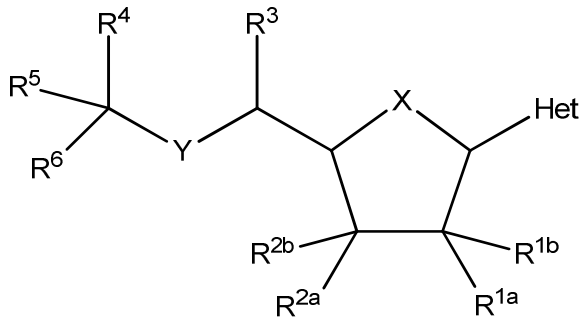
**Claims:**

1. A compound of formula (I):




(I)

or a pharmaceutically acceptable salt and/or prodrug thereof, wherein

X is O, $NR^7$ or $CR^7R^8$;

Y is O or S;

Z is $NR^{19}$, O or S;

Het is heterocyclyl or heteroaryl;

$R^{1a}$ is selected from H, halo, hydroxy, cyano, azido, amino, $C_{1-6}$alkyl, hydroxy$C_{1-6}$alkyl, amino-$C_{1-6}$alkyl, -O-C(O)-O-$C_{1-6}$alkyl, $C_{1-6}$acyloxy, $C_{1-6}$alkoxy, $C_{2-6}$alkenyl, and $C_{2-6}$alkynyl; and

$R^{1b}$ is selected from H, halo, $C_{1-6}$alkyl, hydroxy-$C_{1-6}$alkyl, amino-$C_{1-6}$alkyl, $C_{2-6}$alkenyl, and $C_{2-6}$alkynyl; or

$R^{1a}$ and $R^{1b}$, together with the carbon atom to which they are attached, form a $C=CH_2$ or $C=C(H)C_{1-6}$alkyl;

$R^{2a}$ is selected from H, halo, hydroxy, cyano, azido, amino, $C_{1-6}$alkyl, hydroxy-$C_{1-6}$alkyl, amino-$C_{1-6}$alkyl, $C_{1-6}$acyloxy, -O-C(O)-O-$C_{1-6}$alkyl, $C_{1-6}$alkoxy, $C_{2-6}$alkenyl, and $C_{2-6}$alkynyl;

$R^{2b}$ is selected from H, halo, $C_{1-6}$alkyl, hydroxy-$C_{1-6}$alkyl, amino-$C_{1-6}$alkyl, $C_{2-6}$alkenyl, and $C_{2-6}$alkynyl; or

$R^{2a}$ and $R^{2b}$, together with the carbon atom to which they are attached, form a $C=CH_2$ or $C=C(H)C_{1-6}$alkyl;

$R^3$ is selected from H, alkyl, cycloalkyl, cycloalkylalkyl, heterocyclyl, heterocyclylalkyl, aryl, aralkyl, heteroaryl, heteroaralkyl, and $-(CH_2)-C(O)OR_9$;

$R^4$ is selected from heteroaryl, alkyl, $-C(O)OR^9$, $-C(O)NR^{11}R^{12}$, $-S(O)_2R^{10}$, $-P(O)(OR^{11})(OR^{12})$, and $-P(O)(OR^{11})(NR^{13}R^{15})$;

$R^5$ is selected from H, cyano, alkyl, cycloalkylalkyl, heterocyclylalkyl, aralkyl, heteroaralkyl, and -C(O)$OR^9$;

$R_6$ is selected from -C(O)$OR^9$ and -P(O)($OR^{11}$)($OR^{12}$);

each $R^7$ and $R^8$ is H;

$R^9$ is independently selected from H, alkyl, acyloxyalkyl, alkenyl, alkynyl, cycloalkyl, cycloalkylalkyl, heterocyclyl, heterocyclylalkyl, aryl, aralkyl, heteroaryl, and heteroaralkyl, and -$(CHR^{13})_m$-Z-C(O)-$R^{14}$;

each $R^{10}$ is independently selected from alkyl, alkenyl, alkynyl, amino, cycloalkyl, cycloalkylalkyl, heterocyclyl, heterocyclylalkyl, aryl, aralkyl, heteroaryl, and heteroaralkyl; and

each $R^{11}$ and $R^{12}$ is independently selected from H, alkyl, cycloalkyl, cycloalkylalkyl, heterocyclyl, heterocyclylalkyl, aryl, aralkyl, heteroaryl, heteroaralkyl and -$(CHR^{13})_m$-Z-C(O)-$R^{14}$; or

$R^{11}$ and $R^{12}$, together with the atoms to which they are attached, form a 5- to 7-membered heterocyclyl; and

each $R^{13}$ is independently H or alkyl;

each $R^{14}$ is independently selected from alkyl, aminoalkyl, heterocyclyl, and heterocyclylalkyl;

$R^{15}$ is selected from alkyl, aralkyl, –C($R^{16}$)($R^{17}$)-C(O)O-$R^{18}$;

each $R^{16}$ and $R^{17}$ are selected from H, alkyl, amino-alkyl, hydroxy-alkyl, mercapto-alkyl, sulfonyl-alkyl, cycloalkyl, aryl, aralkyl, heterocyclylalkyl, heteroaralkyl, and -$(CH_2)$C(O)$OR^9$;

$R^{18}$ is selected from H, alkyl, alkoxyalkyl, aminoalkyl, haloalkyl, amido, cycloalkyl, cycloalkylalkyl, heterocyclyl, heterocyclylalkyl, aryl, aralkyl, heteroaryl, heteroaralkyl;

$R^{19}$ is H or alkyl, preferably H; and

m is 1 or 2;

provided that either $R^4$ is tetrazolyl, or $R^5$ is aralkyl or heteroaralkyl, or both.

2. The compound of claim 1, wherein $R^{1a}$ is selected from H, halo, hydroxy, cyano, azido, amino, $C_{1-6}$alkyl, hydroxy$C_{1-6}$alkyl, amino-$C_{1-6}$alkyl, $C_{1-6}$acyloxy, $C_{1-6}$alkoxy, $C_{2-6}$alkenyl, and $C_{2-6}$alkynyl.

3. The compound of claim 1, wherein $R^{1a}$ is fluoro.

4. The compound of claim 1, wherein $R^{1a}$ is chloro.

5. The compound of claim 1, wherein $R^{1a}$ is hydroxy.

6. The compound of claim 1, wherein $R^{2a}$ is selected from H, halo, hydroxy, cyano, azido, amino, $C_{1-6}$alkyl, hydroxy$C_{1-6}$alkyl, amino-$C_{1-6}$alkyl, $C_{1-6}$acyloxy, $C_{1-6}$alkoxy, $C_{2-6}$alkenyl, and $C_{2-6}$alkynyl.

7. The compound of any one of claims 1-6, wherein $R^{2a}$ is $C_{1-6}$alkyl.

8. The compound of any one of claims 1-6, wherein $R^{2a}$ is hydroxy.

9. The compound of any one of claims 1-6, wherein $R^{2a}$ is ethynyl.

10. The compound of any one of claims 1-9, wherein $R^{2b}$ is $C_{1-6}$alkyl.

11. The compound of claim 1, wherein $R_{1a}$ is fluoro and $R^{1b}$ is H.

12. The compound of claim 1, wherein $R^{1a}$ is fluoro and $R^{2a}$ is hydroxy.

13. The compound of claim 1, wherein $R^{1a}$ is chloro and $R^{2a}$ is hydroxy.

14. The compound of claim 1, wherein $R^{1a}$ is hydroxy and $R^{2a}$ is $C_{1-6}$alkyl.

15. The compound of claim 1, wherein $R^{1a}$ is hydroxy and $R^{2a}$ is hydroxyl and $R^{2b}$ is $C_{1-6}$alkynyl.

16. The compound of claim 1, wherein $R^{1a}$ is hydroxy and $R^{2a}$ is $C_{1-6}$alkynyl.

17. The compound of any preceding claim, wherein $R^3$ is H.

18. The compound of any one of claims 1-16, wherein $R^3$ is unsubstituted $C_{1-6}$alkyl.

19. The compound of any one of claims 1-16, wherein $R^3$ is alkyl, and the alkyl is unsubstituted or substituted with one or more substituents selected from halo, CN, $NO_2$, azido, hydroxy, alkoxy, alkylthio, thioalkoxy, carbonyl, thiocarbonyl, amidino, imino, amino, amido, alkoxycarbonyl, carbamate, urea, sulfinamido, sulfonamido, sulfinyl, sulfinamido, sulfonyl, phosphoryl, phosphate, phosphonate, and phosphinate.

20. The compound of claim 19, wherein the substituents are selected from halo, CN, azido, alkoxy, carbonyl, amino, amido, and alkoxycarbonyl.

21. The compound of any preceding claim, wherein $R^4$ is heteroaryl.

22. The compound of any preceding claim, wherein $R^4$ is tetrazolyl.

23. The compound of any preceding claim, wherein $R^4$ is selected from $-C(O)OR_9$, $-C(O)NR_{11}R_{12}$, $-S(O)_2R_{10}$, and $-P(O)(OR_{11})(OR_{12})$.

24. The compound of any preceding claim, wherein $R^4$ is $-C(O)OR_9$.

25. The compound of any one of claims 1-20, wherein $R^4$ is alkyl.

26. The compound of any one of claims 1-21, wherein $R^4$ is $-C(O)NR^{11}R^{12}$.

27. The compound of any preceding claim, wherein $R^5$ is selected from alkyl, cycloalkylalkyl, heterocyclylalkyl, aralkyl and heteroaralkyl, and each is unsubstituted or substituted with one or more substituents, selected from halo, CN, $NO_2$, azido, hydroxy, alkoxy, alkylthio, thioalkoxy, carbonyl, thiocarbonyl, amidino, imino, amino, amido, alkoxycarbonyl, carbamate, urea, sulfinamido, sulfonamido, sulfinyl, sulfinamido, sulfonyl, phosphoryl, phosphate, phosphonate, phosphinate, cycloalkyl, heterocyclyl, arylalkyl and heteroarylalkyl.

28. The compound of claim 27, wherein the substituents are selected from halo, CN, azido, alkoxy, carbonyl, amino, amido, and alkoxycarbonyl.

29. The compound of any preceding claim, wherein $R^5$ is selected from H, alkyl, cycloalkylalkyl, heterocyclylalkyl, aralkyl, and heteroaralkyl.

30. The compound of any preceding claim, wherein $R^5$ is H or aralkyl.

31. The compound of any one of claims 1-29, wherein $R^5$ is aralkyl or heteroaralkyl.

32. The compound of claim 31, wherein $R^5$ is heteroaralkyl, wherein the heteroaryl ring is selected from benzofuranyl, benzothienyl, benzothiazolyl, pyridyl, thienyl, furanyl, pyrazolyl, thiazolyl, and oxazolyl, and oxadiazolyl, each of which may be substituted or unsubstituted.

33. The compound of any one of claims 31-32, wherein $R^5$ is unsubstituted or substituted with one or more substituents selected from halo, CN, OH, alkyl, alkenyl, haloalkyl, hydroxyalkyl, alkoxy, haloalkoxy, aryloxy, aralkyloxy, alkylsulfonyl, sulfonamido, amido, amino, hydroxycarbonyl, alkoxycarbonyl, heteroaryl, aryl, aralkyl, and heteroaralkyl.

34. The compound of claim 33, wherein the substituents are selected from halo, CN, haloalkyl, haloalkoxy, carboxy, alkoxycarbonyl, and aryl.

35. The compound of claim 33, wherein the substituents are selected from tetrazolyl, substituted or unsubstituted phenyl, or substituted or unsubstituted benzyl.

36. The compound of claim 33, wherein $R^5$ is unsubstituted or substituted with one or more substituents, selected from chloro, trifluoromethyl, trifluoromethoxy, phenyloxy, dimethylamido, methylsulfonyl, CN, and carboxylic acid.

37. The compound of any preceding claim, wherein $R^6$ is $-C(O)OR_9$.

38. The compound of any preceding claim, wherein $R^9$ is H, $C_{1-6}$alkyl or amido.

39. The compound of any preceding claim, wherein $R^9$ is H, methyl or ethyl.

40. The compound of any preceding claim, wherein $R^{11}$ and $R^{12}$ are each H.

41. The compound of any one of claims 1-39, wherein $R^{11}$ and $R^{12}$ are each alkyl.

42. The compound of any one of claims 1-37, wherein each $R^7$, $R^8$, $R^9$, $R^{10}$, $R^{11}$ and $R^{12}$ is independently selected from alkyl, alkenyl, alkynyl, amido, cycloalkyl, cycloalkylalkyl, heterocyclyl, heterocycylalkyl, aryl, aralkyl, heteroaryl, and heteroaralkyl, and each is unsubstituted or substituted, with one or more selected from halo, CN, $NO_2$, azido, hydroxy, alkoxy, alkylthio, thioalkoxy, carbonyl, thiocarbonyl, amidino, imino, amino, amido, alkoxycarbonyl, carbamate, urea, sulfinamido, sulfonamido, sulfinyl, sulfinamido, sulfonyl, phosphoryl, phosphate, phosphonate, and phosphinate.

43. The compound of claim 42, wherein the substituents on each $R^7$, $R^8$, $R^9$, $R^{10}$, $R^{11}$ and $R^{12}$ are selected from halo, CN, azido, alkoxy, carbonyl, amino, amido, and alkoxycarbonyl.

44. The compound of any preceding claim, wherein X is O.

45. The compound of any preceding claim, wherein Y is O.

46. The compound of any preceding claim, wherein Z is O.

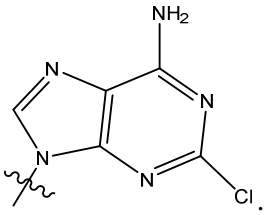
47. The compound of any preceding claim, wherein Het is a nitrogen-containing heterocyclyl or heteroaryl.

48. The compound of any preceding claim, wherein Het is a 5- to 8-membered monocyclic or 5- to 10-membered bicyclic heteroaryl and is unsubstituted or substituted, with one or more

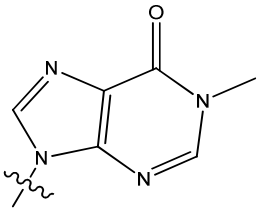
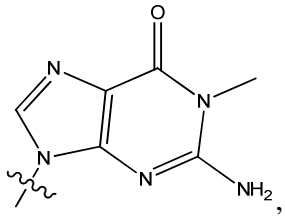
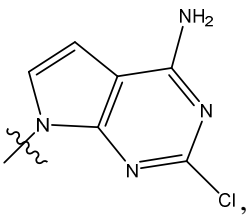
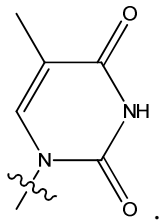
substituents selected from halo, CN, $NO_2$, azido, hydroxy, alkoxy, alkylthio, thioalkoxy, carbonyl, thiocarbonyl, amidino, imino, amino, amido, alkoxycarbonyl, carbamate, urea, sulfinamido, sulfonamido, sulfinyl, sulfinamido, sulfonyl, phosphoryl, phosphate, phosphonate, and phosphinate.

49. The compound of claim 48, wherein the substituents are selected from halo, CN, azido, alkoxy, carbonyl, amino, amido, and alkoxycarbonyl.

50. The compound of any one of claims 1-47, wherein Het is

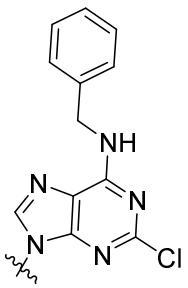
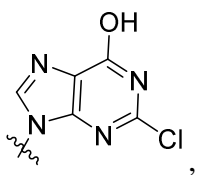
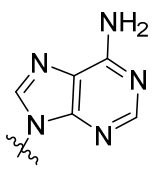
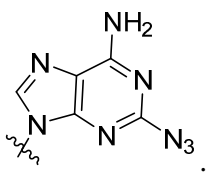


51. The compound of claim 1, wherein Het is selected from

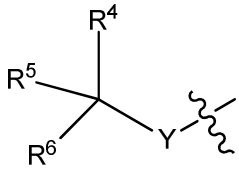
 ,  ,  , and  .

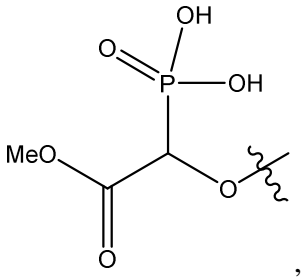
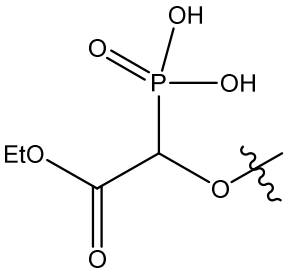
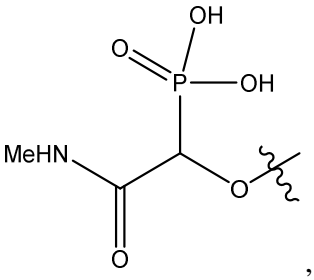
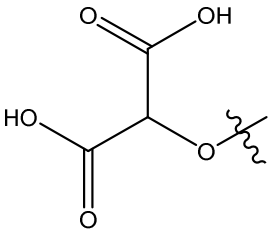
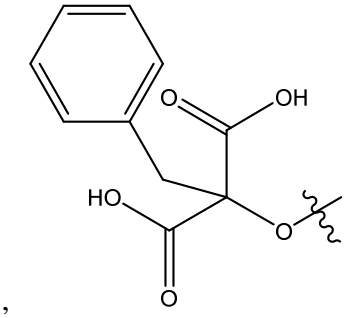
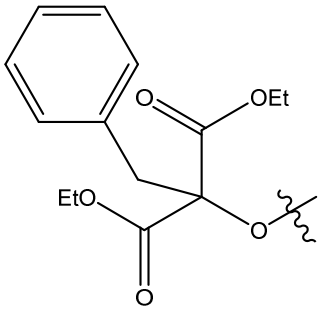
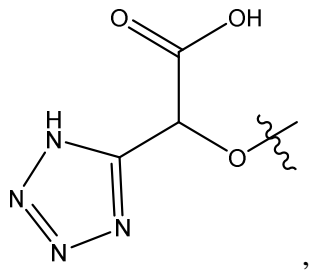
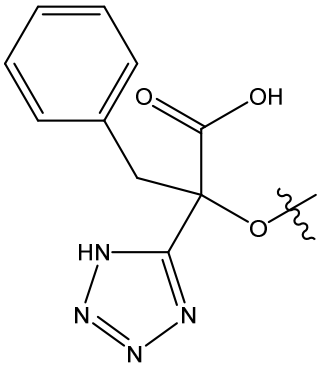
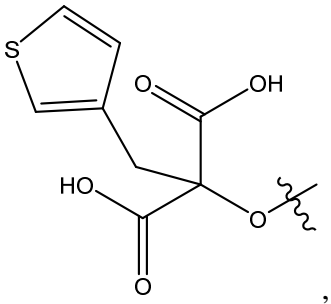
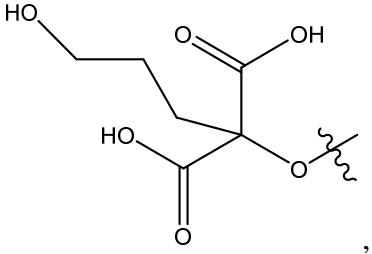
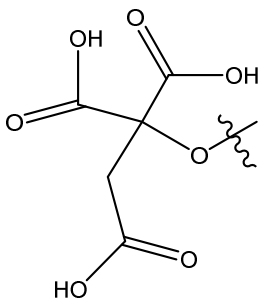
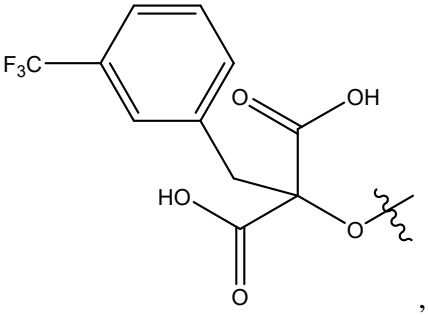
52. The compound of claim 1, wherein Het is substituted with one or two substituents selected from halo, aralkyl, amino, azido and hydroxy.

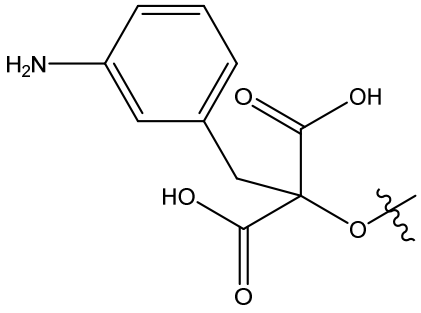
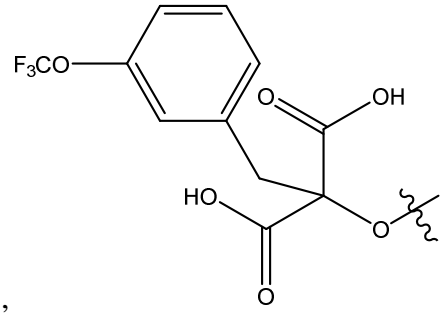
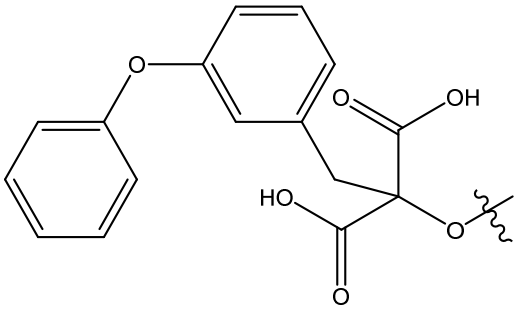
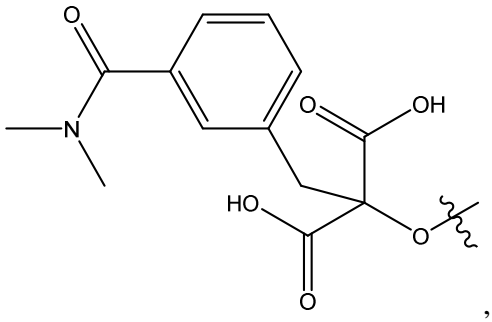
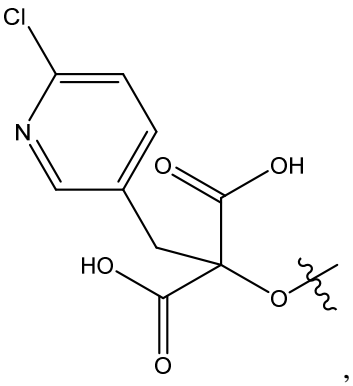
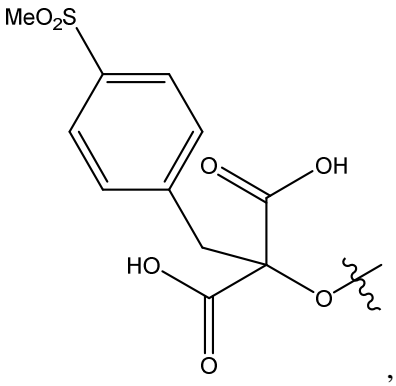
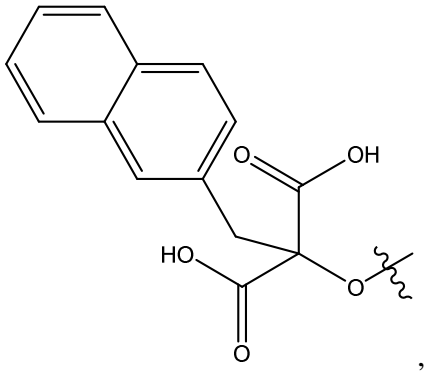
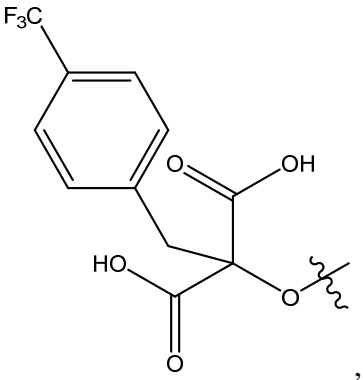
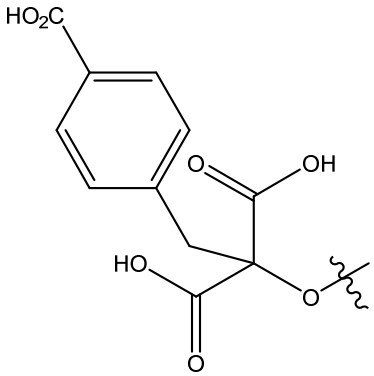
53. The compound of claim 52, wherein Het is selected from

 ,  ,  and  .

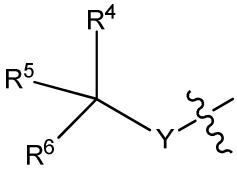
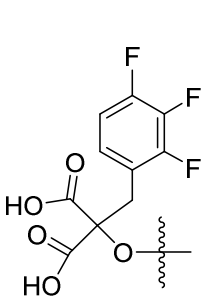
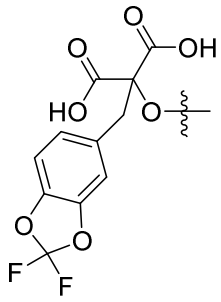
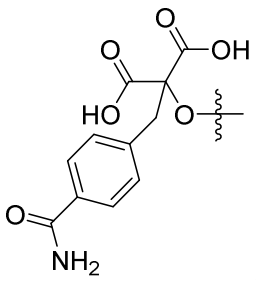
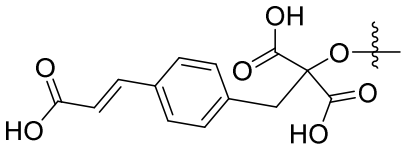
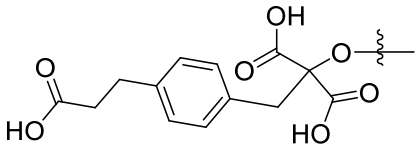
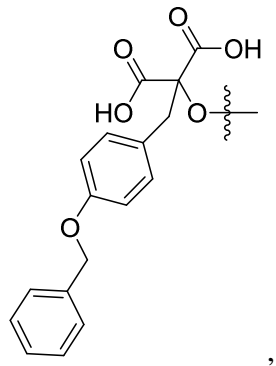
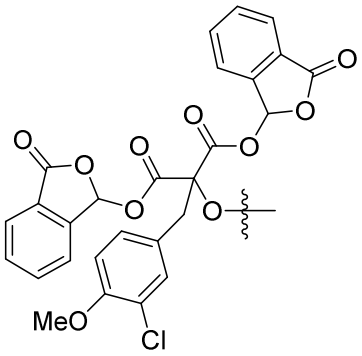
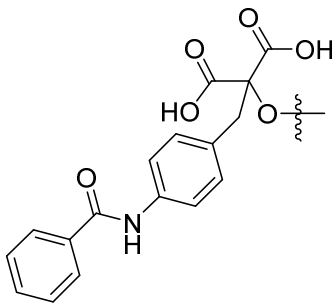
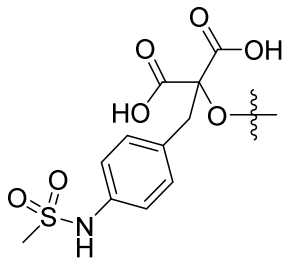
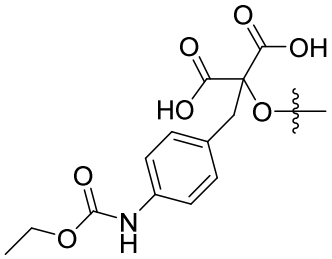
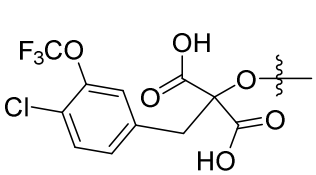
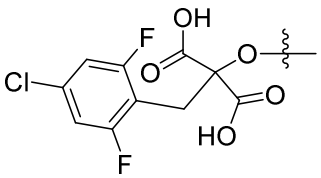
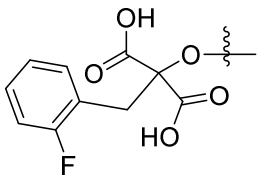
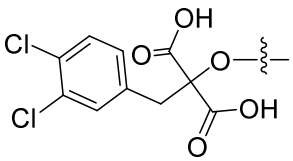
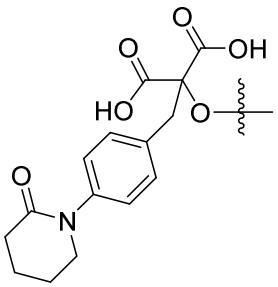
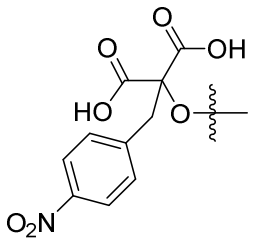
54. The compound of claim 1, wherein

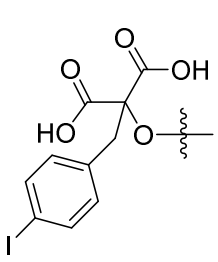
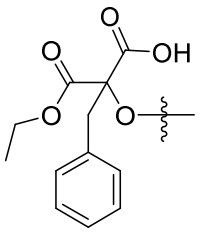
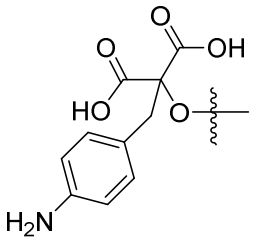
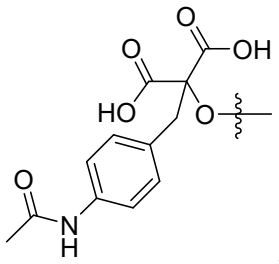
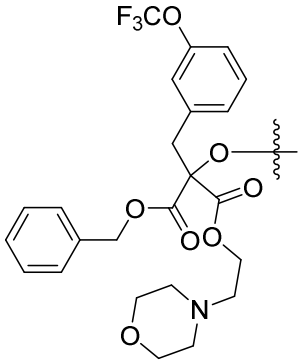
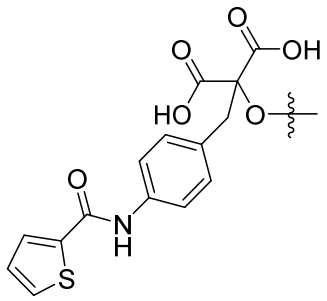
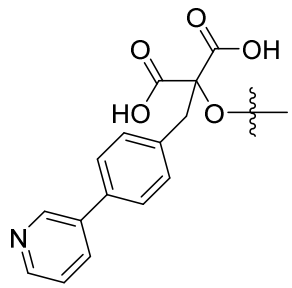
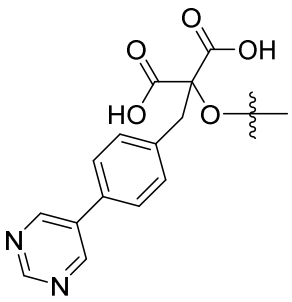
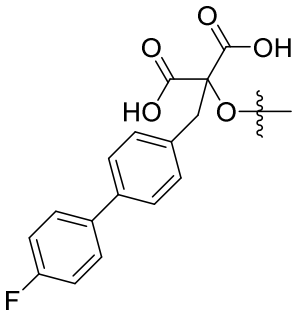
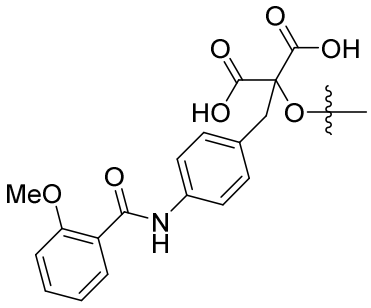
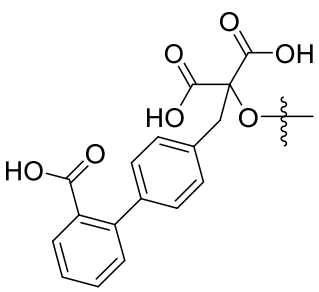
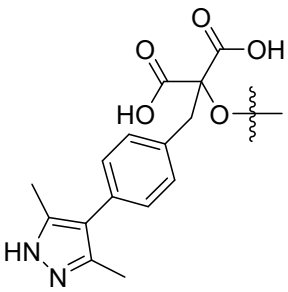
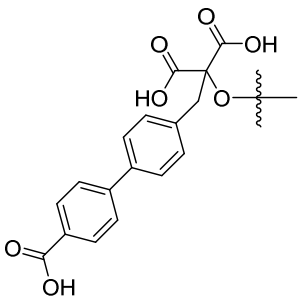
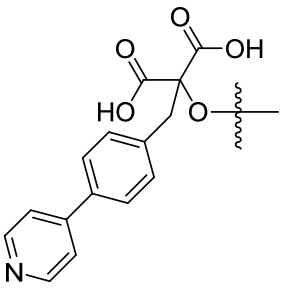
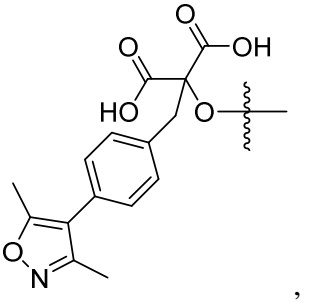
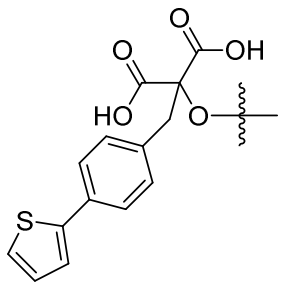

represents

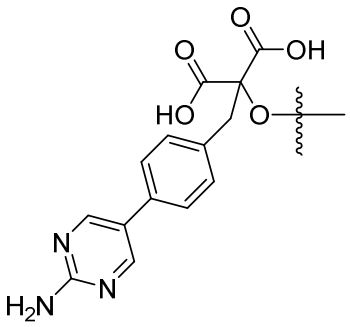
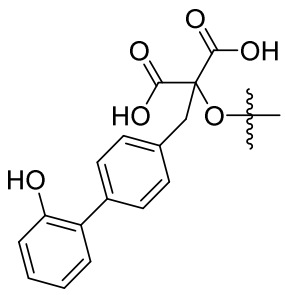
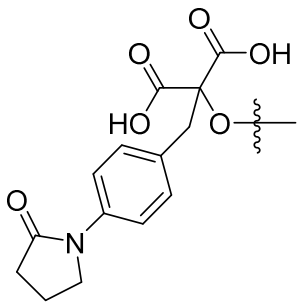
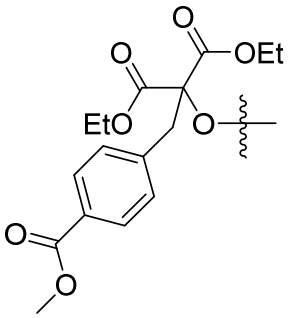
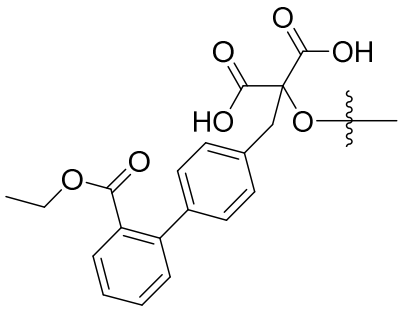
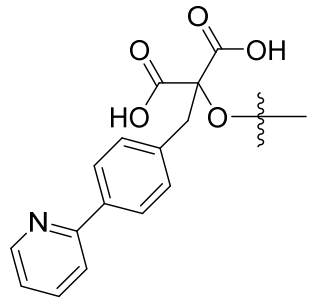
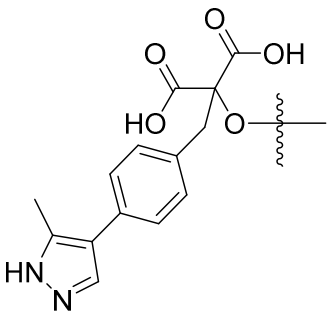
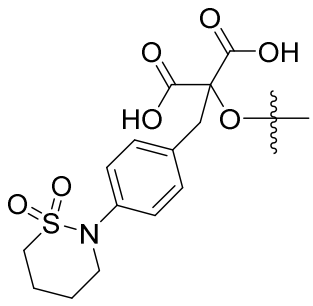
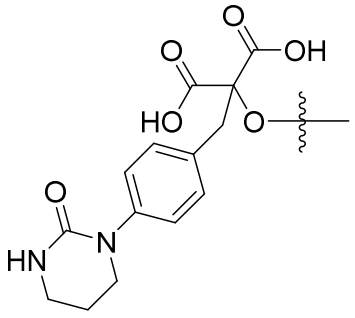
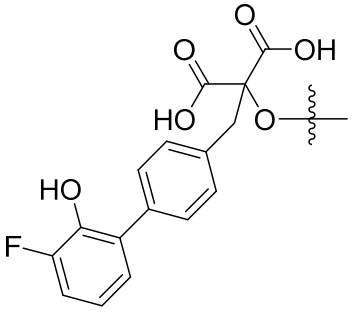
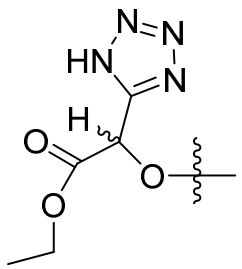
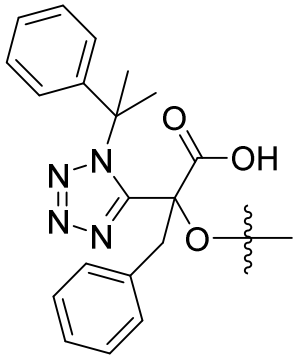
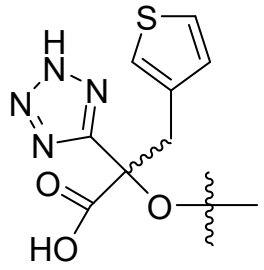

,

,

,

,

,

,

,

,

,

,

,

,

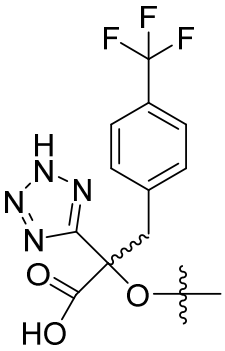
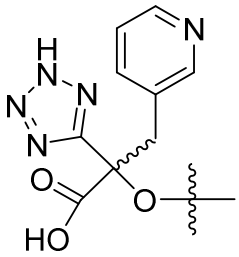
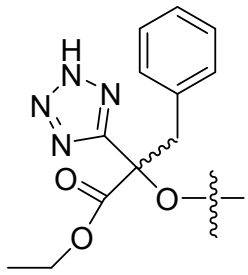
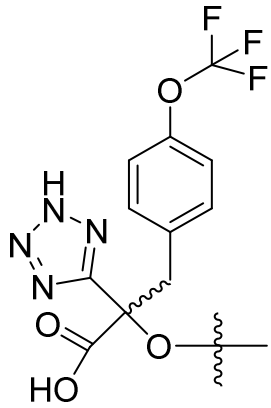
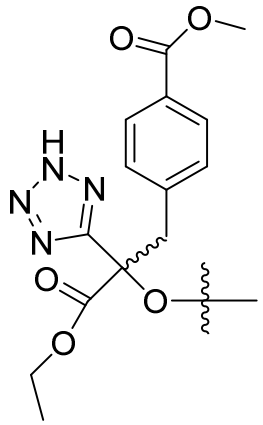
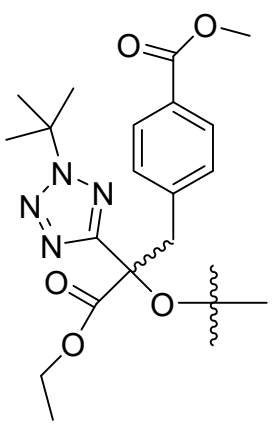
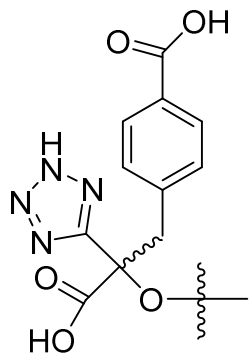
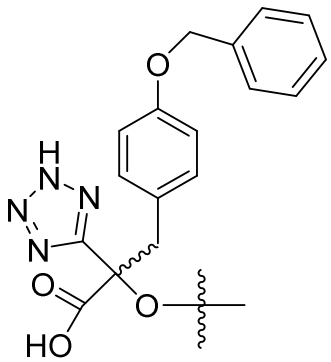
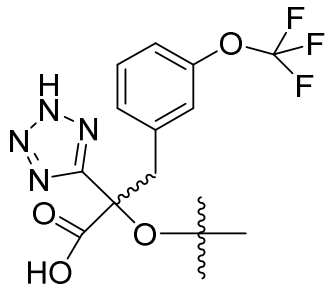
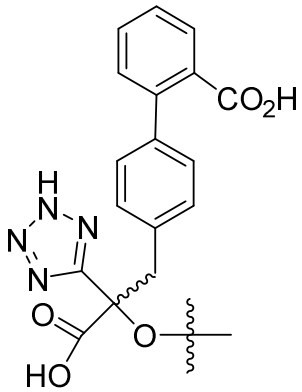
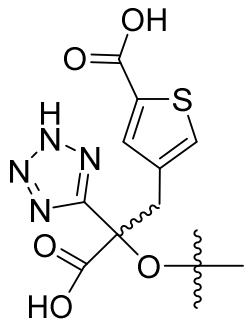
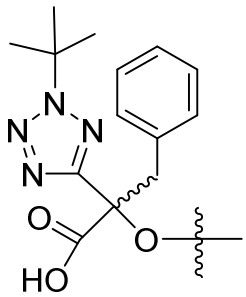

,

,

,

,

,

,

,

, or

.

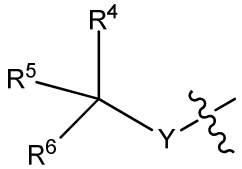
55. The compound of claim 1, wherein

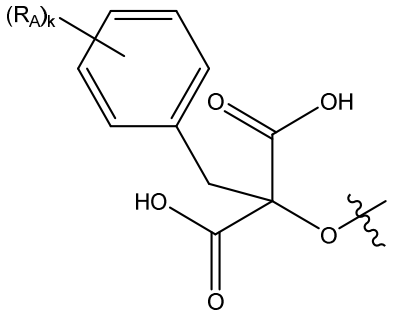

represents  ,  ,  ,  ,  ,  ,  ,  ,  ,  ,  ,  ,  ,  ,  ,  .


, ,

,

,

, ,

,

,

,

,

,

,

,

,

,

,

,

,


,

,

,

,

,

,

,

,

,

,

,

,

,


,

,

,

,

,

,

,

,

,

,

, or

.

56. The compound of claim 1, wherein  represents

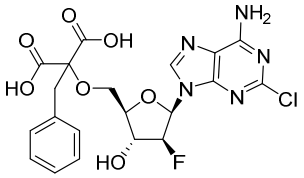
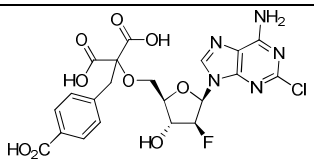
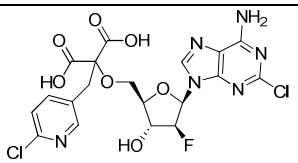
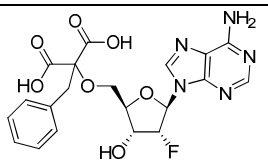
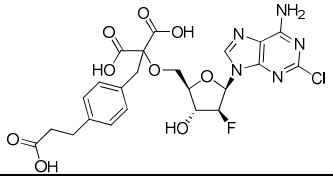


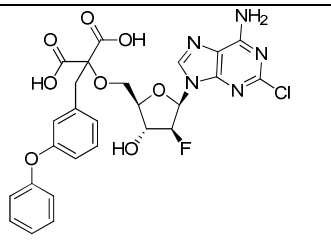
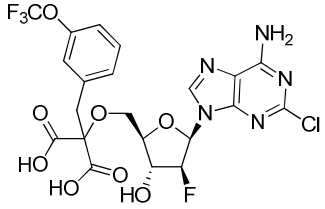
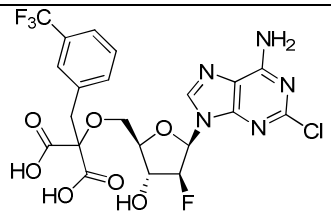
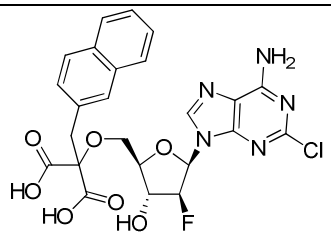
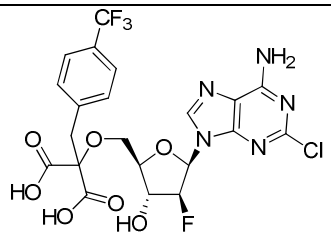
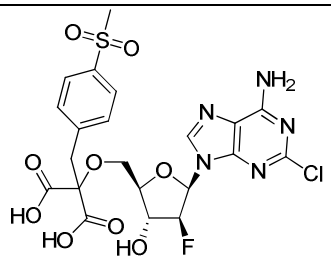
where each $R_A$ is independently selected from H, halo, CN, OH, alkyl, haloalkyl, hydroxyalkyl, alkoxy, haloalkoxy, aryloxy, aralkyloxy, alkylsulfonyl, sulfonamido, amido, amino, hydroxycarbonyl, alkoxycarbonyl, heteroaryl, aryl, aralkyl, and heteroaralkyl; and

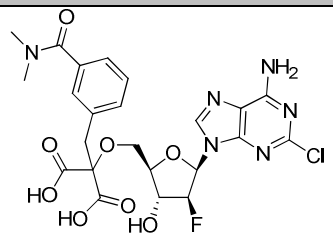
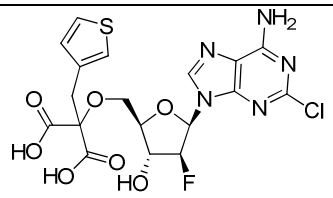
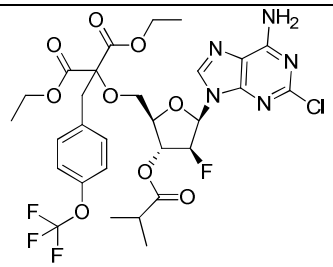
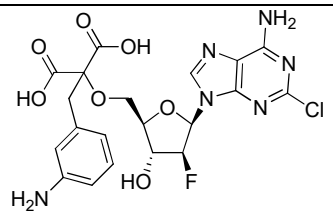
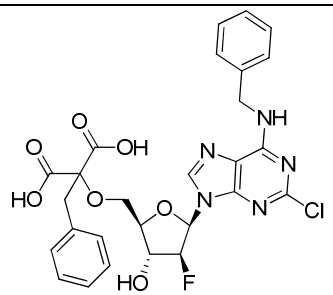
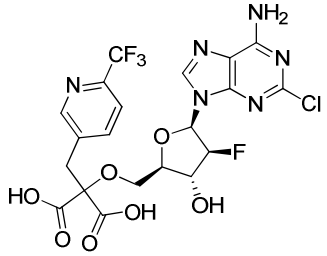
k is 1, 2, or 3.

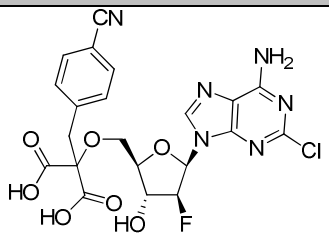
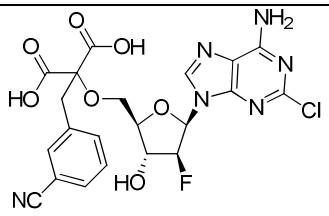
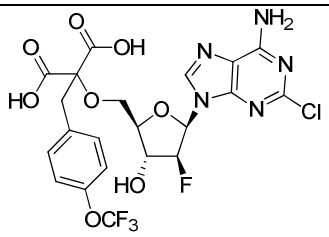
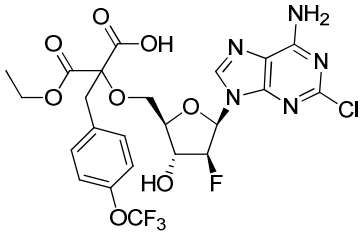
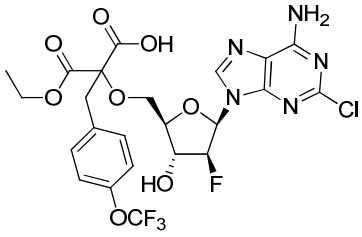
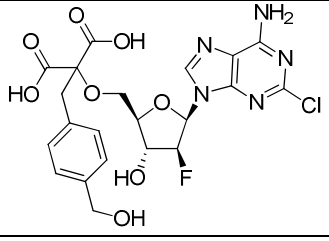
57. The compound of claim 56, wherein $R_A$ is selected from pyridyl, pyrazolyl, pyrrolidinonyl, azapanonyl, morpholinonyl, piperazonyl, tetrahydropyrimidinonyl, phenyl, and benzyloxy.

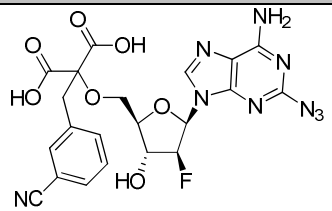
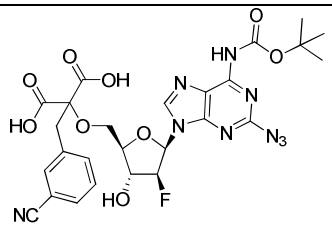
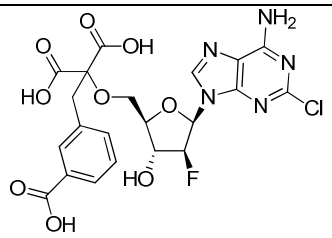
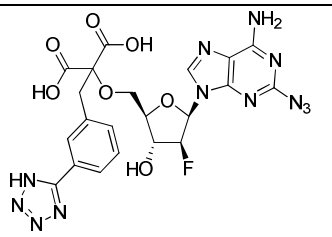
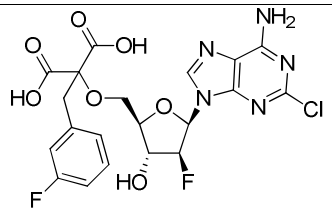
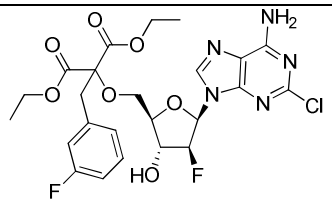
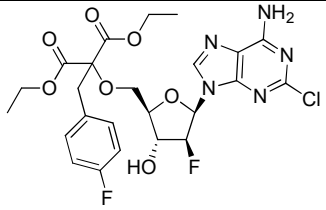
58. A compound selected from:

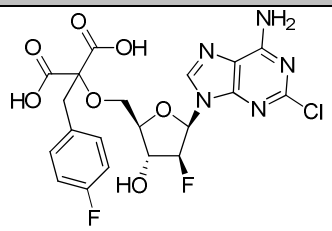
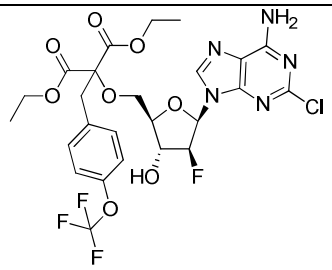
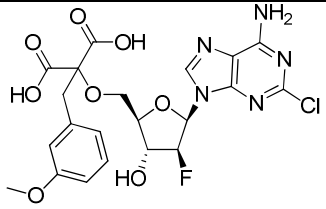
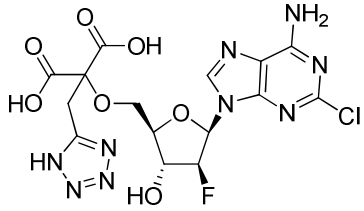
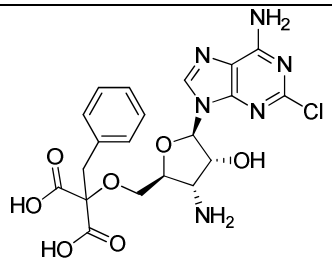
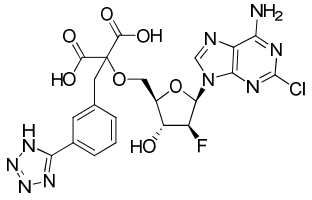
| Cpd. # | Compound | Name |
|---|---|---|
| 6 |  | 2-(((*2R,3R,4S,5R*)-5-(6-amino-2-chloro-9*H*-purin-9-yl)-4-fluoro-3-hydroxytetrahydro-furan-2-yl)methoxy)-2-benzylmalonic acid |
| 7 |  | 2-(((*2R,3R,4S,5R*)-5-(6-amino-2-chloro-9*H*-purin-9-yl)-4-fluoro-3-hydroxytetrahydro-furan-2-yl)methoxy)-2-(4-carboxybenzyl)-malonic acid |
| 8 |  | 2-(((*2R,3R,4S,5R*)-5-(6-amino-2-chloro-9*H*-purin-9-yl)-4-fluoro-3-hydroxytetrahydro-furan-2-yl)methoxy)-2-((6-chloropyridin-3-yl)methyl)malonic acid |
| 10 |  | 2-(((*2R,3R,4R,5R*)-5-(6-amino-9H-purin-9-yl)-4-fluoro-3-hydroxytetrahydrofuran-2-yl)methoxy)-2-benzylmalonic acid |
| 12 |  | 2-(((2R,3R,4S,5R)-5-(6-amino-2-chloro-9H-purin-9-yl)-4-fluoro-3-hydroxytetrahydrofuran-2-yl)methoxy)-2- |

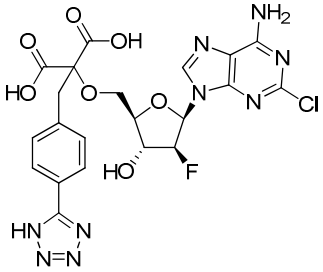
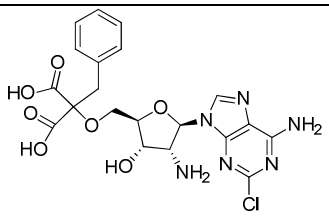
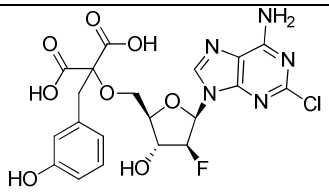
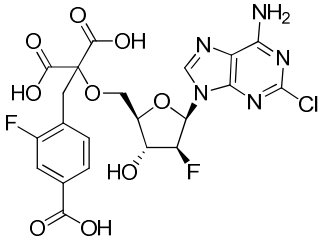
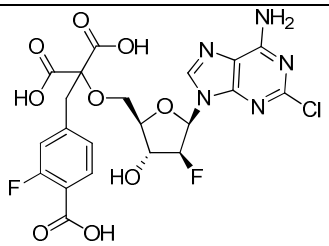
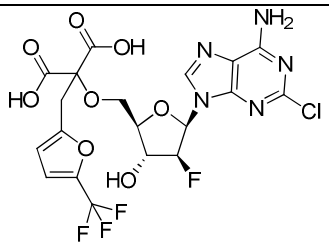
| Cpd. # | Compound | Name |
|---|---|---|
| | | (4-(2-carboxyethyl)benzyl)malonic acid |
| 13 |  | 2-(((2R,3R,4S,5R)-5-(6-amino-2-chloro-9H-purin-9-yl)-4-fluoro-3-hydroxytetrahydrofuran-2-yl)methoxy)-2-(3-phenoxybenzyl)malonic acid |
| 15 |  | 2-(((2R,3R,4S,5R)-5-(6-amino-2-chloro-9H-purin-9-yl)-4-fluoro-3-hydroxytetrahydrofuran-2-yl)methoxy)-2-(3-(trifluoromethoxy)benzyl)malonic acid |
| 16 |  | 2-(((2R,3R,4S,5R)-5-(6-amino-2-chloro-9H-purin-9-yl)-4-fluoro-3-hydroxytetrahydrofuran-2-yl)methoxy)-2-(3-(trifluoromethyl)benzyl)malonic acid |
| 17 |  | 2-(((2R,3R,4S,5R)-5-(6-amino-2-chloro-9H-purin-9-yl)-4-fluoro-3-hydroxytetrahydrofuran-2-yl)methoxy)-2-(naphthalen-2-ylmethyl)malonic acid |
| 20 |  | 2-(((2R,3R,4S,5R)-5-(6-amino-2-chloro-9H-purin-9-yl)-4-fluoro-3-hydroxytetrahydrofuran-2-yl)methoxy)-2-(4-(trifluoromethyl)benzyl)malonic acid |
| 21 |  | 2-(((2R,3R,4S,5R)-5-(6-amino-2-chloro-9H-purin-9-yl)-4-fluoro-3-hydroxytetrahydrofuran-2-yl)methoxy)-2-(4-(methylsulfonyl)benzyl)malonic acid |

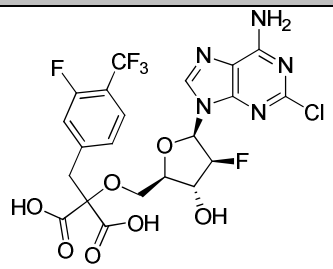
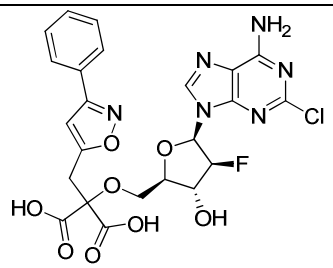
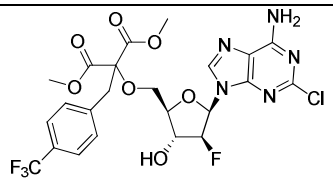
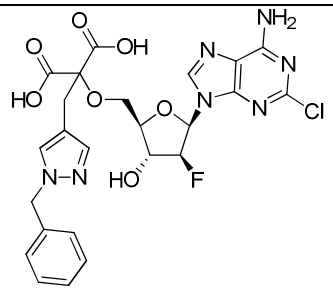
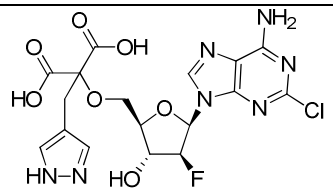
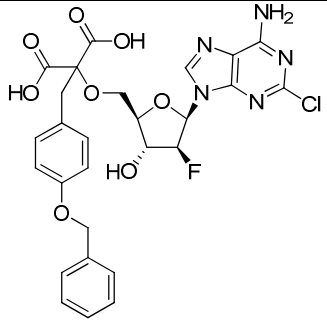
| Cpd. # | Compound | Name |
|---|---|---|
| 22 |  | 2-(((2R,3R,4S,5R)-5-(6-amino-2-chloro-9H-purin-9-yl)-4-fluoro-3-hydroxytetrahydrofuran-2-yl)methoxy)-2-(3-(dimethylcarbamoyl)benzyl)malonic acid |
| 23 |  | 2-(((2R,3R,4S,5R)-5-(6-amino-2-chloro-9H-purin-9-yl)-4-fluoro-3-hydroxytetrahydrofuran-2-yl)methoxy)-2-(thiophen-3-ylmethyl)malonic acid |
| 25 |  | diethyl 2-(((2R,3R,4S,5R)-5-(6-amino-2-chloro-9H-purin-9-yl)-4-fluoro-3-(isobutyryloxy)tetrahydrofuran-2-yl)methoxy)-2-(4-(trifluoromethoxy)benzyl)malonate |
| 27 |  | 2-(((2R,3R,4S,5R)-5-(6-amino-2-chloro-9H-purin-9-yl)-4-fluoro-3-hydroxytetrahydrofuran-2-yl)methoxy)-2-(3-aminobenzyl)malonic acid |
| 28 |  | 2-benzyl-2-(((2R,3R,4S,5R)-5-(6-(benzylamino)-2-chloro-9H-purin-9-yl)-4-fluoro-3-hydroxytetrahydrofuran-2-yl)methoxy)malonic acid |
| 32 |  | 2-(((2R,3R,4S,5R)-5-(6-amino-2-chloro-9H-purin-9-yl)-4-fluoro-3-hydroxytetrahydrofuran-2-yl)methoxy)-2-((6-(trifluoromethyl)pyridin-3-yl)methyl)malonic acid |

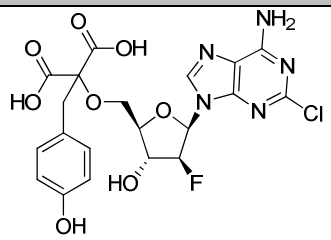
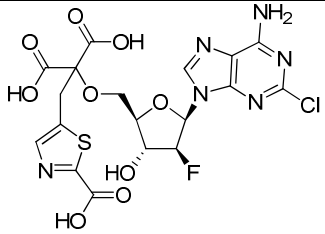
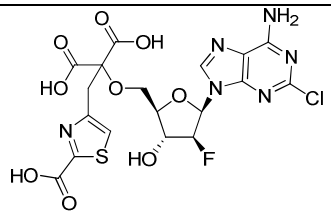
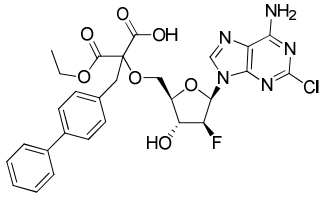
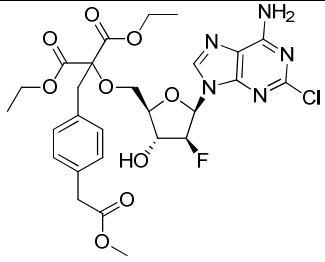
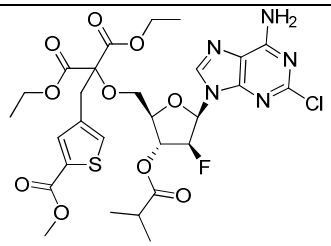
| Cpd. # | Compound | Name |
|---|---|---|
| 34 |  | 2-(((2R,3R,4S,5R)-5-(6-amino-2-chloro-9H-purin-9-yl)-4-fluoro-3-hydroxytetrahydrofuran-2-yl)methoxy)-2-(4-cyanobenzyl)malonic acid |
| 35 |  | 2-(((2R,3R,4S,5R)-5-(6-amino-2-chloro-9H-purin-9-yl)-4-fluoro-3-hydroxytetrahydrofuran-2-yl)methoxy)-2-(3-cyanobenzyl)malonic acid |
| 36 |  | 2-(((2R,3R,4S,5R)-5-(6-amino-2-chloro-9H-purin-9-yl)-4-fluoro-3-hydroxytetrahydrofuran-2-yl)methoxy)-2-(4-(trifluoromethoxy)benzyl)malonic acid |
| 37 |  Isomer 1 | 2-(((2R,3R,4S,5R)-5-(6-amino-2-chloro-9H-purin-9-yl)-4-fluoro-3-hydroxytetrahydrofuran-2-yl)methoxy)-3-ethoxy-3-oxo-2-(4-(trifluoromethoxy)benzyl)propanoic acid |
| 38 |  Isomer 2 | 2-(((2R,3R,4S,5R)-5-(6-amino-2-chloro-9H-purin-9-yl)-4-fluoro-3-hydroxytetrahydrofuran-2-yl)methoxy)-3-ethoxy-3-oxo-2-(4-(trifluoromethoxy)benzyl)propanoic acid |
| 39 |  | 2-(((2R,3R,4S,5R)-5-(6-amino-2-chloro-9H-purin-9-yl)-4-fluoro-3-hydroxytetrahydrofuran-2-yl)methoxy)-2-(4-(hydroxymethyl)benzyl)malonic acid |

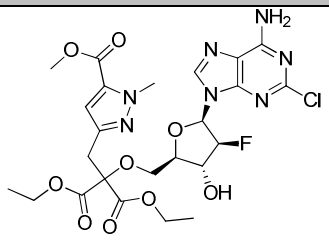
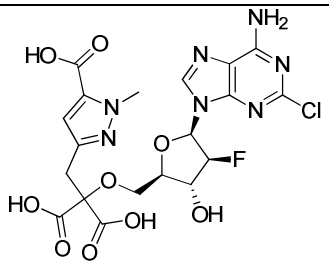
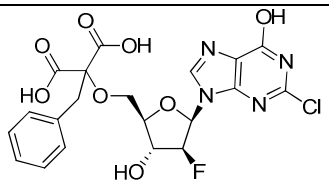
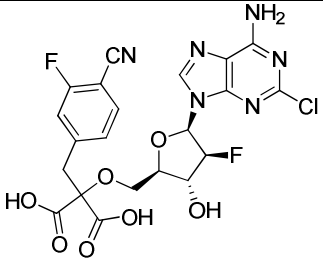
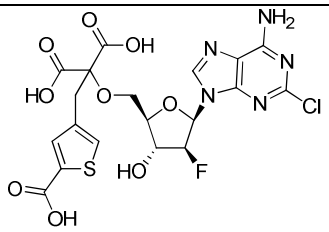
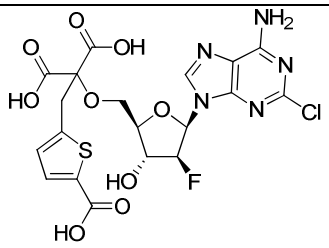
| Cpd. # | Compound | Name |
|---|---|---|
| 40 |  | 2-(((2R,3R,4S,5R)-5-(6-amino-2-azido-9H-purin-9-yl)-4-fluoro-3-hydroxytetrahydrofuran-2-yl)methoxy)-2-(3-cyanobenzyl)malonic acid |
| 41 |  | 2-(((2R,3R,4S,5R)-5-(2-azido-6-((tert-butoxycarbonyl)amino)-9H-purin-9-yl)-4-fluoro-3-hydroxytetrahydrofuran-2-yl)methoxy)-2-(3-cyanobenzyl)malonic acid |
| 42 |  | 2-(((2R,3R,4S,5R)-5-(6-amino-2-chloro-9H-purin-9-yl)-4-fluoro-3-hydroxytetrahydro-furan-2-yl)methoxy)-2-(3-carboxybenzyl)-malonic acid |
| 43 |  | 2-(3-(1H-tetrazol-5-yl)benzyl)-2-(((2R,3R,4S,5R)-5-(6-amino-2-azido-9H-purin-9-yl)-4-fluoro-3-hydroxytetrahydrofuran-2-yl)methoxy)malonic acid |
| 44 |  | 2-(((2R,3R,4S,5R)-5-(6-amino-2-chloro-9H-purin-9-yl)-4-fluoro-3-hydroxytetrahydrofuran-2-yl)methoxy)-2-(3-fluorobenzyl)malonic acid |
| 45 |  | diethyl 2-(((2R,3R,4S,5R)-5-(6-amino-2-chloro-9H-purin-9-yl)-4-fluoro-3-hydroxytetrahydrofuran-2-yl)methoxy)-2-(3-fluorobenzyl)malonate |
| 46 |  | diethyl 2-(((2R,3R,4S,5R)-5-(6-amino-2-chloro-9H-purin-9-yl)-4-fluoro-3-hydroxytetrahydrofuran-2-yl)methoxy)-2-(4-fluorobenzyl)malonate |

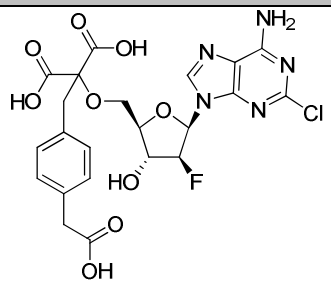
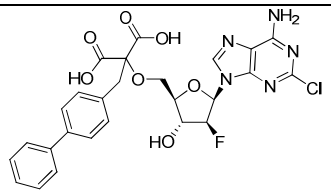
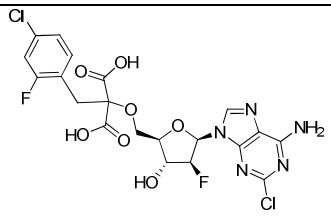
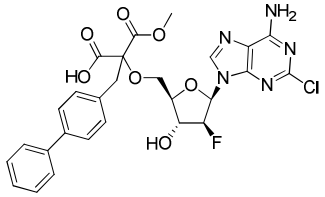
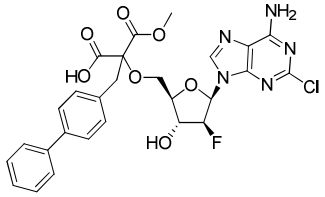
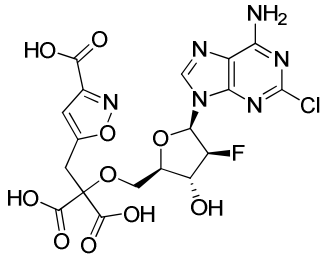
| Cpd. # | Compound | Name |
|---|---|---|
| 47 |  | 2-(((2R,3R,4S,5R)-5-(6-amino-2-chloro-9H-purin-9-yl)-4-fluoro-3-hydroxytetrahydrofuran-2-yl)methoxy)-2-(4-fluorobenzyl)malonic acid |
| 48 |  | diethyl 2-(((2R,3R,4S,5R)-5-(6-amino-2-chloro-9H-purin-9-yl)-4-fluoro-3-hydroxytetrahydrofuran-2-yl)methoxy)-2-(4-(trifluoromethoxy)benzyl)malonate |
| 49 |  | 2-(((2R,3R,4S,5R)-5-(6-amino-2-chloro-9H-purin-9-yl)-4-fluoro-3-hydroxytetrahydrofuran-2-yl)methoxy)-2-(3-methoxybenzyl)malonic acid |
| 50 |  | 2-((1H-tetrazol-5-yl)methyl)-2-(((2R,3R,4S,5R)-5-(6-amino-2-chloro-9H-purin-9-yl)-4-fluoro-3-hydroxytetrahydrofuran-2-yl)methoxy)malonic acid |
| 51 |  | 2-(((2S,3S,4R,5R)-3-amino-5-(6-amino-2-chloro-9H-purin-9-yl)-4-hydroxytetrahydrofuran-2-yl)methoxy)-2-benzylmalonic acid |
| 53 |  | 2-(3-(1H-tetrazol-5-yl)benzyl)-2-(((2R,3R,4S,5R)-5-(6-amino-2-chloro-9H-purin-9-yl)-4-fluoro-3-hydroxytetrahydrofuran-2-yl)methoxy)malonic acid |

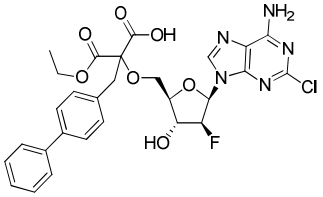
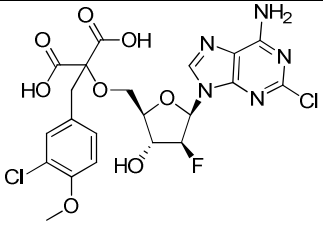
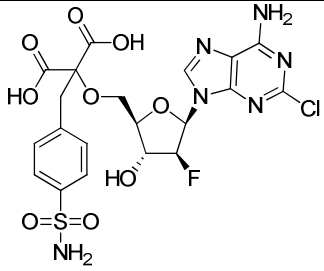
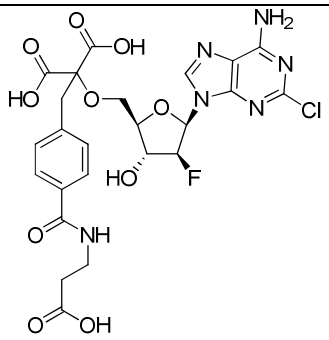
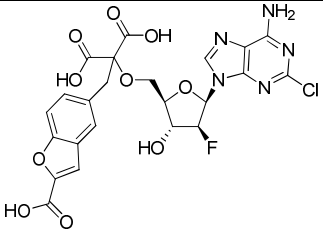
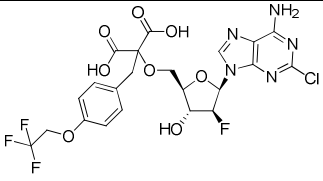
| Cpd. # | Compound | Name |
|---|---|---|
| 54 |  | 2-(4-(1H-tetrazol-5-yl)benzyl)-2-(((2R,3R,4S,5R)-5-(6-amino-2-chloro-9H-purin-9-yl)-4-fluoro-3-hydroxytetrahydro-furan-2-yl)methoxy)malonic acid |
| 55 |  | 2-(((2R,3S,4R,5R)-4-amino-5-(6-amino-2-chloro-9H-purin-9-yl)-3-hydroxytetrahydrofuran-2-yl)methoxy)-2-benzylmalonic acid |
| 56 |  | 2-(((2R,3R,4S,5R)-5-(6-amino-2-chloro-9H-purin-9-yl)-4-fluoro-3-hydroxytetrahydrofuran-2-yl)methoxy)-2-(3-hydroxybenzyl)malonic acid |
| 57 |  | 2-(((2R,3R,4S,5R)-5-(6-amino-2-chloro-9H-purin-9-yl)-4-fluoro-3-hydroxytetrahydrofuran-2-yl)methoxy)-2-(4-carboxy-2-fluorobenzyl)malonic acid |
| 58 |  | 2-(((2R,3R,4S,5R)-5-(6-amino-2-chloro-9H-purin-9-yl)-4-fluoro-3-hydroxytetrahydro-furan-2-yl)methoxy)-2-(4-carboxy-3-fluorobenzyl)malonic acid |
| 59 |  | 2-(((2R,3R,4S,5R)-5-(6-amino-2-chloro-9H-purin-9-yl)-4-fluoro-3-hydroxytetrahydro-furan-2-yl)methoxy)-2-((5-(trifluoromethyl)-furan-2-yl)methyl)malonic acid |

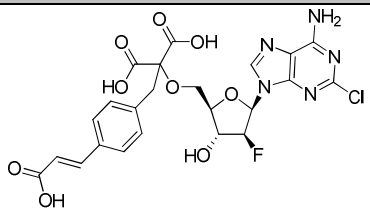
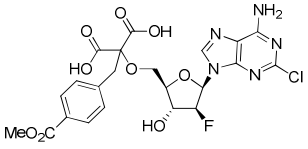
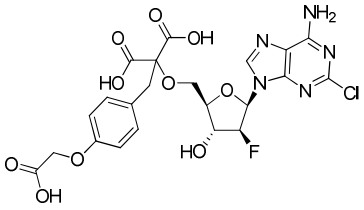
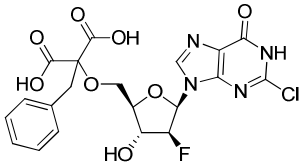
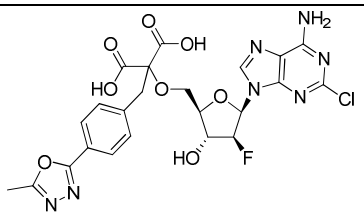
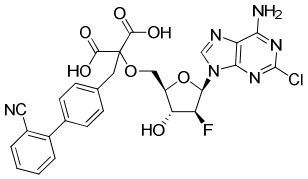
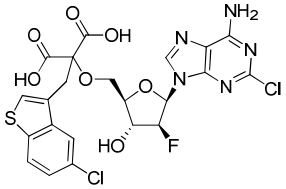
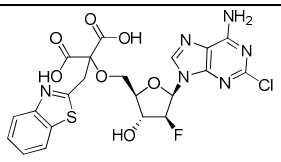
| Cpd. # | Compound | Name |
|---|---|---|
| 60 |  | 2-(((2R,3R,4S,5R)-5-(6-amino-2-chloro-9H-purin-9-yl)-4-fluoro-3-hydroxytetrahydro-furan-2-yl)methoxy)-2-(3-fluoro-4-(trifluoromethyl)benzyl)malonic acid |
| 61 |  | 2-(((2R,3R,4S,5R)-5-(6-amino-2-chloro-9H-purin-9-yl)-4-fluoro-3-hydroxytetrahydrofuran-2-yl)methoxy)-2-((3-phenylisoxazol-5-yl)methyl)malonic acid |
| 62 |  | dimethyl 2-(((2R,3R,4S,5R)-5-(6-amino-2-chloro-9H-purin-9-yl)-4-fluoro-3-hydroxytetrahydrofuran-2-yl)methoxy)-2-(4-(trifluoromethyl)benzyl)malonate |
| 63 |  | 2-(((2R,3R,4S,5R)-5-(6-amino-2-chloro-9H-purin-9-yl)-4-fluoro-3-hydroxytetrahydro-furan-2-yl)methoxy)-2-((1-benzyl-1H-pyrazol-4-yl)methyl)malonic acid |
| 64 |  | 2-((1H-pyrazol-4-yl)methyl)-2-(((2R,3R,4S,5R)-5-(6-amino-2-chloro-9H-purin-9-yl)-4-fluoro-3-hydroxytetrahydrofuran-2-yl)methoxy)malonic acid |
| 65 |  | 2-(((2R,3R,4S,5R)-5-(6-amino-2-chloro-9H-purin-9-yl)-4-fluoro-3-hydroxytetrahydrofuran-2-yl)methoxy)-2-(4-(benzyloxy)benzyl)malonic acid |

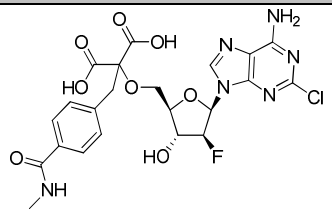
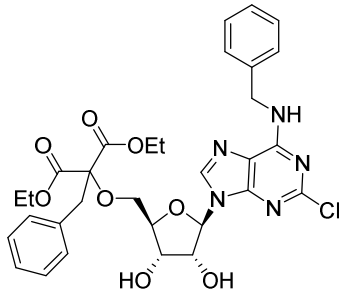
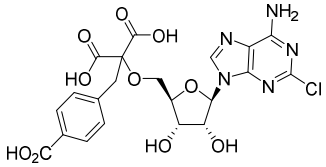
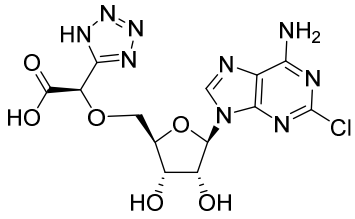
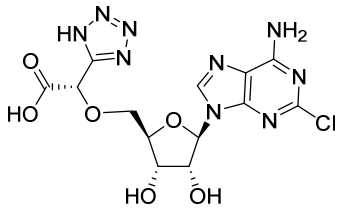
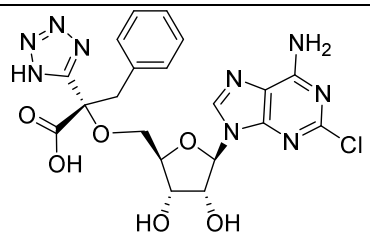
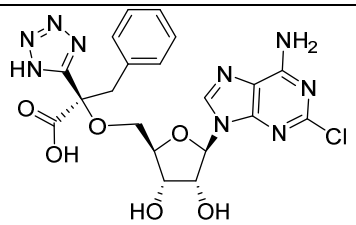
| Cpd. # | Compound | Name |
|---|---|---|
| 66 |  | 2-(((2R,3R,4S,5R)-5-(6-amino-2-chloro-9H-purin-9-yl)-4-fluoro-3-hydroxytetrahydrofuran-2-yl)methoxy)-2-(4-hydroxybenzyl)malonic acid |
| 67 |  | 2-(((2R,3R,4S,5R)-5-(6-amino-2-chloro-9H-purin-9-yl)-4-fluoro-3-hydroxytetrahydro-furan-2-yl)methoxy)-2-((2-carboxythiazol-5-yl)methyl)malonic acid |
| 68 |  | 2-(((2R,3R,4S,5R)-5-(6-amino-2-chloro-9H-purin-9-yl)-4-fluoro-3-hydroxytetrahydro-furan-2-yl)methoxy)-2-((2-carboxythiazol-4-yl)methyl)malonic acid |
| 69 |  Isomer 1 | 2-([1,1'-biphenyl]-4-ylmethyl)-2-(((2R,3R,4S,5R)-5-(6-amino-2-chloro-9H-purin-9-yl)-4-fluoro-3-hydroxytetrahydro-furan-2-yl)methoxy)-3-ethoxy-3-oxopropanoic acid |
| 70 |  | diethyl 2-(((2R,3R,4S,5R)-5-(6-amino-2-chloro-9H-purin-9-yl)-4-fluoro-3-hydroxytetrahydrofuran-2-yl)methoxy)-2-(4-(2-methoxy-2-oxoethyl)benzyl)malonate |
| 71 |  | diethyl 2-(((2R,3R,4S,5R)-5-(6-amino-2-chloro-9H-purin-9-yl)-4-fluoro-3-(isobutyryloxy)tetrahydrofuran-2-yl)methoxy)-2-((5-(methoxycarbonyl)thiophen-3-yl)methyl)malonate |

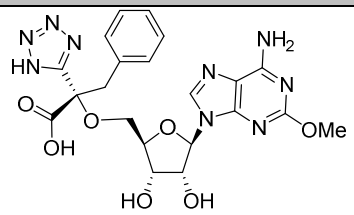
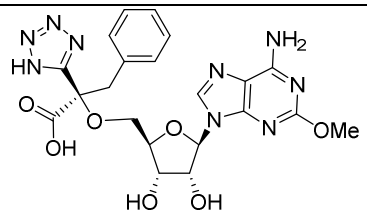
| Cpd. # | Compound | Name |
|---|---|---|
| 72 |  | diethyl 2-(((2R,3R,4S,5R)-5-(6-amino-2-chloro-9H-purin-9-yl)-4-fluoro-3-hydroxytetrahydrofuran-2-yl)methoxy)-2-((5-(methoxycarbonyl)-1-methyl-1H-pyrazol-3-yl)methyl)malonate |
| 73 |  | 2-(((2R,3R,4S,5R)-5-(6-amino-2-chloro-9H-purin-9-yl)-4-fluoro-3-hydroxytetrahydrofuran-2-yl)methoxy)-2-((5-carboxy-1-methyl-1H-pyrazol-3-yl)methyl)malonic acid |
| 74 |  | 2-benzyl-2-(((2R,3R,4S,5R)-5-(2-chloro-6-hydroxy-9H-purin-9-yl)-4-fluoro-3-hydroxytetrahydrofuran-2-yl)methoxy)malonic acid |
| 75 |  | 2-(((2R,3R,4S,5R)-5-(6-amino-2-chloro-9H-purin-9-yl)-4-fluoro-3-hydroxytetrahydrofuran-2-yl)methoxy)-2-(4-cyano-3-fluorobenzyl)malonic acid |
| 76 |  | 2-(((2R,3R,4S,5R)-5-(6-amino-2-chloro-9H-purin-9-yl)-4-fluoro-3-hydroxytetrahydro-furan-2-yl)methoxy)-2-((5-carboxythiophen-3-yl)methyl)malonic acid |
| 77 |  | 2-(((2R,3R,4S,5R)-5-(6-amino-2-chloro-9H-purin-9-yl)-4-fluoro-3-hydroxytetrahydro-furan-2-yl)methoxy)-2-((5-carboxythiophen-2-yl)methyl)malonic acid |

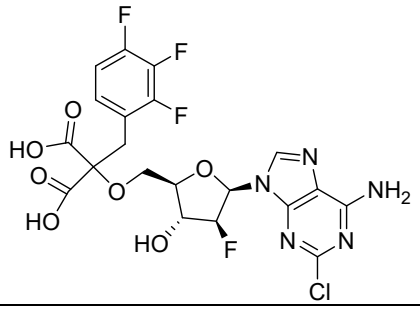
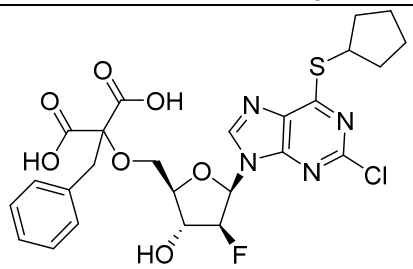
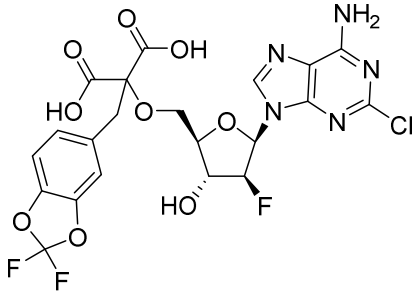
| Cpd. # | Compound | Name |
|---|---|---|
| 78 |  | 2-(((2R,3R,4S,5R)-5-(6-amino-2-chloro-9H-purin-9-yl)-4-fluoro-3-hydroxytetrahydrofuran-2-yl)methoxy)-2-(4-(carboxymethyl)benzyl)malonic acid |
| 79 |  | 2-([1,1'-biphenyl]-4-ylmethyl)-2-(((2R,3R,4S,5R)-5-(6-amino-2-chloro-9H-purin-9-yl)-4-fluoro-3-hydroxytetrahydrofuran-2-yl)methoxy)malonic acid |
| 80 |  | 2-(((2R,3R,4S,5R)-5-(6-amino-2-chloro-9H-purin-9-yl)-4-fluoro-3-hydroxytetrahydrofuran-2-yl)methoxy)-2-(4-chloro-2-fluorobenzyl)malonic acid |
| 81 |  Isomer 1 | 2-([1,1'-biphenyl]-4-ylmethyl)-2-(((2R,3R,4S,5R)-5-(6-amino-2-chloro-9H-purin-9-yl)-4-fluoro-3-hydroxytetrahydrofuran-2-yl)methoxy)-3-methoxy-3-oxopropanoic acid |
| 82 |  Isomer 2 | 2-([1,1'-biphenyl]-4-ylmethyl)-2-(((2R,3R,4S,5R)-5-(6-amino-2-chloro-9H-purin-9-yl)-4-fluoro-3-hydroxytetrahydrofuran-2-yl)methoxy)-3-methoxy-3-oxopropanoic acid |
| 83 |  | 2-(((2R,3R,4S,5R)-5-(6-amino-2-chloro-9H-purin-9-yl)-4-fluoro-3-hydroxytetrahydrofuran-2-yl)methoxy)-2-((3-carboxyisoxazol-5-yl)methyl)malonic acid |

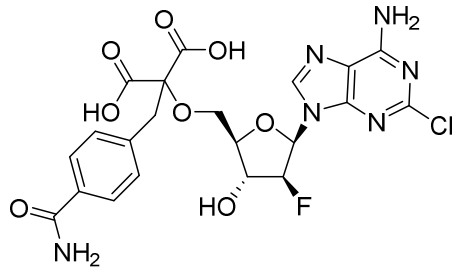
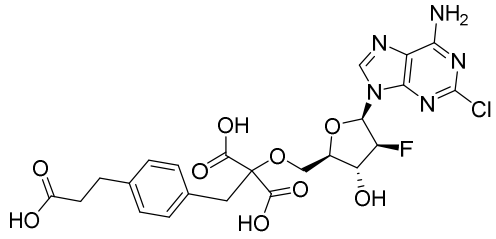
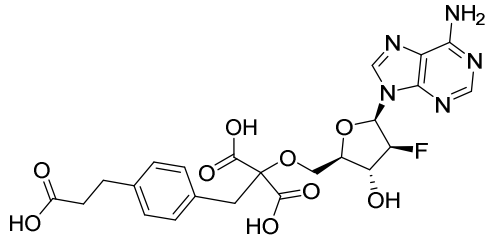
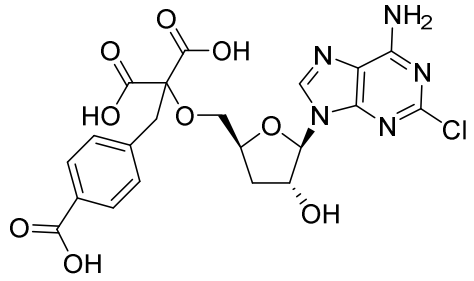
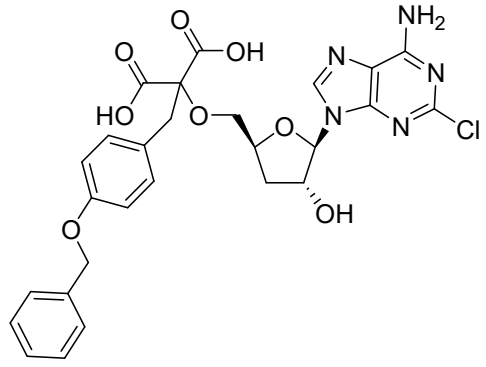
| Cpd. # | Compound | Name |
|---|---|---|
| 84 |  Isomer 2 | 2-([1,1'-biphenyl]-4-ylmethyl)-2-(((2R,3R,4S,5R)-5-(6-amino-2-chloro-9H-purin-9-yl)-4-fluoro-3-hydroxytetrahydro-furan-2-yl)methoxy)-3-ethoxy-3-oxopropanoic acid |
| 85 |  | 2-(((2R,3R,4S,5R)-5-(6-amino-2-chloro-9H-purin-9-yl)-4-fluoro-3-hydroxytetrahydrofuran-2-yl)methoxy)-2-(3-chloro-4-methoxybenzyl)malonic acid |
| 86 |  | 2-(((2R,3R,4S,5R)-5-(6-amino-2-chloro-9H-purin-9-yl)-4-fluoro-3-hydroxytetrahydrofuran-2-yl)methoxy)-2-(4-sulfamoylbenzyl)malonic acid |
| 87 |  | 2-(((2R,3R,4S,5R)-5-(6-amino-2-chloro-9H-purin-9-yl)-4-fluoro-3-hydroxytetrahydro-furan-2-yl)methoxy)-2-(4-((2-carboxy-ethyl)carbamoyl)benzyl)malonic acid |
| 88 |  | 2-(((2R,3R,4S,5R)-5-(6-amino-2-chloro-9H-purin-9-yl)-4-fluoro-3-hydroxytetrahydro-furan-2-yl)methoxy)-2-((2-carboxybenzofuran-5-yl)methyl)malonic acid |
| 89 |  | 2-(((2R,3R,4S,5R)-5-(6-amino-2-chloro-9H-purin-9-yl)-4-fluoro-3-hydroxytetrahydrofuran-2-yl)methoxy)-2-(4-(2,2,2-trifluoroethoxy)benzyl)malonic acid |

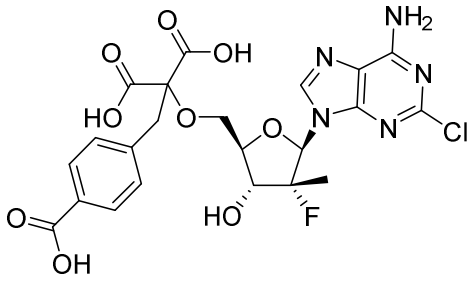
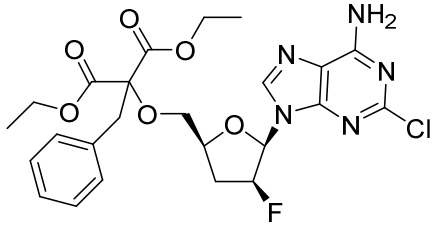
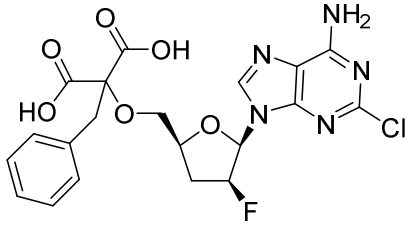
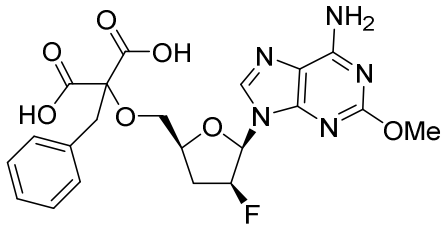
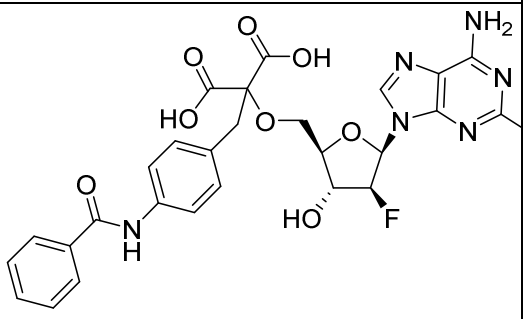
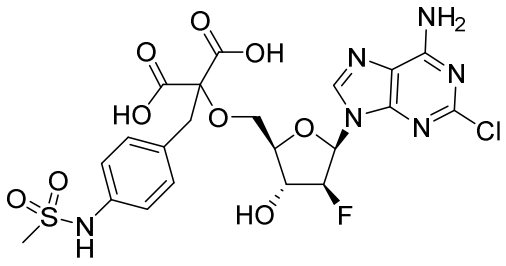
| Cpd. # | Compound | Name |
|---|---|---|
| 90 |  | 2-(((*2R,3R,4S,5R*)-5-(6-amino-2-chloro-9*H*-purin-9-yl)-4-fluoro-3-hydroxytetrahydrofuran-2-yl)methoxy)-2-(4-((*E*)-2-carboxyvinyl)benzyl)malonic acid |
| 91 |  | 2-(((*2R,3R,4S,5R*)-5-(6-amino-2-chloro-9*H*-purin-9-yl)-4-fluoro-3-hydroxytetrahydrofuran-2-yl)methoxy)-2-(4-(methoxycarbonyl)benzyl)malonic acid |
| 92 |  | 2-(((*2R,3R,4S,5R*)-5-(6-amino-2-chloro-9*H*-purin-9-yl)-4-fluoro-3-hydroxytetrahydrofuran-2-yl)methoxy)-2-(4-(carboxymethoxy)benzyl)malonic acid |
| 93 |  | 2-benzyl-2-(((*2R,3R,4S,5R*)-5-(2-chloro-6-oxo-1*H*-purin-9(6H)-yl)-4-fluoro-3-hydroxytetrahydrofuran-2-yl)methoxy)malonic acid |
| 94 |  | 2-(((*2R,3R,4S,5R*)-5-(6-amino-2-chloro-9*H*-purin-9-yl)-4-fluoro-3-hydroxytetrahydrofuran-2-yl)methoxy)-2-(4-(5-methyl-1,3,4-oxadiazol-2-yl)benzyl)malonic acid |
| 95 |  | of 2-(((*2R,3R,4S,5R*)-5-(6-amino-2-chloro-9*H*-purin-9-yl)-4-fluoro-3-hydroxytetrahydrofuran-2-yl)methoxy)-2-((2'-cyano-[1,1'-biphenyl]-4-yl)-methyl)malonic acid |
| 96 |  | 2-(((*2R,3R,4S,5R*)-5-(6-amino-2-chloro-9*H*-purin-9-yl)-4-fluoro-3-hydroxytetrahydrofuran-2-yl)methoxy)-2-((5-chlorobenzo[b]thiophen-3-yl)methyl)-malonic acid |
| 97 |  | 2-(((*2R,3R,4S,5R*)-5-(6-amino-2-chloro-9*H*-purin-9-yl)-4-fluoro-3-hydroxytetrahydrofuran-2-yl)methoxy)-2-(benzo[*d*]thiazol-2-ylmethyl)malonic acid |

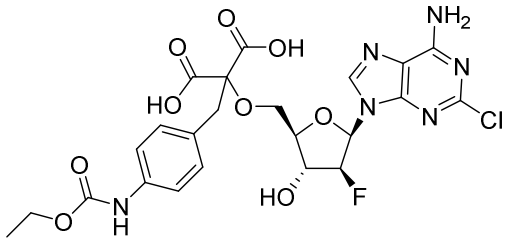
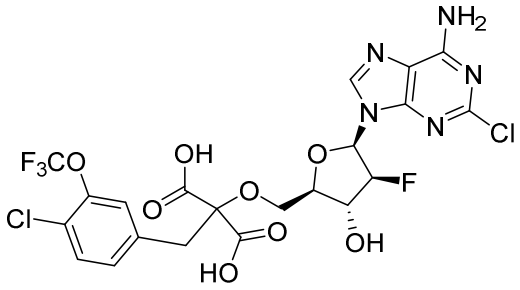
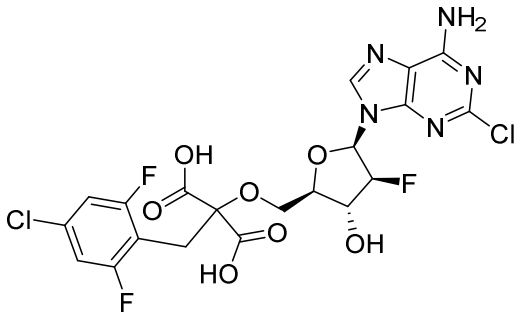
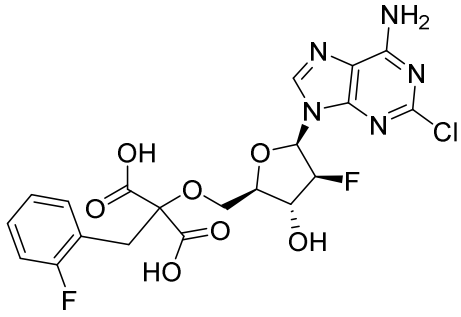
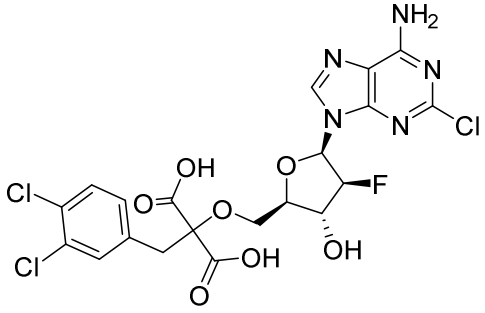
| Cpd. # | Compound | Name |
|---|---|---|
| 98 |  | 2-(((*2R,3R,4S,5R*)-5-(6-amino-2-chloro-9*H*-purin-9-yl)-4-fluoro-3-hydroxytetrahydrofuran-2-yl)methoxy)-2-(4-(methylcarbamoyl)benzyl)malonic acid |
| 99 |  | Diethyl 2-(((*2R,3S,4R,5R*)-5-(6-amino-2-chloro-9*H*-purin-9-yl)-3,4-dihydroxytetrahydrofuran-2-yl)methoxy)-2-benzyl malonate |
| 100 |  | 2-(((*2R,3S,4R,5R*)-5-(6-amino-2-chloro-9*H*-purin-9-yl)-3,4-dihydroxytetrahydrofuran-2-yl)methoxy)-2-(4-carboxybenzyl)malonic acid |
| 101 |  | *S*)-2-(((*2R,3S,4R,5R*)-5-(6-amino-2-chloro-9*H*-purin-9-yl)-3,4-dihydroxytetrahydrofuran-2-yl)methoxy)-2-(1H-tetrazol-5-yl)acetic acid |
| 102 |  | (*R*)-2-(((*2R,3S,4R,5R*)-5-(6-amino-2-chloro-9*H*-purin-9-yl)-3,4-dihydroxytetrahydrofuran-2-yl)methoxy)-2-(1H-tetrazol-5-yl)acetic acid |
| 103 |  | (*S*)-2-(((*2R,3S,4R,5R*)-5-(6-amino-2-chloro-9*H*-purin-9-yl)-3,4-dihydroxytetrahydrofuran-2-yl)methoxy)-3-phenyl-2-(1*H*-tetrazol-5-yl)propanoic acid |
| 104 |  | (*R*)-2-(((2R,3S,4R,5R)-5-(6-amino-2-chloro-9*H*-purin-9-yl)-3,4-dihydroxytetrahydrofuran-2-yl)methoxy)-3-phenyl-2-(1*H*-tetrazol-5-yl)propanoic acid |

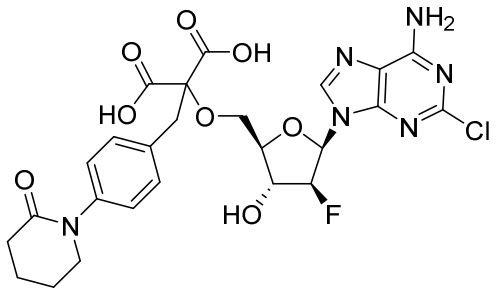
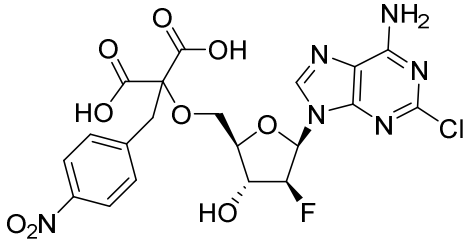
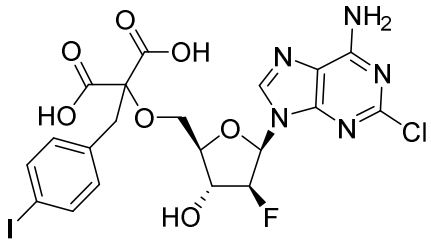
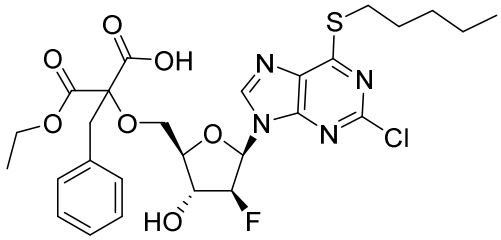
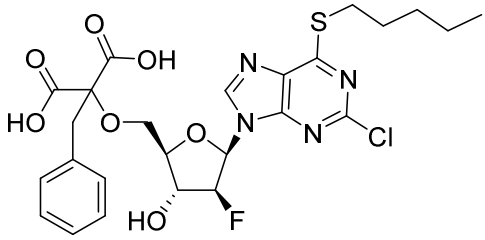
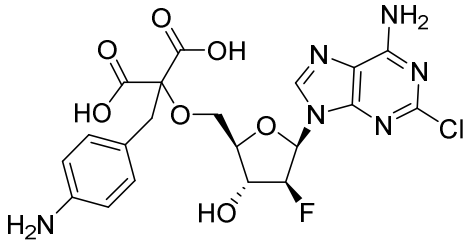
| Cpd. # | Compound | Name |
|---|---|---|
| 105 |  | (*S*)-2-(((*2R,3S,4R,5R*)-5-(6-amino-2-methoxy-9*H*-purin-9-yl)-3,4-dihydroxytetrahydrofuran-2-yl)methoxy)-3-phenyl-2-(1*H*-tetrazol-5-yl)propanoic acid |
| 106 |  | (*R*)-2-(((*2R,3S,4R,5R*)-5-(6-amino-2-methoxy-9*H*-purin-9-yl)-3,4-dihydroxytetrahydrofuran-2-yl)methoxy)-3-phenyl-2-(1*H*-tetrazol-5-yl)propanoic acid |

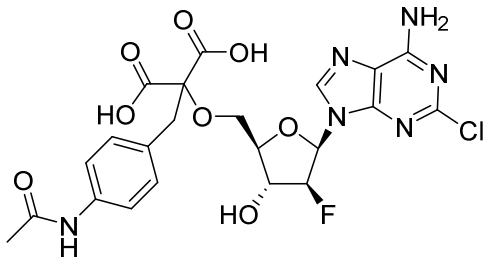
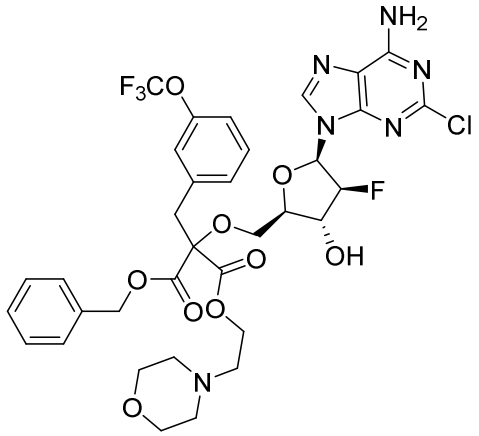
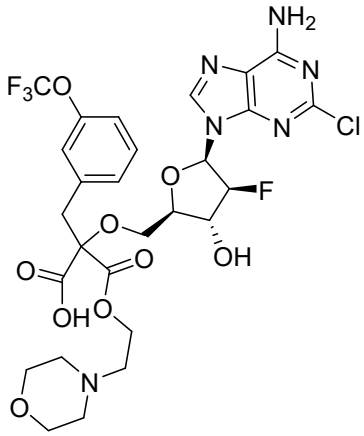
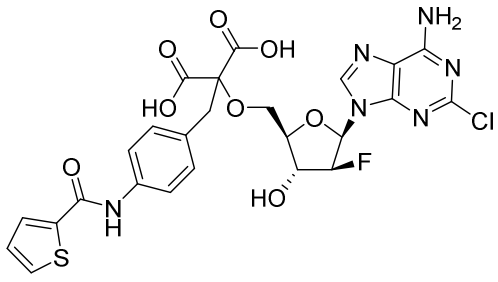
| Cpd. # | Compound |
|---|---|
| 108 |  |
| 109 |  |
| 110 |  |

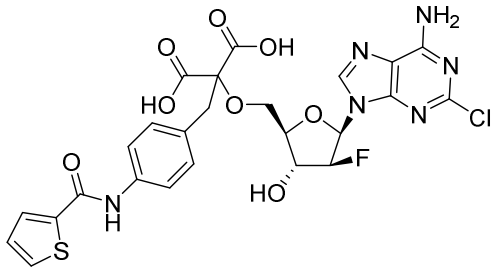
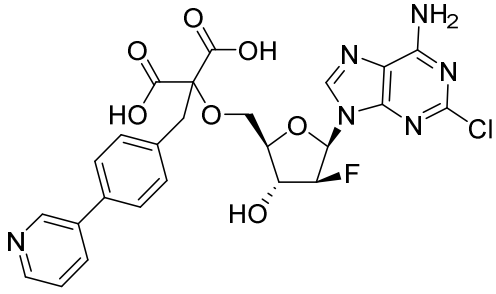
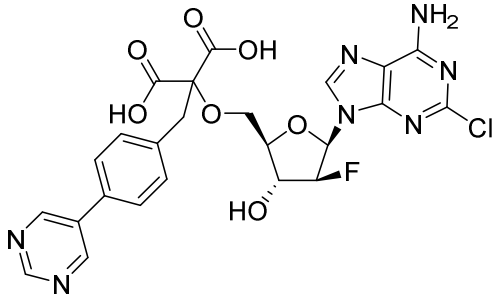
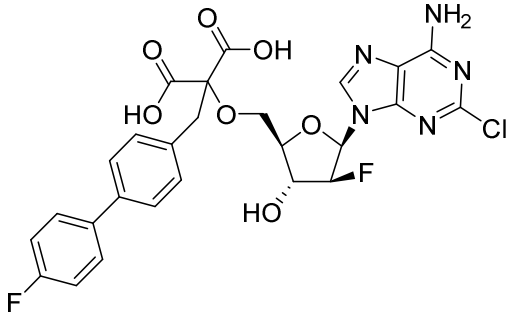
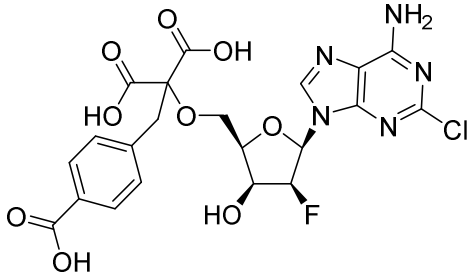
| | |
|---|---|
| 111 |  |
| 113 |  |
| 114 |  |
| 115 |  |
| 116 |  |

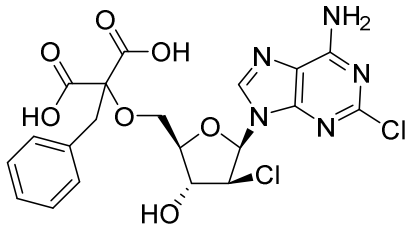
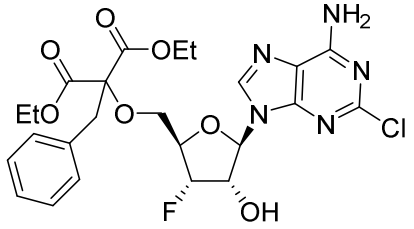
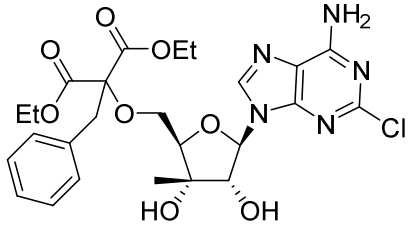
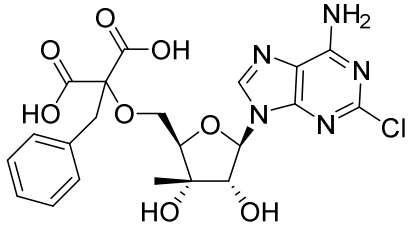
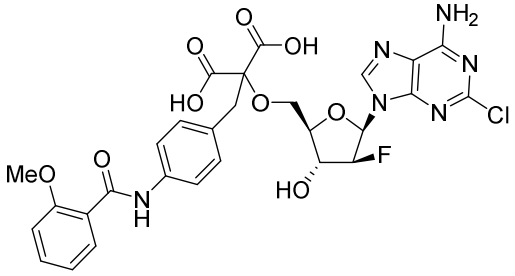
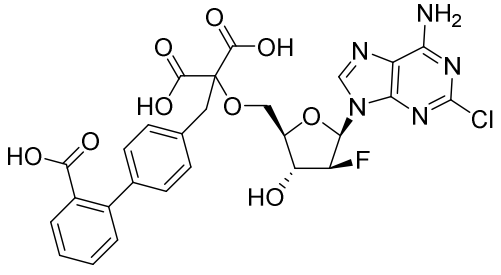
| | |
|---|---|
| 117 |  |
| 118 |  |
| 119 |  |
| 120 |  |
| 122 |  |
| 123 |  |

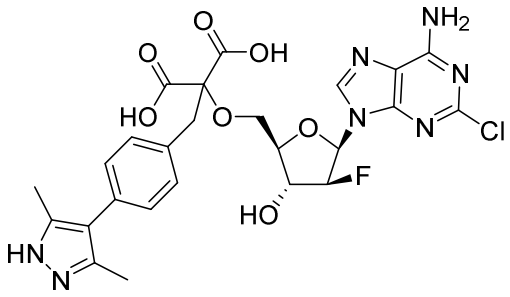
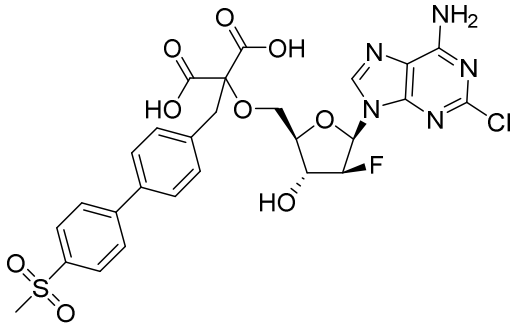
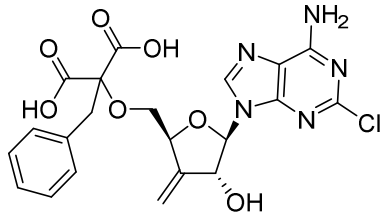
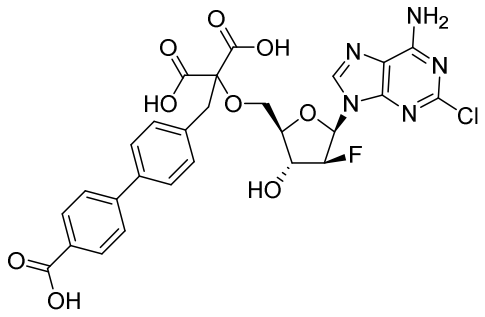
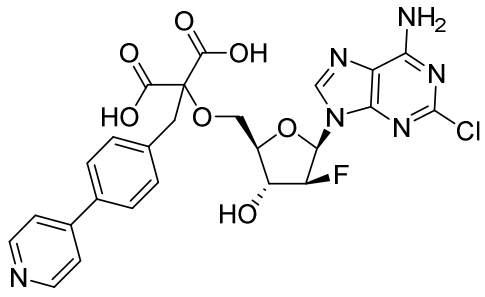
| | |
|---|---|
| 124 |  |
| 125 |  |
| 126 |  |
| 127 |  |
| 128 |  |

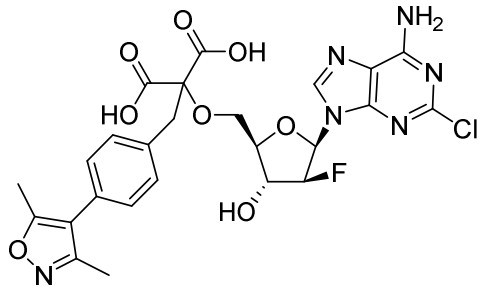
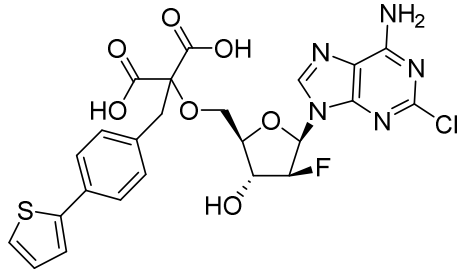
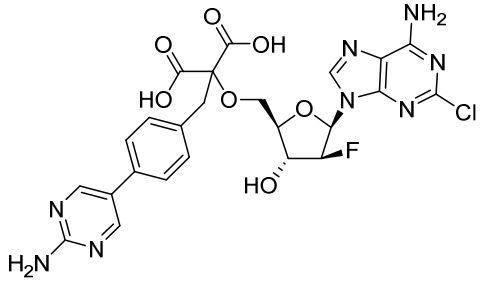
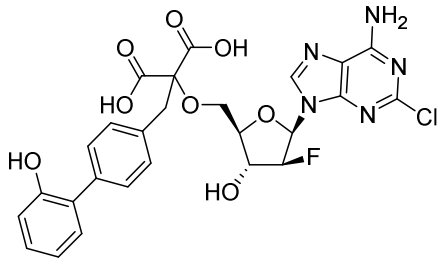
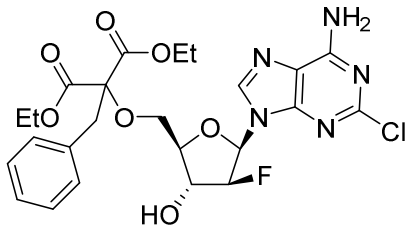
| | |
|---|---|
| 129 |  |
| 130 |  |
| 131 |  |
| 133 |  |
| 134 |  |
| 135 |  |

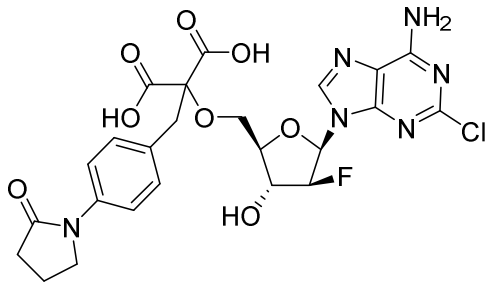
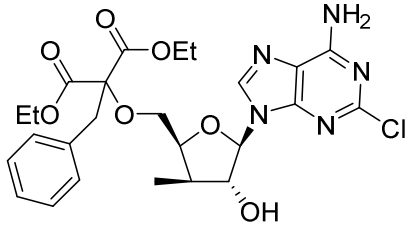
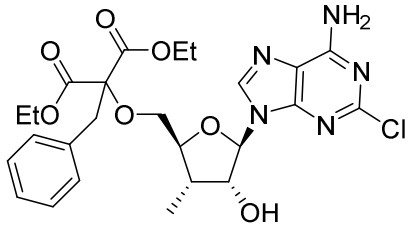
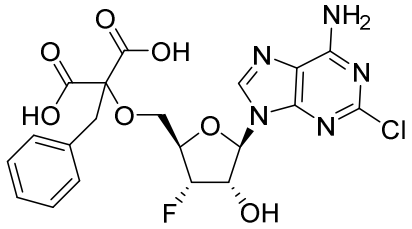
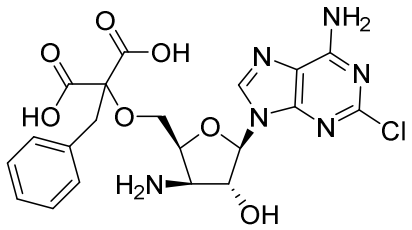
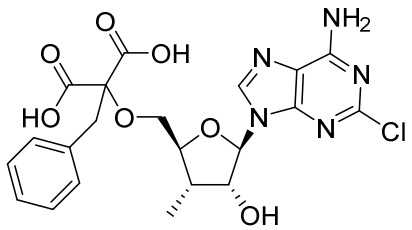
| | |
|---|---|
| 136 |  |
| 138 |  |
| 139 |  |
| 140 |  |

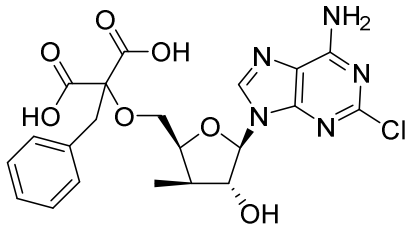
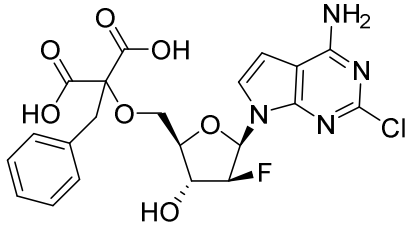
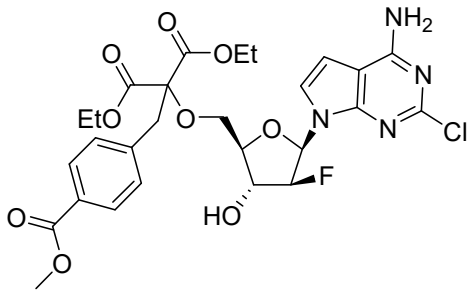
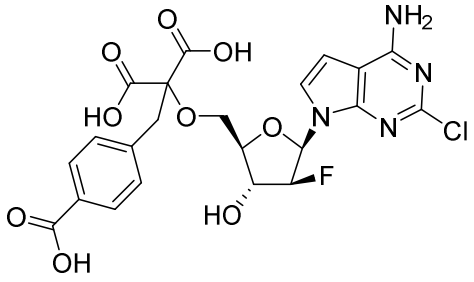
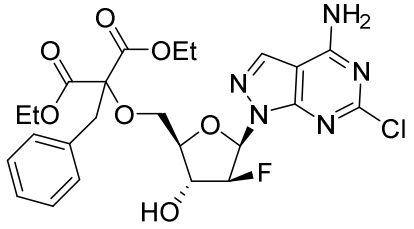
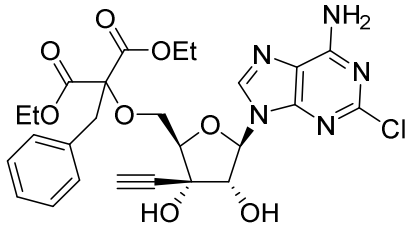
| | |
|---|---|
| 141 |  |
| 142 |  |
| 143 |  |
| 144 |  |
| 145 |  |

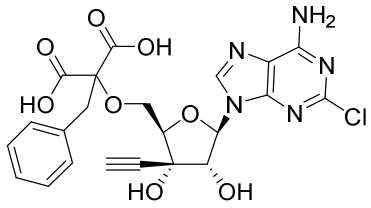
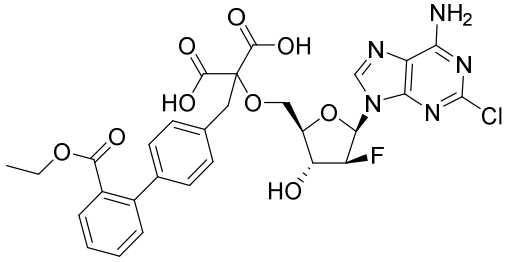
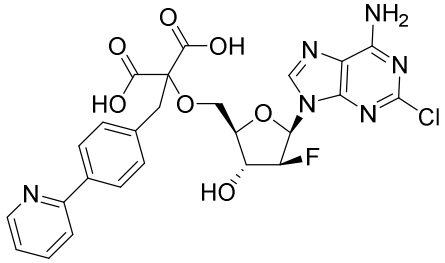
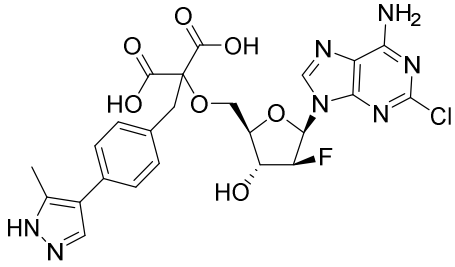
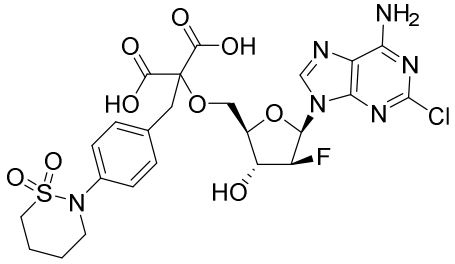
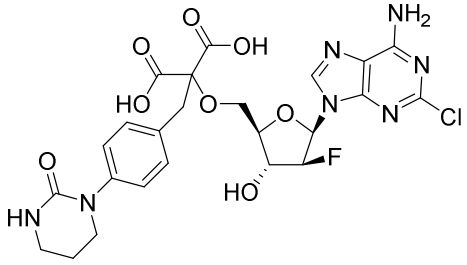
| | |
|---|---|
| 146 |  |
| 147 |  |
| 148 |  |
| 149 |  |
| 150 |  |
| 151 |  |

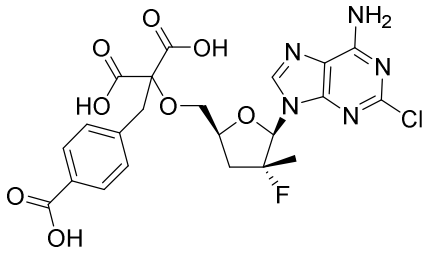
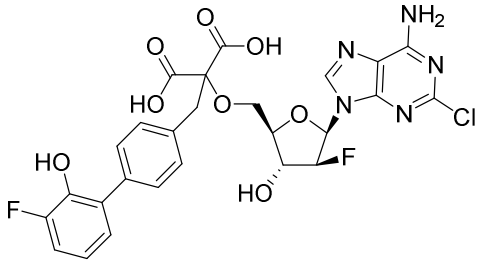
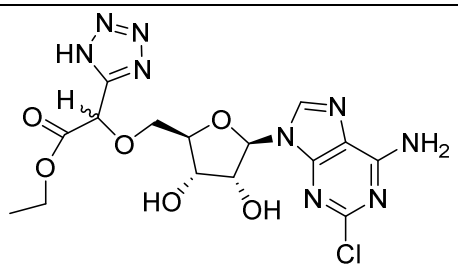
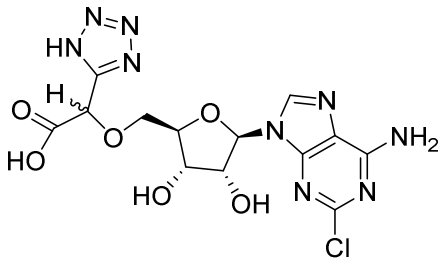
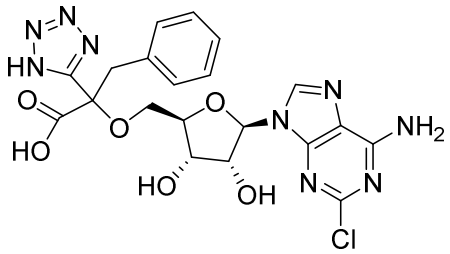
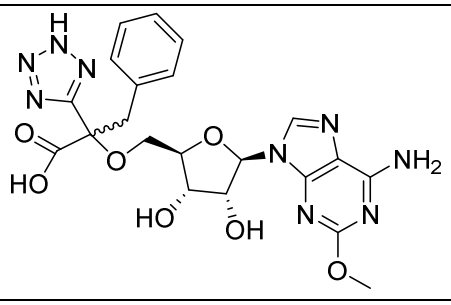
| | |
|---|---|
| 152 |  |
| 153 |  |
| 154 |  |
| 155 |  |
| 156 |  |

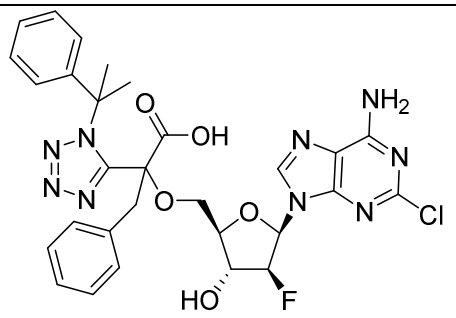
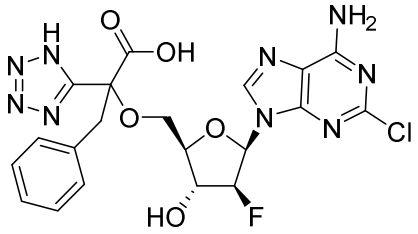
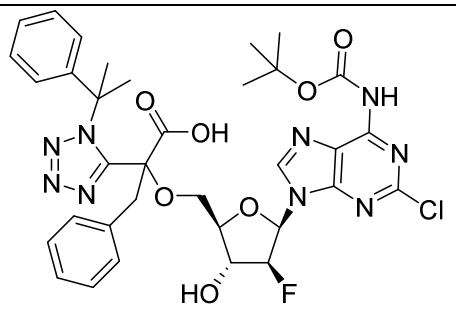
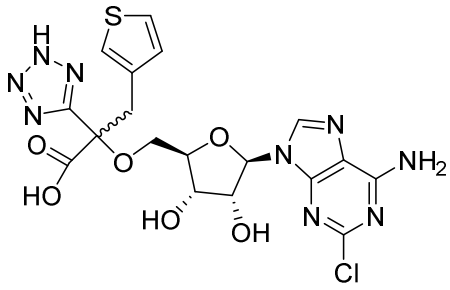
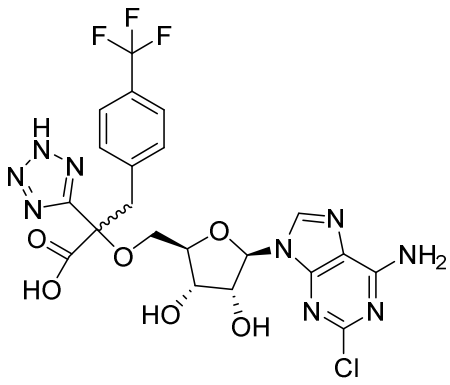
| | |
|---|---|
| 157 |  |
| 158 |  |
| 159 |  |
| 160 |  |
| 161 |  |

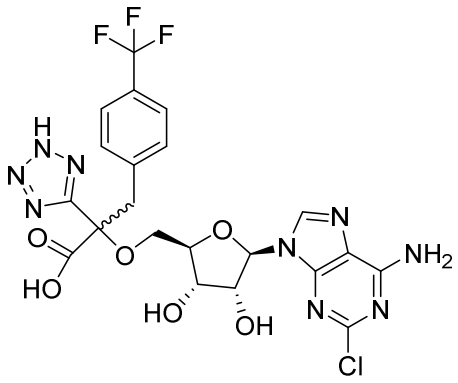
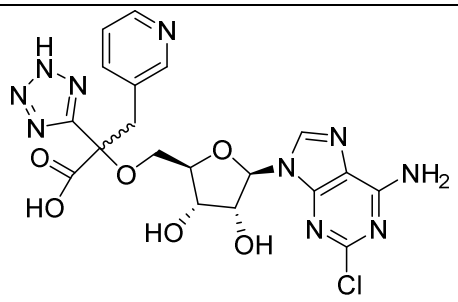
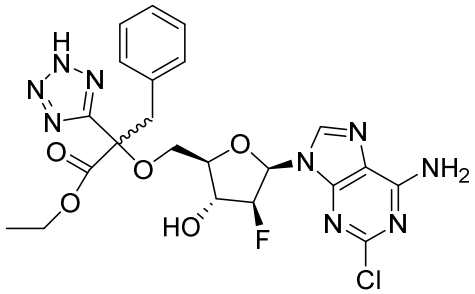
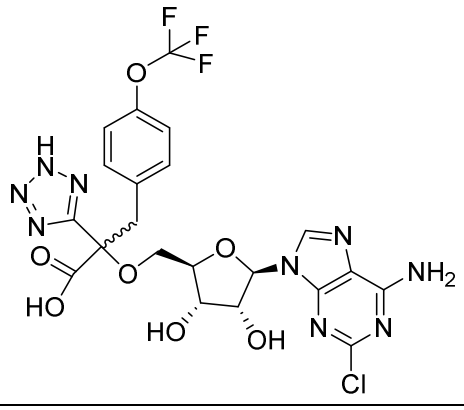
| | |
|---|---|
| 162 |  |
| 163 |  |
| 164 |  |
| 165 |  |
| 166 |  |
| 167 |  |

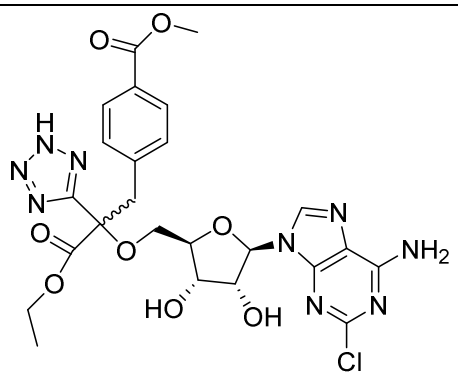
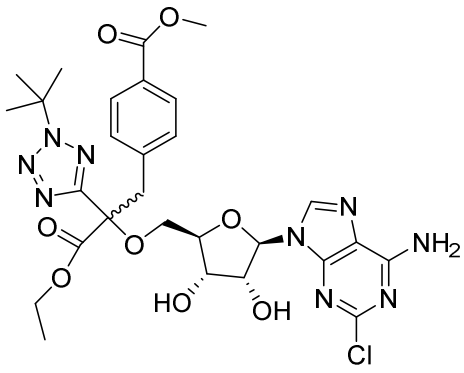
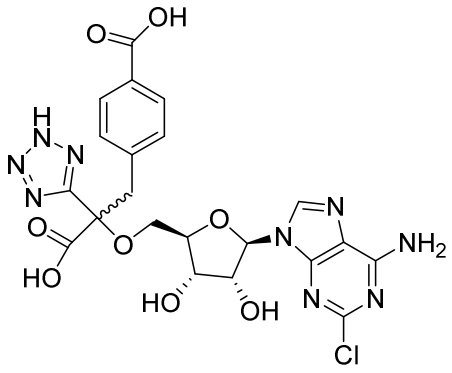
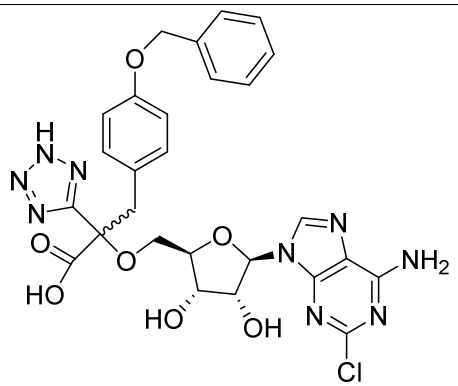
| | |
|---|---|
| 168 |  |
| 169 |  |
| 170 |  |
| 171 |  |
| 172 |  |
| 173 |  |

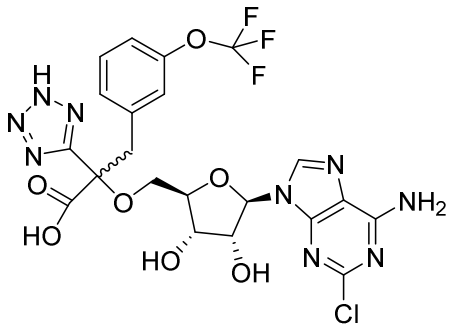
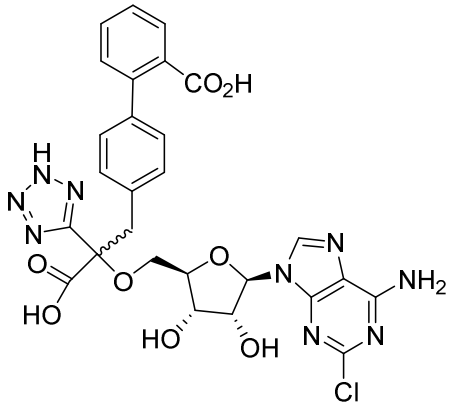
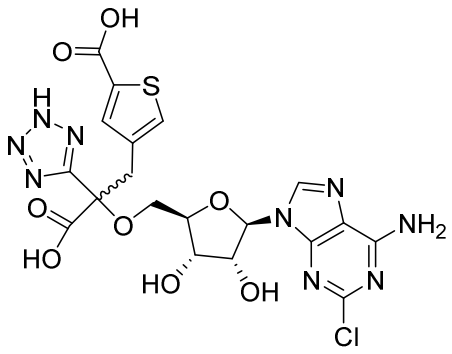
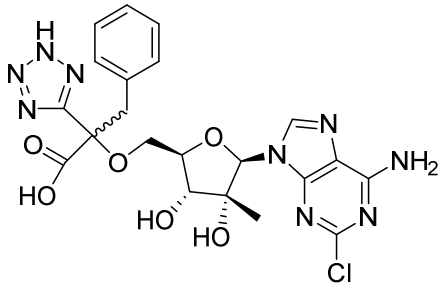
| | |
|---|---|
| 174 |  |
| 175 |  |
| 176 |  |
| 177 |  |
| 178 |  |
| 179 |  |

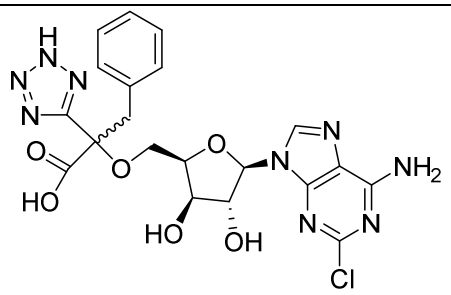
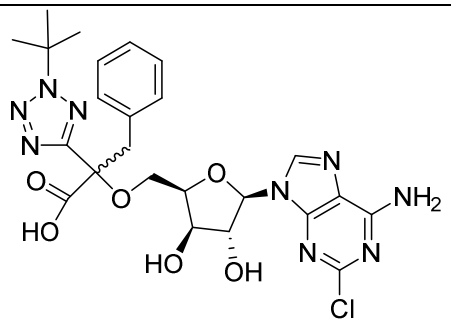
| | |
|---|---|
| 180 |  |
| 181 |  |
| 182 |  |
| 183 |  |
| 184 |  |
| 185 |  |

| | |
|---|---|
| 186 |  |
| 187 |  |
| 188 |  |
| 189 |  |
| 190 |  |

| | |
|---|---|
| 191 |  |
| 192 |  |
| 193 |  |
| 194 |  |

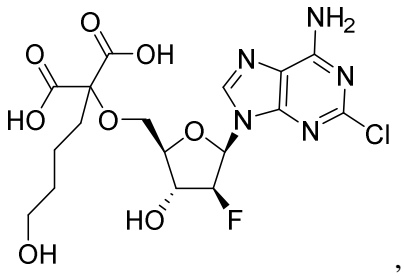
| | |
|---|---|
| 195 |  |
| 196 |  |
| 197 |  |
| 198 |  |

| | |
|---|---|
| 199 |  |
| 200 |  |
| 201 |  |
| 202 |  |

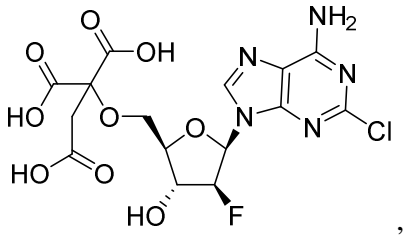
| | |
|---|---|
| 203 |  |
| 204 |  |

or a pharmaceutically acceptable salt thereof.

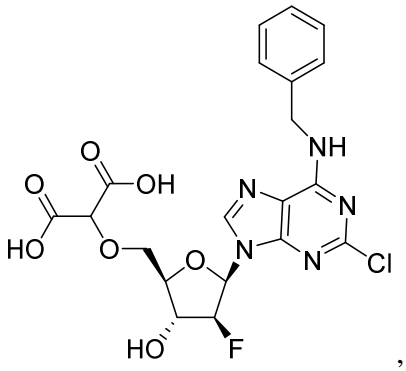
59. A compound selected from:

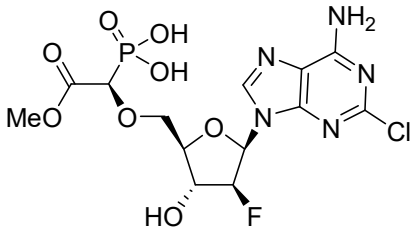


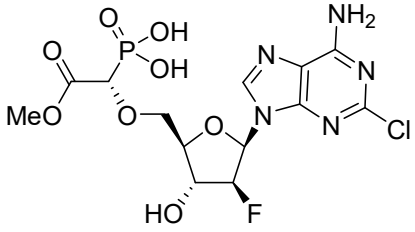
,

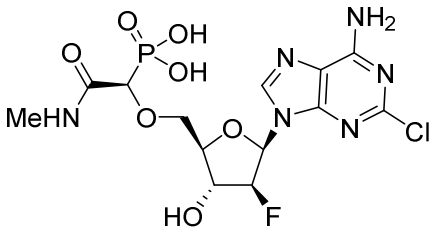


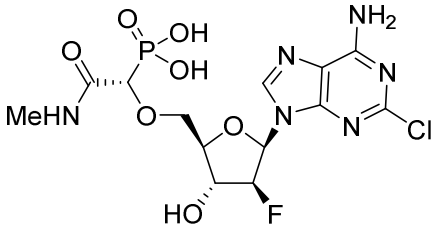
,

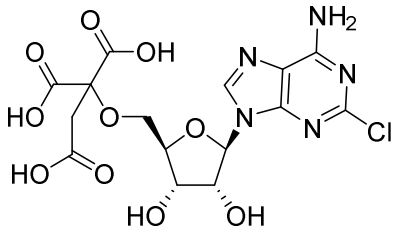

,


,


,


,


, and



, or a pharmaceutically acceptable salt thereof.

60. A pharmaceutical composition comprising a compound according to any one of claims 1-59, or a pharmaceutically acceptable salt thereof, and one or more pharmaceutically acceptable excipients.

61. A method of inhibiting CD73 in a cell in vitro, comprising contacting the cell with a compound of formula (I), or a pharmaceutically acceptable salt thereof, according to any one of claims 1-59.

62. Use of a compound of claim 1 in the manufacture of a medicament for treating a disease or disorder selected from cancer, cerebral and cardiac ischemic diseases, fibrosis, immune and inflammatory disorders, inflammatory gut motility disorder, neurological, neurodegenerative and CNS disorders and diseases, depression, Parkinson's disease, and sleep disorders.

63. The use of claim 62, wherein the cancer is selected from bladder cancer, bone cancer, brain cancer, breast cancer, cardiac cancer, cervical cancer, colon cancer, colorectal cancer, esophageal cancer, fibrosarcoma, gastric cancer, gastrointestinal cancer, head & neck cancer, Kaposi's sarcoma, kidney cancer, leukemia, liver cancer, lung cancer, lymphoma, melanoma, myeloma, ovarian cancer, pancreatic cancer, penile cancer, prostate cancer, testicular germ cell cancer, thymoma and thymic carcinoma.

64. The use of claim 63, wherein the cancer is selected from breast cancer, brain cancer, colon cancer, fibrosarcoma, kidney cancer, lung cancer, melanoma, ovarian cancer, and prostate cancer.

65. The use of claim 64, wherein the cancer is breast cancer.