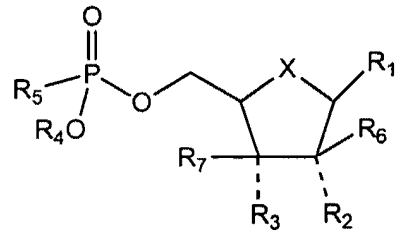
## CLAIMS

What is claimed is:

1. A compound of formula I:



I

wherein:

$R_1$ is adenine, guanine, cytosine, thymine, 3-deazaadenine, or uracil, optionally substituted by 1, 2, or 3 U; wherein each U is independently halo, hydroxy, $(C_1\text{-}C_6)$alkyl, $(C_3\text{-}C_6)$cycloalkyl, $(C_1\text{-}C_6)$alkoxy, $(C_3\text{-}C_6)$cycloalkyloxy, $(C_1\text{-}C_6)$alkanoyl, $(C_1\text{-}C_6)$alkanoyloxy, trifluoromethyl, hydroxy$(C_1\text{-}C_6)$alkyl, $-(CH_2)_{1\text{-}4}P(=O)(OR_w)_2$ aryl, aryl$(C_1\text{-}C_6)$alkyl, or $NR_xR_y$;

$R_2$ and $R_6$ are each independently hydrogen, halo, hydroxy, $(C_1\text{-}C_6)$alkyl, $(C_3\text{-}C_6)$cycloalkyl, $(C_1\text{-}C_6)$alkoxy, $(C_3\text{-}C_6)$cycloalkyloxy, $(C_1\text{-}C_6)$alkanoyl, $(C_1\text{-}C_6)$alkanoyloxy, trifluoromethyl, azido, cyano, $-N(R_z)C(=O)N(R_{aa})(R_{ab})$, $-N(R_z)C(=O)OR_{ac}$, or $NR_{ad}R_{ae}$, provided that one of $R_2$ and $R_6$ is hydroxy halo, $(C_1\text{-}C_6)$alkoxy, $(C_3\text{-}C_6)$cycloalkyloxy, trifluoromethyl, cyano, or $NR_{ad}R_{ae}$;

$R_3$ is hydrogen, halo, hydroxy, $(C_1\text{-}C_6)$alkyl, $(C_3\text{-}C_6)$cycloalkyl, $(C_1\text{-}C_6)$alkoxy, $(C_3\text{-}C_6)$cycloalkyloxy, $(C_1\text{-}C_6)$alkanoyl, $(C_1\text{-}C_6)$alkanoyloxy, trifluoromethyl, azido, cyano, $-N(R_z)C(=O)N(R_{aa})(R_{ab})$, $-N(R_z)C(=O)OR_{ac}$, or $NR_{ad}R_{ae}$;

$R_4$ is hydrogen, $(C_1\text{-}C_6)$alkyl, $(C_3\text{-}C_6)$cycloalkyl, aryl, aryl$(C_1\text{-}C_6)$alkyl, or 2-cyanoethyl;

$R_5$ is an amino acid, a peptide, or $NR_a R_b$;

$R_7$ is hydrogen, halo, hydroxy, $(C_1$-$C_6)$alkyl, $(C_3$-$C_6)$cycloalkyl, $(C_1$-$C_6)$alkoxy, $(C_3$-$C_6)$cycloalkyloxy, $(C_1$-$C_6)$alkanoyl, $(C_1$-$C_6)$alkanoyloxy, trifluoromethyl, azido, cyano, $-N(R_z)C(=O)N(R_{aa})(R_{ab})$, $-N(R_z)C(=O)OR_{ac}$, or $NR_{ad}R_{ae}$;

X is oxy, thio, or methylene;

each $R_a$ and $R_b$ is independently hydrogen, $(C_1$-$C_6)$alkyl, $(C_3$-$C_6)$cycloalkyl, aryl, or aryl$(C_1$-$C_6)$alkyl; or $R_a$ and $R_b$ together with the nitrogen to which they are attached form a pyrrolidino, piperidino or morpholino;

each $R_w$ is independently hydrogen or $(C_1$-$C_6)$alkyl;

$R_x$ and $R_y$ are each independently hydrogen, $(C_1$-$C_6)$alkyl, $(C_3$-$C_6)$cycloalkyl, phenyl, benzyl, phenethyl, or $(C_1$-$C_6)$alkanoyl; or $R_x$ and $R_y$ together with the nitrogen to which they are attached are pyrrolidino, piperidino or morpholino;

$R_z$ is hydrogen, $(C_1$-$C_6)$alkyl, $(C_3$-$C_6)$cycloalkyl, phenyl, benzyl, or phenethyl;

$R_{aa}$ and $R_{ab}$ are each independently hydrogen, $(C_1$-$C_6)$alkyl, $(C_3$-$C_6)$cycloalkyl, phenyl, benzyl, or phenethyl; or $R_{aa}$ and $R_{ab}$ together with the nitrogen to which they are attached are pyrrolidino, piperidino or morpholino;

$R_{ac}$ is hydrogen, $(C_1$-$C_6)$alkyl, $(C_3$-$C_6)$cycloalkyl, phenyl, benzyl, or phenethyl;

$R_{ad}$ is hydrogen $(C_1$-$C_6)$alkyl, $(C_3$-$C_6)$cycloalkyl, phenyl, benzyl, or phenethyl;

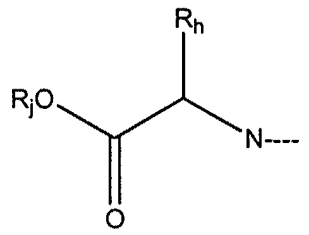
$R_{ae}$ is hydrogen, $(C_1$-$C_6)$alkyl, $(C_3$-$C_6)$cycloalkyl, phenyl, benzyl, or phenethyl;

wherein any $(C_1$-$C_6)$alkyl of $R_1$-$R_7$, $R_a$, $R_b$, $R_w$, $R_x$, $R_y$, $R_z$, $R_{aa}$, $R_{ab}$, $R_{ac}$, $R_{ad}$, and $R_{ae}$ is optionally substituted with one or more (e.g. 1, 2, 3, or 4) halo, hydroxy, $(C_1$-$C_6)$alkoxy, $(C_3$-$C_6)$cycloalkyloxy, $(C_1$-$C_6)$alkanoyl, $(C_1$-$C_6)$alkanoyloxy, trifluoromethyl, azido, cyano, oxo (=O), $(C_1$-$C_6)$alkyl, $(C_3$-$C_6)$cycloalkyl, $(C_3$-$C_6)$cycloalkyl$(C_1$-$C_6)$alkyl, $(C_1$-$C_6)$alkyl-S-$(C_1$-$C_6)$alkyl-, aryl, heteroaryl, aryl$(C_1$-$C_6)$alkyl, or heteroaryl$(C_1$-$C_6)$alkyl, or $NR_{aj}R_{ak}$; wherein each $R_{aj}$ and $R_{ak}$ is independently hydrogen, $(C_1$-$C_6)$alkyl, $(C_3$-$C_6)$cycloalkyl, phenyl, benzyl, or phenethyl;

and wherein any aryl or heteroaryl may optionally be substituted with one or more substituents selected from the group consisting of halo, hydroxy, ($C_1$-$C_6$)alkyl, ($C_3$-$C_6$)cycloalkyl, ($C_1$-$C_6$)alkoxy, ($C_3$-$C_6$)cycloalkyloxy, ($C_1$-$C_6$)alkanoyl, ($C_1$-$C_6$)alkanoyloxy, trifluoromethyl, trifluoromethoxy, nitro, cyano, and amino;

or a pharmaceutically acceptable salt thereof;

provided that $R_2$ and $R_3$ are each not hydroxy when $R_1$ is adenine, guanine, cytosine, thymine, or uracil, X is oxy, $R_6$ is hydrogen, and $R_7$ is hydrogen; and; provided $R_1$ is not 3-deazaadenine, when $R_2$ is hydroxy; $R_3$ is hydroxy; $R_4$ is hydrogen; $R_5$ a nitrogen linked radical of formula III;




III

wherein $R_h$ is benzyl or 3-indolylmethyl; and $R_j$ is methyl; x is oxy, $R_6$ is hydrogen, and $R_7$ is hydrogen.

2. The compound of claim 1 wherein $R_1$ is guanine, cytosine, thymine, 3-deazaadenine, or uracil, optionally substituted by 1, 2, or 3 U; wherein each U is independently halo, hydroxy, ($C_1$-$C_6$)alkyl, ($C_3$-$C_6$)cycloalkyl, ($C_1$-$C_6$)alkoxy, ($C_3$-$C_6$)cycloalkyloxy, ($C_1$-$C_6$)alkanoyl, ($C_1$-$C_6$)alkanoyloxy, trifluoromethyl, hydroxy($C_1$-$C_6$)alkyl, -$(CH_2)_{1-4}P(=O)(OR_w)_2$ aryl, aryl($C_1$-$C_6$)alkyl, or $NR_xR_y$.

3. The compound of claim 1 wherein $R_1$ is adenine, cytosine, thymine, 3-deazaadenine, or uracil, optionally substituted by 1, 2, or 3 U; wherein each U is independently halo, hydroxy, ($C_1$-$C_6$)alkyl, ($C_3$-$C_6$)cycloalkyl, ($C_1$-$C_6$)alkoxy, ($C_3$-$C_6$)cycloalkyloxy, ($C_1$-$C_6$)alkanoyl, ($C_1$-$C_6$)alkanoyloxy, trifluoromethyl, hydroxy($C_1$-$C_6$)alkyl, -$(CH_2)_{1-4}P(=O)(OR_w)_2$ aryl, aryl($C_1$-$C_6$)alkyl, or $NR_xR_y$.

4. The compound of claim 1 wherein $R_1$ is adenine, guanine, cytosine, thymine, or uracil, optionally substituted by 1, 2, or 3 U; wherein each U is independently halo, hydroxy, $(C_1\text{-}C_6)$alkyl, $(C_3\text{-}C_6)$cycloalkyl, $(C_1\text{-}C_6)$alkoxy, $(C_3\text{-}C_6)$cycloalkyloxy, $(C_1\text{-}C_6)$alkanoyl, $(C_1\text{-}C_6)$alkanoyloxy, trifluoromethyl, hydroxy$(C_1\text{-}C_6)$alkyl, $-(CH_2)_{1\text{-}4}P(=O)(OR_w)_2$ aryl, aryl$(C_1\text{-}C_6)$alkyl, or $_{NrxRy}$.

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5. The compound of claim 1 wherein $R_1$ is cytosine, thymine, 3-deazaadenine, or uracil, optionally substituted by 1, 2, or 3 U; wherein each U is independently halo, hydroxy, $(C_1\text{-}C_6)$alkyl, $(C_3\text{-}C_6)$cycloalkyl, $(C_1\text{-}C_6)$alkoxy, $(C_3\text{-}C_6)$cycloalkyloxy, $(C_1\text{-}C_6)$alkanoyl, $(C_1\text{-}C_6)$alkanoyloxy, trifluoromethyl, hydroxy$(C_1\text{-}C_6)$alkyl, $-(CH_2)_{1\text{-}4}P(=O)(OR_w)_2$ aryl, aryl$(C_1\text{-}C_6)$alkyl, or $_{NrxRy}$.

6. The compound of claim 1 wherein $R_1$ is 3-deazaadenine optionally substituted by 1, 2, or 3 U; wherein each U is independently halo, hydroxy, $(C_1\text{-}C_6)$alkyl, $(C_3\text{-}C_6)$cycloalkyl, $(C_1\text{-}C_6)$alkoxy, $(C_3\text{-}C_6)$cycloalkyloxy, $(C_1\text{-}C_6)$alkanoyl, $(C_1\text{-}C_6)$alkanoyloxy, trifluoromethyl, hydroxy$(C_1\text{-}C_6)$alkyl, $-(CH_2)_{1\text{-}4}P(=O)(OR_w)_2$ aryl, aryl$(C_1\text{-}C_6)$alkyl, or $_{NrxRy}$.

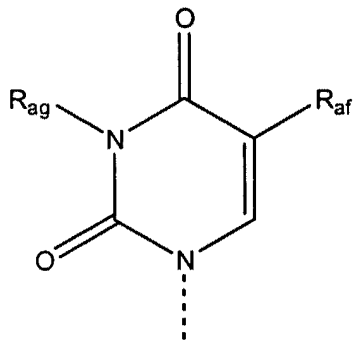
7. The compound of claim 1 wherein $R_1$ is adenine, guanine, cytosine, thymine, 3-deazaadenine, or uracil,

8. The compound of claim 1 wherein $R_1$ is guanine, cytosine, thymine, 3-deazaadenine, or uracil.

9. The compound of claim 1 wherein $R_1$ is cytosine, thymine, 3-deazaadenine, or uracil.

10. The compound of claim 1 wherein $R_1$ is cytosine, thymine, or uracil.

11. The compound of claim 1 wherein $R_1$ is a nitrogen linked radical of formula VI:



VI

wherein $R_{af}$ is hydrogen, halo, $(C_1\text{-}C_6)$alkyl, $(C_3\text{-}C_6)$cycloalkyl, or trifluoromethyl; and $R_{ag}$ is hydrogen, $(C_1\text{-}C_6)$alkyl, $(C_3\text{-}C_6)$cycloalkyl, trifluoromethyl, hydroxy$(C_1\text{-}C_6)$alkyl, or $-(CH_2)_{1\text{-}4}P(=O)(OR_w)_2$.

12. The compound of any one of claims 1-11 wherein $R_2$ is hydroxy.

13. The compound of any one of claims 1-11 wherein $R_2$ is halo.

14. The compound of any one of claims 1-11 wherein $R_2$ is fluoro.

15. The compound of any one of claims 1-11 wherein $R_2$ is chloro.

16. The compound of any one of claims 1-11 wherein $R_2$ is $(C_1\text{-}C_6)$alkoxy.

17. The compound of any one of claims 1-11 wherein $R_2$ is methoxy.

18. The compound of any one of claims 1-11 wherein $R_2$ trifluoromethyl.;

19. The compound of any one of claims 1-11 wherein $R_2$ is cyano.

20. The compound of any one of claims 1-11 wherein $R_2$ is amino, methylamino, dimethylamino, ethylamino, or dimethylamino.

21. The compound of any one of claims 1-20 wherein $R_3$ is hydroxy.

22. The compound of any one of claims 1-20 wherein $R_3$ is hydrogen.

23. The compound of any one of claims 1-20 wherein $R_3$ is halo.

24. The compound of any one of claims 1-20 wherein $R_3$ is fluoro.

25. The compound of any one of claims 1-20 wherein $R_3$ is chloro.

26. The compound of any one of claims 1-20 wherein $R_3$ is trifluoromethyl.

27. The compound of any one of claims 1-20 wherein $R_3$ is azido

28. The compound of any one of claims 1-20 wherein $R_3$ is cyano.

29. The compound of any one of claims 1-20 wherein $R_3$ is amino, methylamino, dimethylamino, ethylamino, or dimethylamino.

30. The compound of any one of claims 1-29 wherein $R_4$ is hydrogen.

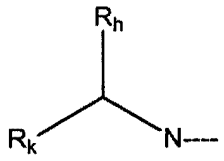
31. The compound of any one of claims 1-29 wherein $R_4$ is methyl or ethyl.

32. The compound of any one of claims 1-29 wherein $R_4$ is 2-cyanoethyl.

33. The method of any one of claims 1-32 wherein $R_5$ is an amino acid.

34. The method of any one of claims 1-32 wherein $R_5$ is a peptide.

35. The compound of any one of claims 1-32 wherein $R_5$ is a nitrogen linked radical of formula II:



II

wherein:

$R_h$ is hydrogen, $(C_1\text{-}C_6)$alkyl, $(C_3\text{-}C_6)$cycloalkyl, $(C_3\text{-}C_6)$cycloalkyl$(C_1\text{-}C_6)$alkyl, $(C_1\text{-}C_6)$alkyl-S-$(C_1\text{-}C_6)$alkyl-, aryl, heteroaryl, aryl$(C_1\text{-}C_6)$alkyl, or heteroaryl$(C_1\text{-}C_6)$alkyl; wherein any aryl or heteroaryl may optionally be substituted with 1, 2, or 3 Z;

each Z is independently halo, hydroxy, $(C_1\text{-}C_6)$alkyl, $(C_3\text{-}C_6)$cycloalkyl, $(C_1\text{-}C_6)$alkoxy, $(C_3\text{-}C_6)$cycloalkyloxy, $(C_1\text{-}C_6)$alkanoyl, $(C_1\text{-}C_6)$alkanoyloxy, trifluoromethyl, trifluoromethoxy, nitro, cyano, or amino; and

$R_k$ is $(C_1\text{-}C_5)$alkyl is optionally substituted with one or more (e.g. 1, 2, 3, or 4) halo, hydroxy, $(C_1\text{-}C_6)$alkoxy, $(C_3\text{-}C_6)$cycloalkyloxy, $(C_1\text{-}C_6)$alkanoyl, $(C_1\text{-}C_6)$alkanoyloxy, trifluoromethyl, azido, cyano, oxo (=O) or $NR_{ad}R_{ae}$.

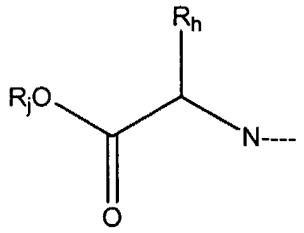
36. The compound of claim 35 wherein $R_h$ is hydrogen, $(C_1\text{-}C_6)$alkyl, phenylmethyl, or 3-indolylmethyl.

37. The compound of claim 35 wherein $R_h$ is phenylmethyl.

38. The compound of claim 35 wherein $R_h$ is 3-indolylmethyl.

39. The compound of any one of claims 35-38 wherein the carbon bearing $R_h$ has the (R) absolute configuration.

40. The compound of any one of claims 1-32 wherein $R_5$ is a nitrogen linked radical of formula III:




III

wherein $R_h$ is hydrogen, $(C_1\text{-}C_6)$alkyl, $(C_3\text{-}C_6)$cycloalkyl, $(C_3\text{-}C_6)$cycloalkyl$(C_1\text{-}C_6)$alkyl, $(C_1\text{-}C_6)$alkyl-S-$(C_1\text{-}C_6)$alkyl-, aryl, heteroaryl, aryl$(C_1\text{-}C_6)$alkyl, or heteroaryl$(C_1\text{-}C_6)$alkyl; wherein any aryl or heteroaryl may optionally be substituted with 1, 2, or 3 Z; $R_j$ is hydrogen, $(C_1\text{-}C_6)$alkyl, phenyl, benzyl, or phenethyl; and wherein each Z is independently halo, hydroxy, $(C_1\text{-}C_6)$alkyl, $(C_3\text{-}C_6)$cycloalkyl, $(C_1\text{-}C_6)$alkoxy, $(C_3\text{-}C_6)$cycloalkyloxy, $(C_1\text{-}C_6)$alkanoyl, $(C_1\text{-}C_6)$alkanoyloxy, trifluoromethyl, trifluoromethoxy, nitro, cyano, or amino.

41. The compound of claim 40 wherein $R_h$ is hydrogen, $(C_1\text{-}C_6)$alkyl, phenylmethyl, or 3-indolylmethyl.

42. The compound of claim 40 wherein $R_h$ is phenylmethyl.

43. The compound of claim 40 wherein $R_h$ is 3-indolylmethyl.

44. The compound of any one of claims 40-43 wherein the carbon bearing $R_h$ has the (R) absolute configuration.

45. The compound of any one of claims 1-44 wherein $R_6$ is hydrogen or $(C_1\text{-}C_6)$alkyl.

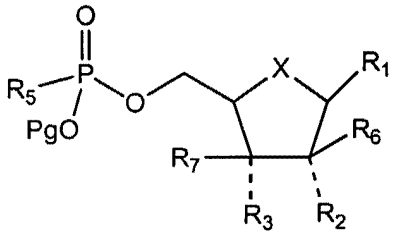
46. The compound of any one of claims 1-11 and 21-44 wherein $R_2$ is hydrogen or alkyl; and $R_6$ is halo, hydroxy, $(C_1\text{-}C_6)$alkyl, $(C_3\text{-}C_6)$cycloalkyl, $(C_1\text{-}C_6)$alkoxy, $(C_3\text{-}C_6)$cycloalkyloxy, $(C_1\text{-}C_6)$alkanoyl, $(C_1\text{-}C_6)$alkanoyloxy, trifluoromethyl, azido, cyano, $-N(R_z)C(=O)N(R_{aa})(R_{ab})$, $-N(R_z)C(=O)OR_{ac}$, or $NR_{ad}R_{ae}$.

47. The compound of any one of claims 1-46 wherein $R_7$ is hydrogen or ($C_1$-$C_6$)alkyl.

48. The compound of any one of claims 1-20 and 30-44 wherein $R_3$ is hydrogen or alkyl; and $R_7$ is halo, hydroxy, ($C_1$-$C_6$)alkyl, ($C_3$-$C_6$)cycloalkyl, ($C_1$-$C_6$)alkoxy, ($C_3$-$C_6$)cycloalkyloxy, ($C_1$-$C_6$)alkanoyl, ($C_1$-$C_6$)alkanoyloxy, trifluoromethyl, azido, cyano, $-N(R_z)C(=O)N(R_{aa})(R_{ab})$, $-N(R_z)C(=O)OR_{ac}$, or $NR_{ad}R_{ae}$;

49. The compound of claim 1 which is(2-(3-indolyl)-1(R)-methylcarbamoylethyl)phosphoramidic acid mono (1-B-arabinofuranosyladenosine)ester; or a pharmaceutically acceptable salt thereof.

50. A process for preparing a compound of formula I as described in claim 1, wherein $R_4$ is hydrogen, comprising deprotecting a corresponding compound of formula 1:

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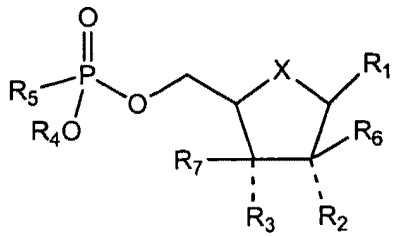
wherein Pg is a suitable removable protecting group.

51. A method for treating a viral infection in an animal comprising administering an animal in need of such treatment an effective amount of a compound of formula I:



I

wherein:

$R_1$ is adenine, guanine, cytosine, thymine, 3-deazaadenine, or uracil, optionally substituted by 1, 2, or 3 U; wherein each U is independently halo, hydroxy, $(C_1\text{-}C_6)$alkyl, $(C_3\text{-}C_6)$cycloalkyl, $(C_1\text{-}C_6)$alkoxy, $(C_3\text{-}C_6)$cycloalkyloxy, $(C_1\text{-}C_6)$alkanoyl, $(C_1\text{-}C_6)$alkanoyloxy, trifluoromethyl, hydroxy$(C_1\text{-}C_6)$alkyl, $-(CH_2)_{1\text{-}4}P(=O)(OR_w)_2$ aryl, aryl$(C_1\text{-}C_6)$alkyl, or $NR_xR_y$;

$R_2$ and $R_6$ are each independently hydrogen, halo, hydroxy, $(C_1\text{-}C_6)$alkyl, $(C_3\text{-}C_6)$cycloalkyl, $(C_1\text{-}C_6)$alkoxy, $(C_3\text{-}C_6)$cycloalkyloxy, $(C_1\text{-}C_6)$alkanoyl, $(C_1\text{-}C_6)$alkanoyloxy, trifluoromethyl, azido, cyano, $-N(R_z)C(=O)N(R_{aa})(R_{ab})$, $-N(R_z)C(=O)OR_{ac}$, or $NR_{ad}R_{ae}$, provided that one of $R_2$ and $R_6$ is hydroxy halo, $(C_1\text{-}C_6)$alkoxy, $(C_3\text{-}C_6)$cycloalkyloxy, trifluoromethyl, cyano, or $NR_{ad}R_{ae}$;

$R_3$ is hydrogen, halo, hydroxy, $(C_1\text{-}C_6)$alkyl, $(C_3\text{-}C_6)$cycloalkyl, $(C_1\text{-}C_6)$alkoxy, $(C_3\text{-}C_6)$cycloalkyloxy, $(C_1\text{-}C_6)$alkanoyl, $(C_1\text{-}C_6)$alkanoyloxy, trifluoromethyl, azido, cyano, $-N(R_z)C(=O)N(R_{aa})(R_{ab})$, $-N(R_z)C(=O)OR_{ac}$, or $NR_{ad}R_{ae}$;

$R_4$ is hydrogen, $(C_1\text{-}C_6)$alkyl, $(C_3\text{-}C_6)$cycloalkyl, aryl, aryl$(C_1\text{-}C_6)$alkyl, or 2-cyanoethyl;

$R_5$ is an amino acid, a peptide, or $NR_a R_b$;

$R_7$ is hydrogen, halo, hydroxy, $(C_1\text{-}C_6)$alkyl, $(C_3\text{-}C_6)$cycloalkyl, $(C_1\text{-}C_6)$alkoxy, $(C_3\text{-}C_6)$cycloalkyloxy, $(C_1\text{-}C_6)$alkanoyl, $(C_1\text{-}C_6)$alkanoyloxy, trifluoromethyl, azido, cyano, $-N(R_z)C(=O)N(R_{aa})(R_{ab})$, $-N(R_z)C(=O)OR_{ac}$, or $NR_{ad}R_{ae}$;

X is oxy, thio, or methylene;

each $R_a$ and $R_b$ is independently hydrogen, $(C_1$-$C_6)$alkyl, $(C_3$-$C_6)$cycloalkyl, aryl, or aryl$(C_1$-$C_6)$alkyl; or $R_a$ and $R_b$ together with the nitrogen to which they are attached form a pyrrolidino, piperidino or morpholino;

each $R_w$ is independently hydrogen or $(C_1$-$C_6)$alkyl;

$R_x$ and $R_y$ are each independently hydrogen, $(C_1$-$C_6)$alkyl, $(C_3$-$C_6)$cycloalkyl, phenyl, benzyl, phenethyl, or $(C_1$-$C_6)$alkanoyl; or $R_x$ and $R_y$ together with the nitrogen to which they are attached are pyrrolidino, piperidino or morpholino;

$R_z$ is hydrogen, $(C_1$-$C_6)$alkyl, $(C_3$-$C_6)$cycloalkyl, phenyl, benzyl, or phenethyl;

$R_{aa}$ and $R_{ab}$ are each independently hydrogen, $(C_1$-$C_6)$alkyl, $(C_3$-$C_6)$cycloalkyl, phenyl, benzyl, or phenethyl; or $R_{aa}$ and $R_{ab}$ together with the nitrogen to which they are attached are pyrrolidino, piperidino or morpholino;

$R_{ac}$ is hydrogen, $(C_1$-$C_6)$alkyl, $(C_3$-$C_6)$cycloalkyl, phenyl, benzyl, or phenethyl;

$R_{ad}$ is hydrogen $(C_1$-$C_6)$alkyl, $(C_3$-$C_6)$cycloalkyl, phenyl, benzyl, or phenethyl;

$R_{ae}$ is hydrogen, $(C_1$-$C_6)$alkyl, $(C_3$-$C_6)$cycloalkyl, phenyl, benzyl, or phenethyl;

wherein any $(C_1$-$C_6)$alkyl of $R_1$-$R_7$, $R_a$, $R_b$, $R_w$, $R_x$, $R_y$, $R_z$, $R_{aa}$, $R_{ab}$, $R_{ac}$, $R_{ad}$, and $R_{ae}$ is optionally substituted with one or more (e.g. 1, 2, 3, or 4) halo, hydroxy, $(C_1$-$C_6)$alkoxy, $(C_3$-$C_6)$cycloalkyloxy, $(C_1$-$C_6)$alkanoyl, $(C_1$-$C_6)$alkanoyloxy, trifluoromethyl, azido, cyano, oxo (=O), $(C_1$-$C_6)$alkyl, $(C_3$-$C_6)$cycloalkyl, $(C_3$-$C_6)$cycloalkyl$(C_1$-$C_6)$alkyl, $(C_1$-$C_6)$alkyl-S-$(C_1$-$C_6)$alkyl-, aryl, heteroaryl, aryl$(C_1$-$C_6)$alkyl, or heteroaryl$(C_1$-$C_6)$alkyl, or $NR_{aj}R_{ak}$; wherein each $R_{aj}$ and $R_{ak}$ is independently hydrogen, $(C_1$-$C_6)$alkyl, $(C_3$-$C_6)$cycloalkyl, phenyl, benzyl, or phenethyl;

and wherein any aryl or heteroaryl may optionally be substituted with one or more substituents selected from the group consisting of halo, hydroxy, $(C_1$-$C_6)$alkyl, $(C_3$-$C_6)$cycloalkyl, $(C_1$-$C_6)$alkoxy, $(C_3$-$C_6)$cycloalkyloxy, $(C_1$-$C_6)$alkanoyl, $(C_1$-$C_6)$alkanoyloxy, trifluoromethyl, trifluoromethoxy, nitro, cyano, and amino;

or a pharmaceutically acceptable salt thereof;

provided that $R_2$ and $R_3$ are each not hydroxy when $R_1$ is adenine, guanine, cytosine, thymine, or uracil, X is oxy, $R_6$ is hydrogen, and $R_7$ is hydrogen.

52. A method for treating a viral infection in an animal comprising administering an effective amount of a compound as described in any one of claims 1-49 and 51 to an animal in need of such treatment.

53. A method for treating HCV in an animal comprising administering an effective amount of a compound as described in any one of claims 1-49 and 51 to an animal in need of such treatment.

54. A method for treating a metabolic liver disorder, in an animal comprising administering an effective amount of a compound as described in any one of claims 1-49 and 51 to an animal in need of such treatment.

55. A method for treating a cancer in the liver of an animal comprising administering an effective amount of a compound as described in any one of claims 1-49 and 51 to an animal in need of such treatment.

56. A method for treating cancer in the brain of an animal comprising administering an effective amount of a compound as described in any one of claims 1-49 and 51 to an animal in need of such treatment.

57. A method for treating breast cancer, lung cancer or ovarian cancer in an animal comprising administering an effective amount of as described in any one of claims 1-49 and 51 to an animal in need of such treatment.

58. The use of a compound of formula I as described in any one of claims 1-49 and 51 to prepare a medicament for treating a viral infection in an animal.

59. The use of a compound of formula I as described in any one of claims 1-49 and 51 to prepare a medicament for treating HCV in an animal.

60. The use of a compound of formula I as described in any one of claims 1-49 and 51 to prepare a medicament for treating a metabolic liver disorder in an animal.

61. The use of a compound of formula I as described in any one of claims 1-49 and 51 to prepare a medicament for treating a cancer in the liver of an animal.

62. The use of a compound of formula I as described in any one of claims 1-49 and 51 to prepare a medicament for treating cancer in the brain of an animal.

63. The use of a compound of formula I as described in any one of claims 1-49 and 51 to prepare a medicament useful for treating breast cancer, lung cancer or ovarian cancer in an animal.