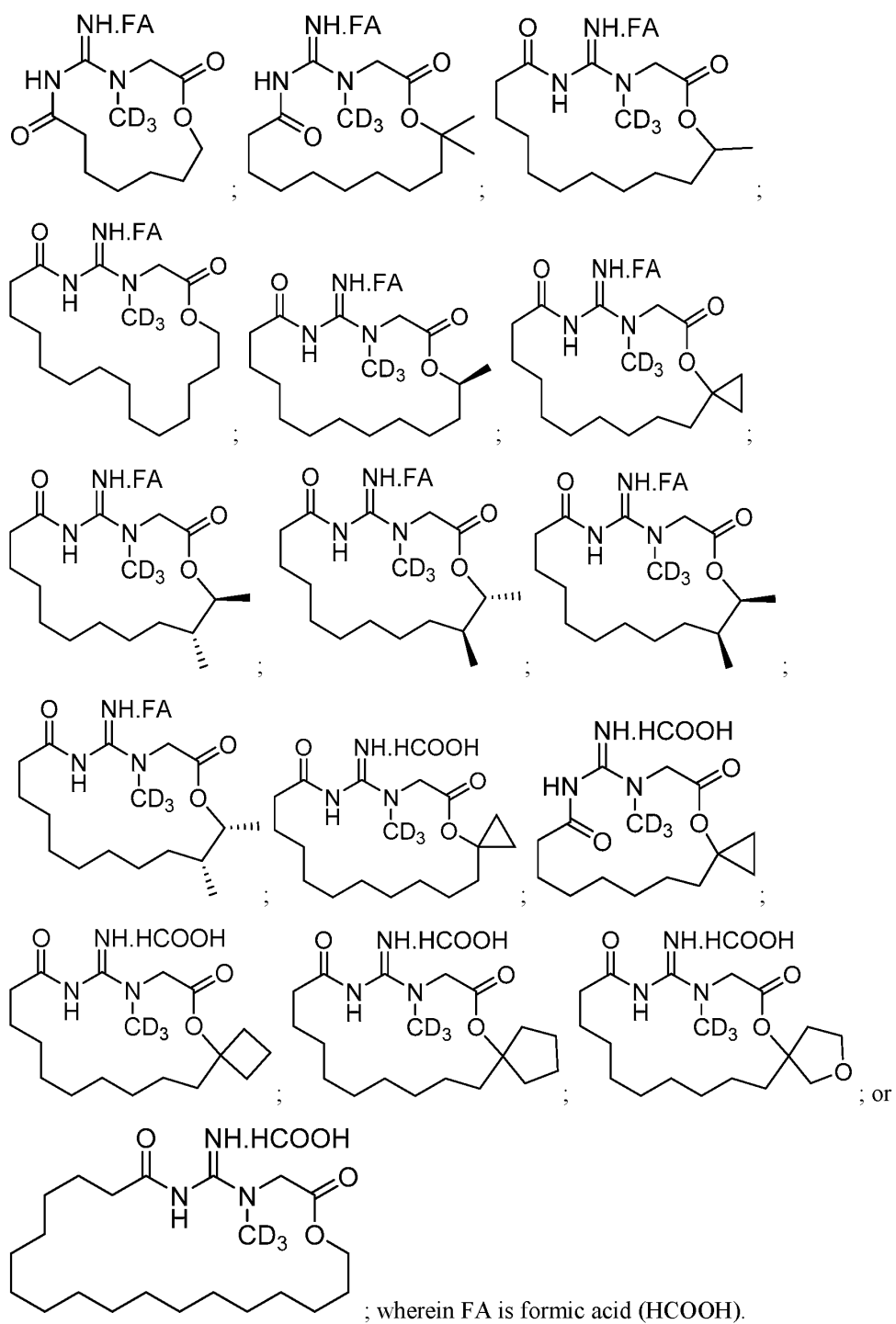
45. The compound of claim 1, selected from:



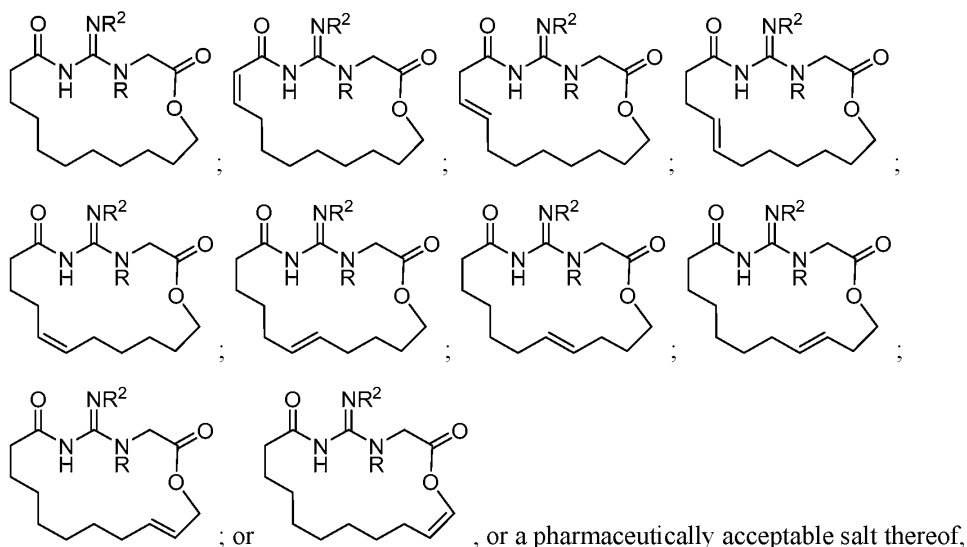
or a pharmaceutically acceptable salt thereof.

46. The compound of claim 1, selected from:





47. The compound of claim 1, selected from:



48. The compound of claim 1, selected from Table S1 or Table S2.

49. A pharmaceutical composition comprising a compound of any one of claims 1 to 48, or a pharmaceutically acceptable salt or solvate thereof, and a pharmaceutically acceptable carrier.

50. A method of delivering creatine or deuterated creatine to a patient in need thereof comprising administering to the patient a therapeutically effective amount of a compound of any one of claims 1 to 48, or a pharmaceutically acceptable salt or solvate thereof.

51. A method for treating creatine deficiency in a patient in need thereof comprising administering to the patient a therapeutically effective amount of a compound of any one of claims 1 to 48, or a pharmaceutically acceptable salt or solvate thereof.

52. The method of claim 51, wherein the creatine deficiency comprises a disease or condition associated with creatine transporter dysfunction.

53. The method of claim 51, wherein the creatine deficiency comprises a disease or condition associated with creatine synthesis disorder.

54. A method of treating a disease in a patient in need thereof comprising administering a therapeutically effective amount of a compound of any one of claims 1 to 48, or a pharmaceutically acceptable salt or solvate thereof; wherein the disease is ischemia, oxidative stress, a neurodegenerative disease, ischemic reperfusion injury, a cardiovascular disease, a genetic disease affecting the creatine kinase system, multiple sclerosis, a psychotic disorder or muscle fatigue.

55. The method of claim 54, wherein the genetic disease affecting the creatine kinase system is a creatine transporter disorder or a creatine synthesis disorder.

56. A method of enhancing muscle strength in a patient comprising administering to a patient in need of such enhancement a therapeutically effective amount of a compound of any one of claims 1 to 48, or a pharmaceutically acceptable salt or solvate thereof.