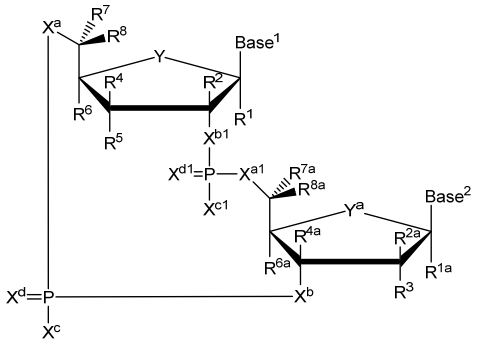
SUMMARY ~~OF THE INVENTION~~

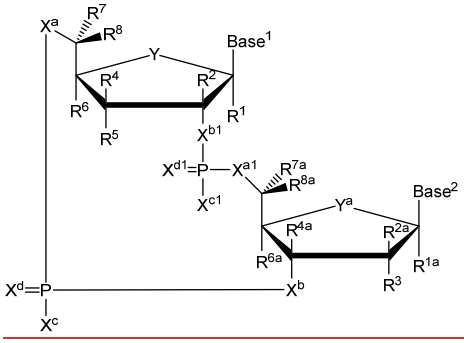
The present disclosure relates to novel cyclic di-nucleotide compounds of general formula (I), general formula (I'), and/or general formula (I"). In particular, the present disclosure relates to compounds having the general structural formula (I):



(I)

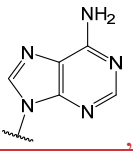
or pharmaceutically acceptable salts, hydrates, solvates, or prodrugs thereof, as described herein.

In one aspect, there is provided a compound of formula (I):

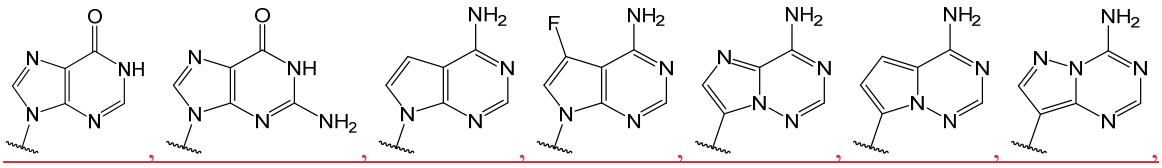


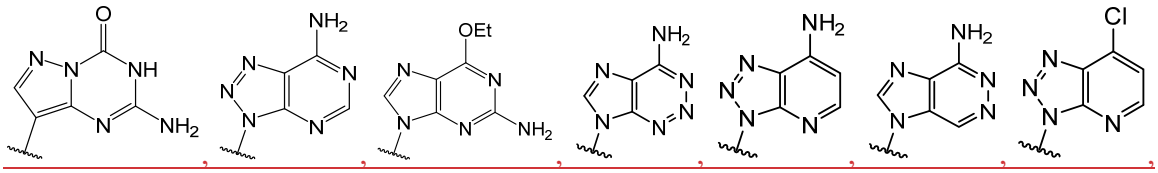
(I)

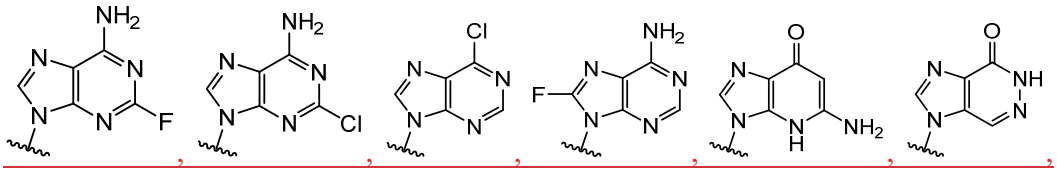
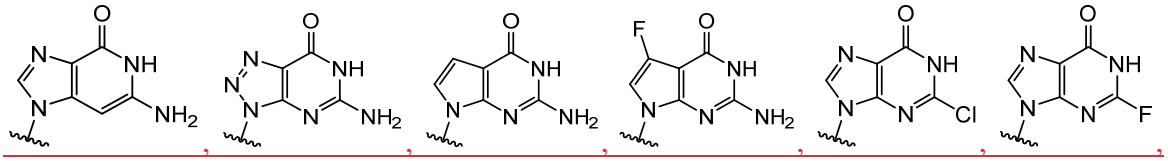
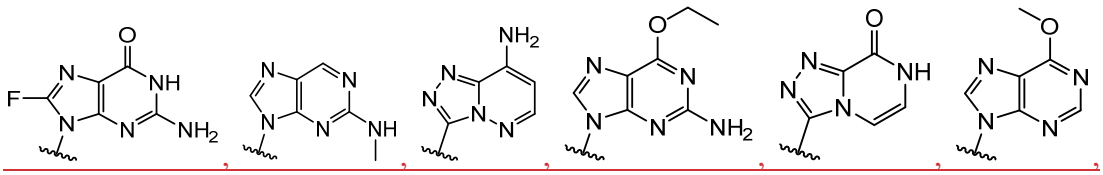
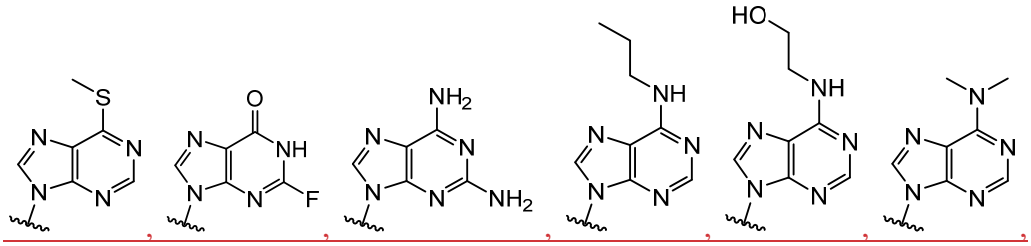
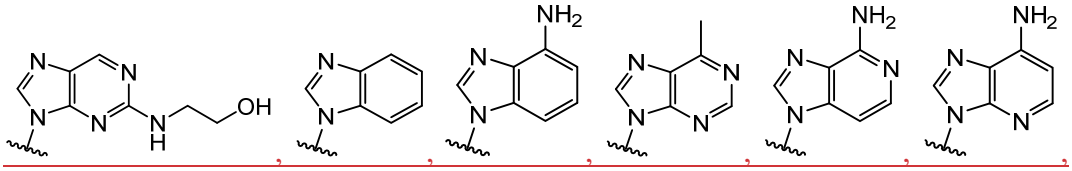
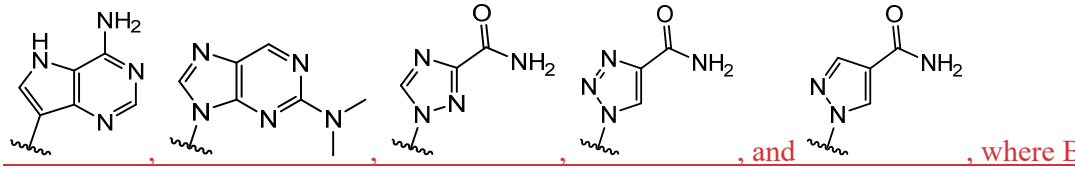
or a pharmaceutically acceptable salt, hydrate, solvate, or prodrug thereof, wherein



$Base^1$ and $Base^2$ are each independently selected from the group consisting of ,





and Base[2] each may be independently substituted by 0-3 substituents R^{10}, where each R^{10} is independently selected from the group consisting of F, Cl, I, Br, OH, SH, NH_2, C_{1-3} alkyl, C_{3-6} cycloalkyl, $O(C_{1-3}$ alkyl), $O(C_{3-6}$ cycloalkyl), $S(C_{1-3}$ alkyl), $S(C_{3-6}$ cycloalkyl), $NH(C_{1-3}$ alkyl), $NH(C_{3-6}$ cycloalkyl), $N(C_{1-3}$ alkyl)$_2$, and $N(C_{3-6}$ cycloalkyl)$_2$;

Y and Y^a are each independently selected from the group consisting of -O- and -S-;

X^a and X^{a1} are each independently selected from the group consisting of O, C, and S;

X^b and X^{b1} are each independently selected from the group consisting of O, C, and S;

X^c and X^{c1} are each independently selected from the group consisting of SR^9, OR^9, and NR^9R^9;

X^d and X^{d1} are each independently selected from the group consisting of O and S;

R^1 and R^{1a} are each independently selected from the group consisting of H, F, Cl, Br, I, OH, CN, N_3, C_1-C_6 alkyl, C_2-C_6 alkenyl, C_2-C_6 alkynyl, C_1-C_6 haloalkyl, C_2-C_6 haloalkenyl, C_2-C_6 haloalkynyl, -O-C_1-C_6 alkyl, -O-C_2-C_6 alkenyl, and -O-C_2-C_6 alkynyl, where said R^1 and R^{1a} C_1-C_6 alkyl, C_2-C_6 alkenyl, C_2-C_6 alkynyl, C_1-C_6 haloalkyl, C_2-C_6 haloalkenyl, C_2-C_6 haloalkynyl, -O-C_1-C_6 alkyl, -O-C_2-C_6 alkenyl, and -O-C_2-C_6 alkynyl are substituted by 0 to 3 substituents selected from the group consisting of F, Cl, Br, I, OH, CN, and N_3;

R^2 and R^{2a} are each independently selected from the group consisting of H, F, Cl, Br, I, OH, CN, N_3, C_1-C_6 alkyl, C_2-C_6 alkenyl, C_2-C_6 alkynyl, C_1-C_6 haloalkyl, C_2-C_6 haloalkenyl, C_2-C_6 haloalkynyl, -O-C_1-C_6 alkyl, -O-C_2-C_6 alkenyl, and -O-C_2-C_6 alkynyl, where said R^2 and R^{2a} C_1-C_6 alkyl, C_2-C_6 alkenyl, C_2-C_6 alkynyl, C_1-C_6 haloalkyl, C_2-C_6 haloalkenyl, C_2-C_6 haloalkynyl, -O-C_1-C_6 alkyl, -O-C_2-C_6 alkenyl, and -O-C_2-C_6 alkynyl are substituted by 0 to 3 substituents selected from the group consisting of F, Cl, Br, I, OH, CN, and N_3;

R^3 is selected from the group consisting of H, F, Cl, Br, I, OH, CN, N_3, C_1-C_6 alkyl, C_2-C_6 alkenyl, C_2-C_6 alkynyl, C_1-C_6 haloalkyl, C_2-C_6 haloalkenyl, C_2-C_6 haloalkynyl, -O-C_1-C_6 alkyl, -O-C_2-C_6 alkenyl, and -O-C_2-C_6 alkynyl, where said R^3 C_1-C_6 alkyl, C_2-C_6 alkenyl, C_2-C_6 alkynyl, C_1-C_6 haloalkyl, C_2-C_6 haloalkenyl, C_2-C_6 haloalkynyl, -O-C_1-C_6 alkyl, -O-C_2-C_6 alkenyl, and -O-C_2-C_6 alkynyl are substituted by 0 to 3 substituents selected from the group consisting of F, Cl, Br, I, OH, CN, and N_3;

R^4 and R^{4a} are each independently selected from the group consisting of H, F, Cl, Br, I, OH, CN, N_3, C_1-C_6 alkyl, C_2-C_6 alkenyl, C_2-C_6 alkynyl, C_1-C_6 haloalkyl, C_2-C_6 haloalkenyl, C_2-C_6 haloalkynyl, -O-C_1-C_6 alkyl, -O-C_2-C_6 alkenyl, and -O-C_2-C_6 alkynyl, where said R^4 and R^{4a} C_1-C_6 alkyl, C_2-C_6 alkenyl, C_2-C_6 alkynyl, C_1-C_6 haloalkyl, C_2-C_6 haloalkenyl, C_2-C_6 haloalkynyl, -O-C_1-C_6 alkyl, -O-C_2-C_6 alkenyl, and -O-C_2-C_6 alkynyl are substituted by 0 to 3 substituents selected from the group consisting of F, Cl, Br, I, OH, CN, and N_3;

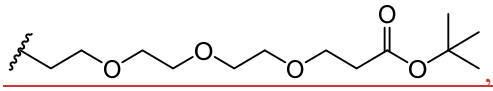
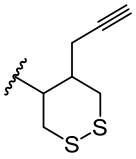
R^5 is selected from the group consisting of H, F, Cl, Br, I, OH, CN, N_3, C_1-C_6 alkyl, C_2-C_6 alkenyl, C_2-C_6 alkynyl, C_1-C_6 haloalkyl, C_2-C_6 haloalkenyl, C_2-C_6 haloalkynyl, -O-C_1-C_6 alkyl, -O-C_2-C_6 alkenyl, and -O-C_2-C_6 alkynyl, where said R^5 C_1-C_6 alkyl, C_2-C_6 alkenyl, C_2-C_6 alkynyl, C_1-C_6 haloalkyl, C_2-C_6 haloalkenyl, C_2-C_6 haloalkynyl, -O-C_1-C_6 alkyl, -O-C_2-C_6 alkenyl, and -O-C_2-C_6 alkynyl are substituted by 0 to 3 substituents selected from the group consisting of F, Cl, Br, I, OH, CN, and N_3;

R^6 and R^{6a} are each independently selected from the group consisting of H, F, Cl, Br, I, OH, CN, N_3, C_1-C_6 alkyl, C_2-C_6 alkenyl, C_2-C_6 alkynyl, C_1-C_6 haloalkyl, C_2-C_6 haloalkenyl, C_2-C_6 haloalkynyl, -O-C_1-C_6 alkyl, -O-C_2-C_6 alkenyl, and -O-C_2-C_6 alkynyl, where said R^6 and

R^{6a} C_1-C_6 alkyl, C_2-C_6 alkenyl, C_2-C_6 alkynyl, C_1-C_6 haloalkyl, C_2-C_6 haloalkenyl, C_2-C_6 haloalkynyl, -O-C_1-C_6 alkyl, -O-C_2-C_6 alkenyl, and -O-C_2-C_6 alkynyl are substituted by 0 to 3 substituents selected from the group consisting of F, Cl, Br, I, OH, CN, and N_3;

R^7 and R^{7a} are each independently selected from the group consisting of H, F, Cl, Br, I, OH, CN, N_3, C_1-C_6 alkyl, C_2-C_6 alkenyl, C_2-C_6 alkynyl, C_1-C_6 haloalkyl, C_2-C_6 haloalkenyl, C_2-C_6 haloalkynyl, -O-C_1-C_6 alkyl, -O-C_2-C_6 alkenyl, and -O-C_2-C_6 alkynyl, where said R^7 and R^{7a} C_1-C_6 alkyl, C_2-C_6 alkenyl, C_2-C_6 alkynyl, C_1-C_6 haloalkyl, C_2-C_6 haloalkenyl, C_2-C_6 haloalkynyl, -O-C_1-C_6 alkyl, -O-C_2-C_6 alkenyl, and -O-C_2-C_6 alkynyl are substituted by 0 to 3 substituents selected from the group consisting of F, Cl, Br, I, OH, CN, and N_3;

R^8 and R^{8a} are each independently selected from the group consisting of H, F, Cl, Br, I, OH, CN, N_3, C_1-C_6 alkyl, C_2-C_6 alkenyl, C_2-C_6 alkynyl, C_1-C_6 haloalkyl, C_2-C_6 haloalkenyl, C_2-C_6 haloalkynyl, -O-C_1-C_6 alkyl, -O-C_2-C_6 alkenyl, and -O-C_2-C_6 alkynyl, where said R^8 and R^{8a} C_1-C_6 alkyl, C_2-C_6 alkenyl, C_2-C_6 alkynyl, C_1-C_6 haloalkyl, C_2-C_6 haloalkenyl, C_2-C_6 haloalkynyl, -O-C_1-C_6 alkyl, -O-C_2-C_6 alkenyl, and -O-C_2-C_6 alkynyl are substituted by 0 to 3 substituents selected from the group consisting of F, Cl, Br, I, OH, CN, and N_3;

each R^9 is independently selected from the group consisting of H, C_1-C_{20} alkyl,  , and  , where each R^9 C_1-C_{20} alkyl is optionally substituted by 0 to 3 substituents independently selected from the group consisting of OH, -O-C_1-C_{20} alkyl,-S-C(O)C_1-C_6 alkyl, and C(O)OC_1-C_6 alkyl;

optionally R^{1a} and R^3 are connected to form C_1-C_6 alkylene, C_2-C_6 alkenylene, C_2-C_6 alkynylene, -O-C_1-C_6 alkylene, -O-C_2-C_6 alkenylene, or -O-C_2-C_6 alkynylene, such that where R^{1a} and R^3 are connected to form -O-C_1-C_6 alkylene, -O-C_2-C_6 alkenylene, or -O-C_2-C_6 alkynylene, said O is bound at the R^3 position;

optionally R^{2a} and R^3 are connected to form C_1-C_6 alkylene, C_2-C_6 alkenylene, C_2-C_6 alkynylene, -O-C_1-C_6 alkylene, -O-C_2-C_6 alkenylene, or -O-C_2-C_6 alkynylene, such that where R^{2a} and R^3 are connected to form -O-C_1-C_6 alkylene, -O-C_2-C_6 alkenylene, or -O-C_2-C_6 alkynylene, said O is bound at the R^3 position;

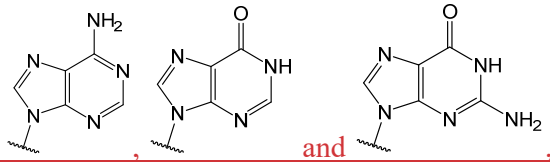
optionally R^3 and R^{6a} are connected to form -O-C_1-C_6 alkylene, -O-C_2-C_6 alkenylene, or -O-C_2-C_6 alkynylene, such that where R^3 and R^{6a} are connected to form -O-C_1-C_6 alkylene, -O-C_2-C_6 alkenylene, or -O-C_2-C_6 alkynylene, said O is bound at the R^3 position;

optionally R^4 and R^5 are connected to form are connected to form C_1-C_6 alkylene, C_2-C_6 alkenylene, C_2-C_6 alkynylene, -O-C_1-C_6 alkylene, -O-C_2-C_6 alkenylene, or -O-C_2-C_6 alkynylene, such that where R^4 and R^5 are connected to form -O-C_1-C_6 alkylene, -O-C_2-C_6 alkenylene, or -O-C_2-C_6 alkynylene, said O is bound at the R^5 position;

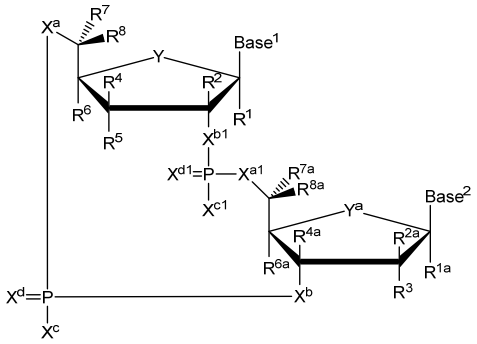
optionally R^5 and R^6 are connected to form -O-C_1-C_6 alkylene, -O-C_2-C_6 alkenylene, or -O-C_2-C_6 alkynylene, such that where R^5 and R^6 are connected to form -O-C_1-C_6 alkylene, -O-C_2-C_6 alkenylene, or -O-C_2-C_6 alkynylene, said O is bound at the R^5 position;

optionally R^7 and R^8 are connected to form C_1-C_6 alkylene, C_2-C_6 alkenylene, or C_2-C_6 alkynylene; and

optionally R^{7a} and R^{8a} are connected to form C_1-C_6 alkylene, C_2-C_6 alkenylene, or C_2-C_6 alkynylene; and

providing that when Y and Y^a are each O, X^a and X^{a1} are each O, X^b and X^{b1} are each O, and X^c and X^{c1} are each OH or SH, X^d and X^{d1} are each O, R^1 and R^{1a} are each H, R^2 is H, R^6 and R^{6a} are each H, R^7 and R^{7a} are each H, R^8 and R^{8a} are each H, and $Base^1$ and $Base^2$ are each selected from the group consisting of  , R^5 and R^3 are not both selected from the group consisting of H, F and OH.

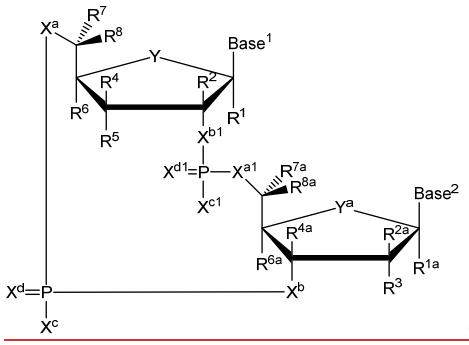
The present disclosure also relates to compounds having general structural formula (I'):



(I')

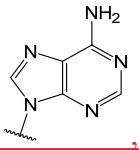
or pharmaceutically acceptable salts, hydrates, solvates, or prodrugs thereof, as described herein.

In another aspect, there is provided a compound of formula (I'):

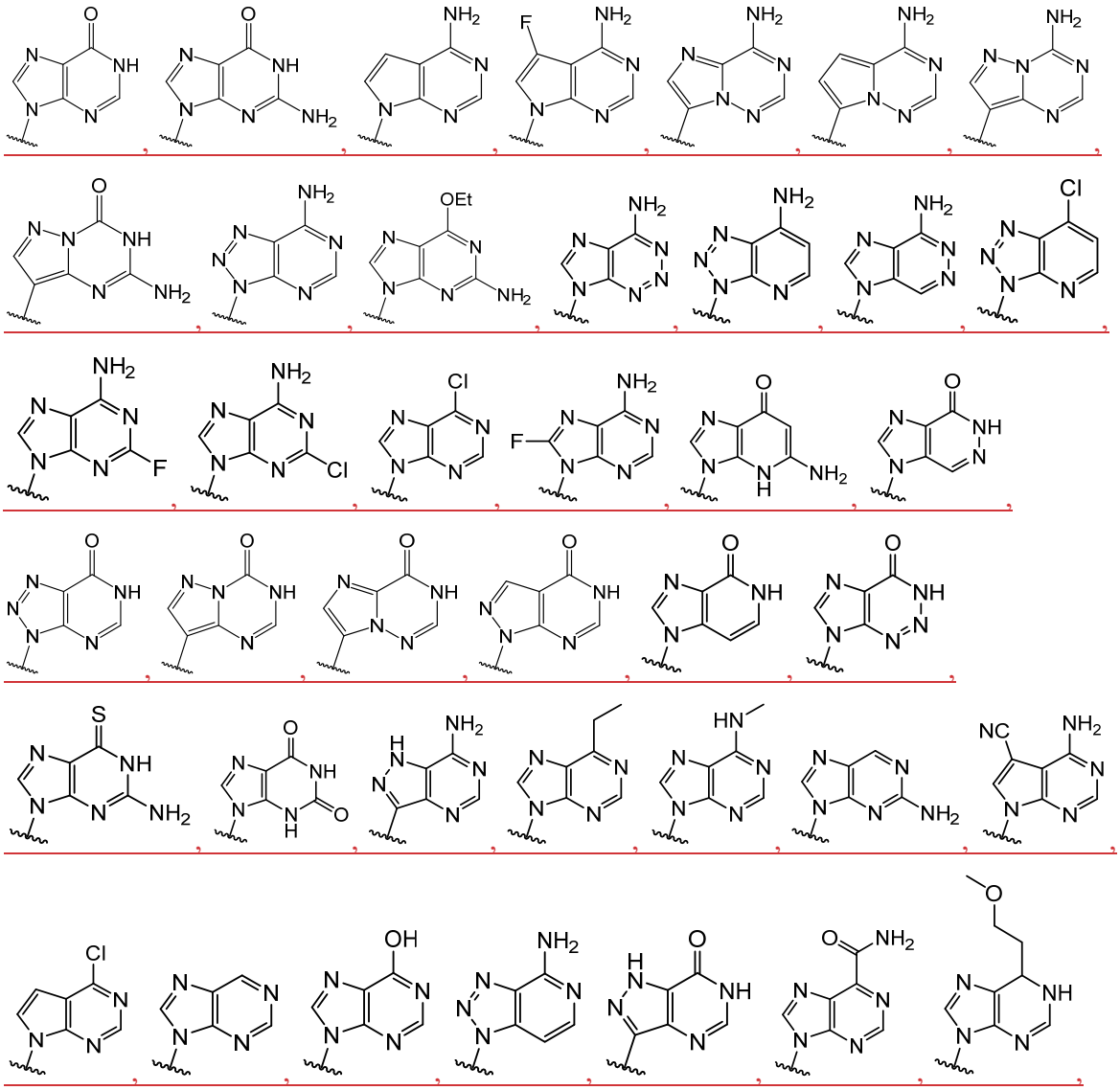


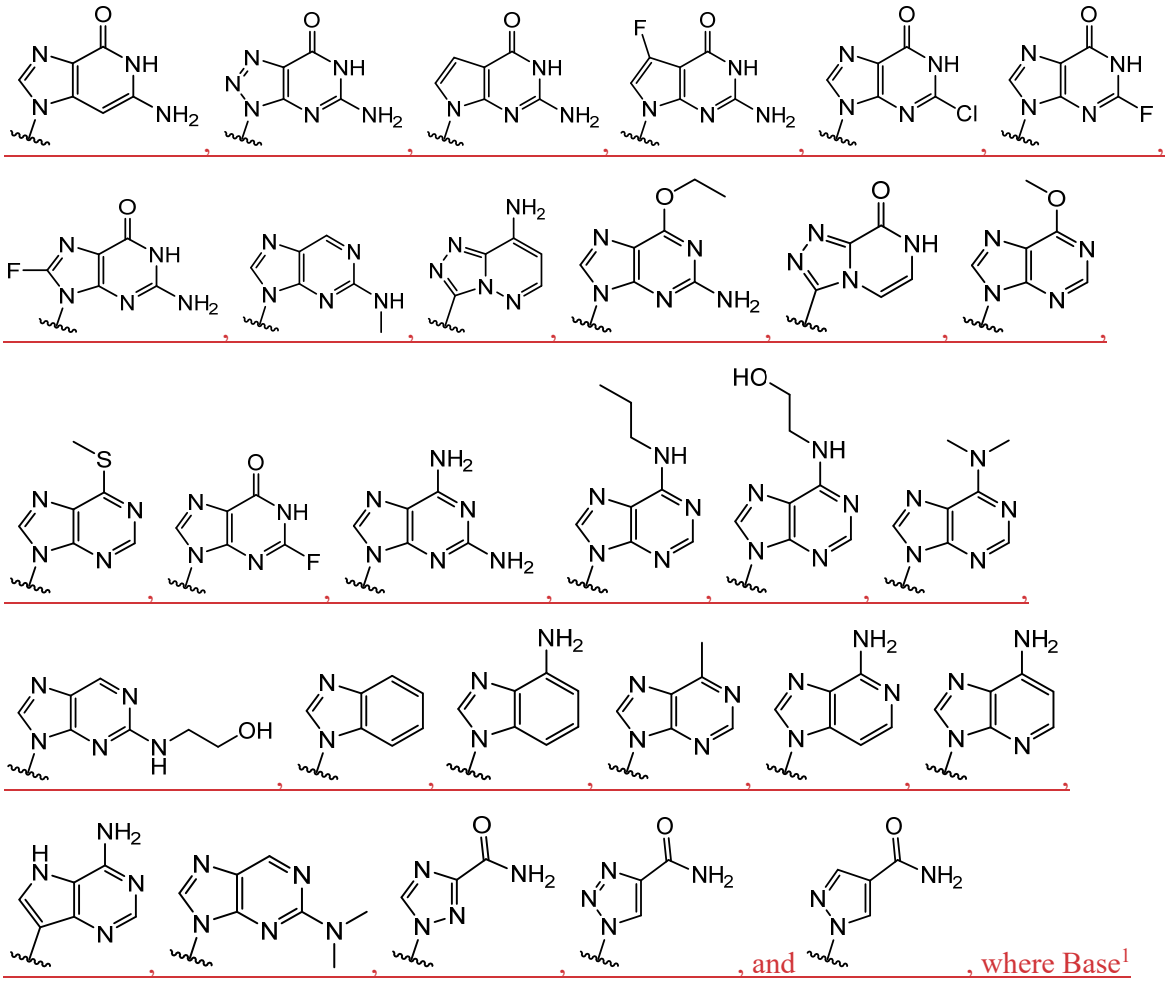
(I')

or a pharmaceutically acceptable salt, hydrate, solvate, or prodrug thereof, wherein



Base[1] and Base[2] are each independently selected from the group consisting of





, where Base[1] and Base[2] each may be independently substituted by 0-3 substituents R^{10}, where each R^{10} is independently selected from the group consisting of F, Cl, I, Br, OH, SH, NH_2, C_{1-3} alkyl, C_{3-6} cycloalkyl, $O(C_{1-3}$ alkyl), $O(C_{3-6}$ cycloalkyl), $S(C_{1-3}$ alkyl), $S(C_{3-6}$ cycloalkyl), $NH(C_{1-3}$ alkyl), $NH(C_{3-6}$ cycloalkyl), $N(C_{1-3}$ alkyl)$_2$, and $N(C_{3-6}$ cycloalkyl)$_2$;

Y and Y^a are each independently selected from the group consisting of -O- and -S-;

X^a and X^{a1} are each independently selected from the group consisting of O, and S;

X^b and X^{b1} are each independently selected from the group consisting of O, and S;

X^c and X^{c1} are each independently selected from the group consisting of OR^9, SR^9, and NR^9R^9;

X^d and X^{d1} are each independently selected from the group consisting of O and S;

R^1 and R^{1a} are each independently selected from the group consisting of H, F, Cl, Br, I, OH, CN, N_3, C_1-C_6 alkyl, C_2-C_6 alkenyl, C_2-C_6 alkynyl, C_1-C_6 haloalkyl, C_2-C_6 haloalkenyl, C_2-C_6 haloalkynyl, -O-C_1-C_6 alkyl, -O-C_2-C_6 alkenyl, and -O-C_2-C_6 alkynyl, where said R^1 and R^{1a} C_1-C_6 alkyl, C_2-C_6 alkenyl, C_2-C_6 alkynyl, C_1-C_6 haloalkyl, C_2-C_6 haloalkenyl, C_2-C_6

haloalkynyl, -O-C_1-C_6 alkyl, -O-C_2-C_6 alkenyl, and -O-C_2-C_6 alkynyl are substituted by 0 to 3 substituents selected from the group consisting of F, Cl, Br, I, OH, CN, and N_3;

R^2 and R^{2a} are each independently selected from the group consisting of H, F, Cl, Br, I, OH, CN, N_3, C_1-C_6 alkyl, C_2-C_6 alkenyl, C_2-C_6 alkynyl, C_1-C_6 haloalkyl, C_2-C_6 haloalkenyl, C_2-C_6 haloalkynyl, -O-C_1-C_6 alkyl, -O-C_2-C_6 alkenyl, and -O-C_2-C_6 alkynyl, where said R^2 and R^{2a} C_1-C_6 alkyl, C_2-C_6 alkenyl, C_2-C_6 alkynyl, C_1-C_6 haloalkyl, C_2-C_6 haloalkenyl, C_2-C_6 haloalkynyl, -O-C_1-C_6 alkyl, -O-C_2-C_6 alkenyl, and -O-C_2-C_6 alkynyl are substituted by 0 to 3 substituents selected from the group consisting of F, Cl, Br, I, OH, CN, and N_3;

R^3 is selected from the group consisting of H, F, Cl, Br, I, OH, CN, N_3, C_1-C_6 alkyl, C_2-C_6 alkenyl, C_2-C_6 alkynyl, C_1-C_6 haloalkyl, C_2-C_6 haloalkenyl, C_2-C_6 haloalkynyl, -O-C_1-C_6 alkyl, -O-C_2-C_6 alkenyl, and -O-C_2-C_6 alkynyl, where said R^3 C_1-C_6 alkyl, C_2-C_6 alkenyl, C_2-C_6 alkynyl, C_1-C_6 haloalkyl, C_2-C_6 haloalkenyl, C_2-C_6 haloalkynyl, -O-C_1-C_6 alkyl, -O-C_2-C_6 alkenyl, and -O-C_2-C_6 alkynyl are substituted by 0 to 3 substituents selected from the group consisting of F, Cl, Br, I, OH, CN, and N_3;

R^4 and R^{4a} are each independently selected from the group consisting of H, F, Cl, Br, I, OH, CN, N_3, C_1-C_6 alkyl, C_2-C_6 alkenyl, C_2-C_6 alkynyl, C_1-C_6 haloalkyl, C_2-C_6 haloalkenyl, C_2-C_6 haloalkynyl, -O-C_1-C_6 alkyl, -O-C_2-C_6 alkenyl, and -O-C_2-C_6 alkynyl, where said R^4 and R^{4a} C_1-C_6 alkyl, C_2-C_6 alkenyl, C_2-C_6 alkynyl, C_1-C_6 haloalkyl, C_2-C_6 haloalkenyl, C_2-C_6 haloalkynyl, -O-C_1-C_6 alkyl, -O-C_2-C_6 alkenyl, and -O-C_2-C_6 alkynyl are substituted by 0 to 3 substituents selected from the group consisting of F, Cl, Br, I, OH, CN, and N_3;

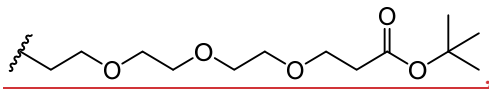
R^5 is selected from the group consisting of H, F, Cl, Br, I, OH, CN, NH_2, N_3, C_1-C_6 alkyl, C_2-C_6 alkenyl, C_2-C_6 alkynyl, C_1-C_6 haloalkyl, C_2-C_6 haloalkenyl, C_2-C_6 haloalkynyl, -O-C_1-C_6 alkyl, -O-C_2-C_6 alkenyl, and -O-C_2-C_6 alkynyl, where said R^5 C_1-C_6 alkyl, C_2-C_6 alkenyl, C_2-C_6 alkynyl, C_1-C_6 haloalkyl, C_2-C_6 haloalkenyl, C_2-C_6 haloalkynyl, -O-C_1-C_6 alkyl, -O-C_2-C_6 alkenyl, and -O-C_2-C_6 alkynyl are substituted by 0 to 3 substituents selected from the group consisting of F, Cl, Br, I, OH, CN, NR^9R^9, and N_3;

R^6 and R^{6a} are each independently selected from the group consisting of H, F, Cl, Br, I, OH, CN, N_3, C_1-C_6 alkyl, C_2-C_6 alkenyl, C_2-C_6 alkynyl, C_1-C_6 haloalkyl, C_2-C_6 haloalkenyl, C_2-C_6 haloalkynyl, -O-C_1-C_6 alkyl, -O-C_2-C_6 alkenyl, and -O-C_2-C_6 alkynyl, where said R^6 and R^{6a} C_1-C_6 alkyl, C_2-C_6 alkenyl, C_2-C_6 alkynyl, C_1-C_6 haloalkyl, C_2-C_6 haloalkenyl, C_2-C_6 haloalkynyl, -O-C_1-C_6 alkyl, -O-C_2-C_6 alkenyl, and -O-C_2-C_6 alkynyl are substituted by 0 to 3 substituents selected from the group consisting of F, Cl, Br, I, OH, CN, and N_3;

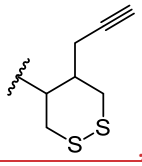
R^7 and R^{7a} are each independently selected from the group consisting of H, F, Cl, Br, I, OH, CN, N_3, C_1-C_6 alkyl, C_2-C_6 alkenyl, C_2-C_6 alkynyl, C_1-C_6 haloalkyl, C_2-C_6 haloalkenyl, C_2-C_6 haloalkynyl, -O-C_1-C_6 alkyl, -O-C_2-C_6 alkenyl, and -O-C_2-C_6 alkynyl, where said R^7 and R^{7a} C_1-C_6 alkyl, C_2-C_6 alkenyl, C_2-C_6 alkynyl, C_1-C_6 haloalkyl, C_2-C_6 haloalkenyl, C_2-C_6 haloalkynyl, -O-C_1-C_6 alkyl, -O-C_2-C_6 alkenyl, and -O-C_2-C_6 alkynyl are substituted by 0 to 3 substituents selected from the group consisting of F, Cl, Br, I, OH, CN, and N_3;

R^8 and R^{8a} are each independently selected from the group consisting of H, F, Cl, Br, I, OH, CN, N_3, C_1-C_6 alkyl, C_2-C_6 alkenyl, C_2-C_6 alkynyl, C_1-C_6 haloalkyl, C_2-C_6 haloalkenyl, C_2-C_6 haloalkynyl, -O-C_1-C_6 alkyl, -O-C_2-C_6 alkenyl, and -O-C_2-C_6 alkynyl, where said R^8 and R^{8a} C_1-C_6 alkyl, C_2-C_6 alkenyl, C_2-C_6 alkynyl, C_1-C_6 haloalkyl, C_2-C_6 haloalkenyl, C_2-C_6 haloalkynyl, -O-C_1-C_6 alkyl, -O-C_2-C_6 alkenyl, and -O-C_2-C_6 alkynyl are substituted by 0 to 3 substituents selected from the group consisting of F, Cl, Br, I, OH, CN, and N_3;

each R^9 is independently selected from the group consisting of H, C_1-C_{20} alkyl,



, and



, where each R^9 C_1-C_{20} alkyl is optionally substituted by 0 to 3 substituents independently selected from the group consisting of OH, -O-C_1-C_{20} alkyl,-S-C(O)C_1-C_6 alkyl, and C(O)OC_1-C_6 alkyl;

optionally R^{1a} and R^3 are connected to form C_1-C_6 alkylene, C_2-C_6 alkenylene, C_2-C_6 alkynylene, -O-C_1-C_6 alkylene, -O-C_2-C_6 alkenylene, or -O-C_2-C_6 alkynylene, such that where R^{1a} and R^3 are connected to form -O-C_1-C_6 alkylene, -O-C_2-C_6 alkenylene, or -O-C_2-C_6 alkynylene, said O is bound at the R^3 position;

optionally R^{2a} and R^3 are connected to form C_1-C_6 alkylene, C_2-C_6 alkenylene, C_2-C_6 alkynylene, -O-C_1-C_6 alkylene, -O-C_2-C_6 alkenylene, or -O-C_2-C_6 alkynylene, such that where R^{2a} and R^3 are connected to form -O-C_1-C_6 alkylene, -O-C_2-C_6 alkenylene, or -O-C_2-C_6 alkynylene, said O is bound at the R^3 position;

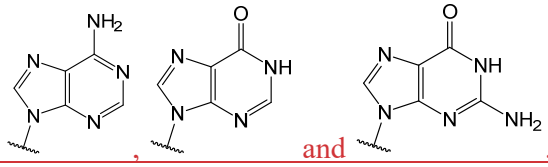
optionally R^3 and R^{6a} are connected to form -O-C_1-C_6 alkylene, -O-C_2-C_6 alkenylene, or -O-C_2-C_6 alkynylene, such that where R^3 and R^{6a} are connected to form -O-C_1-C_6 alkylene, -O-C_2-C_6 alkenylene, or -O-C_2-C_6 alkynylene, said O is bound at the R^3 position;

optionally R^4 and R^5 are connected to form are connected to form C_1-C_6 alkylene, C_2-C_6 alkenylene, C_2-C_6 alkynylene, -O-C_1-C_6 alkylene, -O-C_2-C_6 alkenylene, or -O-C_2-C_6 alkynylene, such that where R^4 and R^5 are connected to form -O-C_1-C_6 alkylene, -O-C_2-C_6 alkenylene, or -O-C_2-C_6 alkynylene, said O is bound at the R^5 position;

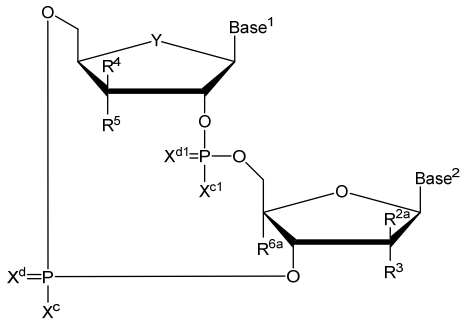
optionally R^5 and R^6 are connected to form -O-C_1-C_6 alkylene, -O-C_2-C_6 alkenylene, or -O-C_2-C_6 alkynylene, such that where R^5 and R^6 are connected to form -O-C_1-C_6 alkylene, -O-C_2-C_6 alkenylene, or -O-C_2-C_6 alkynylene, said O is bound at the R^5 position;

optionally R^7 and R^8 are connected to form C_1-C_6 alkylene, C_2-C_6 alkenylene, or C_2-C_6 alkynylene; and

optionally R^{7a} and R^{8a} are connected to form C_1-C_6 alkylene, C_2-C_6 alkenylene, or C_2-C_6 alkynylene; and

providing that when Y and Y^a are each O, X^a and X^{a1} are each O, X^b and X^{b1} are each O, and X^c and X^{c1} are each OH or SH, X^d and X^{d1} are each O, R^1 and R^{1a} are each H, R^2 is H, R^6 and R^{6a} are each H, R^7 and R^{7a} are each H, R^8 and R^{8a} are each H, and $Base^1$ and $Base^2$ are each selected from the group consisting of  , R^5 and R^3 are not both selected from the group consisting of H, F and OH.

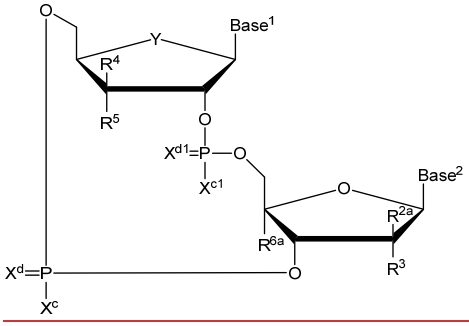
The present disclosure also relates to compounds having general structural formula (I"):



(I")

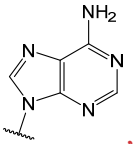
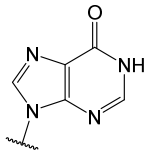
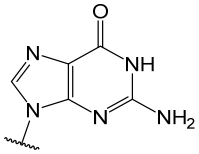
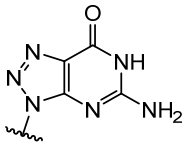
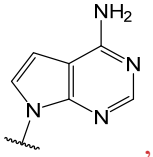
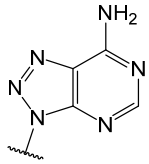
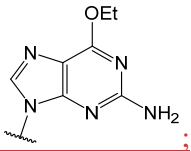
or pharmaceutically acceptable salts, hydrates, solvates, or prodrugs thereof, as described herein.

In another aspect, there is provided a compound of formula (I"):



(I")

or a pharmaceutically acceptable salt, hydrate, solvate, or prodrug thereof, wherein

Base[1] and Base[2] are each independently selected from the group consisting of  ,  ,  ,  ,  ,  , and  ;

Y is selected from the group consisting of -O- and -S-;

X^c and X^{c1} are each independently selected from the group consisting of OR^9 and SR^9;

X^d and X^{d1} are each independently selected from the group consisting of O and S;

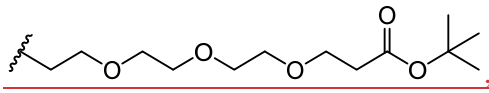
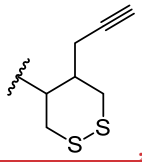
R^{2a} is selected from the group consisting of H, F, Cl, Br, I, OH, CN, N_3, C_1-C_6 alkyl, C_2-C_6 alkenyl, C_2-C_6 alkynyl, C_1-C_6 haloalkyl, C_2-C_6 haloalkenyl, C_2-C_6 haloalkynyl, -O-C_1-C_6 alkyl, -O-C_2-C_6 alkenyl, and -O-C_2-C_6 alkynyl;

R^3 is selected from the group consisting of H, F, Cl, Br, I, OH, CN, N_3, C_1-C_6 alkyl, C_2-C_6 alkenyl, C_2-C_6 alkynyl, C_1-C_6 haloalkyl, C_2-C_6 haloalkenyl, C_2-C_6 haloalkynyl, -O-C_1-C_6 alkyl, -O-C_2-C_6 alkenyl, and -O-C_2-C_6 alkynyl;

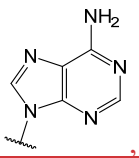
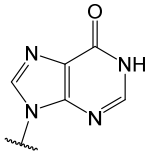
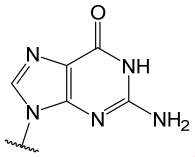
R^4 is selected from the group consisting of H, F, Cl, Br, I, OH, CN, N_3, C_1-C_6 alkyl, C_2-C_6 alkenyl, C_2-C_6 alkynyl, C_1-C_6 haloalkyl, C_2-C_6 haloalkenyl, C_2-C_6 haloalkynyl, -O-C_1-C_6 alkyl, -O-C_2-C_6 alkenyl, and -O-C_2-C_6 alkynyl;

R^5 is selected from the group consisting of H, F, Cl, Br, I, OH, CN, NH_2, N_3, C_1-C_6 alkyl, C_2-C_6 alkenyl, C_2-C_6 alkynyl, C_1-C_6 haloalkyl, C_2-C_6 haloalkenyl, C_2-C_6 haloalkynyl, -O-C_1-C_6 alkyl, -O-C_2-C_6 alkenyl, and -O-C_2-C_6 alkynyl;

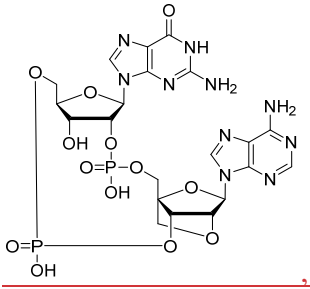
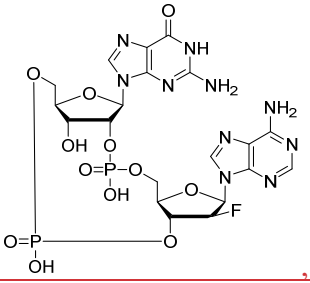
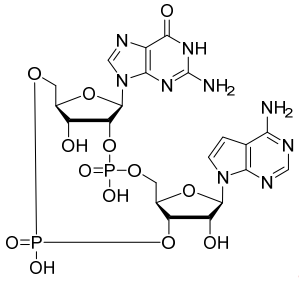
R^{6a} is selected from the group consisting of H, F, Cl, Br, I, OH, CN, N_3, C_1-C_6 alkyl, C_2-C_6 alkenyl, C_2-C_6 alkynyl, C_1-C_6 haloalkyl, C_2-C_6 haloalkenyl, C_2-C_6 haloalkynyl, -O-C_1-C_6 alkyl, -O-C_2-C_6 alkenyl, and -O-C_2-C_6 alkynyl;

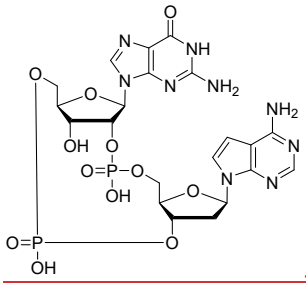
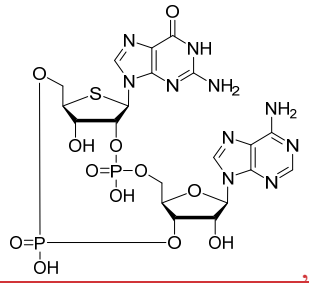
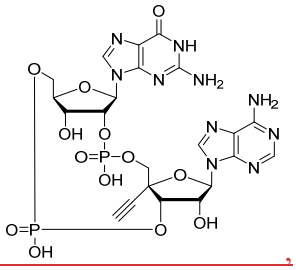
each R^9 is independently selected from the group consisting of H, C_1-C_{20} alkyl,  , and  , where each R^9 C_1-C_{20} alkyl is optionally substituted by 0 to 3 substituents independently selected from the group consisting of OH, -O-C_1-C_{20} alkyl,-S-C(O)C_1-C_6 alkyl, and C(O)OC_1-C_6 alkyl; and

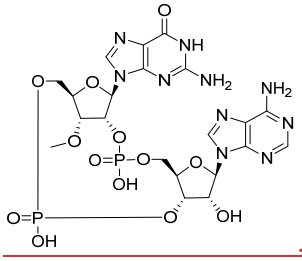
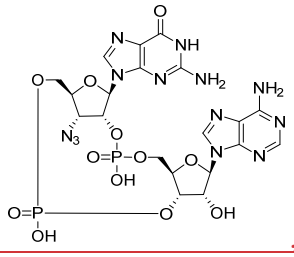
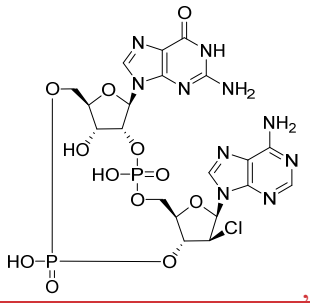
optionally R^3 and R^{6a} are connected to form -O-C_1-C_6 alkylene, -O-C_2-C_6 alkenylene, or -O-C_2-C_6 alkynylene, such that where R^3 and R^{6a} are connected to form -O-C_1-C_6 alkylene, -O-C_2-C_6 alkenylene, or -O-C_2-C_6 alkynylene, said O is bound at the R^3 position; and

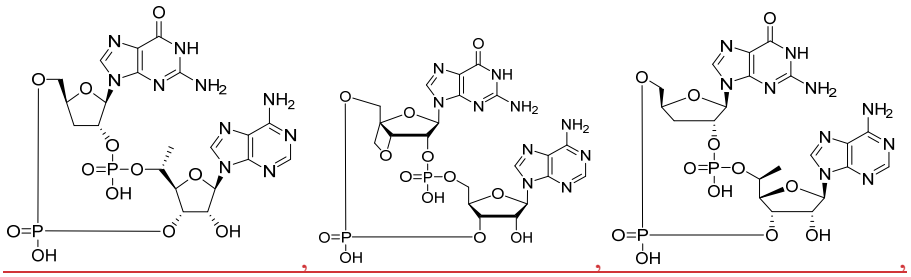
providing that when Y and Y^a are each O, X^a and X^{a1} are each O, X^b and X^{b1} are each O, and X^c and X^{c1} are each OH or SH, X^d and X^{d1} are each O, R^1 and R^{1a} are each H, R^2 is H, R^6 and R^{6a} are each H, R^7 and R^{7a} are each H, R^8 and R^{8a} are each H, and $Base^1$ and $Base^2$ are each selected from the group consisting of  ,  and  , R^5 and R^3 are not both selected from the group consisting of H, F and OH.

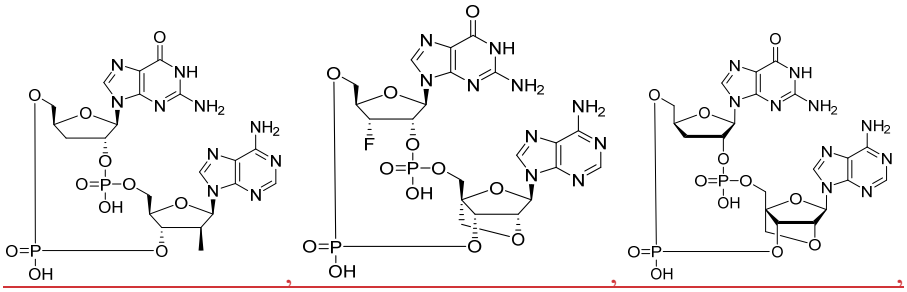
In another aspect, there is provided a compound selected from the group consisting of:

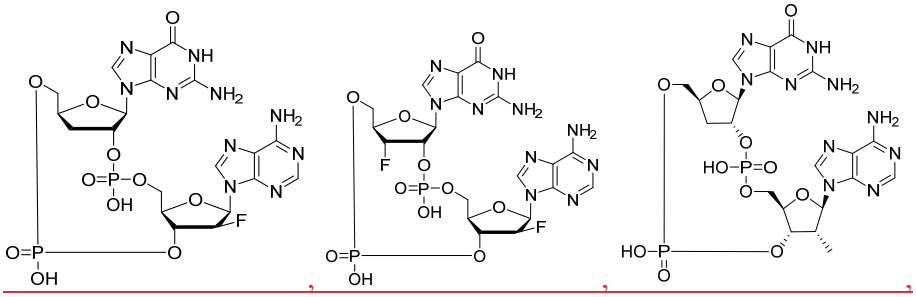
 ,  ,  ,

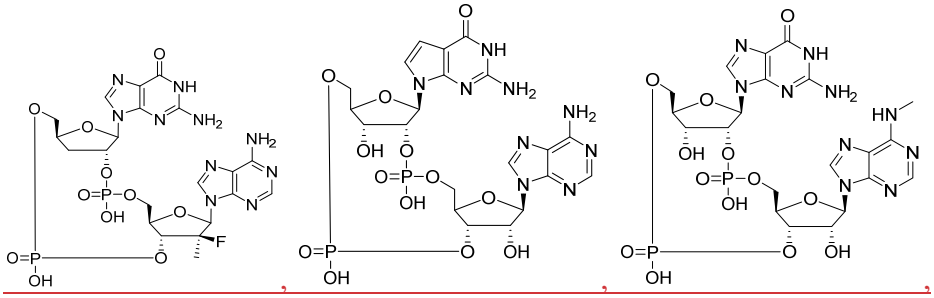
 ,  ,  ,

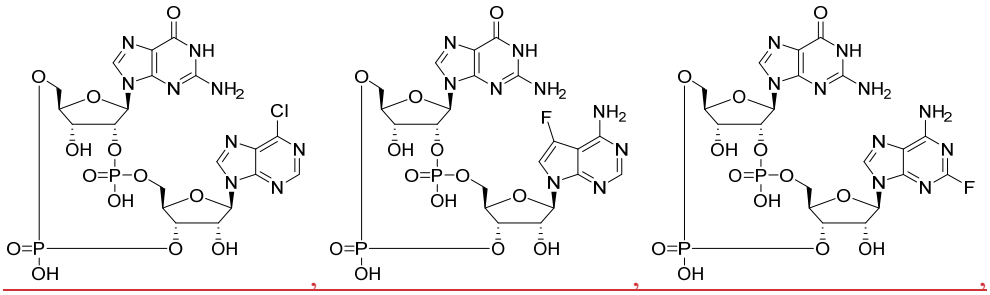
 ,  ,  ,

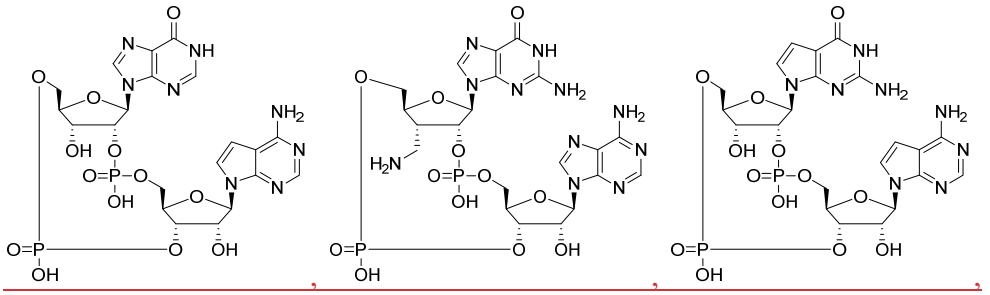


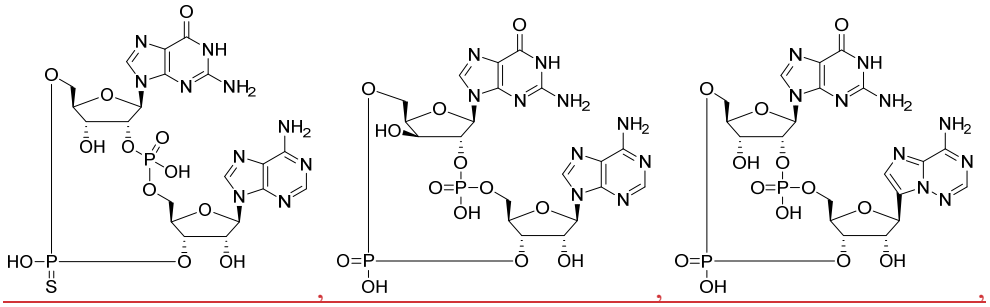


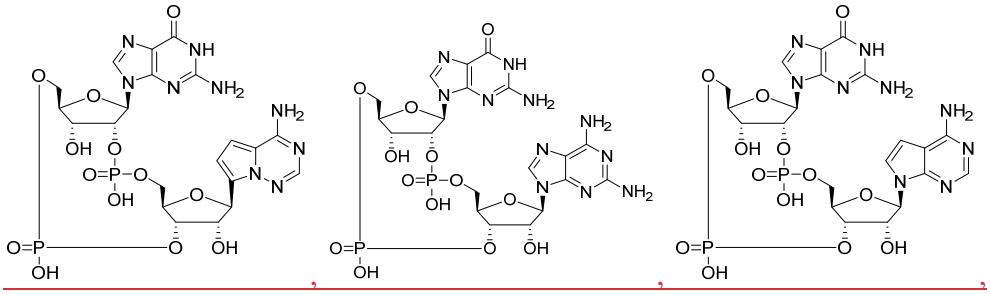


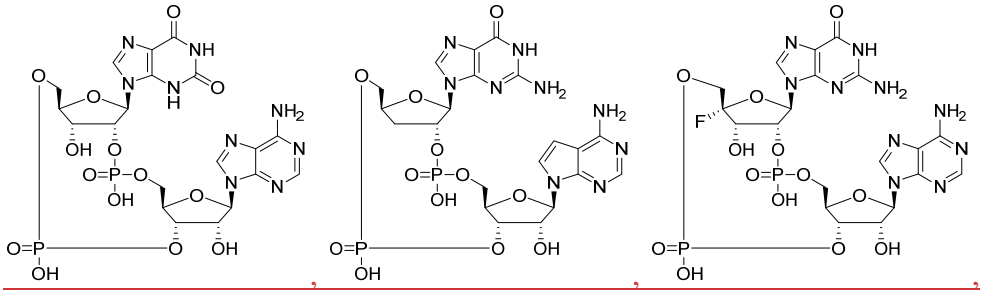


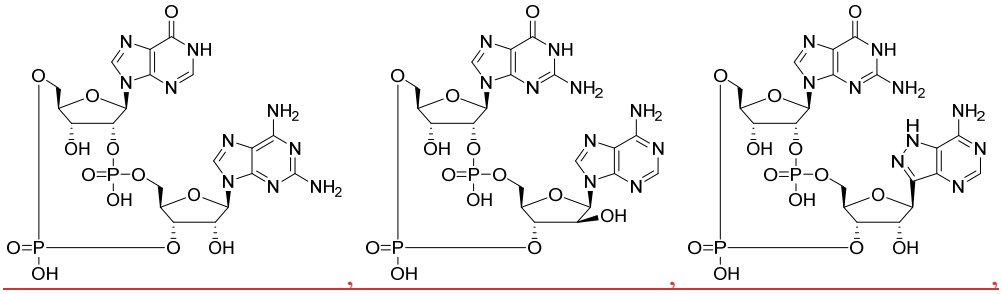


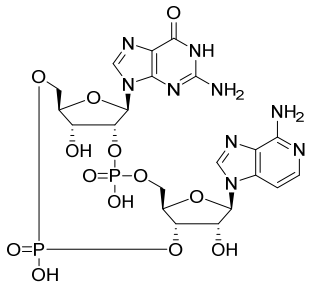








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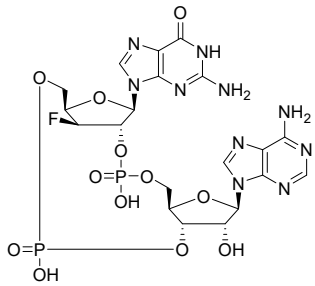
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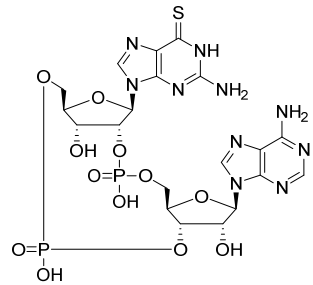
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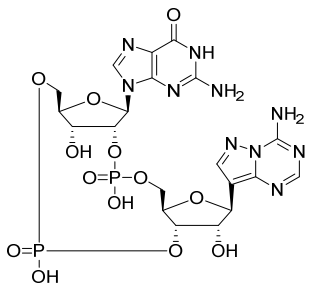
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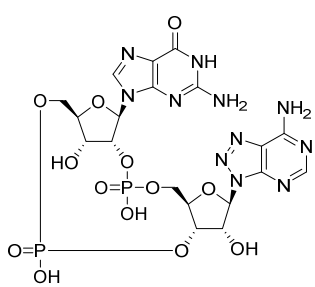
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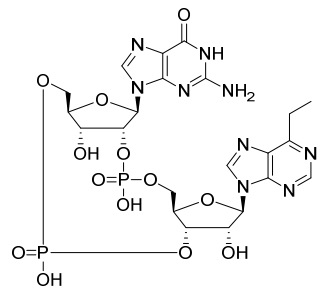
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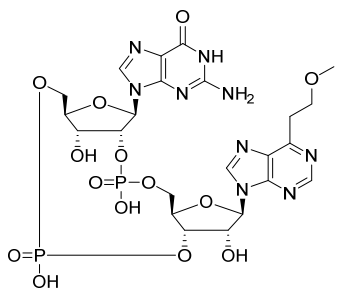
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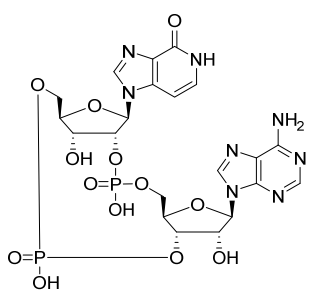
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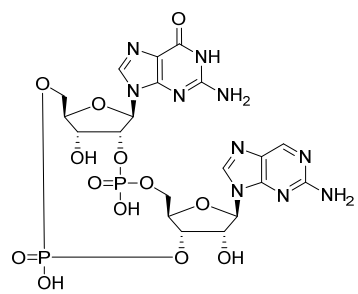
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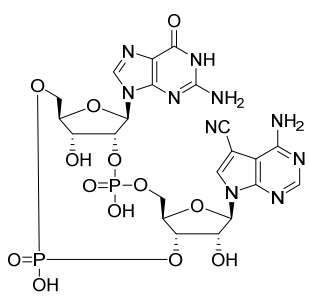
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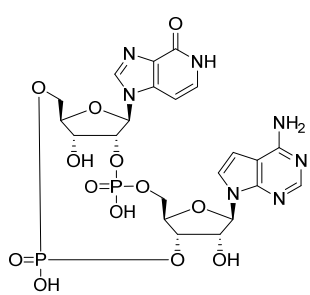
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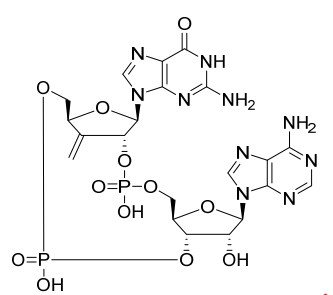
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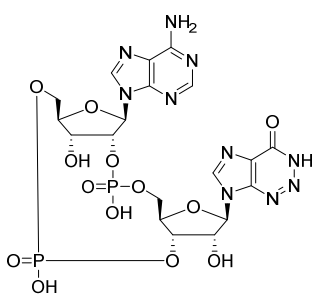
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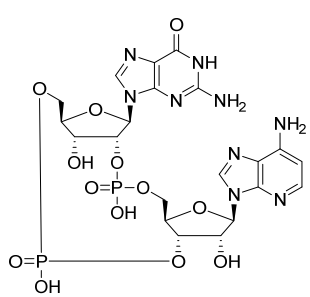
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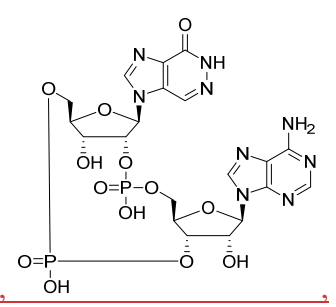
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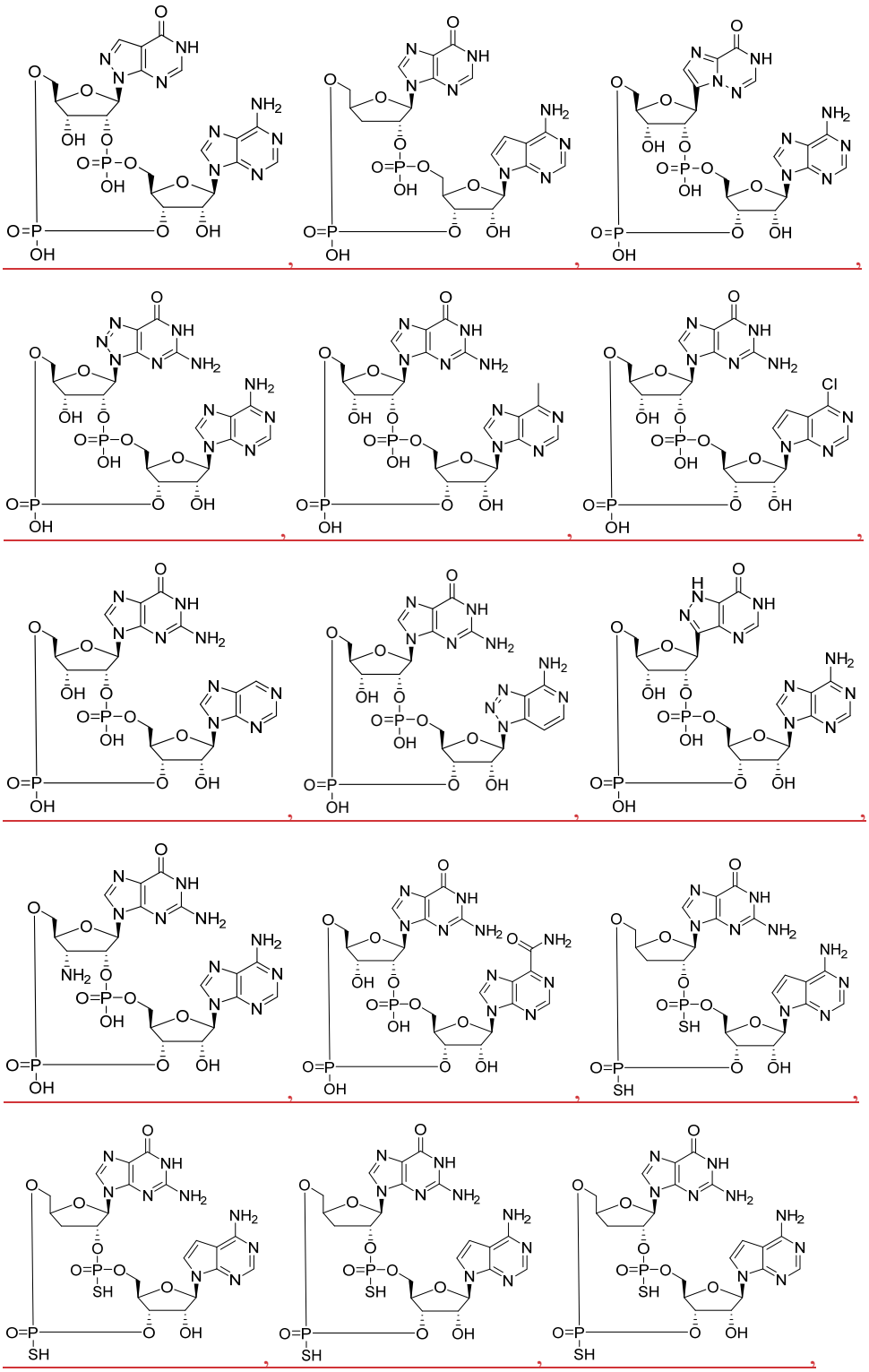

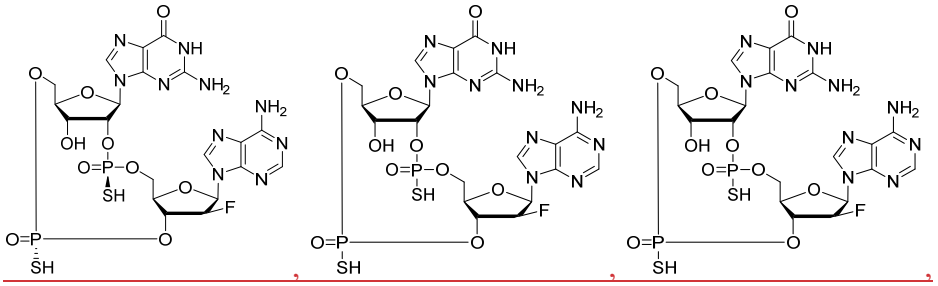

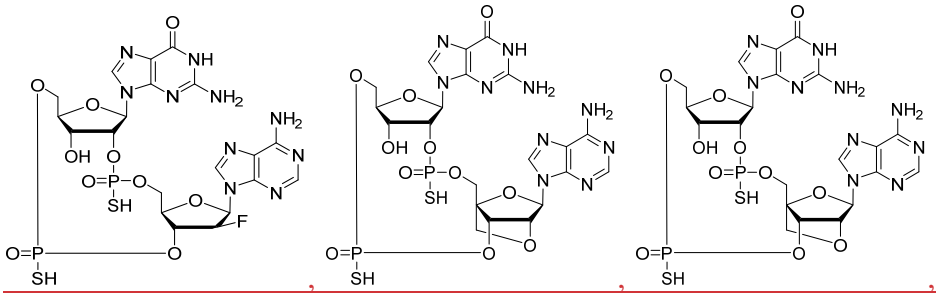

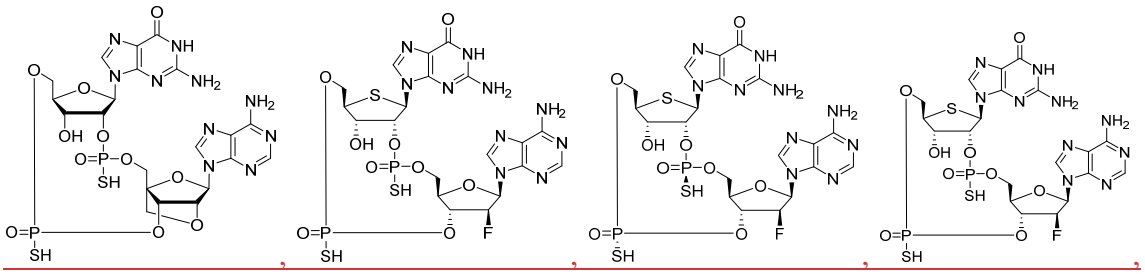

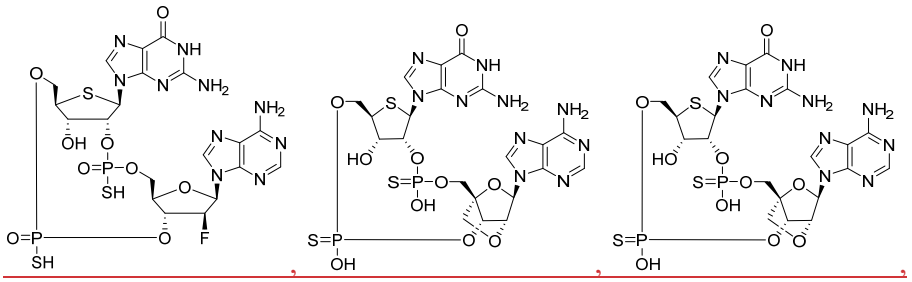

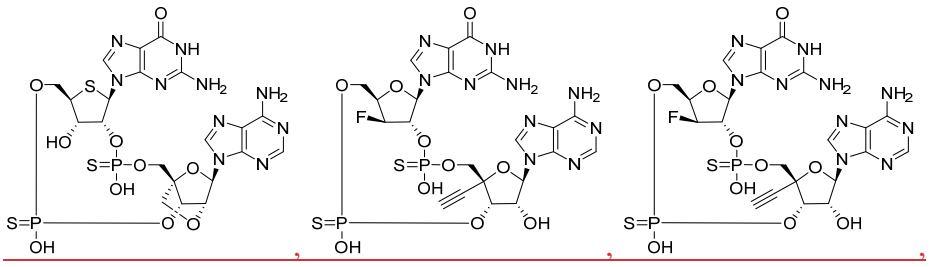

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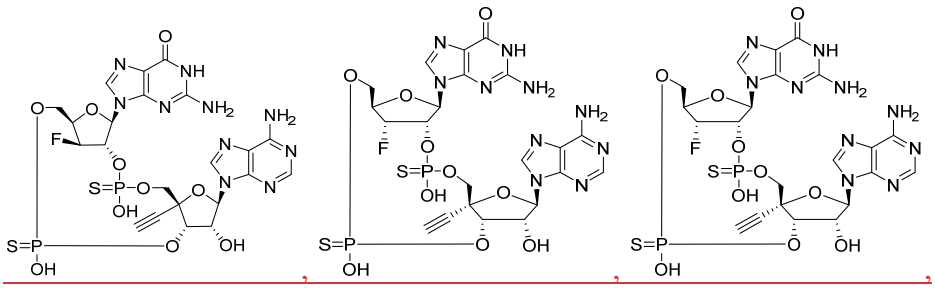

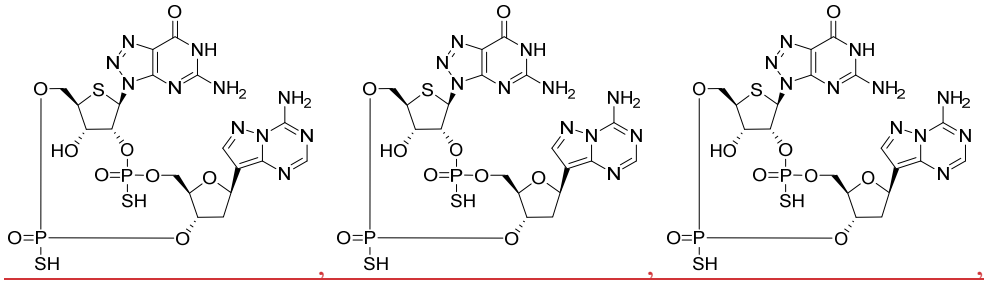

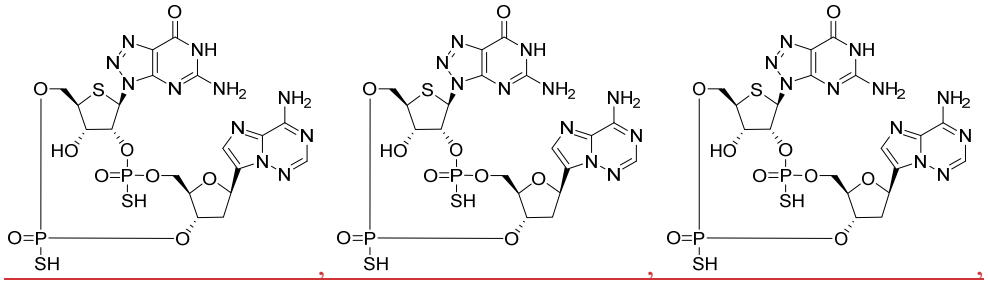

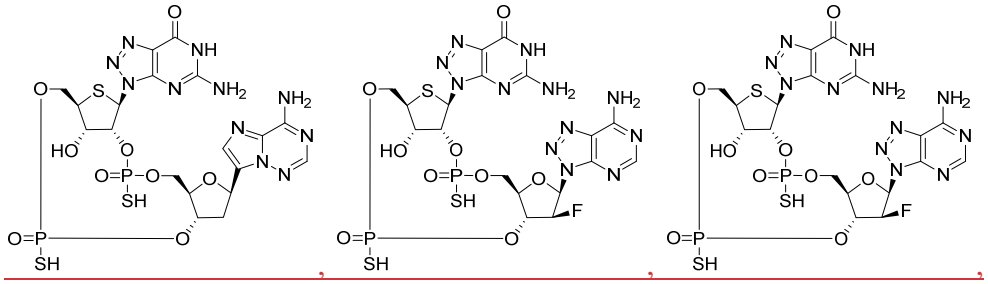

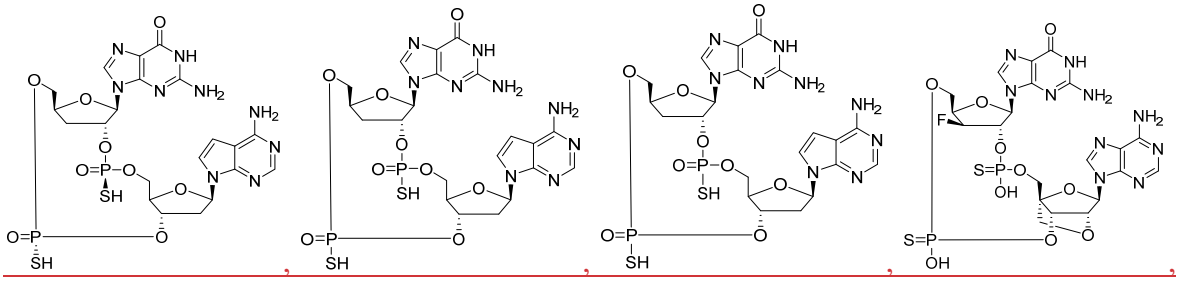

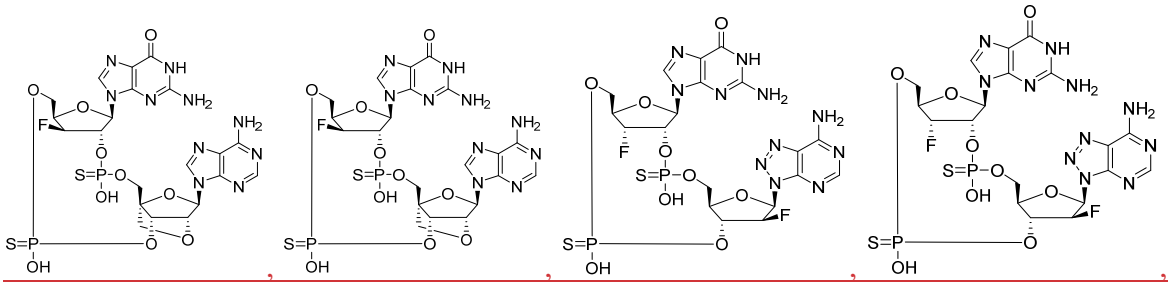

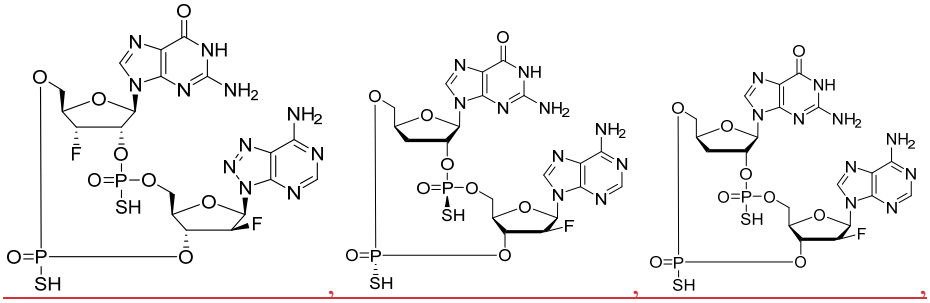

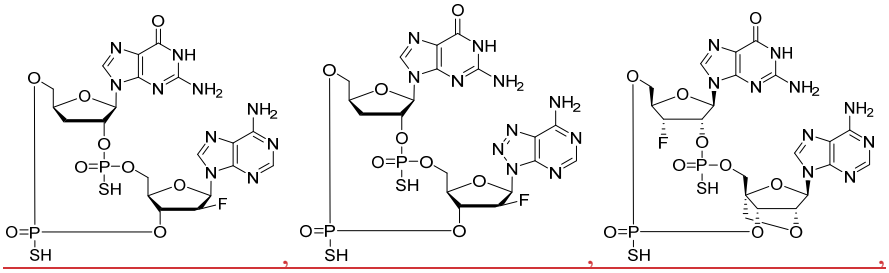

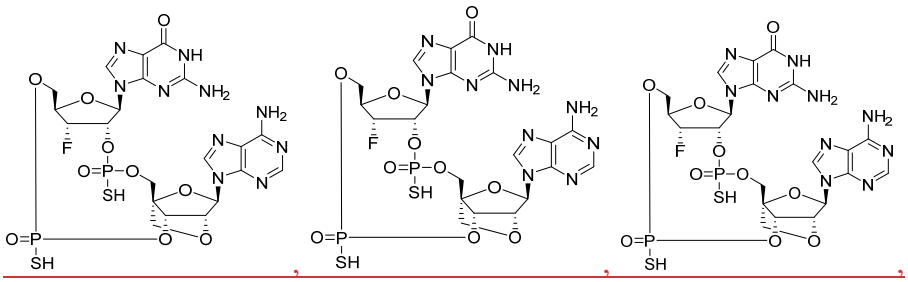

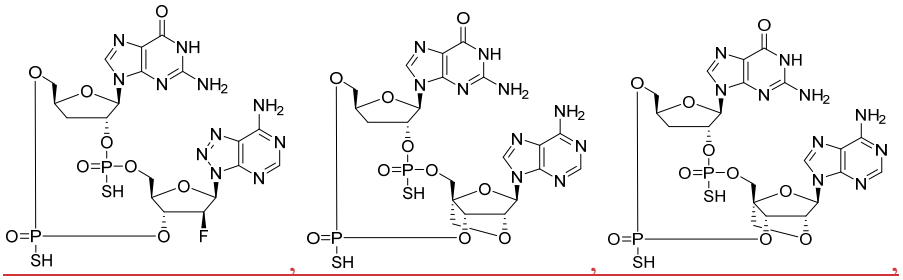

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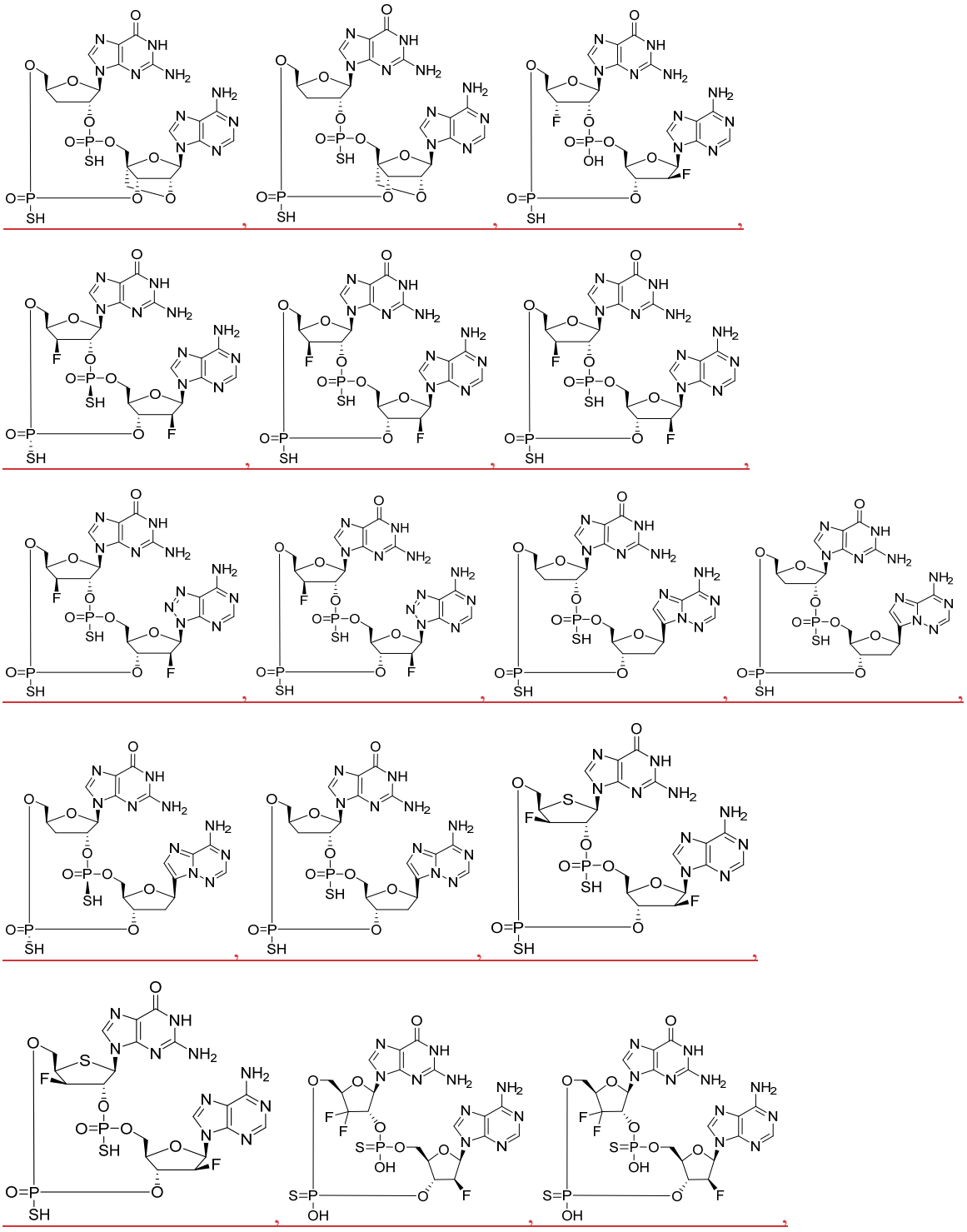

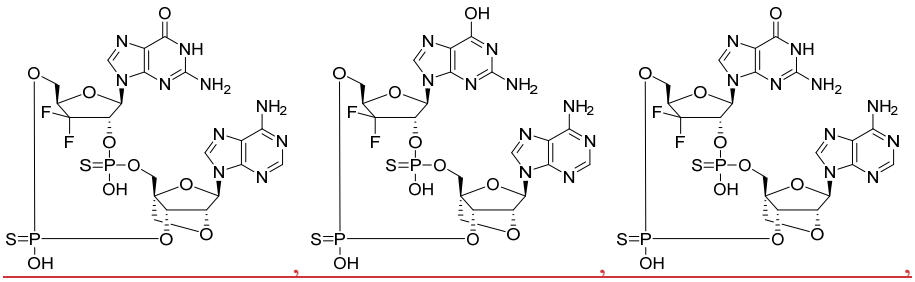
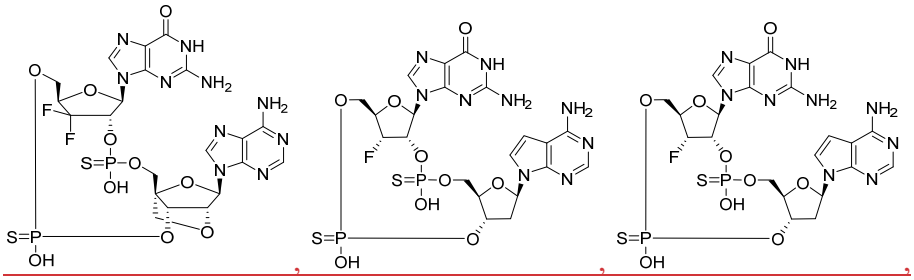
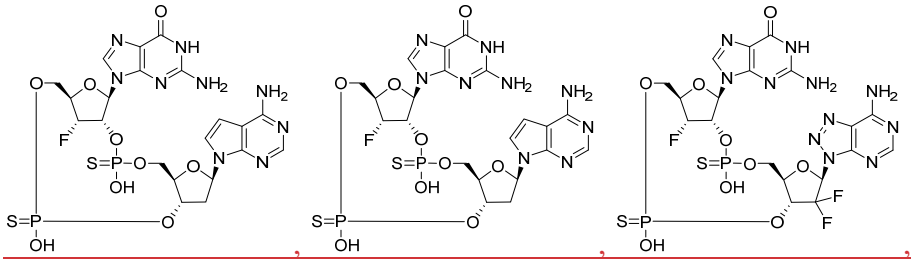
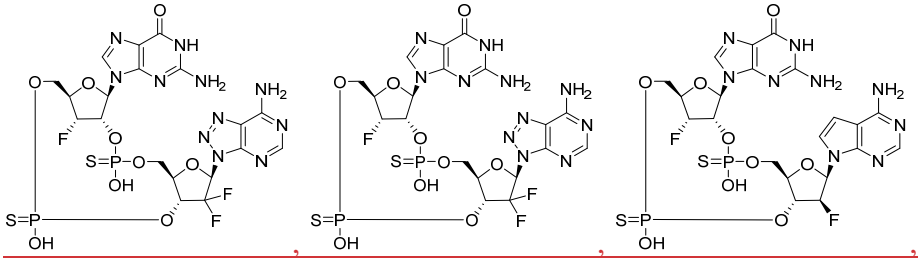
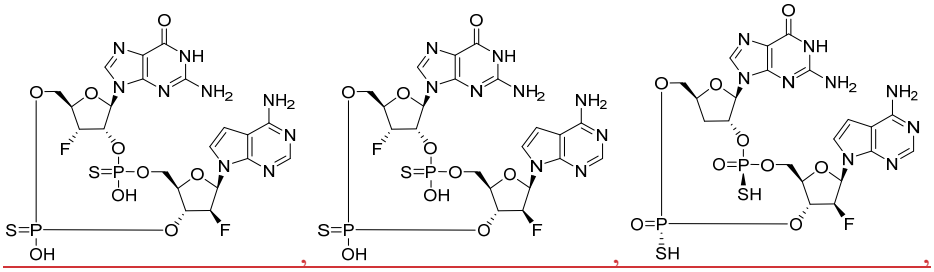
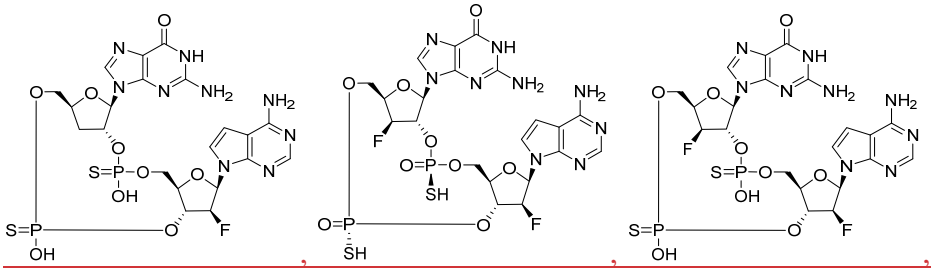

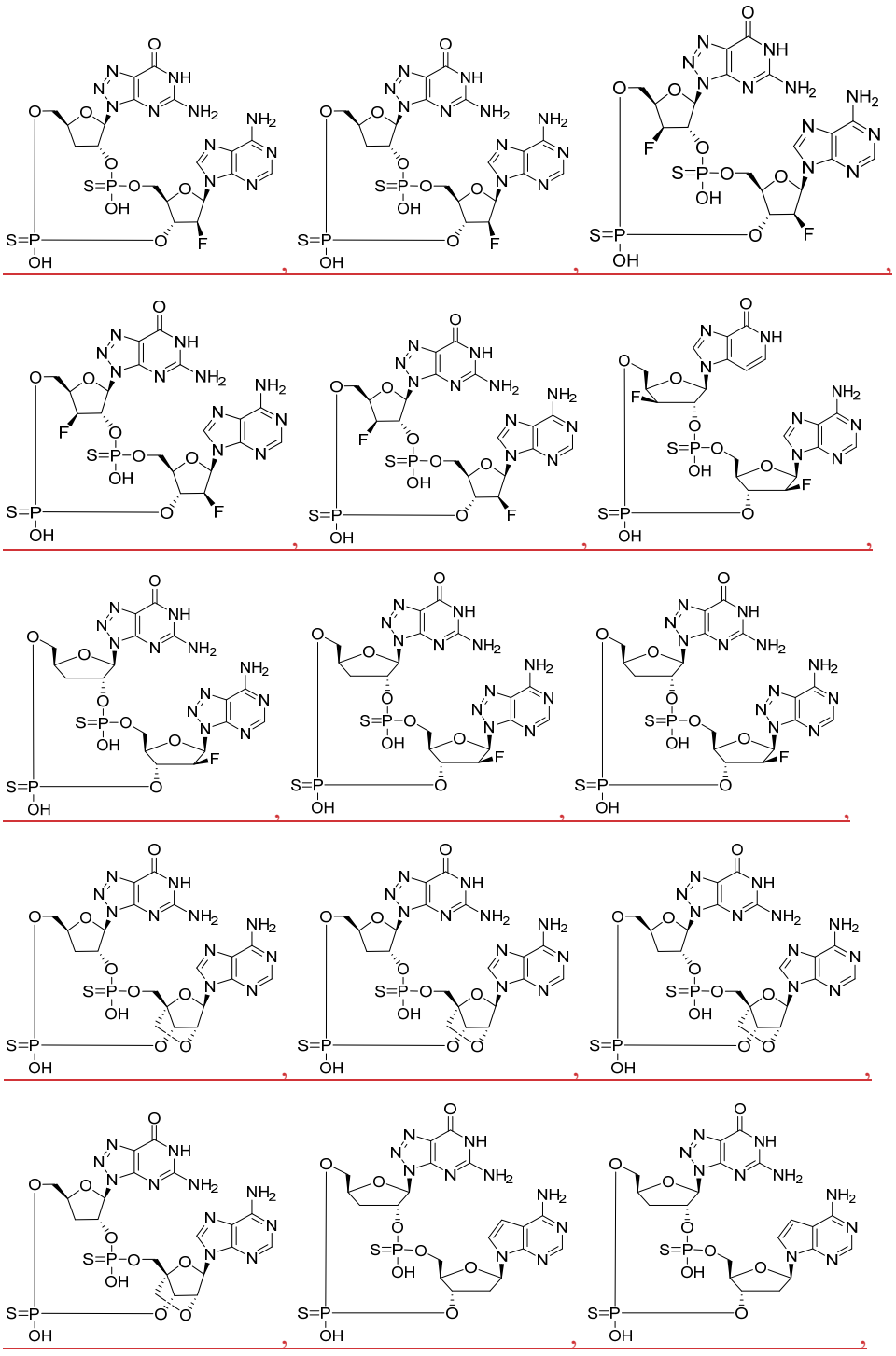

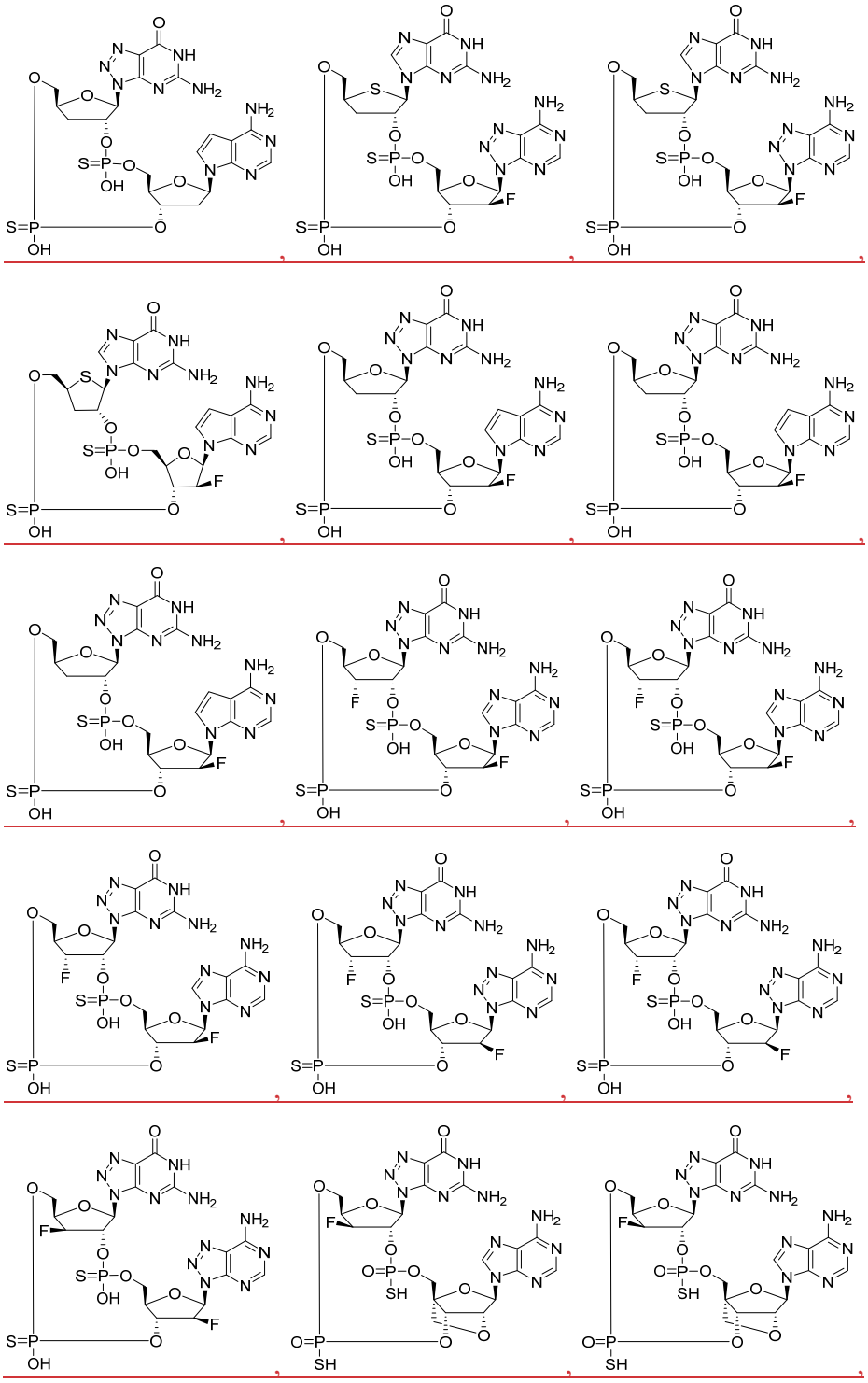

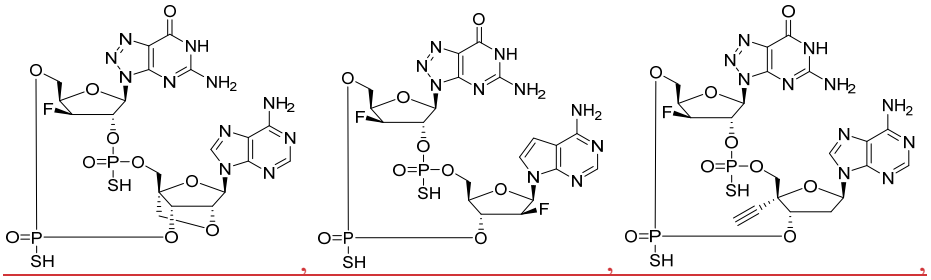
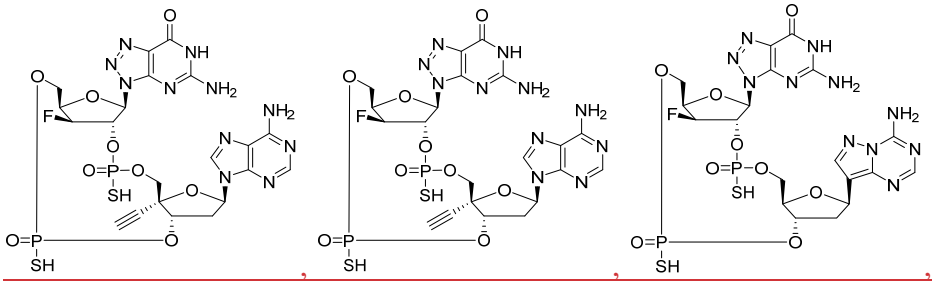
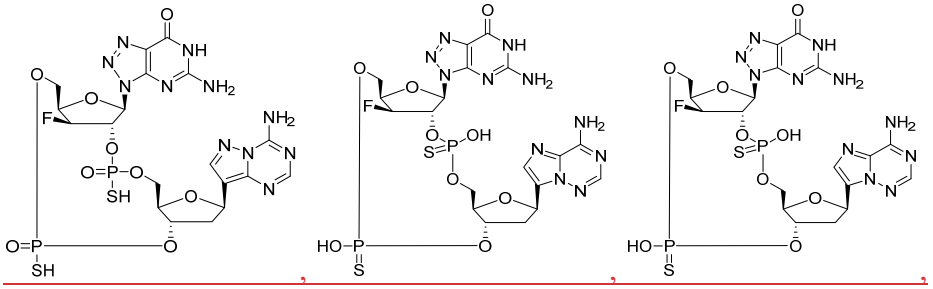
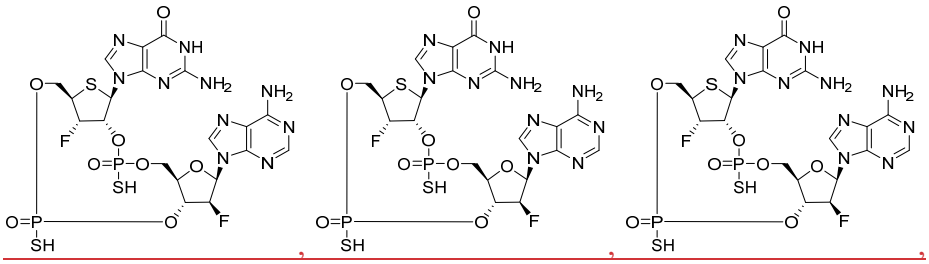
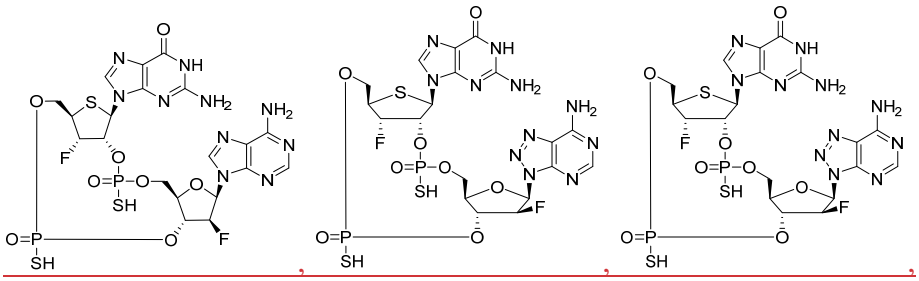

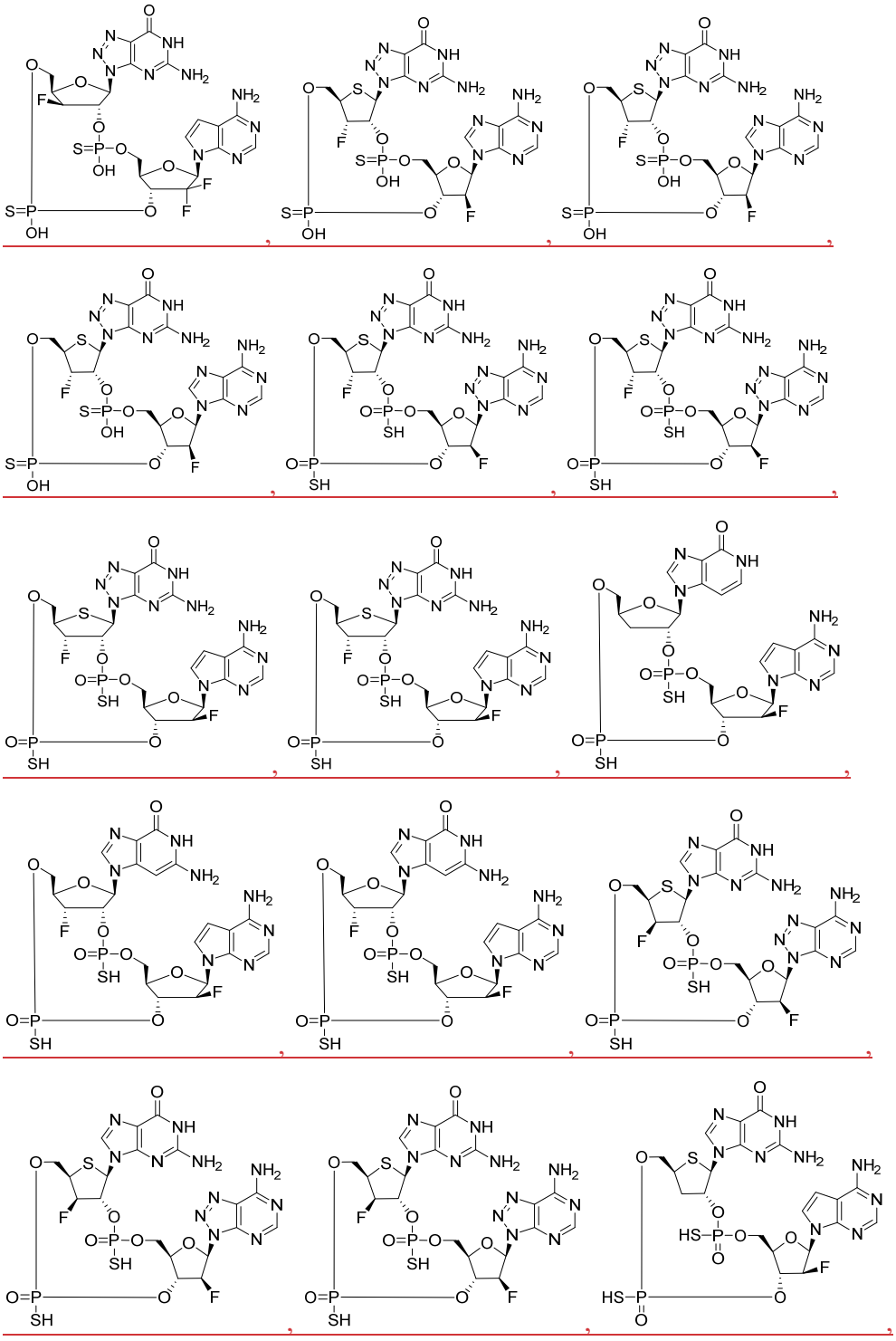

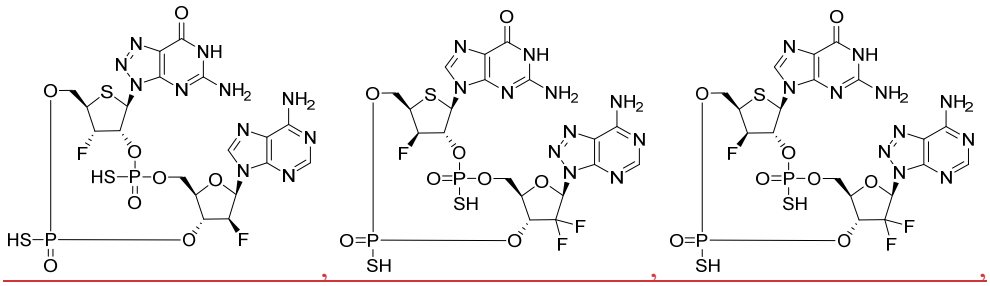

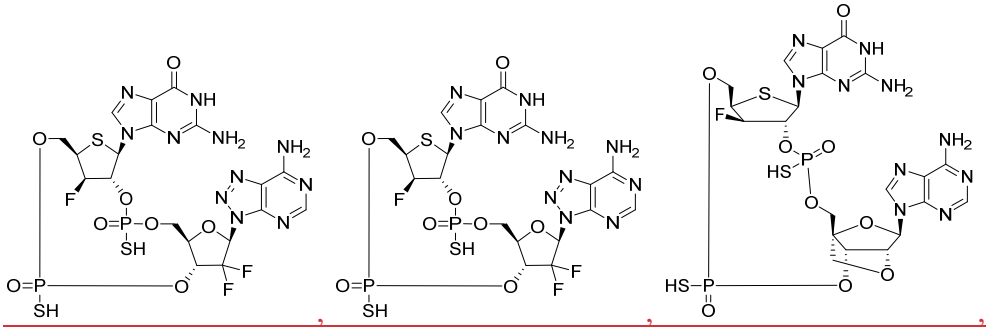

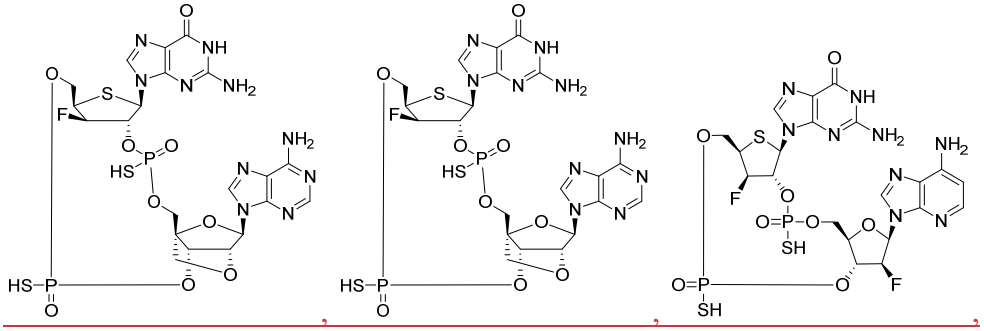

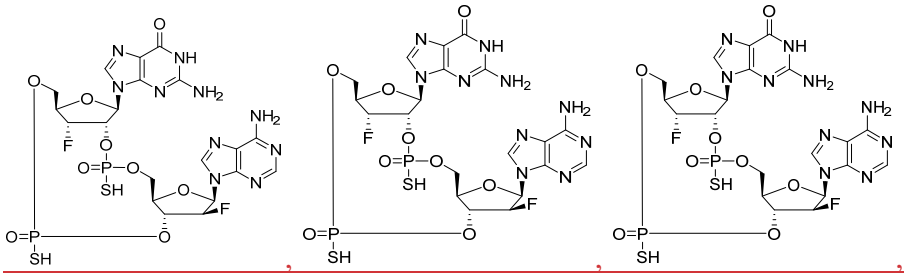

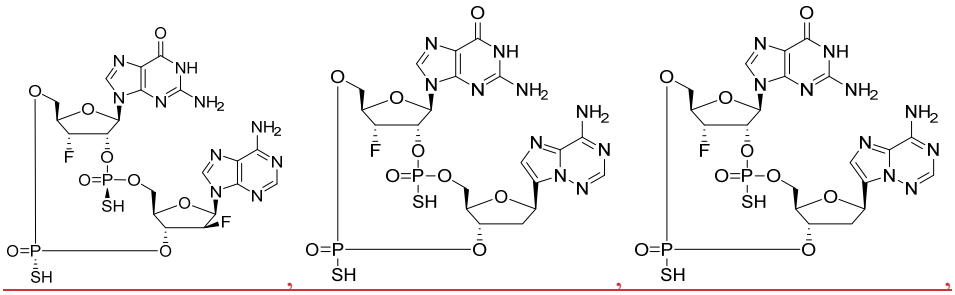

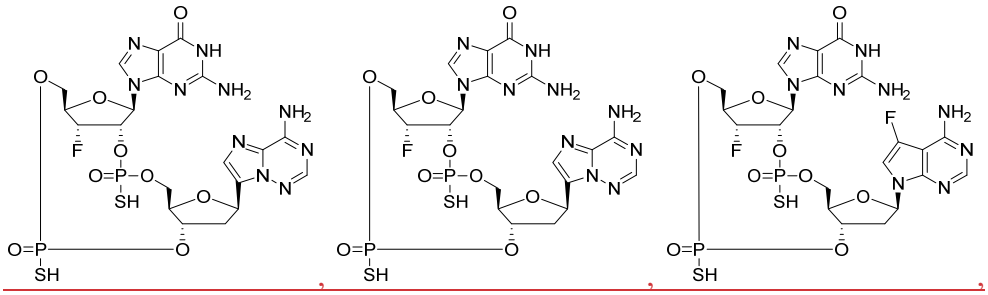

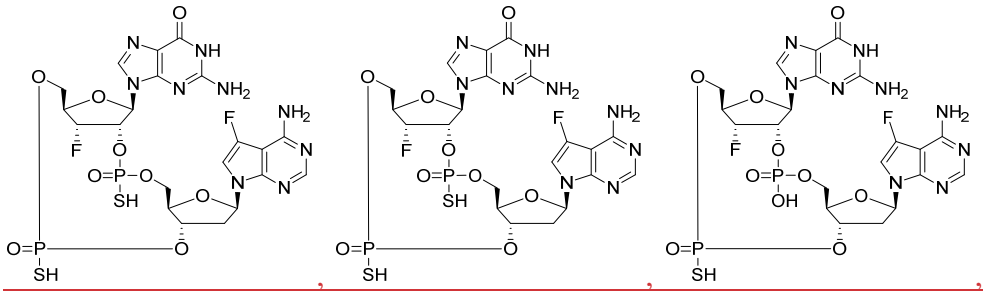

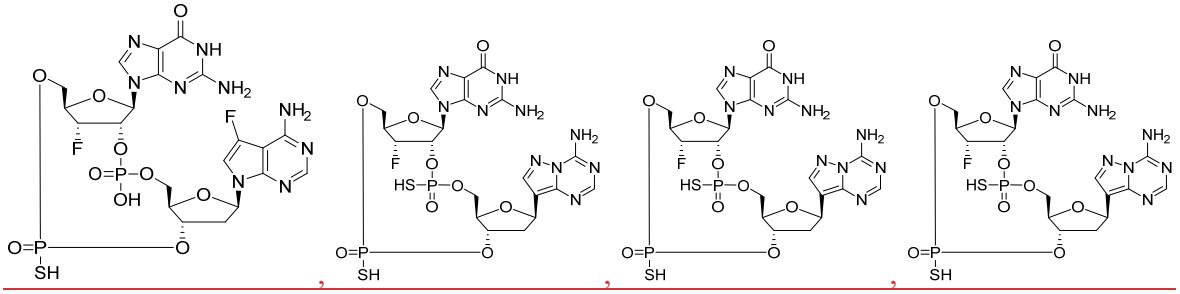

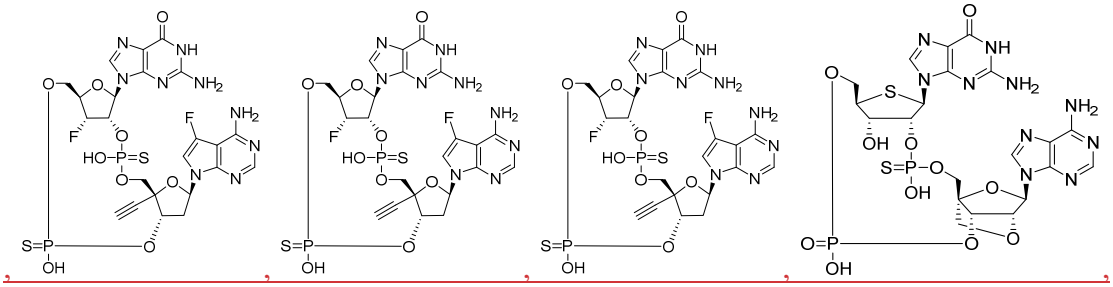

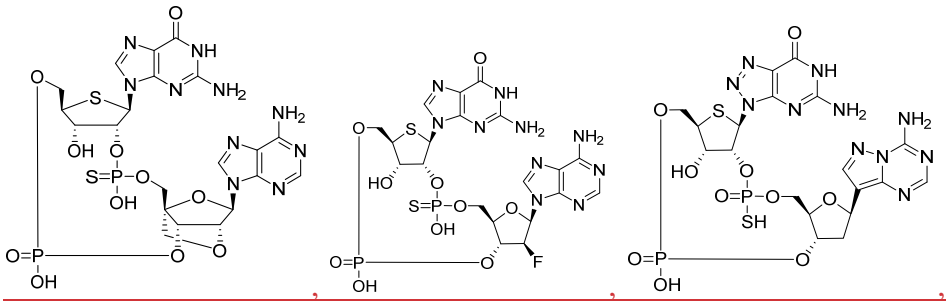

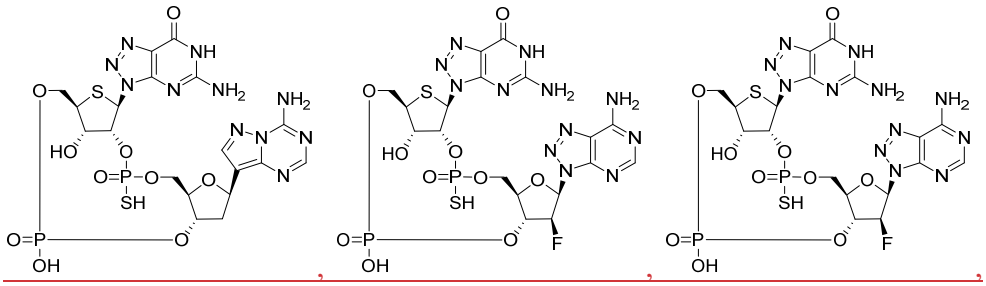

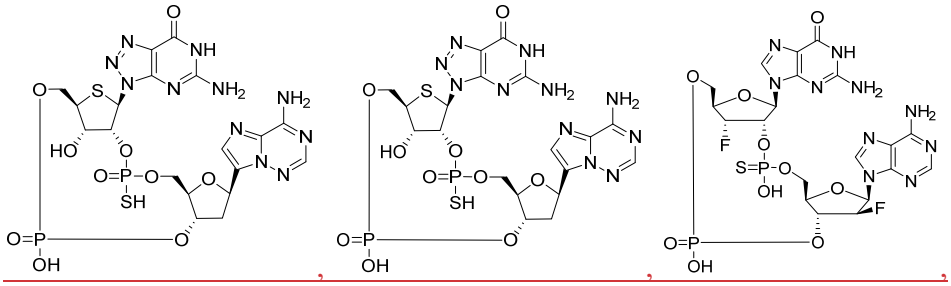

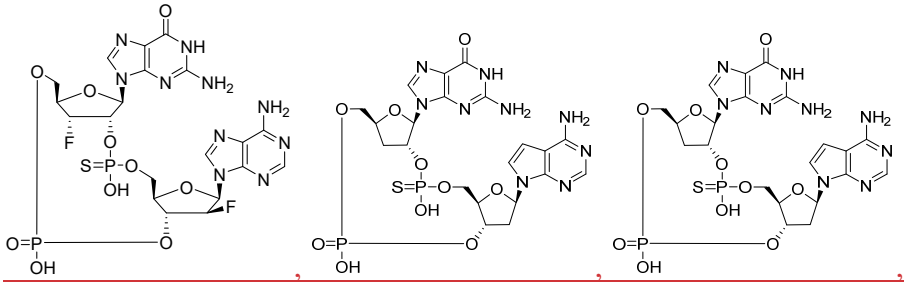

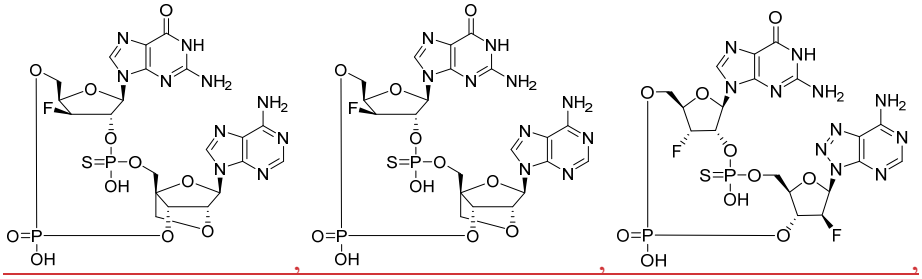

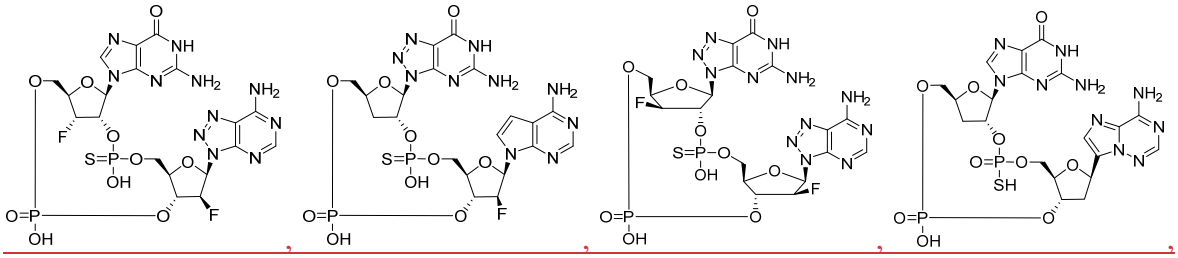

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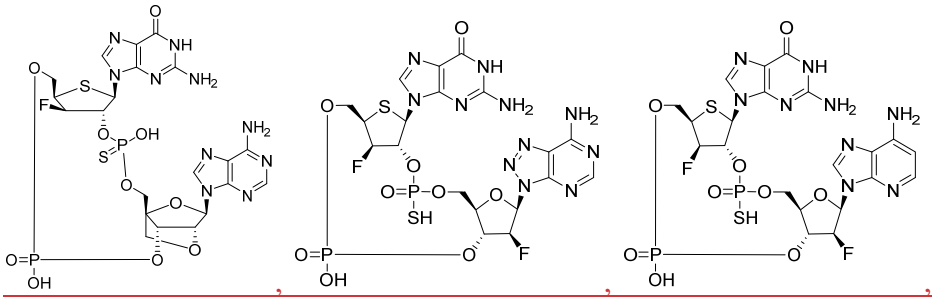

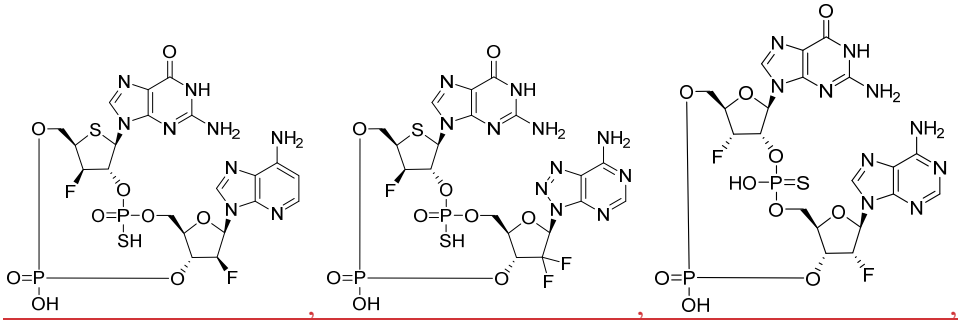

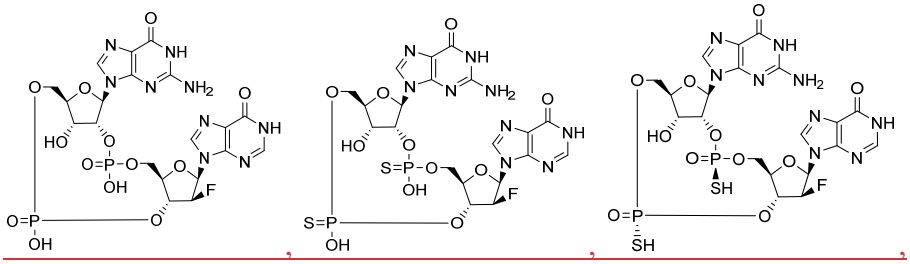

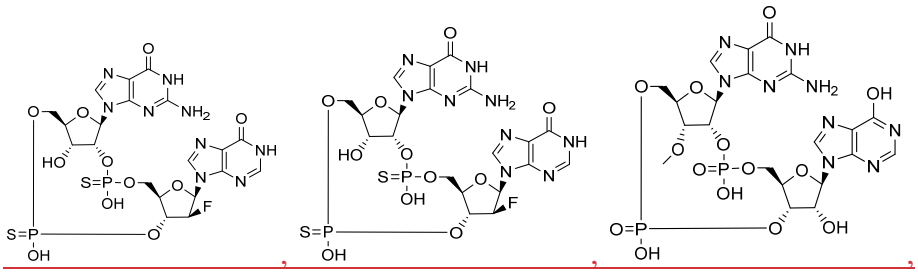

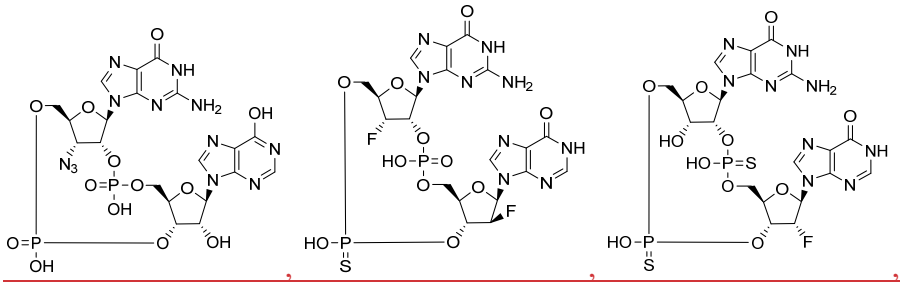

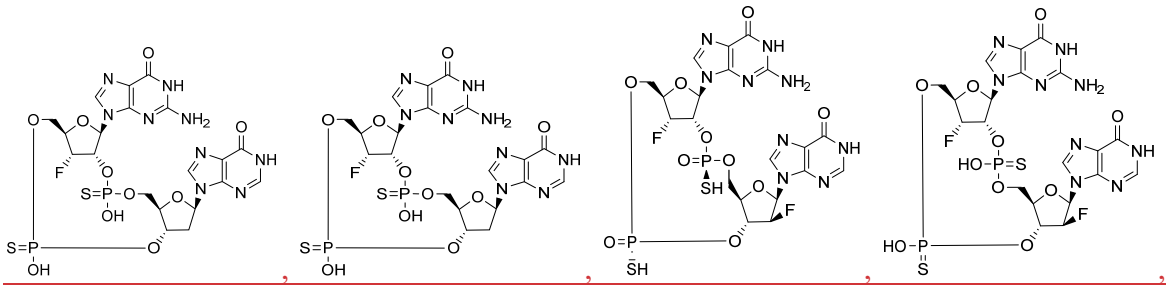

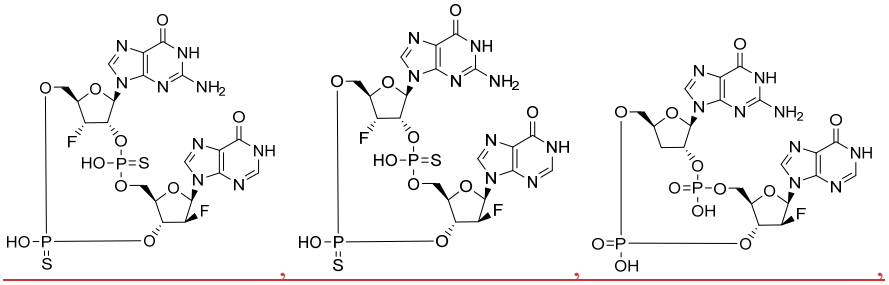

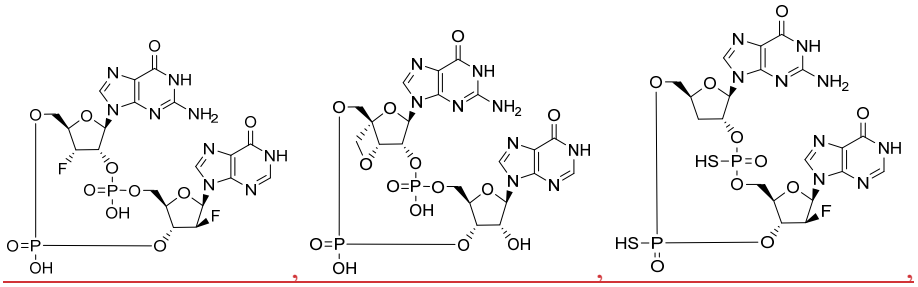

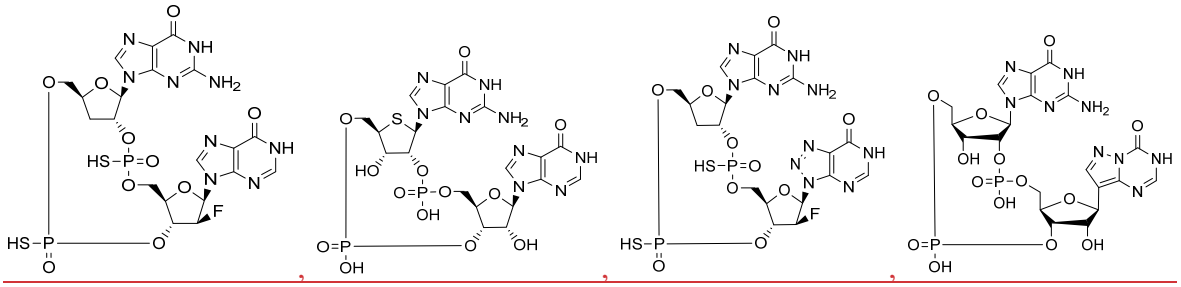

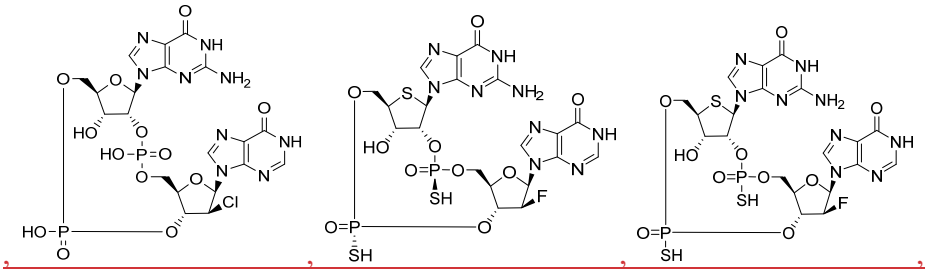

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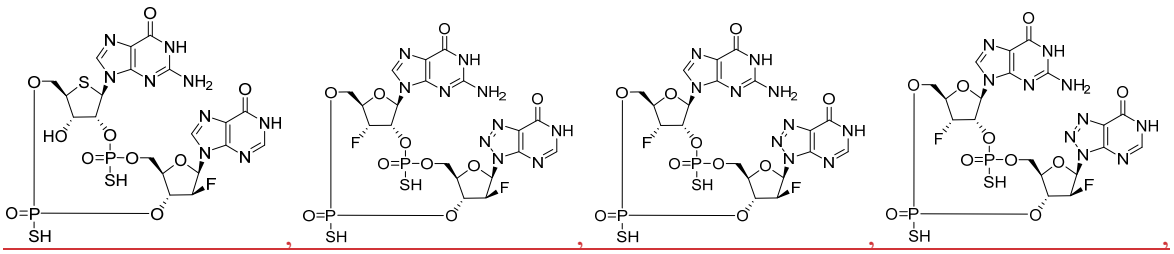

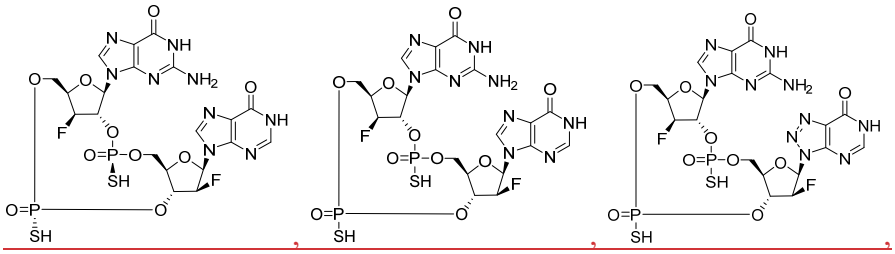

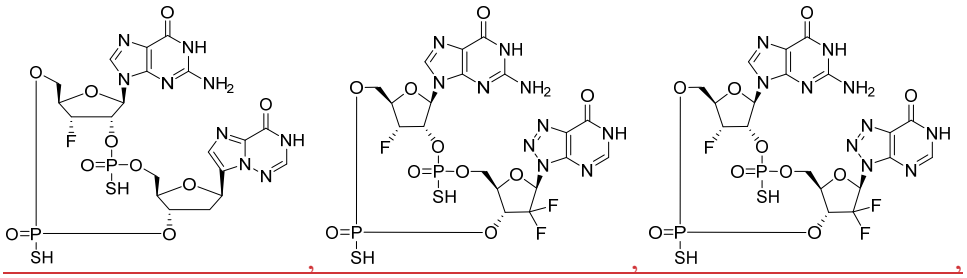

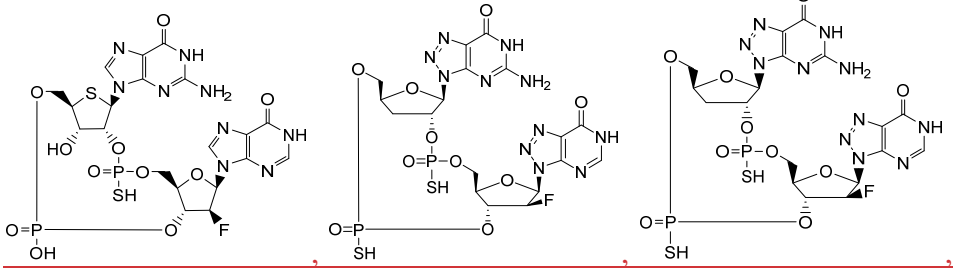

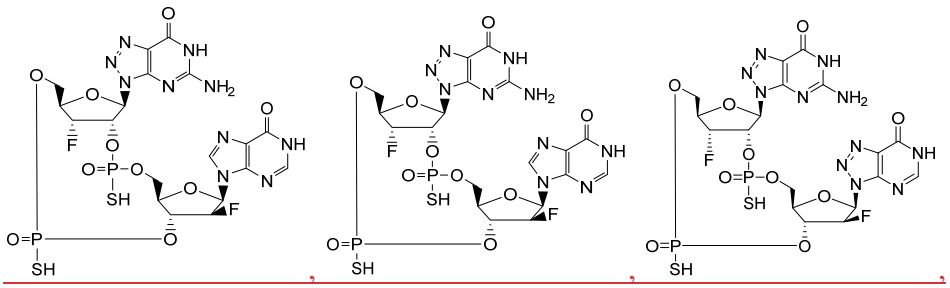

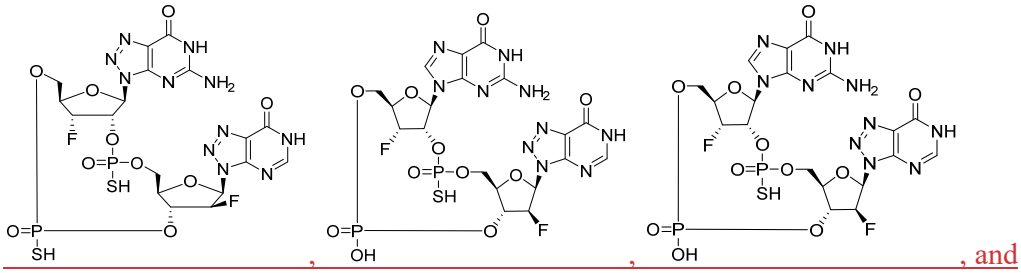
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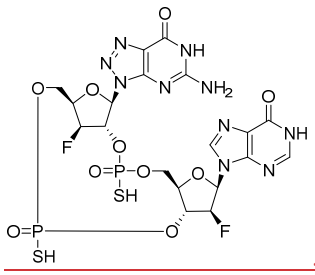


, and pharmaceutically acceptable salts, hydrates, solvates, or prodrugs thereof.

~~Embodiments of t~~The disclosure also includes compounds of general formula (I), compounds of general formula (I'), and/or compounds of general formula (I"), and pharmaceutically acceptable salts, hydrates, solvates, or prodrugs thereof, as well as synthesis and isolation of compounds of

general formula (I), compounds of general formula (I'), and/or compounds of general formula (I''), and pharmaceutically acceptable salts, hydrates, solvates, or prodrugs thereof.

In another aspect, there is provided a pharmaceutical composition, said pharmaceutical composition comprising: (a) a compound as described herein or a pharmaceutically acceptable salt, hydrate, solvate, or prodrug thereof; and (b) a pharmaceutically acceptable carrier.

Uses of compounds of general formula (I), compounds of general formula (I'), and/or compounds of general formula (I'') are also disclosed.

In another aspect, there is provided use of a compound as described herein in the manufacture of a medicament for inducing an immune response.

In another aspect, there is provided use of a pharmaceutical composition as described herein in the manufacture of a medicament for inducing an immune response.

In another aspect, there is provided use of a compound as described herein in the manufacture of a medicament for inducing a STING-dependent type I interferon production.

In another aspect, there is provided use of a pharmaceutical composition as described herein in the manufacture of a medicament for inducing a STING-dependent type I interferon production.

In another aspect, there is provided use of a compound as described herein in the manufacture of a medicament for treating a cell proliferation disorder.

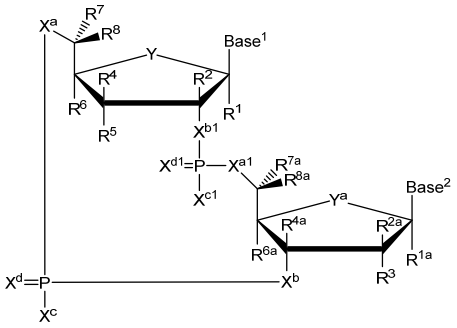
In another aspect, there is provided use of a pharmaceutical composition as described herein in the manufacture of a medicament for treating a cell proliferation disorder.

Other ~~embodiments~~examples, aspects and features of the present disclosure are either further described in or will be apparent from the ensuing description, examples and appended claims.

DETAILED DESCRIPTION OF THE INVENTION

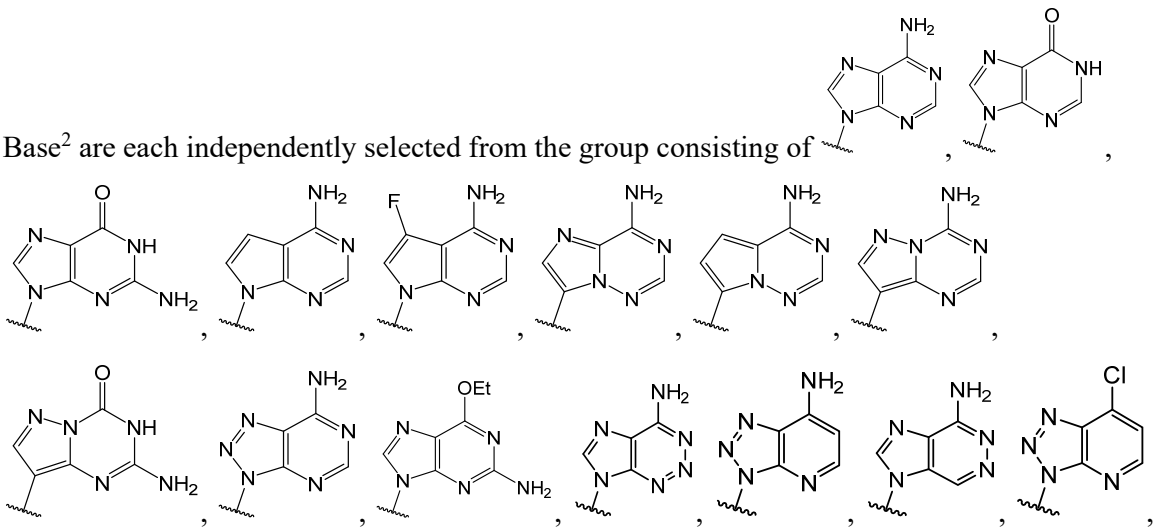
The present disclosure includes compounds of general formula (I), compounds of general formula (I'), and/or compounds of general formula (I'') above, and pharmaceutically acceptable salts, hydrates, solvates, or prodrugs thereof. These compounds and their pharmaceutically acceptable salts, hydrates, solvates, and/or prodrugs are useful as agents to induce interferon production.

A first embodiment of the disclosure relates to cyclic di-nucleotide compounds of general formula (I):



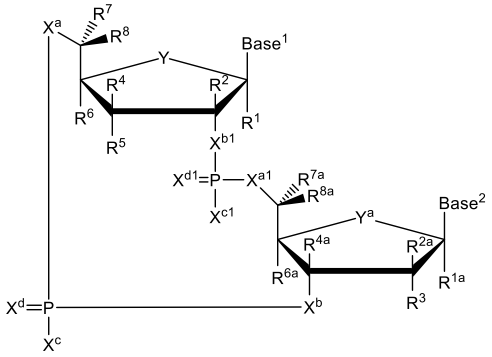
(I)

or a pharmaceutically acceptable salt, hydrate, solvate, or prodrug thereof, wherein $Base^1$ and $Base^2$ are each independently selected from the group consisting of



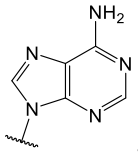
WHAT IS CLAIMED IS:

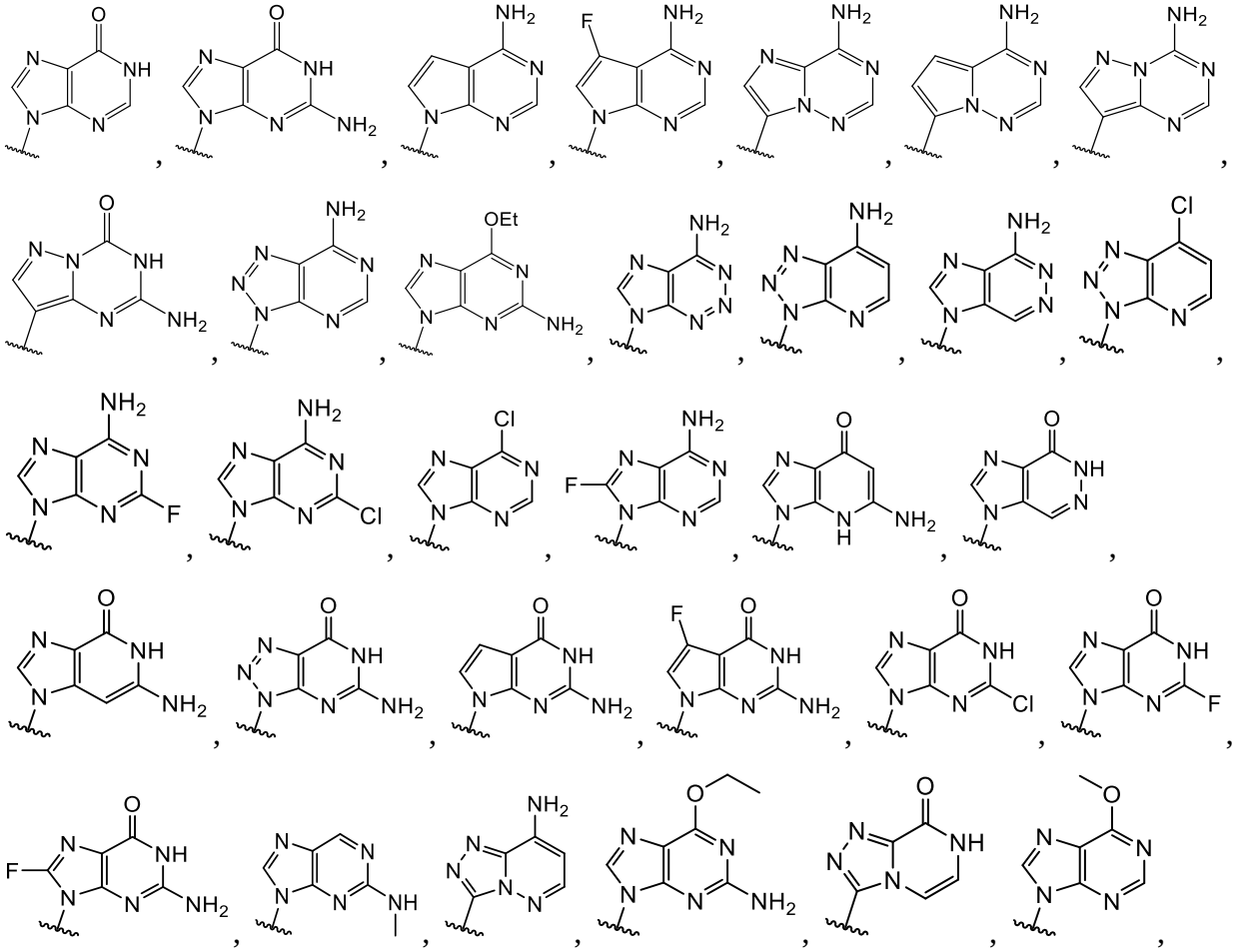
1. A compound of formula (I):

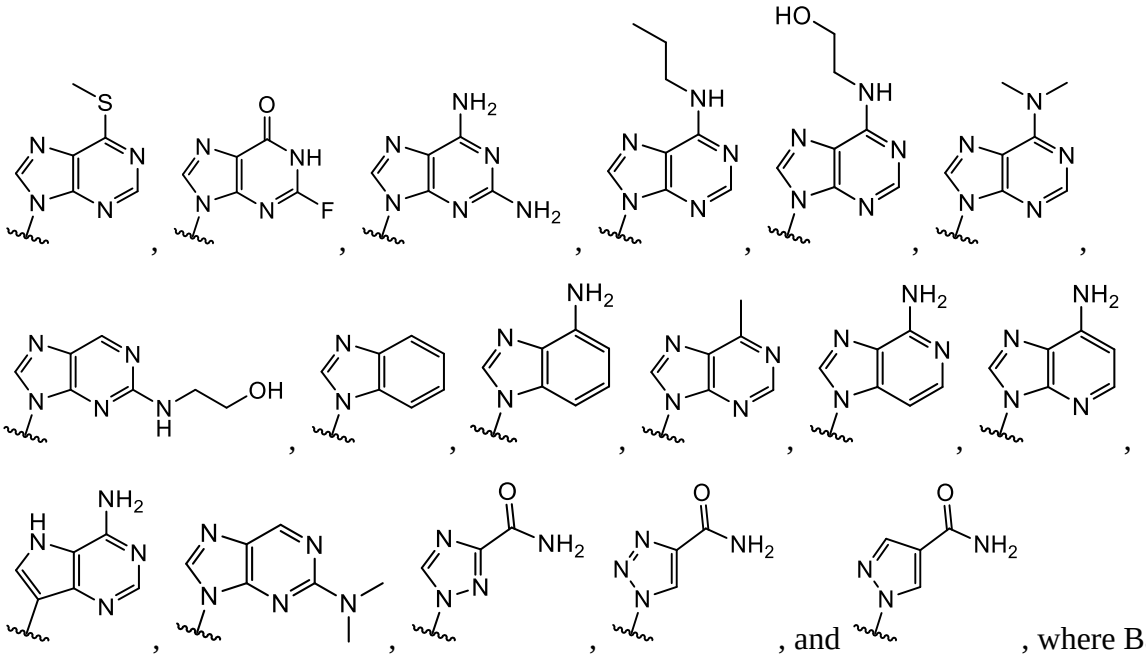


(I)

or a pharmaceutically acceptable salt, hydrate, solvate, or prodrug thereof, wherein

Base^1 and Base^2 are each independently selected from the group consisting of  ,





and Base[2] each may be independently substituted by 0-3 substituents R^{10}, where each R^{10} is independently selected from the group consisting of F, Cl, I, Br, OH, SH, NH_2, C_{1-3} alkyl, C_{3-6} cycloalkyl, $O(C_{1-3}$ alkyl), $O(C_{3-6}$ cycloalkyl), $S(C_{1-3}$ alkyl), $S(C_{3-6}$ cycloalkyl), $NH(C_{1-3}$ alkyl), $NH(C_{3-6}$ cycloalkyl), $N(C_{1-3}$ alkyl)$_2$, and $N(C_{3-6}$ cycloalkyl)$_2$;

Y and Y^a are each independently selected from the group consisting of -O- and -S-;

X^a and X^{a1} are each independently selected from the group consisting of O, C, and S;

X^b and X^{b1} are each independently selected from the group consisting of O, C, and S;

X^c and X^{c1} are each independently selected from the group consisting of SR^9, OR^9, and NR^9R^9;

X^d and X^{d1} are each independently selected from the group consisting of O and S;

R^1 and R^{1a} are each independently selected from the group consisting of H, F, Cl, Br, I, OH, CN, N_3, C_1-C_6 alkyl, C_2-C_6 alkenyl, C_2-C_6 alkynyl, C_1-C_6 haloalkyl, C_2-C_6 haloalkenyl, C_2-C_6 haloalkynyl, -O-C_1-C_6 alkyl, -O-C_2-C_6 alkenyl, and -O-C_2-C_6 alkynyl, where said R^1 and R^{1a} C_1-C_6 alkyl, C_2-C_6 alkenyl, C_2-C_6 alkynyl, C_1-C_6 haloalkyl, C_2-C_6 haloalkenyl, C_2-C_6 haloalkynyl, -O-C_1-C_6 alkyl, -O-C_2-C_6 alkenyl, and -O-C_2-C_6 alkynyl are substituted by 0 to 3 substituents selected from the group consisting of F, Cl, Br, I, OH, CN, and N_3;

R^2 and R^{2a} are each independently selected from the group consisting of H, F, Cl, Br, I, OH, CN, N_3, C_1-C_6 alkyl, C_2-C_6 alkenyl, C_2-C_6 alkynyl, C_1-C_6 haloalkyl, C_2-C_6 haloalkenyl, C_2-C_6 haloalkynyl, -O-C_1-C_6 alkyl, -O-C_2-C_6 alkenyl, and -O-C_2-C_6 alkynyl, where said R^2 and R^{2a} C_1-C_6 alkyl, C_2-C_6 alkenyl, C_2-C_6 alkynyl, C_1-C_6 haloalkyl, C_2-C_6 haloalkenyl, C_2-C_6

haloalkynyl, -O-C_1-C_6 alkyl, -O-C_2-C_6 alkenyl, and -O-C_2-C_6 alkynyl are substituted by 0 to 3 substituents selected from the group consisting of F, Cl, Br, I, OH, CN, and N_3;

R^3 is selected from the group consisting of H, F, Cl, Br, I, OH, CN, N_3, C_1-C_6 alkyl, C_2-C_6 alkenyl, C_2-C_6 alkynyl, C_1-C_6 haloalkyl, C_2-C_6 haloalkenyl, C_2-C_6 haloalkynyl, -O-C_1-C_6 alkyl, -O-C_2-C_6 alkenyl, and -O-C_2-C_6 alkynyl, where said R^3 C_1-C_6 alkyl, C_2-C_6 alkenyl, C_2-C_6 alkynyl, C_1-C_6 haloalkyl, C_2-C_6 haloalkenyl, C_2-C_6 haloalkynyl, -O-C_1-C_6 alkyl, -O-C_2-C_6 alkenyl, and -O-C_2-C_6 alkynyl are substituted by 0 to 3 substituents selected from the group consisting of F, Cl, Br, I, OH, CN, and N_3;

R^4 and R^{4a} are each independently selected from the group consisting of H, F, Cl, Br, I, OH, CN, N_3, C_1-C_6 alkyl, C_2-C_6 alkenyl, C_2-C_6 alkynyl, C_1-C_6 haloalkyl, C_2-C_6 haloalkenyl, C_2-C_6 haloalkynyl, -O-C_1-C_6 alkyl, -O-C_2-C_6 alkenyl, and -O-C_2-C_6 alkynyl, where said R^4 and R^{4a} C_1-C_6 alkyl, C_2-C_6 alkenyl, C_2-C_6 alkynyl, C_1-C_6 haloalkyl, C_2-C_6 haloalkenyl, C_2-C_6 haloalkynyl, -O-C_1-C_6 alkyl, -O-C_2-C_6 alkenyl, and -O-C_2-C_6 alkynyl are substituted by 0 to 3 substituents selected from the group consisting of F, Cl, Br, I, OH, CN, and N_3;

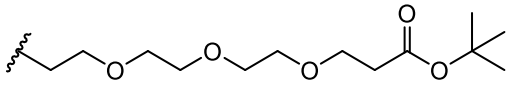
R^5 is selected from the group consisting of H, F, Cl, Br, I, OH, CN, N_3, C_1-C_6 alkyl, C_2-C_6 alkenyl, C_2-C_6 alkynyl, C_1-C_6 haloalkyl, C_2-C_6 haloalkenyl, C_2-C_6 haloalkynyl, -O-C_1-C_6 alkyl, -O-C_2-C_6 alkenyl, and -O-C_2-C_6 alkynyl, where said R^5 C_1-C_6 alkyl, C_2-C_6 alkenyl, C_2-C_6 alkynyl, C_1-C_6 haloalkyl, C_2-C_6 haloalkenyl, C_2-C_6 haloalkynyl, -O-C_1-C_6 alkyl, -O-C_2-C_6 alkenyl, and -O-C_2-C_6 alkynyl are substituted by 0 to 3 substituents selected from the group consisting of F, Cl, Br, I, OH, CN, and N_3;

R^6 and R^{6a} are each independently selected from the group consisting of H, F, Cl, Br, I, OH, CN, N_3, C_1-C_6 alkyl, C_2-C_6 alkenyl, C_2-C_6 alkynyl, C_1-C_6 haloalkyl, C_2-C_6 haloalkenyl, C_2-C_6 haloalkynyl, -O-C_1-C_6 alkyl, -O-C_2-C_6 alkenyl, and -O-C_2-C_6 alkynyl, where said R^6 and R^{6a} C_1-C_6 alkyl, C_2-C_6 alkenyl, C_2-C_6 alkynyl, C_1-C_6 haloalkyl, C_2-C_6 haloalkenyl, C_2-C_6 haloalkynyl, -O-C_1-C_6 alkyl, -O-C_2-C_6 alkenyl, and -O-C_2-C_6 alkynyl are substituted by 0 to 3 substituents selected from the group consisting of F, Cl, Br, I, OH, CN, and N_3;

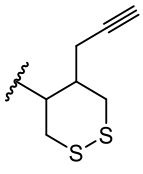
R^7 and R^{7a} are each independently selected from the group consisting of H, F, Cl, Br, I, OH, CN, N_3, C_1-C_6 alkyl, C_2-C_6 alkenyl, C_2-C_6 alkynyl, C_1-C_6 haloalkyl, C_2-C_6 haloalkenyl, C_2-C_6 haloalkynyl, -O-C_1-C_6 alkyl, -O-C_2-C_6 alkenyl, and -O-C_2-C_6 alkynyl, where said R^7 and R^{7a} C_1-C_6 alkyl, C_2-C_6 alkenyl, C_2-C_6 alkynyl, C_1-C_6 haloalkyl, C_2-C_6 haloalkenyl, C_2-C_6 haloalkynyl, -O-C_1-C_6 alkyl, -O-C_2-C_6 alkenyl, and -O-C_2-C_6 alkynyl are substituted by 0 to 3 substituents selected from the group consisting of F, Cl, Br, I, OH, CN, and N_3;

R^8 and R^{8a} are each independently selected from the group consisting of H, F, Cl, Br, I, OH, CN, N_3, C_1-C_6 alkyl, C_2-C_6 alkenyl, C_2-C_6 alkynyl, C_1-C_6 haloalkyl, C_2-C_6 haloalkenyl, C_2-C_6 haloalkynyl, -O-C_1-C_6 alkyl, -O-C_2-C_6 alkenyl, and -O-C_2-C_6 alkynyl, where said R^8 and R^{8a} C_1-C_6 alkyl, C_2-C_6 alkenyl, C_2-C_6 alkynyl, C_1-C_6 haloalkyl, C_2-C_6 haloalkenyl, C_2-C_6 haloalkynyl, -O-C_1-C_6 alkyl, -O-C_2-C_6 alkenyl, and -O-C_2-C_6 alkynyl are substituted by 0 to 3 substituents selected from the group consisting of F, Cl, Br, I, OH, CN, and N_3;

each R^9 is independently selected from the group consisting of H, C_1-C_{20} alkyl,



, and



, where each R^9 C_1-C_{20} alkyl is optionally substituted by 0 to 3 substituents independently selected from the group consisting of OH, -O-C_1-C_{20} alkyl,-S-C(O)C_1-C_6 alkyl, and C(O)OC_1-C_6 alkyl;

optionally R^{1a} and R^3 are connected to form C_1-C_6 alkylene, C_2-C_6 alkenylene, C_2-C_6 alkynylene, -O-C_1-C_6 alkylene, -O-C_2-C_6 alkenylene, or -O-C_2-C_6 alkynylene, such that where R^{1a} and R^3 are connected to form -O-C_1-C_6 alkylene, -O-C_2-C_6 alkenylene, or -O-C_2-C_6 alkynylene, said O is bound at the R^3 position;

optionally R^{2a} and R^3 are connected to form C_1-C_6 alkylene, C_2-C_6 alkenylene, C_2-C_6 alkynylene, -O-C_1-C_6 alkylene, -O-C_2-C_6 alkenylene, or -O-C_2-C_6 alkynylene, such that where R^{2a} and R^3 are connected to form -O-C_1-C_6 alkylene, -O-C_2-C_6 alkenylene, or -O-C_2-C_6 alkynylene, said O is bound at the R^3 position;

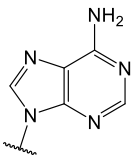
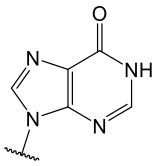
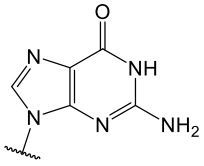
optionally R^3 and R^{6a} are connected to form -O-C_1-C_6 alkylene, -O-C_2-C_6 alkenylene, or -O-C_2-C_6 alkynylene, such that where R^3 and R^{6a} are connected to form -O-C_1-C_6 alkylene, -O-C_2-C_6 alkenylene, or -O-C_2-C_6 alkynylene, said O is bound at the R^3 position;

optionally R^4 and R^5 are connected to form are connected to form C_1-C_6 alkylene, C_2-C_6 alkenylene, C_2-C_6 alkynylene, -O-C_1-C_6 alkylene, -O-C_2-C_6 alkenylene, or -O-C_2-C_6 alkynylene, such that where R^4 and R^5 are connected to form -O-C_1-C_6 alkylene, -O-C_2-C_6 alkenylene, or -O-C_2-C_6 alkynylene, said O is bound at the R^5 position;

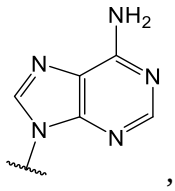
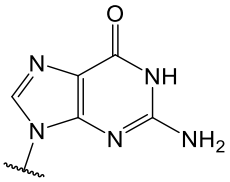
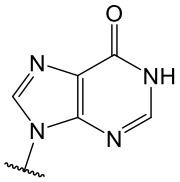
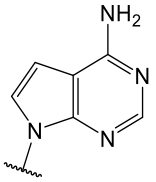
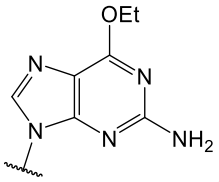
optionally R^5 and R^6 are connected to form -O-C_1-C_6 alkylene, -O-C_2-C_6 alkenylene, or -O-C_2-C_6 alkynylene, such that where R^5 and R^6 are connected to form -O-C_1-C_6 alkylene, -O-C_2-C_6 alkenylene, or -O-C_2-C_6 alkynylene, said O is bound at the R^5 position;

optionally R^7 and R^8 are connected to form C_1-C_6 alkylene, C_2-C_6 alkenylene, or C_2-C_6 alkynylene; and

optionally R^{7a} and R^{8a} are connected to form C_1-C_6 alkylene, C_2-C_6 alkenylene, or C_2-C_6 alkynylene; and

providing that when Y and Y^a are each O, X^a and X^{a1} are each O, X^b and X^{b1} are each O, and X^c and X^{c1} are each OH or SH, X^d and X^{d1} are each O, R^1 and R^{1a} are each H, R^2 is H, R^6 and R^{6a} are each H, R^7 and R^{7a} are each H, R^8 and R^{8a} are each H, and $Base^1$ and $Base^2$ are each selected from the group consisting of  ,  and  , R^5 and R^3 are not both selected from the group consisting of H, F and OH.

2. The compound according to claim 1, or a pharmaceutically acceptable salt, hydrate, solvate, or prodrug thereof, wherein

$Base^1$ and $Base^2$ are each independently selected from the group consisting of  ,  ,  ,  , and  , where $Base^1$ and $Base^2$ each may be independently substituted by 0-3 substituents R^{10}, where each R^{10} is independently selected from the group consisting of F, Cl, I, Br, OH, SH, NH_2, C_{1-3} alkyl, C_{3-6} cycloalkyl, $O(C_{1-3}$ alkyl), $O(C_{3-6}$ cycloalkyl), $S(C_{1-3}$ alkyl), $S(C_{3-6}$ cycloalkyl), $NH(C_{1-3}$ alkyl), $NH(C_{3-6}$ cycloalkyl), $N(C_{1-3}$ alkyl)$_2$, and $N(C_{3-6}$ cycloalkyl)$_2$;

Y and Y^a are each independently selected from the group consisting of -O- and -S-;

X^a and X^{a1} are each independently selected from the group consisting of O and S;

X^b and X^{b1} are each independently selected from the group consisting of O and S;

X^c and X^{c1} are each independently selected from the group consisting of SR^9, OR^9, and NR^9R^9;

X^d and X^{d1} are each independently selected from the group consisting of O and S;

R^1 and R^{1a} are each H;

R^2 and R^{2a} are each independently selected from the group consisting of H, F, Cl, Br, I, OH, N_3, C_1-C_6 alkyl, and C_1-C_6 haloalkyl, where said R^2 and R^{2a} C_1-C_6 alkyl or C_1-C_6 haloalkyl are substituted by 0 to 3 substituents selected from the group consisting of F, Cl, Br, I, OH, CN, and N_3;

R^3 is selected from the group consisting of H, F, Cl, Br, I, OH, CN, N_3, C_1-C_6 alkyl, and C_1-C_6 haloalkyl, where said R^3 C_1-C_6 alkyl or C_1-C_6 haloalkyl are substituted by 0 to 3 substituents selected from the group consisting of F, Cl, Br, I, OH, CN, and N_3;

R^4 and R^{4a} are each independently selected from the group consisting of H, C_1-C_6 alkyl, and C_1-C_6 haloalkyl, where said R^4 and R^{4a} C_1-C_6 alkyl or C_1-C_6 haloalkyl are substituted by 0 to 3 substituents selected from the group consisting of F, Cl, Br, I, OH, CN, and N_3;

R^5 is selected from the group consisting of H, F, Cl, Br, I, OH, N_3, C_1-C_6 alkyl, and C_1-C_6 haloalkyl, where said R^5 C_1-C_6 alkyl or C_1-C_6 haloalkyl are substituted by 0 to 3 substituents selected from the group consisting of F, Cl, Br, I, OH, CN, and N_3;

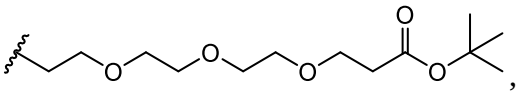
R^3 and R^5 are not both selected from the group consisting of: OH, C_1-C_6 alkyl substituted with OH, or C_1-C_6 haloalkyl substituted with OH; and

R^6 and R^{6a} are each independently selected from the group consisting of H, F, Cl, Br, I, OH, C_1-C_6 alkyl, C_2-C_6 alkenyl, C_2-C_6 alkynyl, and C_1-C_6 haloalkyl, where said R^6 and R^{6a} C_1-C_6 alkyl or C_1-C_6 haloalkyl are substituted by 0 to 3 substituents selected from the group consisting of F, Cl, Br, I, OH, CN, and N_3;

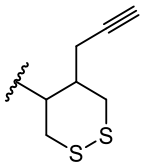
R^7 and R^{7a} are each H;

R^8 and R^{8a} are each H;

each R^9 is independently selected from the group consisting of H, C_2-C_3 alkyl,



, and

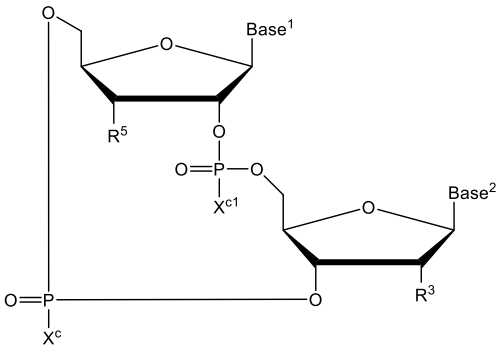


, where each R^9 C_2-C_3 alkyl is optionally substituted by 1 to 2 substituents independently selected from the group consisting of OH, -O-C_1-C_{20} alkyl,-S-C(O)C_1-C_6 alkyl, and C(O)OC_1-C_6 alkyl;

optionally R^3 and R^{6a} are connected to form -O-C_1-C_6 alkylene, -O-C_2-C_6 alkenylene, and -O-C_2-C_6 alkynylene, such that where R^3 and R^{6a} are connected to form -O-C_1-C_6 alkylene, -O-C_2-C_6 alkenylene, or -O-C_2-C_6 alkynylene, said O is bound at the R^3 position; and

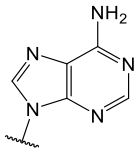
optionally R^4 and R^5 are connected by C_1-C_6 alkylene, -O-C_1-C_6 alkylene, -O-C_2-C_6 alkenylene, or -O-C_2-C_6 alkynylene, such that where R^4 and R^5 are connected to form -O-C_1-C_6 alkylene, -O-C_2-C_6 alkenylene, or -O-C_2-C_6 alkynylene, said O is bound at the R^5 position.

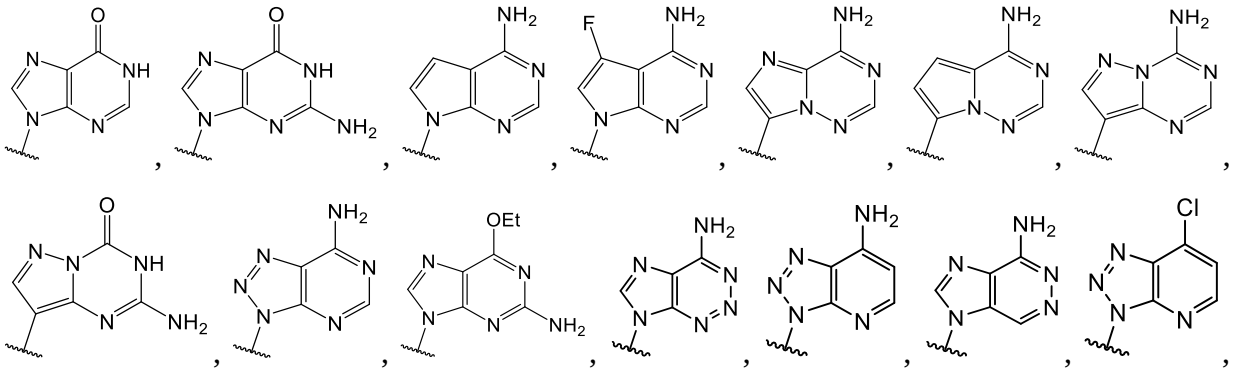
3. The compound according to claim 1, wherein the compound of formula (I) is a compound of formula (Ia):

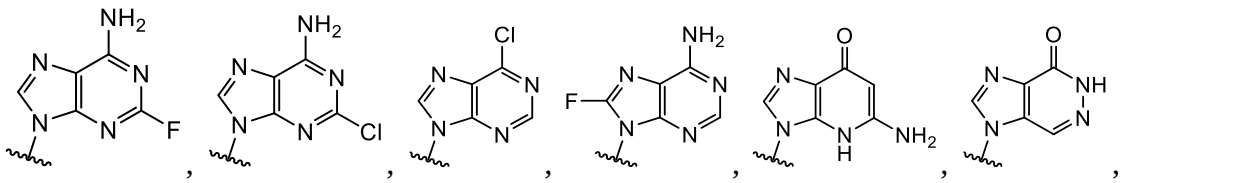


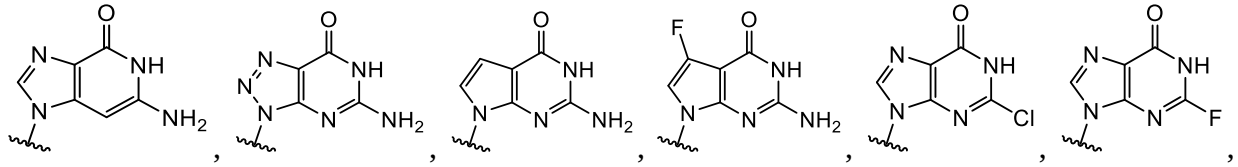
(Ia)

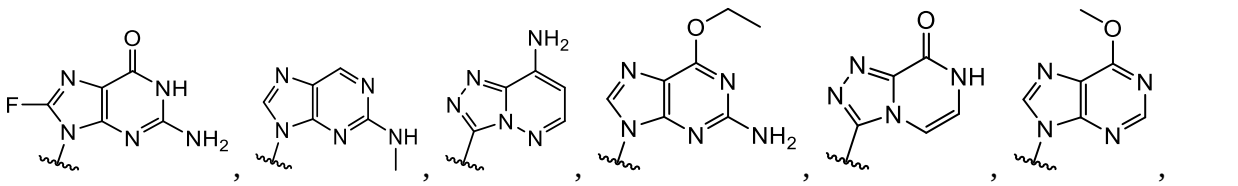
or a pharmaceutically acceptable salt, hydrate, solvate, or prodrug thereof, wherein

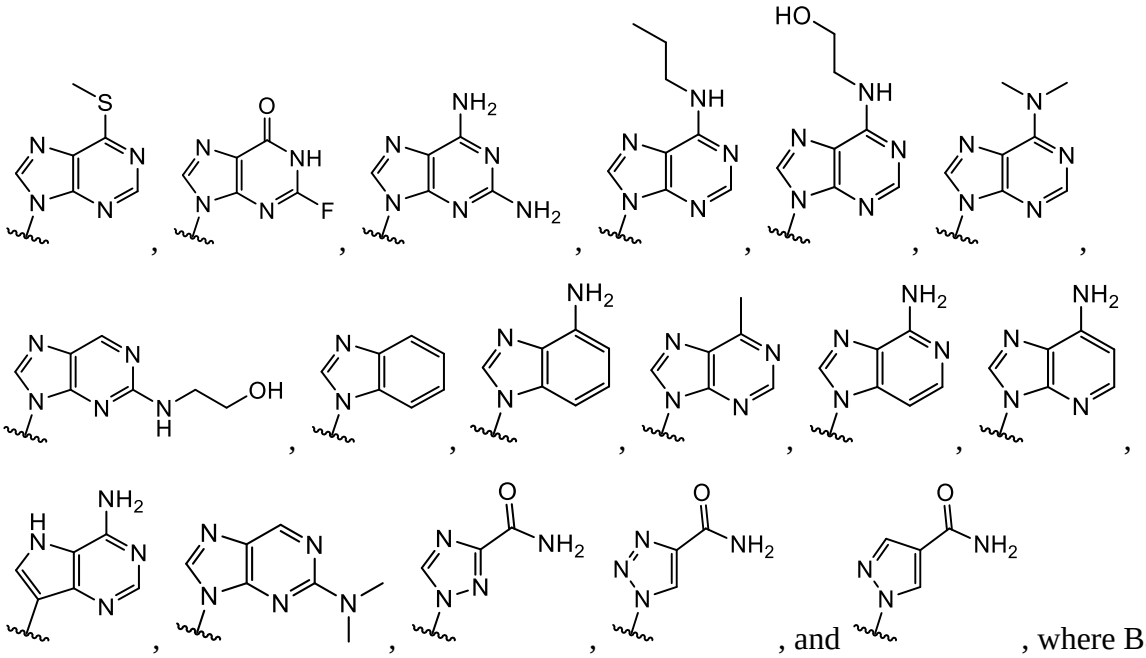
Base^1 and Base^2 are each independently selected from the group consisting of  ,











and Base[2] each may be independently substituted by 0-3 substituents R^{10}, where each R^{10} is independently selected from the group consisting of F, Cl, I, Br, OH, SH, NH_2, C_{1-3} alkyl, C_{3-6} cycloalkyl, $O(C_{1-3}$ alkyl), $O(C_{3-6}$ cycloalkyl), $S(C_{1-3}$ alkyl), $S(C_{3-6}$ cycloalkyl), $NH(C_{1-3}$ alkyl), $NH(C_{3-6}$ cycloalkyl), $N(C_{1-3}$ alkyl)$_2$, and $N(C_{3-6}$ cycloalkyl)$_2$;

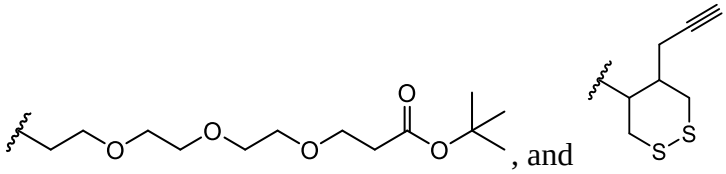
X^c and X^{c1} are each independently selected from the group consisting of SR^9, OR^9, and NR^9R^9;

R^3 is selected from the group consisting of H, F, Cl, Br, I, OH, CN, N_3, C_1-C_6 alkyl, and C_1-C_6 haloalkyl, where said R^3 C_1-C_6 alkyl or C_1-C_6 haloalkyl are substituted by 0 to 3 substituents selected from the group consisting of F, Cl, Br, I, and OH;

R^5 is selected from the group consisting of H, F, Cl, Br, I, OH, CN, N_3, C_1-C_6 alkyl, and C_1-C_6 haloalkyl, where said R^5 C_1-C_6 alkyl or C_1-C_6 haloalkyl are substituted by 0 to 3 substituents selected from the group consisting of F, Cl, Br, I, and OH;

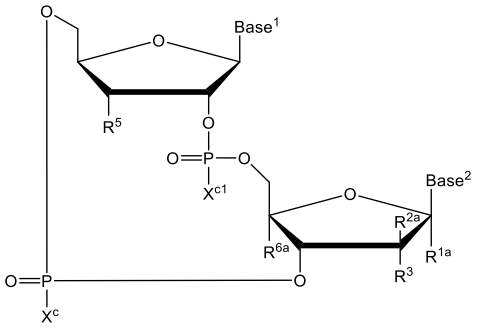
R^3 and R^5 are not both selected from the group consisting of: OH, R^5 C_1-C_6 alkyl substituted with OH, or C_1-C_6 haloalkyl substituted with OH; and

each R^9 is independently selected from the group consisting of H, C_2-C_3 alkyl,



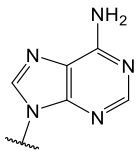
, and , where each R^9 C_2-C_3 alkyl is optionally substituted by 1 to 2 substituents independently selected from the group consisting of OH, -O-C_1-C_{20} alkyl,-S-C(O)C_1-C_6 alkyl, and C(O)OC_1-C_6 alkyl.

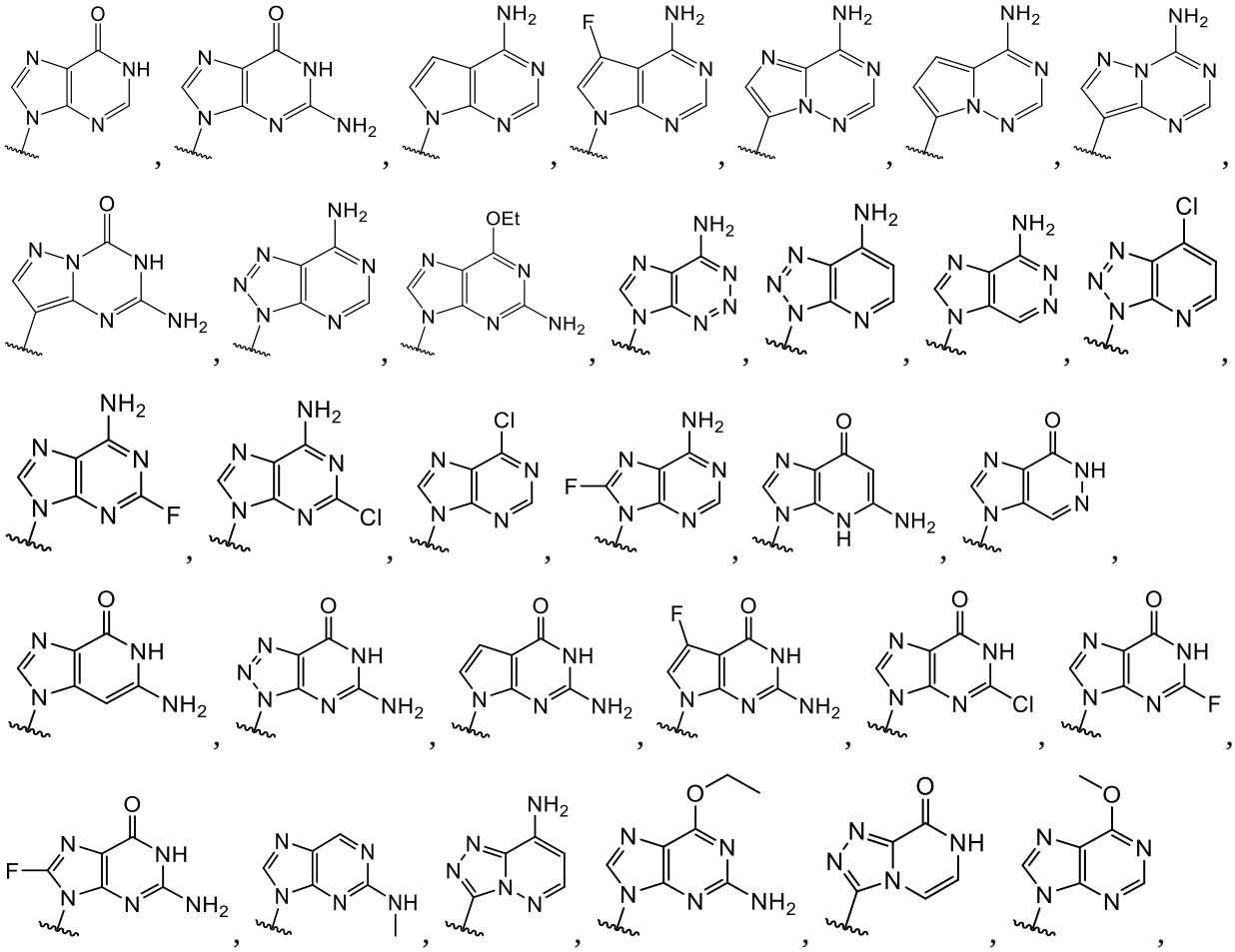
4. The compound according to claim 1, wherein the compound of formula (I) is a compound of formula (Ib):

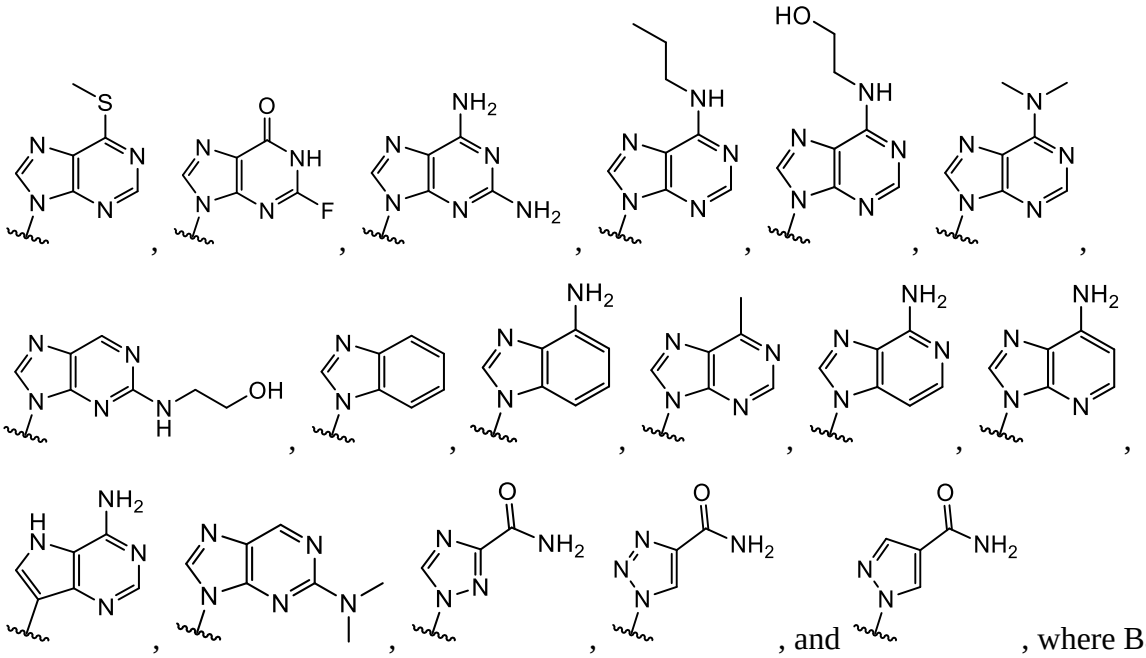


(Ib)

or a pharmaceutically acceptable salt, hydrate, solvate, or prodrug thereof, wherein

$Base^1$ and $Base^2$ are each independently selected from the group consisting of  ,





and Base[2] each may be independently substituted by 0-3 substituents R^{10}, where each R^{10} is independently selected from the group consisting of F, Cl, I, Br, OH, SH, NH_2, C_{1-3} alkyl, C_{3-6} cycloalkyl, $O(C_{1-3}$ alkyl), $O(C_{3-6}$ cycloalkyl), $S(C_{1-3}$ alkyl), $S(C_{3-6}$ cycloalkyl), $NH(C_{1-3}$ alkyl), $NH(C_{3-6}$ cycloalkyl), $N(C_{1-3}$ alkyl)$_2$, and $N(C_{3-6}$ cycloalkyl)$_2$;

X^c and X^{c1} are each independently selected from the group consisting of SR^9, OR^9, and NR^9R^9;

R^{1a} is selected from the group consisting of H, F, Cl, Br, I, OH, CN, N_3, C_1-C_6 alkyl, C_2-C_6 alkenyl, C_2-C_6 alkynyl, C_1-C_6 haloalkyl, C_2-C_6 haloalkenyl, C_2-C_6 haloalkynyl, -O-C_1-C_6 alkyl, -O-C_2-C_6 alkenyl, and -O-C_2-C_6 alkynyl, where said R^{1a} C_1-C_6 alkyl, C_2-C_6 alkenyl, C_2-C_6 alkynyl, C_1-C_6 haloalkyl, C_2-C_6 haloalkenyl, C_2-C_6 haloalkynyl, -O-C_1-C_6 alkyl, -O-C_2-C_6 alkenyl, and -O-C_2-C_6 alkynyl are substituted by 0 to 3 substituents selected from the group consisting of F, Cl, Br, I, OH, CN, and N_3;

R^{2a} is selected from the group consisting of H, F, Cl, Br, I, OH, CN, N_3, C_1-C_6 alkyl, and C_1-C_6 haloalkyl, where said R^{2a} C_1-C_6 alkyl or C_1-C_6 haloalkyl are substituted by 0 to 3 substituents selected from the group consisting of F, Cl, Br, I, and OH;

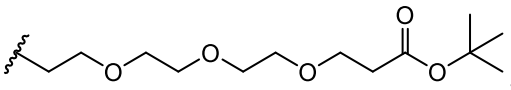
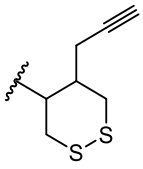
R^3 is selected from the group consisting of H, F, Cl, Br, I, OH, CN, N_3, C_1-C_6 alkyl, and C_1-C_6 haloalkyl, where said R^3 C_1-C_6 alkyl or C_1-C_6 haloalkyl are substituted by 0 to 3 substituents selected from the group consisting of F, Cl, Br, I, and OH;

R^5 is selected from the group consisting of H, F, Cl, Br, I, OH, CN, N_3, C_1-C_6 alkyl, and C_1-C_6 haloalkyl, where said R^5 C_1-C_6 alkyl or C_1-C_6 haloalkyl are substituted by 0 to 3 substituents selected from the group consisting of F, Cl, Br, I, and OH;

R^3 and R^5 are not both selected from the group consisting of OH, C_1-C_6 alkyl substituted with OH, and C_1-C_6 haloalkyl substituted with OH;

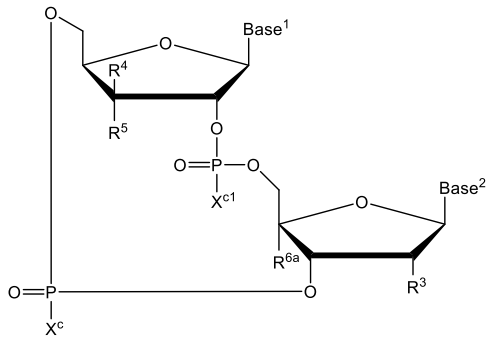
R^{6a} is selected from the group consisting of H, F, Cl, Br, I, OH, C_1-C_6 alkyl, C_2-C_6 alkenyl, and C_2-C_6 alkynyl;

each R^9 is independently selected from the group consisting of H, C_2-C_3 alkyl,

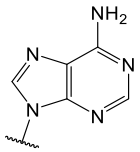

, and

, where each R^9 C_2-C_3 alkyl is optionally substituted by 1 to 2 substituents independently selected from the group consisting of OH, -O-C_1-C_{20} alkyl,-S-C(O)C_1-C_6 alkyl, and C(O)OC_1-C_6 alkyl; and

optionally R^3 and R^{6a} are connected to form -O-C_1-C_6 alkylene, -O-C_2-C_6 alkenylene, and -O-C_2-C_6 alkynylene, such that where R^3 and R^{6a} are connected to form -O-C_1-C_6 alkylene, -O-C_2-C_6 alkenylene, or -O-C_2-C_6 alkynylene, said O is bound at the R^3 position.

5. The compound according to claim 1, wherein the compound of formula (I) is a compound of formula (Ic):


(Ic)

or a pharmaceutically acceptable salt, hydrate, solvate, or prodrug thereof, wherein

$Base^1$ and $Base^2$ are each independently selected from the group consisting of

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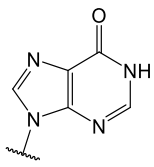
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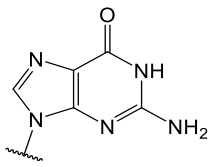
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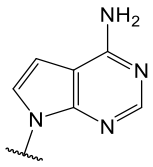
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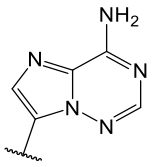
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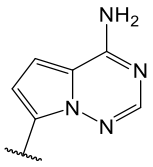
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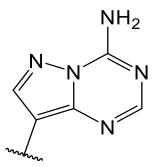
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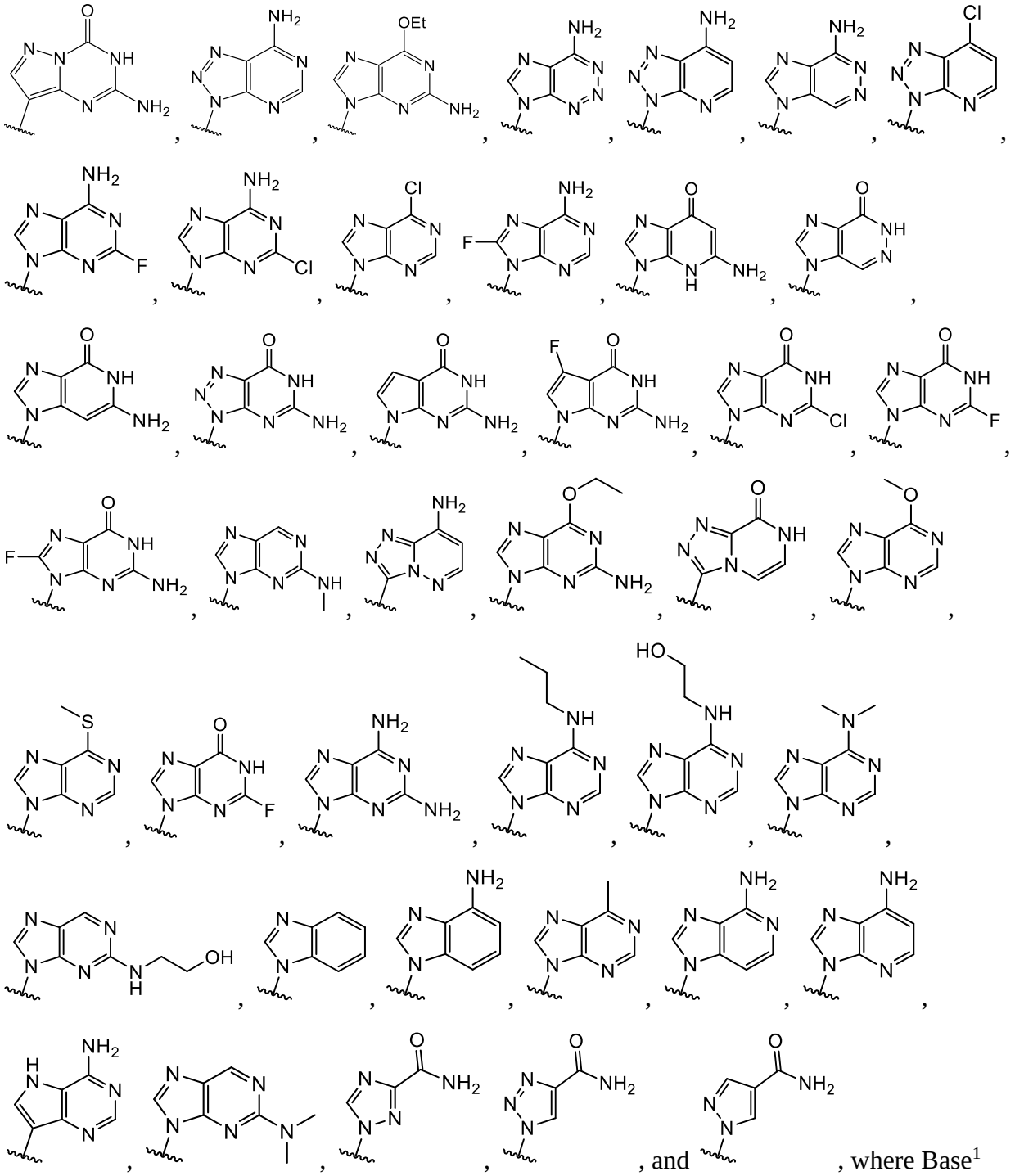


and Base[2] each may be independently substituted by 0-3 substituents R^{10}, where each R^{10} is independently selected from the group consisting of F, Cl, I, Br, OH, SH, NH_2, C_{1-3} alkyl, C_{3-6} cycloalkyl, $O(C_{1-3}$ alkyl), $O(C_{3-6}$ cycloalkyl), $S(C_{1-3}$ alkyl), $S(C_{3-6}$ cycloalkyl), $NH(C_{1-3}$ alkyl), $NH(C_{3-6}$ cycloalkyl), $N(C_{1-3}$ alkyl)$_2$, and $N(C_{3-6}$ cycloalkyl)$_2$;

X^c and X^{c1} are each independently selected from the group consisting of SR^9, OR^9, and NR^9R^9;

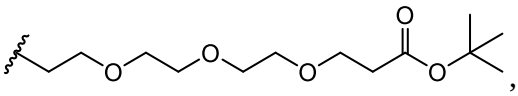
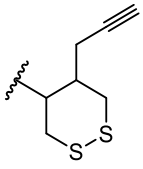
R^3 is selected from the group consisting of H, F, Cl, Br, I, OH, CN, N_3, C_1-C_6 alkyl, and C_1-C_6 haloalkyl, where said R^3 C_1-C_6 alkyl or C_1-C_6 haloalkyl are substituted by 0 to 3 substituents selected from the group consisting of F, Cl, Br, I, and OH;

R^4 is selected from the group consisting of H, F, Cl, Br, I, OH, CN, N_3, C_1-C_6 alkyl, and C_1-C_6 haloalkyl, where said R^4 C_1-C_6 alkyl or C_1-C_6 haloalkyl are substituted by 0 to 3 substituents selected from the group consisting of F, Cl, Br, I, and OH;

R^5 is selected from the group consisting of H, F, Cl, Br, I, OH, CN, N_3, C_1-C_6 alkyl, and C_1-C_6 haloalkyl, where said R^5 C_1-C_6 alkyl or C_1-C_6 haloalkyl are substituted by 0 to 3 substituents selected from the group consisting of F, Cl, Br, I, and OH;

R^3 and R^5 are not both selected from the group consisting of: OH, C_1-C_6 alkyl substituted with OH, or C_1-C_6 haloalkyl substituted with OH;

R^{6a} is selected from the group consisting of H, F, Cl, Br, I, OH, CN, N_3, C_1-C_6 alkyl, and C_1-C_6 haloalkyl, where said R^{6a} C_1-C_6 alkyl or C_1-C_6 haloalkyl are substituted by 0 to 3 substituents selected from the group consisting of F, Cl, Br, I, and OH;

each R^9 is independently selected from the group consisting of H, C_2-C_3 alkyl,  , and  , where each R^9 C_2-C_3 alkyl is optionally substituted by 1 to 2 substituents independently selected from the group consisting of OH, -O-C_1-C_{20} alkyl,-S-C(O)C_1-C_6 alkyl, and C(O)OC_1-C_6 alkyl; and

optionally R^4 and R^5 are connected by C_1-C_6 alkylene, -O-C_1-C_6 alkylene, -O-C_2-C_6 alkenylene, or -O-C_2-C_6 alkynylene, such that where R^4 and R^5 are connected to form -O-C_1-C_6 alkylene, -O-C_2-C_6 alkenylene, or -O-C_2-C_6 alkynylene, said O is bound at the R^5 position.

6. A pharmaceutical composition, said pharmaceutical composition comprising:

(a) a compound according to any one of claims 1 to 5 or a pharmaceutically acceptable salt, hydrate, solvate, or prodrug thereof; and

(b) a pharmaceutically acceptable carrier.

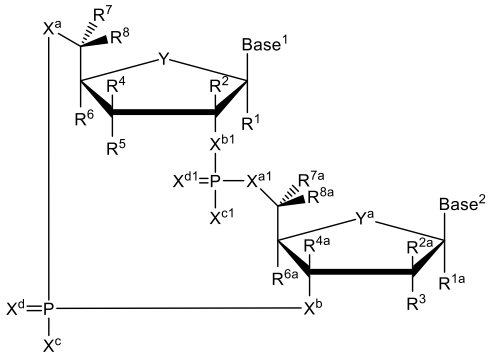
7. Use of a compound according to any one of claims 1 to 5 in the manufacture of a medicament for ~~A method of~~ inducing an immune response ~~in a subject, said method comprising administering a therapeutically effective amount of a compound according to any one of claims 1 to 5 to the subject~~.

8. Use of a pharmaceutical composition according to claim 6 in the manufacture of a medicament for ~~A method of~~ inducing an immune response ~~in a subject, said method comprising administering a therapeutically effective amount of a pharmaceutical composition according to claim 6 to the subject~~.

9. Use of a compound according to any one of claims 1 to 5 in the manufacture of a medicament for ~~A method of~~ inducing a STING-dependent type I interferon production ~~in a subject, said method comprising administering a therapeutically effective amount of a compound according to any one of claims 1 to 5 to the subject~~.

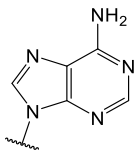
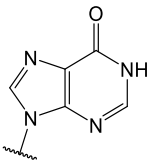
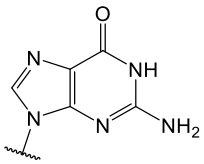
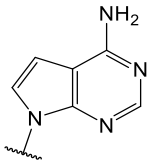
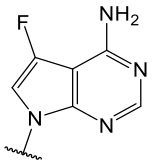
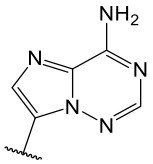
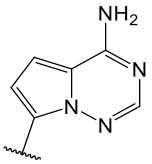
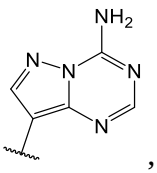
10. Use of a pharmaceutical composition according to claim 6 in the manufacture of a medicament for ~~A method of~~ inducing a STING-dependent type I interferon production ~~in a subject, said method comprising administering a therapeutically effective amount of a pharmaceutical composition according to claim 6 to the subject~~.

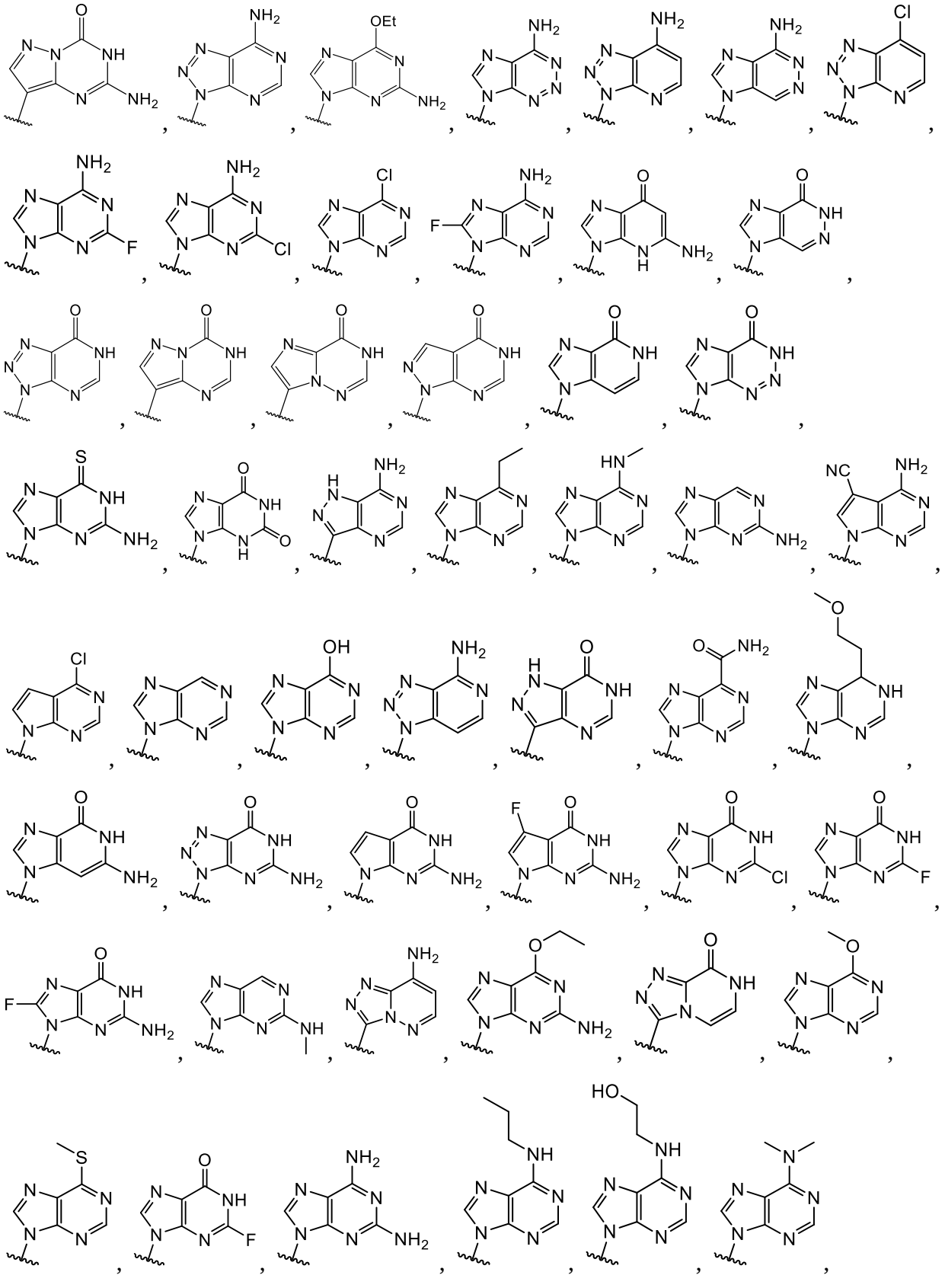
11. A compound of formula (I'):

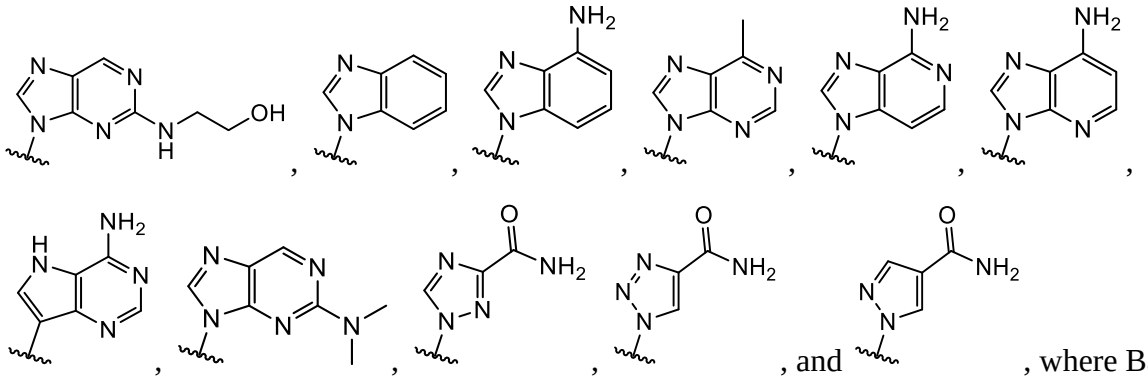


(I')

or a pharmaceutically acceptable salt, hydrate, solvate, or prodrug thereof, wherein

$Base^1$ and $Base^2$ are each independently selected from the group consisting of  ,  ,  ,  ,  ,  ,  ,  ,





and Base[2] each may be independently substituted by 0-3 substituents R^{10}, where each R^{10} is independently selected from the group consisting of F, Cl, I, Br, OH, SH, NH_2, C_{1-3} alkyl, C_{3-6} cycloalkyl, $O(C_{1-3}$ alkyl), $O(C_{3-6}$ cycloalkyl), $S(C_{1-3}$ alkyl), $S(C_{3-6}$ cycloalkyl), $NH(C_{1-3}$ alkyl), $NH(C_{3-6}$ cycloalkyl), $N(C_{1-3}$ alkyl)$_2$, and $N(C_{3-6}$ cycloalkyl)$_2$;

Y and Y^a are each independently selected from the group consisting of -O- and -S-;

X^a and X^{a1} are each independently selected from the group consisting of O, and S;

X^b and X^{b1} are each independently selected from the group consisting of O, and S;

X^c and X^{c1} are each independently selected from the group consisting of OR^9, SR^9, and NR^9R^9;

X^d and X^{d1} are each independently selected from the group consisting of O and S;

R^1 and R^{1a} are each independently selected from the group consisting of H, F, Cl, Br, I, OH, CN, N_3, C_1-C_6 alkyl, C_2-C_6 alkenyl, C_2-C_6 alkynyl, C_1-C_6 haloalkyl, C_2-C_6 haloalkenyl, C_2-C_6 haloalkynyl, -O-C_1-C_6 alkyl, -O-C_2-C_6 alkenyl, and -O-C_2-C_6 alkynyl, where said R^1 and R^{1a} C_1-C_6 alkyl, C_2-C_6 alkenyl, C_2-C_6 alkynyl, C_1-C_6 haloalkyl, C_2-C_6 haloalkenyl, C_2-C_6 haloalkynyl, -O-C_1-C_6 alkyl, -O-C_2-C_6 alkenyl, and -O-C_2-C_6 alkynyl are substituted by 0 to 3 substituents selected from the group consisting of F, Cl, Br, I, OH, CN, and N_3;

R^2 and R^{2a} are each independently selected from the group consisting of H, F, Cl, Br, I, OH, CN, N_3, C_1-C_6 alkyl, C_2-C_6 alkenyl, C_2-C_6 alkynyl, C_1-C_6 haloalkyl, C_2-C_6 haloalkenyl, C_2-C_6 haloalkynyl, -O-C_1-C_6 alkyl, -O-C_2-C_6 alkenyl, and -O-C_2-C_6 alkynyl, where said R^2 and R^{2a} C_1-C_6 alkyl, C_2-C_6 alkenyl, C_2-C_6 alkynyl, C_1-C_6 haloalkyl, C_2-C_6 haloalkenyl, C_2-C_6 haloalkynyl, -O-C_1-C_6 alkyl, -O-C_2-C_6 alkenyl, and -O-C_2-C_6 alkynyl are substituted by 0 to 3 substituents selected from the group consisting of F, Cl, Br, I, OH, CN, and N_3;

R^3 is selected from the group consisting of H, F, Cl, Br, I, OH, CN, N_3, C_1-C_6 alkyl, C_2-C_6 alkenyl, C_2-C_6 alkynyl, C_1-C_6 haloalkyl, C_2-C_6 haloalkenyl, C_2-C_6 haloalkynyl, -O-C_1-C_6 alkyl, -O-C_2-C_6 alkenyl, and -O-C_2-C_6 alkynyl, where said R^3 C_1-C_6 alkyl, C_2-C_6 alkenyl, C_2-C_6 alkynyl, C_1-C_6 haloalkyl, C_2-C_6 haloalkenyl, C_2-C_6 haloalkynyl, -O-C_1-C_6 alkyl, -O-C_2-C_6

alkenyl, and -O-C_2-C_6 alkynyl are substituted by 0 to 3 substituents selected from the group consisting of F, Cl, Br, I, OH, CN, and N_3;

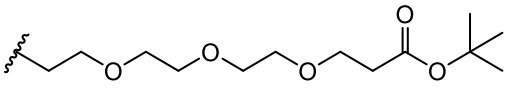
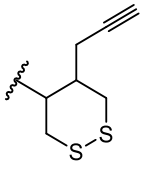
R^4 and R^{4a} are each independently selected from the group consisting of H, F, Cl, Br, I, OH, CN, N_3, C_1-C_6 alkyl, C_2-C_6 alkenyl, C_2-C_6 alkynyl, C_1-C_6 haloalkyl, C_2-C_6 haloalkenyl, C_2-C_6 haloalkynyl, -O-C_1-C_6 alkyl, -O-C_2-C_6 alkenyl, and -O-C_2-C_6 alkynyl, where said R^4 and R^{4a} C_1-C_6 alkyl, C_2-C_6 alkenyl, C_2-C_6 alkynyl, C_1-C_6 haloalkyl, C_2-C_6 haloalkenyl, C_2-C_6 haloalkynyl, -O-C_1-C_6 alkyl, -O-C_2-C_6 alkenyl, and -O-C_2-C_6 alkynyl are substituted by 0 to 3 substituents selected from the group consisting of F, Cl, Br, I, OH, CN, and N_3;

R^5 is selected from the group consisting of H, F, Cl, Br, I, OH, CN, NH_2, N_3, C_1-C_6 alkyl, C_2-C_6 alkenyl, C_2-C_6 alkynyl, C_1-C_6 haloalkyl, C_2-C_6 haloalkenyl, C_2-C_6 haloalkynyl, -O-C_1-C_6 alkyl, -O-C_2-C_6 alkenyl, and -O-C_2-C_6 alkynyl, where said R^5 C_1-C_6 alkyl, C_2-C_6 alkenyl, C_2-C_6 alkynyl, C_1-C_6 haloalkyl, C_2-C_6 haloalkenyl, C_2-C_6 haloalkynyl, -O-C_1-C_6 alkyl, -O-C_2-C_6 alkenyl, and -O-C_2-C_6 alkynyl are substituted by 0 to 3 substituents selected from the group consisting of F, Cl, Br, I, OH, CN, NR^9R^9, and N_3;

R^6 and R^{6a} are each independently selected from the group consisting of H, F, Cl, Br, I, OH, CN, N_3, C_1-C_6 alkyl, C_2-C_6 alkenyl, C_2-C_6 alkynyl, C_1-C_6 haloalkyl, C_2-C_6 haloalkenyl, C_2-C_6 haloalkynyl, -O-C_1-C_6 alkyl, -O-C_2-C_6 alkenyl, and -O-C_2-C_6 alkynyl, where said R^6 and R^{6a} C_1-C_6 alkyl, C_2-C_6 alkenyl, C_2-C_6 alkynyl, C_1-C_6 haloalkyl, C_2-C_6 haloalkenyl, C_2-C_6 haloalkynyl, -O-C_1-C_6 alkyl, -O-C_2-C_6 alkenyl, and -O-C_2-C_6 alkynyl are substituted by 0 to 3 substituents selected from the group consisting of F, Cl, Br, I, OH, CN, and N_3;

R^7 and R^{7a} are each independently selected from the group consisting of H, F, Cl, Br, I, OH, CN, N_3, C_1-C_6 alkyl, C_2-C_6 alkenyl, C_2-C_6 alkynyl, C_1-C_6 haloalkyl, C_2-C_6 haloalkenyl, C_2-C_6 haloalkynyl, -O-C_1-C_6 alkyl, -O-C_2-C_6 alkenyl, and -O-C_2-C_6 alkynyl, where said R^7 and R^{7a} C_1-C_6 alkyl, C_2-C_6 alkenyl, C_2-C_6 alkynyl, C_1-C_6 haloalkyl, C_2-C_6 haloalkenyl, C_2-C_6 haloalkynyl, -O-C_1-C_6 alkyl, -O-C_2-C_6 alkenyl, and -O-C_2-C_6 alkynyl are substituted by 0 to 3 substituents selected from the group consisting of F, Cl, Br, I, OH, CN, and N_3;

R^8 and R^{8a} are each independently selected from the group consisting of H, F, Cl, Br, I, OH, CN, N_3, C_1-C_6 alkyl, C_2-C_6 alkenyl, C_2-C_6 alkynyl, C_1-C_6 haloalkyl, C_2-C_6 haloalkenyl, C_2-C_6 haloalkynyl, -O-C_1-C_6 alkyl, -O-C_2-C_6 alkenyl, and -O-C_2-C_6 alkynyl, where said R^8 and R^{8a} C_1-C_6 alkyl, C_2-C_6 alkenyl, C_2-C_6 alkynyl, C_1-C_6 haloalkyl, C_2-C_6 haloalkenyl, C_2-C_6 haloalkynyl, -O-C_1-C_6 alkyl, -O-C_2-C_6 alkenyl, and -O-C_2-C_6 alkynyl are substituted by 0 to 3 substituents selected from the group consisting of F, Cl, Br, I, OH, CN, and N_3;

each R^9 is independently selected from the group consisting of H, C_1-C_{20} alkyl,  , and  , where each R^9 C_1-C_{20} alkyl is optionally substituted by 0 to 3 substituents independently selected from the group consisting of OH, -O-C_1-C_{20} alkyl,-S-C(O)C_1-C_6 alkyl, and C(O)OC_1-C_6 alkyl;

optionally R^{1a} and R^3 are connected to form C_1-C_6 alkylene, C_2-C_6 alkenylene, C_2-C_6 alkynylene, -O-C_1-C_6 alkylene, -O-C_2-C_6 alkenylene, or -O-C_2-C_6 alkynylene, such that where R^{1a} and R^3 are connected to form -O-C_1-C_6 alkylene, -O-C_2-C_6 alkenylene, or -O-C_2-C_6 alkynylene, said O is bound at the R^3 position;

optionally R^{2a} and R^3 are connected to form C_1-C_6 alkylene, C_2-C_6 alkenylene, C_2-C_6 alkynylene, -O-C_1-C_6 alkylene, -O-C_2-C_6 alkenylene, or -O-C_2-C_6 alkynylene, such that where R^{2a} and R^3 are connected to form -O-C_1-C_6 alkylene, -O-C_2-C_6 alkenylene, or -O-C_2-C_6 alkynylene, said O is bound at the R^3 position;

optionally R^3 and R^{6a} are connected to form -O-C_1-C_6 alkylene, -O-C_2-C_6 alkenylene, or -O-C_2-C_6 alkynylene, such that where R^3 and R^{6a} are connected to form -O-C_1-C_6 alkylene, -O-C_2-C_6 alkenylene, or -O-C_2-C_6 alkynylene, said O is bound at the R^3 position;

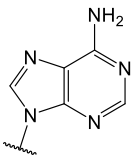
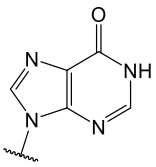
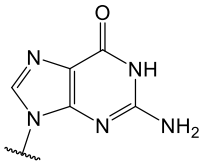
optionally R^4 and R^5 are connected to form are connected to form C_1-C_6 alkylene, C_2-C_6 alkenylene, C_2-C_6 alkynylene, -O-C_1-C_6 alkylene, -O-C_2-C_6 alkenylene, or -O-C_2-C_6 alkynylene, such that where R^4 and R^5 are connected to form -O-C_1-C_6 alkylene, -O-C_2-C_6 alkenylene, or -O-C_2-C_6 alkynylene, said O is bound at the R^5 position;

optionally R^5 and R^6 are connected to form -O-C_1-C_6 alkylene, -O-C_2-C_6 alkenylene, or -O-C_2-C_6 alkynylene, such that where R^5 and R^6 are connected to form -O-C_1-C_6 alkylene, -O-C_2-C_6 alkenylene, or -O-C_2-C_6 alkynylene, said O is bound at the R^5 position;

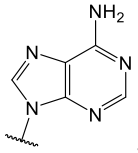
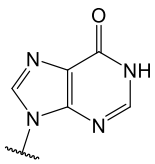
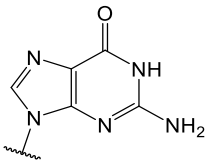
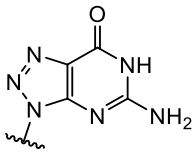
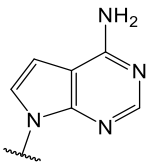
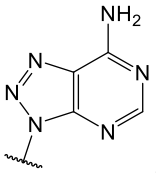
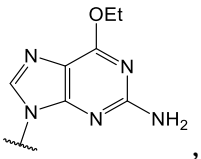
optionally R^7 and R^8 are connected to form C_1-C_6 alkylene, C_2-C_6 alkenylene, or C_2-C_6 alkynylene; and

optionally R^{7a} and R^{8a} are connected to form C_1-C_6 alkylene, C_2-C_6 alkenylene, or C_2-C_6 alkynylene; and

providing that when Y and Y^a are each O, X^a and X^{a1} are each O, X^b and X^{b1} are each O, and X^c and X^{c1} are each OH or SH, X^d and X^{d1} are each O, R^1 and R^{1a} are each H, R^2 is H, R^6 and R^{6a} are each H, R^7 and R^{7a} are each H, R^8 and R^{8a} are each H, and $Base^1$ and $Base^2$ are each

selected from the group consisting of  ,  and  , R^5 and R^3 are not both selected from the group consisting of H, F and OH.

12. The compound according to claim 11, or a pharmaceutically acceptable salt, hydrate, solvate, or prodrug thereof, wherein

$Base^1$ and $Base^2$ are each independently selected from the group consisting of  ,  ,  ,  ,  ,  , and  ,

where $Base^1$ and $Base^2$ each may be independently substituted by 0-3 substituents R^{10}, where each R^{10} is independently selected from the group consisting of F, Cl, I, Br, OH, SH, NH_2, C_{1-3} alkyl, C_{3-6} cycloalkyl, $O(C_{1-3}$ alkyl), $O(C_{3-6}$ cycloalkyl), $S(C_{1-3}$ alkyl), $S(C_{3-6}$ cycloalkyl), $NH(C_{1-3}$ alkyl), $NH(C_{3-6}$ cycloalkyl), $N(C_{1-3}$ alkyl)$_2$, and $N(C_{3-6}$ cycloalkyl)$_2$;

Y and Y^a are each independently selected from the group consisting of -O- and -S-;

X^a and X^{a1} are each independently selected from the group consisting of O and S;

X^b and X^{b1} are each independently selected from the group consisting of O and S;

X^c and X^{c1} are each independently selected from the group consisting of OR^9, SR^9, and NR^9R^9;

X^d and X^{d1} are each independently selected from the group consisting of O and S;

R^1 and R^{1a} are each H;

R^2 and R^{2a} are each independently selected from the group consisting of H, F, Cl, Br, I, OH, N_3, C_1-C_6 alkyl, and C_1-C_6 haloalkyl, where said R^2 and R^{2a} C_1-C_6 alkyl or C_1-C_6 haloalkyl are substituted by 0 to 3 substituents selected from the group consisting of F, Cl, Br, I, OH, CN, and N_3;

R^3 is selected from the group consisting of H, F, Cl, Br, I, OH, CN, N_3, C_1-C_6 alkyl, and C_1-C_6 haloalkyl, where said R^3 C_1-C_6 alkyl or C_1-C_6 haloalkyl are substituted by 0 to 3 substituents selected from the group consisting of F, Cl, Br, I, OH, CN, and N_3;

R^4 and R^{4a} are each independently selected from the group consisting of H, C_1-C_6 alkyl, and C_1-C_6 haloalkyl, where said R^4 and R^{4a} C_1-C_6 alkyl or C_1-C_6 haloalkyl are substituted by 0 to 3 substituents selected from the group consisting of F, Cl, Br, I, OH, CN, and N_3;

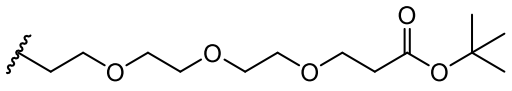
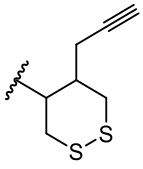
R^5 is selected from the group consisting of H, F, Cl, Br, I, OH, NH_2, N_3, C_1-C_6 alkyl, and C_1-C_6 haloalkyl, where said R^5 C_1-C_6 alkyl or C_1-C_6 haloalkyl are substituted by 0 to 3 substituents selected from the group consisting of F, Cl, Br, I, OH, CN, NR^9R^9, and N_3;

R^3 and R^5 are not both selected from the group consisting of OH, C_1-C_6 alkyl substituted with OH, and C_1-C_6 haloalkyl substituted with OH;

R^6 and R^{6a} are each independently selected from the group consisting of H, F, Cl, Br, I, OH, C_1-C_6 alkyl, C_2-C_6 alkenyl, C_2-C_6 alkynyl, and C_1-C_6 haloalkyl, where said R^6 and R^{6a} C_1-C_6 alkyl or C_1-C_6 haloalkyl are substituted by 0 to 3 substituents selected from the group consisting of F, Cl, Br, I, OH, CN, and N_3;

R^7 and R^{7a} are each H;

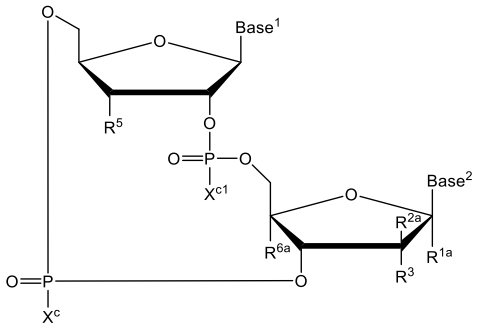
R^8 and R^{8a} are each H;

each R^9 is independently selected from the group consisting of H, C_2-C_3 alkyl,  , and  , where each R^9 C_2-C_3 alkyl is optionally substituted by 1 to 2 substituents independently selected from the group consisting of OH, -O-C_1-C_{20} alkyl,-S-C(O)C_1-C_6 alkyl, and C(O)OC_1-C_6 alkyl;

optionally R^3 and R^{6a} are connected to form -O-C_1-C_6 alkylene, -O-C_2-C_6 alkenylene, and -O-C_2-C_6 alkynylene, such that where R^3 and R^{6a} are connected to form -O-C_1-C_6 alkylene, -O-C_2-C_6 alkenylene, or -O-C_2-C_6 alkynylene, said O is bound at the R^3 position; and

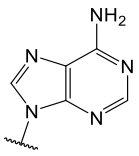
optionally R^4 and R^5 are connected by C_1-C_6 alkylene, -O-C_1-C_6 alkylene, -O-C_2-C_6 alkenylene, or -O-C_2-C_6 alkynylene, such that where R^4 and R^5 are connected to form -O-C_1-C_6 alkylene, -O-C_2-C_6 alkenylene, or -O-C_2-C_6 alkynylene, said O is bound at the R^5 position.

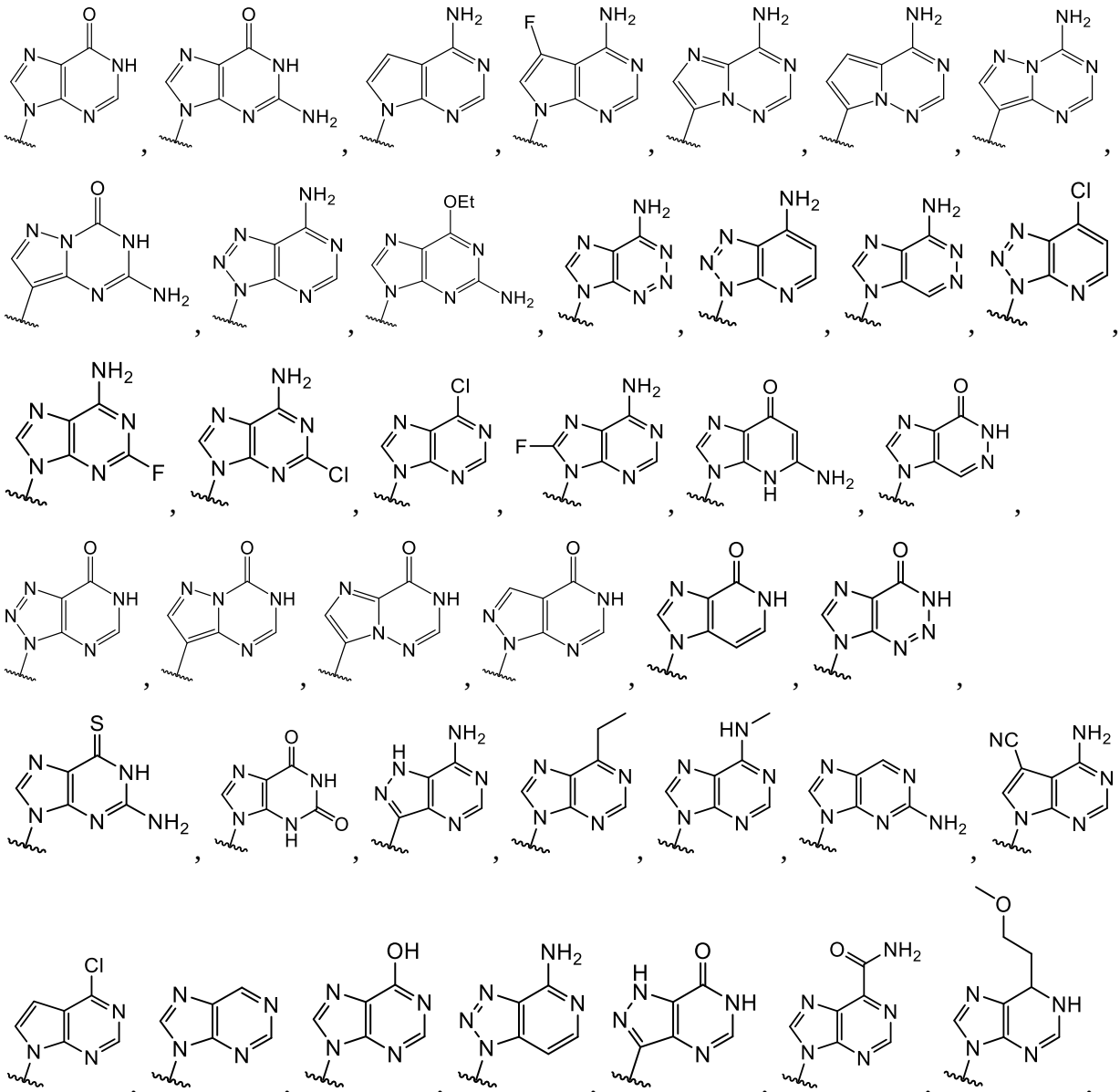
13. The compound according to claim 11, or a pharmaceutically acceptable salt, hydrate, solvate, or prodrug thereof, wherein the compound of formula (I') is a compound of formula (I'b):

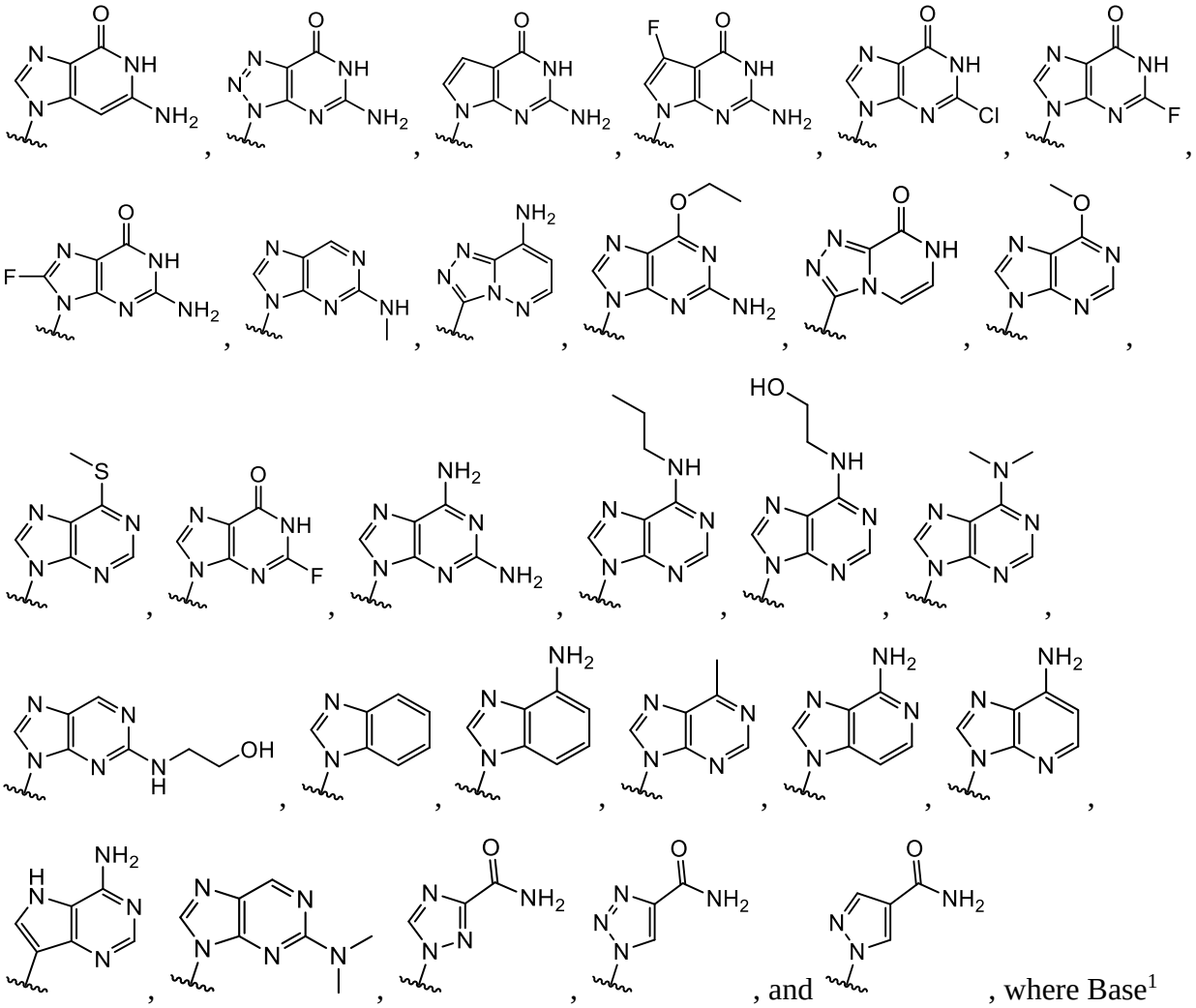


(I'b)

or a pharmaceutically acceptable salt, hydrate, solvate, or prodrug thereof, wherein

Base[1] and Base[2] are each independently selected from the group consisting of  ,





and Base[2] each may be independently substituted by 0-3 substituents R^{10}, where each R^{10} is independently selected from the group consisting of F, Cl, I, Br, OH, SH, NH_2, C_{1-3} alkyl, C_{3-6} cycloalkyl, O(C_{1-3} alkyl), O(C_{3-6} cycloalkyl), S(C_{1-3} alkyl), S(C_{3-6} cycloalkyl), NH(C_{1-3} alkyl), NH(C_{3-6} cycloalkyl), N(C_{1-3} alkyl)$_2$, and N(C_{3-6} cycloalkyl)$_2$;

X^c and X^{c1} are each independently selected from the group consisting of OR^9, SR^9, and NR^9R^9;

R^{1a} is selected from the group consisting of H, F, Cl, Br, I, OH, CN, N_3, C_1-C_6 alkyl, C_2-C_6 alkenyl, C_2-C_6 alkynyl, C_1-C_6 haloalkyl, C_2-C_6 haloalkenyl, C_2-C_6 haloalkynyl, -O-C_1-C_6 alkyl, -O-C_2-C_6 alkenyl, and -O-C_2-C_6 alkynyl, where said R^{1a} C_1-C_6 alkyl, C_2-C_6 alkenyl, C_2-C_6 alkynyl, C_1-C_6 haloalkyl, C_2-C_6 haloalkenyl, C_2-C_6 haloalkynyl, -O-C_1-C_6 alkyl, -O-C_2-C_6 alkenyl, and -O-C_2-C_6 alkynyl are substituted by 0 to 3 substituents selected from the group consisting of F, Cl, Br, I, OH, CN, and N_3;

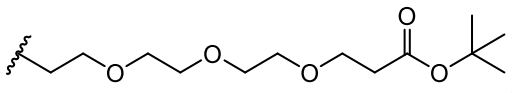
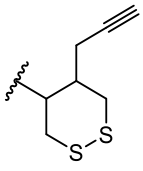
R^{2a} is selected from the group consisting of H, F, Cl, Br, I, OH, CN, N_3, C_1-C_6 alkyl, and C_1-C_6 haloalkyl, where said R^{2a} C_1-C_6 alkyl or C_1-C_6 haloalkyl are substituted by 0 to 3 substituents selected from the group consisting of F, Cl, Br, I, and OH;

R^3 is selected from the group consisting of H, F, Cl, Br, I, OH, CN, N_3, C_1-C_6 alkyl, and C_1-C_6 haloalkyl, where said R^3 C_1-C_6 alkyl or C_1-C_6 haloalkyl are substituted by 0 to 3 substituents selected from the group consisting of F, Cl, Br, I, and OH;

R^5 is selected from the group consisting of H, F, Cl, Br, I, OH, CN, NH_2, N_3, C_1-C_6 alkyl, and C_1-C_6 haloalkyl, where said R^5 C_1-C_6 alkyl or C_1-C_6 haloalkyl are substituted by 0 to 3 substituents selected from the group consisting of F, Cl, Br, I, and OH;

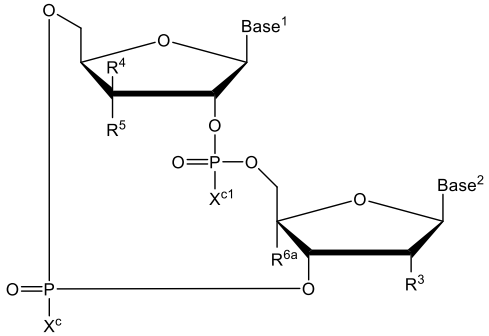
R^3 and R^5 are not both selected from the group consisting of OH, C_1-C_6 alkyl substituted with OH, and C_1-C_6 haloalkyl substituted with OH;

R^{6a} is selected from the group consisting of H, F, Cl, Br, I, OH, C_1-C_6 alkyl, C_2-C_6 alkenyl, and C_2-C_6 alkynyl;

each R^9 is independently selected from the group consisting of H, C_2-C_3 alkyl,  , and  , where each R^9 C_2-C_3 alkyl is optionally substituted by 1 to 2 substituents independently selected from the group consisting of OH, -O-C_1-C_{20} alkyl,-S-C(O)C_1-C_6 alkyl, and C(O)OC_1-C_6 alkyl; and

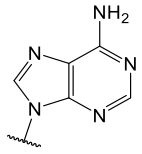
optionally R^3 and R^{6a} are connected to form -O-C_1-C_6 alkylene, -O-C_2-C_6 alkenylene, and -O-C_2-C_6 alkynylene, such that where R^3 and R^{6a} are connected to form -O-C_1-C_6 alkylene, -O-C_2-C_6 alkenylene, or -O-C_2-C_6 alkynylene, said O is bound at the R^3 position.

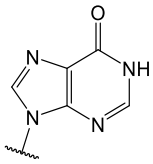
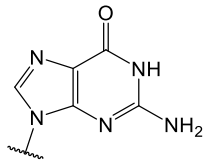
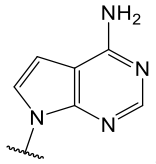
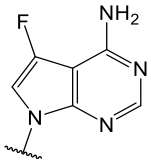
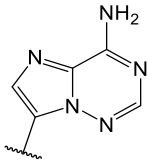
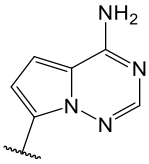
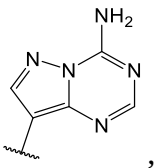
14. The compound according to claim 11, or a pharmaceutically acceptable salt, hydrate, solvate, or prodrug thereof, wherein the compound of formula (I') is a compound of formula (I'c):

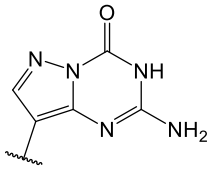
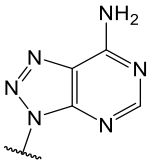
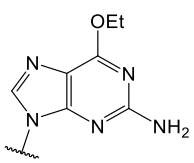
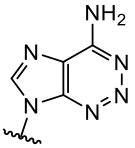
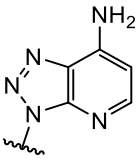
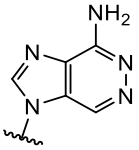
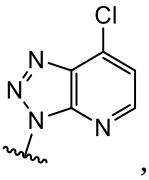


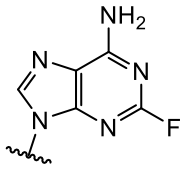
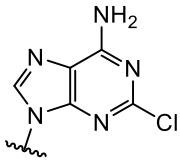
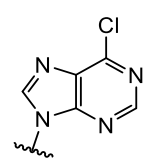
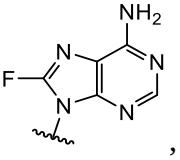
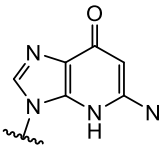
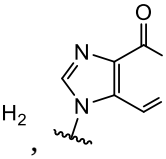
(I'c)

or a pharmaceutically acceptable salt, hydrate, solvate, or prodrug thereof, wherein

Base[1] and Base[2] are each independently selected from the group consisting of  ,

 ,  ,  ,  ,  ,  ,  ,

 ,  ,  ,  ,  ,  ,  ,

 ,  ,  ,  ,  ,  , ,

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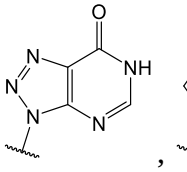
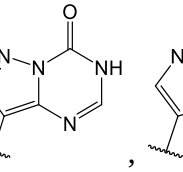
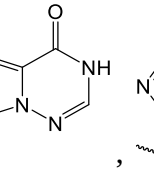
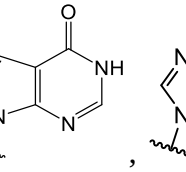
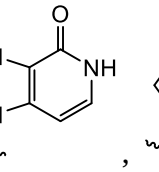
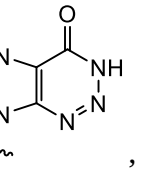
 ,  ,  ,  ,  ,  ,

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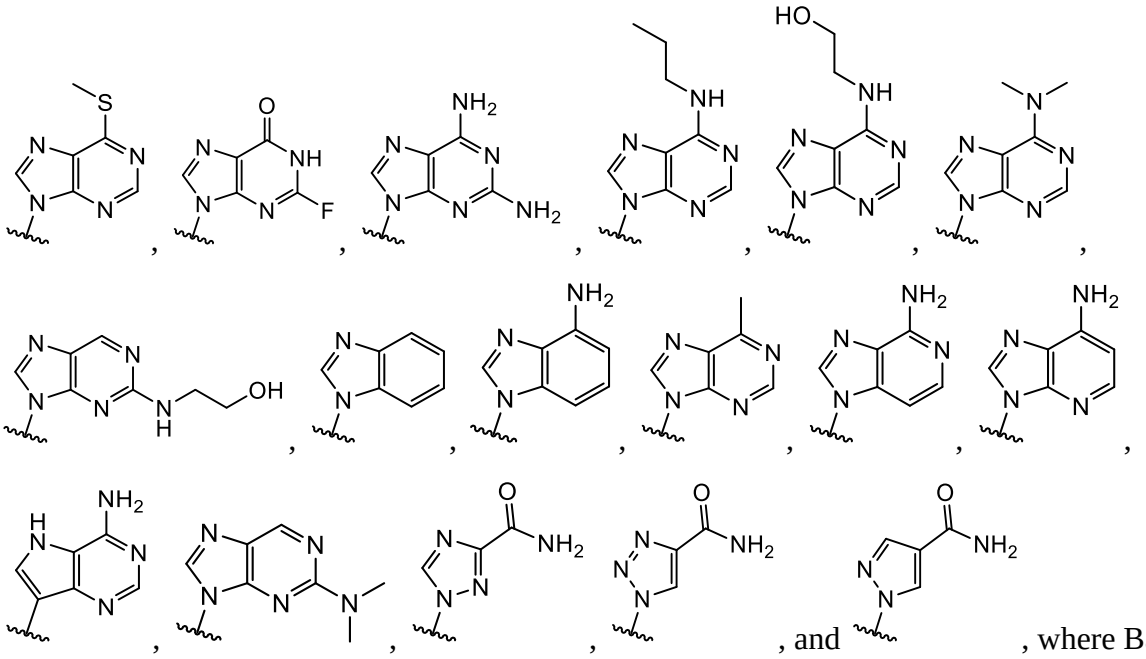


and Base[2] each may be independently substituted by 0-3 substituents R^{10}, where each R^{10} is independently selected from the group consisting of F, Cl, I, Br, OH, SH, NH_2, C_{1-3} alkyl, C_{3-6} cycloalkyl, $O(C_{1-3}$ alkyl), $O(C_{3-6}$ cycloalkyl), $S(C_{1-3}$ alkyl), $S(C_{3-6}$ cycloalkyl), $NH(C_{1-3}$ alkyl), $NH(C_{3-6}$ cycloalkyl), $N(C_{1-3}$ alkyl)$_2$, and $N(C_{3-6}$ cycloalkyl)$_2$;

X^c and X^{c1} are each independently selected from the group consisting of OR^9, SR^9, and NR^9R^9;

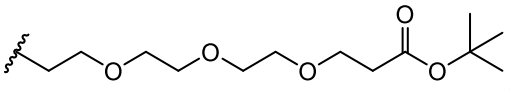
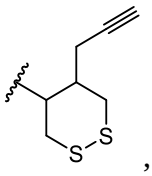
R^3 is selected from the group consisting of H, F, Cl, Br, I, OH, CN, N_3, C_1-C_6 alkyl, and C_1-C_6 haloalkyl, where said R^3 C_1-C_6 alkyl or C_1-C_6 haloalkyl are substituted by 0 to 3 substituents selected from the group consisting of F, Cl, Br, I, and OH;

R^4 is selected from the group consisting of H, F, Cl, Br, I, OH, CN, N_3, C_1-C_6 alkyl, and C_1-C_6 haloalkyl, where said R^4 C_1-C_6 alkyl or C_1-C_6 haloalkyl are substituted by 0 to 3 substituents selected from the group consisting of F, Cl, Br, I, and OH;

R^5 is selected from the group consisting of H, F, Cl, Br, I, OH, CN, NH_2, N_3, C_1-C_6 alkyl, and C_1-C_6 haloalkyl, where said R^5 C_1-C_6 alkyl or C_1-C_6 haloalkyl are substituted by 0 to 3 substituents selected from the group consisting of F, Cl, Br, I, and OH;

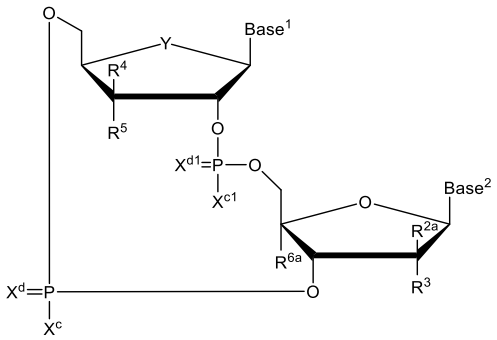
R^{6a} is selected from the group consisting of H, F, Cl, Br, I, OH, CN, N_3, C_1-C_6 alkyl, and C_1-C_6 haloalkyl, where said R^{6a} C_1-C_6 alkyl or C_1-C_6 haloalkyl are substituted by 0 to 3 substituents selected from the group consisting of F, Cl, Br, I, and OH;

each R^9 is independently selected from the group consisting of H, C_2-C_3 alkyl,

 , and  , where each R^9 C_2-C_3 alkyl is optionally substituted by 1 to 2 substituents independently selected from the group consisting of OH, -O-C_1-C_{20} alkyl,-S-C(O)C_1-C_6 alkyl, and C(O)OC_1-C_6 alkyl; and

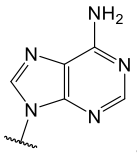
optionally R^4 and R^5 are connected by C_1-C_6 alkylene, -O-C_1-C_6 alkylene, -O-C_2-C_6 alkenylene, or -O-C_2-C_6 alkynylene, such that where R^4 and R^5 are connected to form -O-C_1-C_6 alkylene, -O-C_2-C_6 alkenylene, or -O-C_2-C_6 alkynylene, said O is bound at the R^5 position.

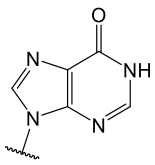
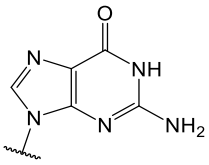
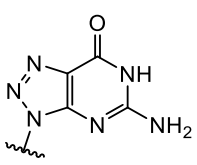
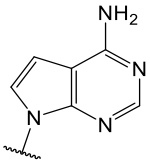
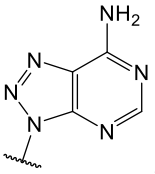
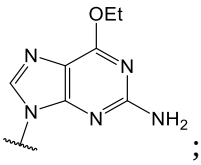
15. A compound of formula (I"):



(I")

or a pharmaceutically acceptable salt, hydrate, solvate, or prodrug thereof, wherein

Base^1 and Base^2 are each independently selected from the group consisting of  ,

 ,  ,  ,  ,  , and  ;

Y is selected from the group consisting of -O- and -S-;

X^c and X^{c1} are each independently selected from the group consisting of OR^9 and SR^9;

X^d and X^{d1} are each independently selected from the group consisting of O and S;

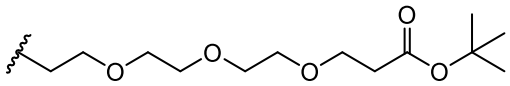
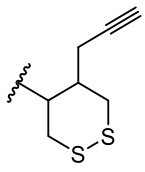
R^{2a} is selected from the group consisting of H, F, Cl, Br, I, OH, CN, N_3, C_1-C_6 alkyl, C_2-C_6 alkenyl, C_2-C_6 alkynyl, C_1-C_6 haloalkyl, C_2-C_6 haloalkenyl, C_2-C_6 haloalkynyl, -O-C_1-C_6 alkyl, -O-C_2-C_6 alkenyl, and -O-C_2-C_6 alkynyl;

R^3 is selected from the group consisting of H, F, Cl, Br, I, OH, CN, N_3, C_1-C_6 alkyl, C_2-C_6 alkenyl, C_2-C_6 alkynyl, C_1-C_6 haloalkyl, C_2-C_6 haloalkenyl, C_2-C_6 haloalkynyl, -O-C_1-C_6 alkyl, -O-C_2-C_6 alkenyl, and -O-C_2-C_6 alkynyl;

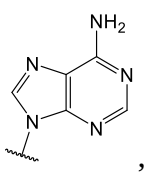
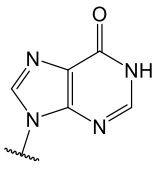
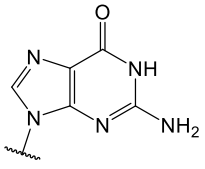
R^4 is selected from the group consisting of H, F, Cl, Br, I, OH, CN, N_3, C_1-C_6 alkyl, C_2-C_6 alkenyl, C_2-C_6 alkynyl, C_1-C_6 haloalkyl, C_2-C_6 haloalkenyl, C_2-C_6 haloalkynyl, -O-C_1-C_6 alkyl, -O-C_2-C_6 alkenyl, and -O-C_2-C_6 alkynyl;

R^5 is selected from the group consisting of H, F, Cl, Br, I, OH, CN, NH_2, N_3, C_1-C_6 alkyl, C_2-C_6 alkenyl, C_2-C_6 alkynyl, C_1-C_6 haloalkyl, C_2-C_6 haloalkenyl, C_2-C_6 haloalkynyl, -O-C_1-C_6 alkyl, -O-C_2-C_6 alkenyl, and -O-C_2-C_6 alkynyl;

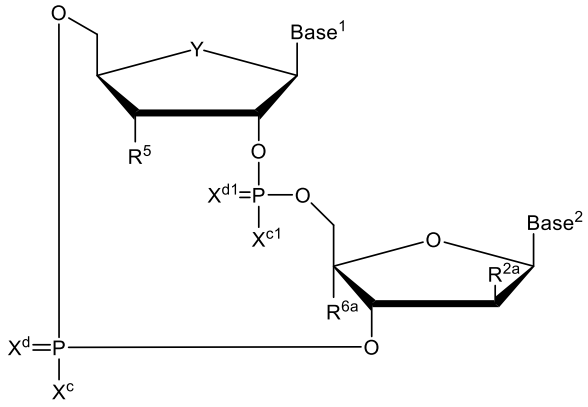
R^{6a} is selected from the group consisting of H, F, Cl, Br, I, OH, CN, N_3, C_1-C_6 alkyl, C_2-C_6 alkenyl, C_2-C_6 alkynyl, C_1-C_6 haloalkyl, C_2-C_6 haloalkenyl, C_2-C_6 haloalkynyl, -O-C_1-C_6 alkyl, -O-C_2-C_6 alkenyl, and -O-C_2-C_6 alkynyl;

each R^9 is independently selected from the group consisting of H, C_1-C_{20} alkyl,  , and  , where each R^9 C_1-C_{20} alkyl is optionally substituted by 0 to 3 substituents independently selected from the group consisting of OH, -O-C_1-C_{20} alkyl,-S-C(O)C_1-C_6 alkyl, and C(O)OC_1-C_6 alkyl; and

optionally R^3 and R^{6a} are connected to form -O-C_1-C_6 alkylene, -O-C_2-C_6 alkenylene, or -O-C_2-C_6 alkynylene, such that where R^3 and R^{6a} are connected to form -O-C_1-C_6 alkylene, -O-C_2-C_6 alkenylene, or -O-C_2-C_6 alkynylene, said O is bound at the R^3 position; and

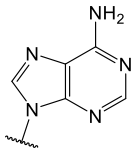
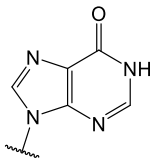
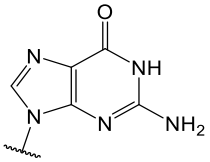
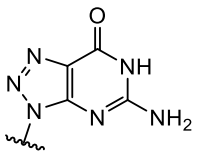
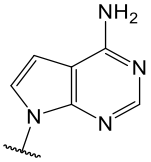
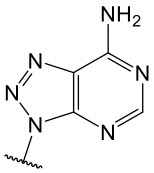
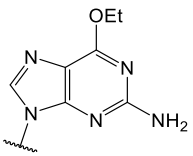
providing that when Y and Y^a are each O, X^a and X^{a1} are each O, X^b and X^{b1} are each O, and X^c and X^{c1} are each OH or SH, X^d and X^{d1} are each O, R^1 and R^{1a} are each H, R^2 is H, R^6 and R^{6a} are each H, R^7 and R^{7a} are each H, R^8 and R^{8a} are each H, and $Base^1$ and $Base^2$ are each selected from the group consisting of  ,  , and  , R^5 and R^3 are not both selected from the group consisting of H, F and OH.

16. The compound according to claim 15, or a pharmaceutically acceptable salt, hydrate, solvate, or prodrug thereof, wherein the compound of formula (I'') is a compound of formula (I''a):



(I''a)

or a pharmaceutically acceptable salt, hydrate, solvate, or prodrug thereof, wherein

$Base^1$ and $Base^2$ are each independently selected from the group consisting of  ,  ,  ,  ,  ,  , and  ;

Y is selected from the group consisting of -O- and -S-;

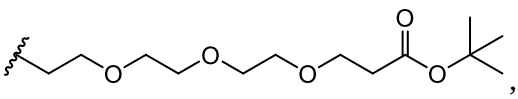
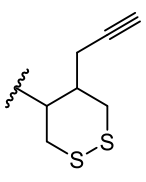
X^c and X^{c1} are each independently selected from the group consisting of OR^9 and SR^9;

X^d and X^{d1} are each independently selected from the group consisting of O and S;

R^{2a} is selected from the group consisting of H, F, Cl, Br, I, OH, CN, N_3, C_1-C_6 alkyl, C_2-C_6 alkenyl, C_2-C_6 alkynyl, C_1-C_6 haloalkyl, C_2-C_6 haloalkenyl, C_2-C_6 haloalkynyl, -O-C_1-C_6 alkyl, -O-C_2-C_6 alkenyl, and -O-C_2-C_6 alkynyl;

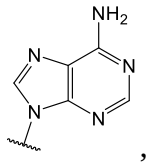
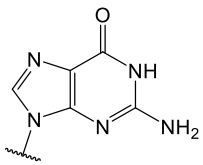
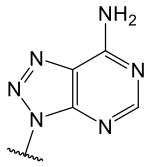
R^5 is selected from the group consisting of H, F, Cl, Br, I, OH, CN, NH_2, N_3, C_1-C_6 alkyl, C_2-C_6 alkenyl, C_2-C_6 alkynyl, C_1-C_6 haloalkyl, C_2-C_6 haloalkenyl, C_2-C_6 haloalkynyl, -O-C_1-C_6 alkyl, -O-C_2-C_6 alkenyl, and -O-C_2-C_6 alkynyl;

R^{6a} is selected from the group consisting of H, F, Cl, Br, I, OH, CN, N_3, C_1-C_6 alkyl, C_2-C_6 alkenyl, C_2-C_6 alkynyl, C_1-C_6 haloalkyl, C_2-C_6 haloalkenyl, C_2-C_6 haloalkynyl, -O-C_1-C_6 alkyl, -O-C_2-C_6 alkenyl, and -O-C_2-C_6 alkynyl; and

each R^9 is independently selected from the group consisting of H, C_1-C_{20} alkyl,  , and  , where each R^9 C_1-C_{20} alkyl is

optionally substituted by 0 to 3 substituents independently selected from the group consisting of OH, -O-C_1-C_{20} alkyl,-S-C(O)C_1-C_6 alkyl, and C(O)OC_1-C_6 alkyl.

17. The compound according to claim 16, or a pharmaceutically acceptable salt, hydrate, solvate, or prodrug thereof, wherein

Base[1] and Base[2] are each independently selected from the group consisting of  ,  , and  ;

Y is selected from the group consisting of -O- and -S-;

X^c and X^{c1} are each independently selected from the group consisting of OR^9 and SR^9;

X^d and X^{d1} are each independently selected from the group consisting of O and S;

R^{2a} is F;

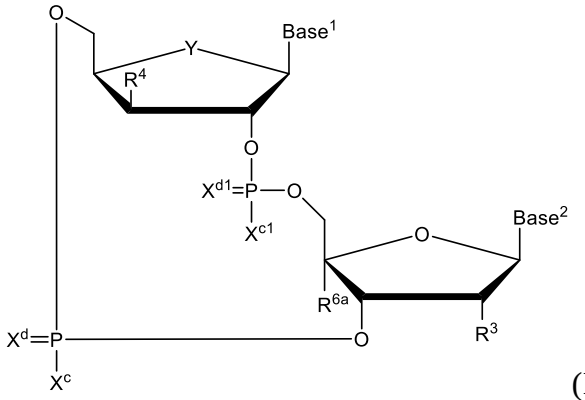
R^5 is selected from the group consisting of H, F, Cl, Br, I, OH, CN, NH_2, N_3, C_1-C_6 alkyl, C_2-C_6 alkenyl, C_2-C_6 alkynyl, C_1-C_6 haloalkyl, C_2-C_6 haloalkenyl, C_2-C_6 haloalkynyl, -O-C_1-C_6 alkyl, -O-C_2-C_6 alkenyl, and -O-C_2-C_6 alkynyl;

R^{6a} is selected from the group consisting of H, F, Cl, Br, I, OH, CN, N_3, C_1-C_6 alkyl, C_2-C_6 alkenyl, C_2-C_6 alkynyl, C_1-C_6 haloalkyl, C_2-C_6 haloalkenyl, C_2-C_6 haloalkynyl, -O-C_1-C_6 alkyl, -O-C_2-C_6 alkenyl, and -O-C_2-C_6 alkynyl; and

each R^9 is independently H.

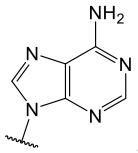
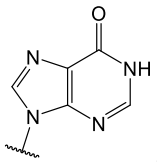
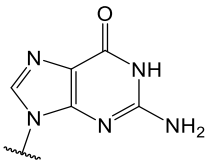
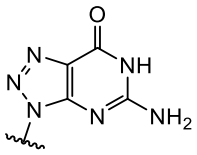
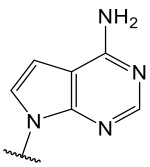
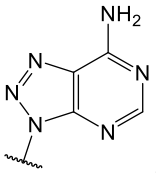
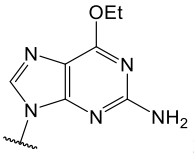
18. The compound according to claim 15, wherein R^3 and R^{6a} are connected to form -O-C_1-C_6 alkylene, -O-C_2-C_6 alkenylene, or -O-C_2-C_6 alkynylene, such that where R^3 and R^{6a} are connected to form -O-C_1-C_6 alkylene, -O-C_2-C_6 alkenylene, or -O-C_2-C_6 alkynylene, said O is bound at the R^3 position.

19. The compound according to claim 15, or a pharmaceutically acceptable salt, hydrate, solvate, or prodrug thereof, wherein the compound of formula (I") is a compound of formula (I"b):



(I"b)

or a pharmaceutically acceptable salt, hydrate, solvate, or prodrug thereof, wherein

$Base^1$ and $Base^2$ are each independently selected from the group consisting of  ,  ,  ,  ,  ,  , and  ;

Y is selected from the group consisting of -O- and -S-;

X^c and X^{c1} are each independently selected from the group consisting of OR^9 and SR^9;

X^d and X^{d1} are each independently selected from the group consisting of O and S;

R^3 is selected from the group consisting of H, F, Cl, Br, I, OH, CN, N_3, C_1-C_6 alkyl, C_2-C_6 alkenyl, C_2-C_6 alkynyl, C_1-C_6 haloalkyl, C_2-C_6 haloalkenyl, C_2-C_6 haloalkynyl, -O-C_1-C_6 alkyl, -O-C_2-C_6 alkenyl, and -O-C_2-C_6 alkynyl;

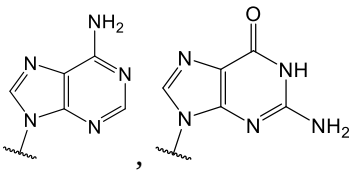
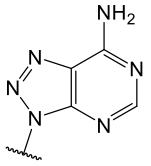
R^4 is selected from the group consisting of H, F, Cl, Br, I, OH, CN, N_3, C_1-C_6 alkyl, C_2-C_6 alkenyl, C_2-C_6 alkynyl, C_1-C_6 haloalkyl, C_2-C_6 haloalkenyl, C_2-C_6 haloalkynyl, -O-C_1-C_6 alkyl, -O-C_2-C_6 alkenyl, and -O-C_2-C_6 alkynyl;

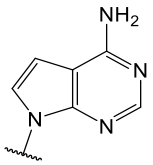
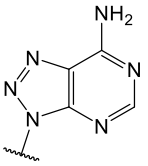
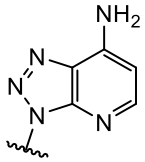
R^5 is selected from the group consisting of H, F, Cl, Br, I, OH, CN, NH_2, N_3, C_1-C_6 alkyl, C_2-C_6 alkenyl, C_2-C_6 alkynyl, C_1-C_6 haloalkyl, C_2-C_6 haloalkenyl, C_2-C_6 haloalkynyl, -O-C_1-C_6 alkyl, -O-C_2-C_6 alkenyl, and -O-C_2-C_6 alkynyl;

R^{6a} is selected from the group consisting of H, F, Cl, Br, I, OH, CN, N_3, C_1-C_6 alkyl, C_2-C_6 alkenyl, C_2-C_6 alkynyl, C_1-C_6 haloalkyl, C_2-C_6 haloalkenyl, C_2-C_6 haloalkynyl, -O-C_1-C_6 alkyl, -O-C_2-C_6 alkenyl, and -O-C_2-C_6 alkynyl;

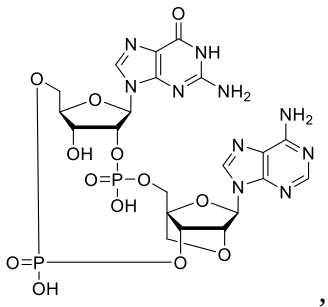
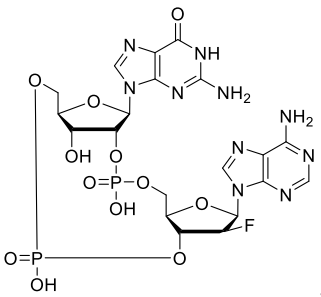
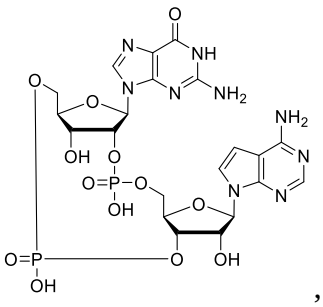
each R^9 is independently H; and

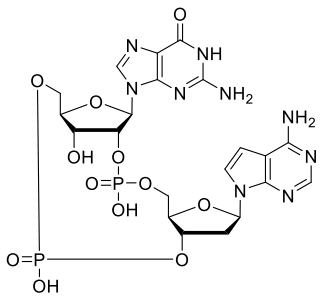
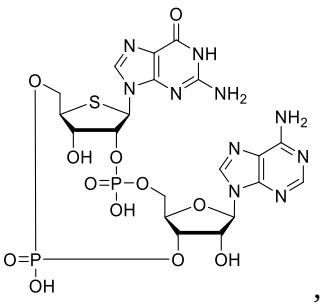
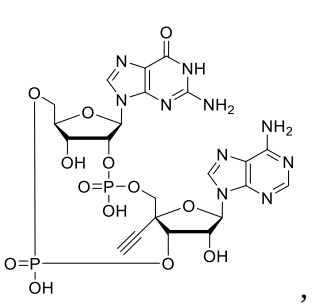
R^3 and R^{6a} are connected to form -O-C_1-C_6 alkylene, -O-C_2-C_6 alkenylene, or -O-C_2-C_6 alkynylene, such that where R^3 and R^{6a} are connected to form -O-C_1-C_6 alkylene, -O-C_2-C_6 alkenylene, or -O-C_2-C_6 alkynylene, said O is bound at the R^3 position.

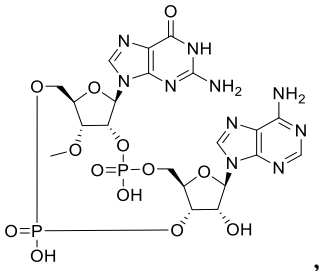
20. The compound according to claim 19, or a pharmaceutically acceptable salt, hydrate, solvate, or prodrug thereof, wherein $Base^1$ and $Base^2$ are each independently selected from the group consisting of  ,  .

21. The compound according to claim 15, wherein at least one of $Base^1$ and $Base^2$ are each independently selected from the group consisting of  ,  , and  .

22. A compound selected from the group consisting of:

 ,  ,  ,

 ,  ,  ,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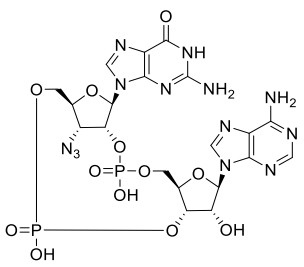
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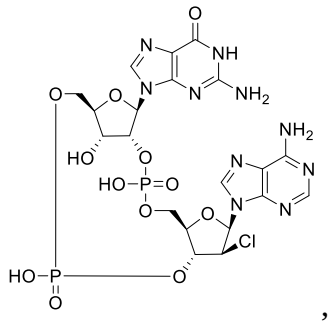
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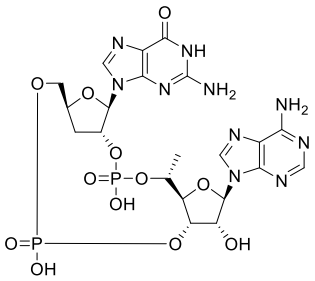
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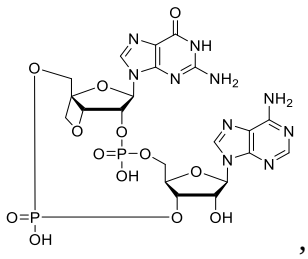
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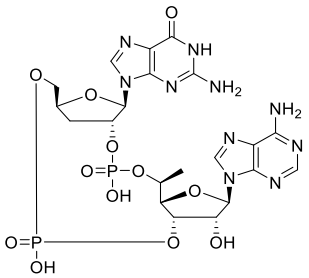
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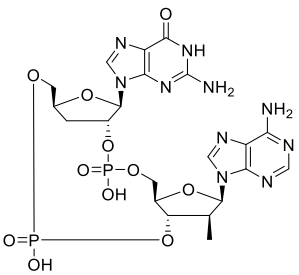
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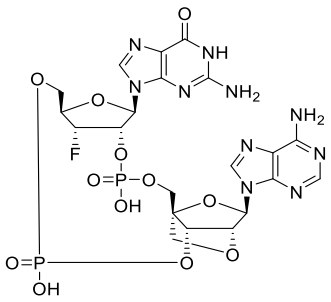
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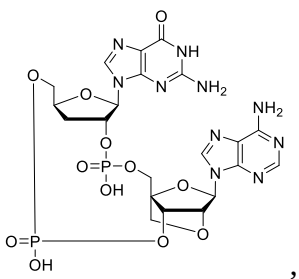
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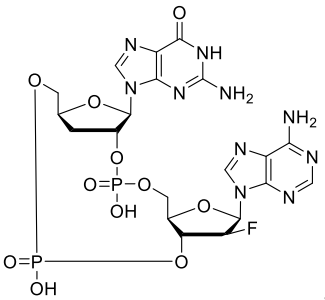
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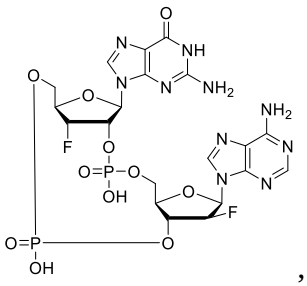
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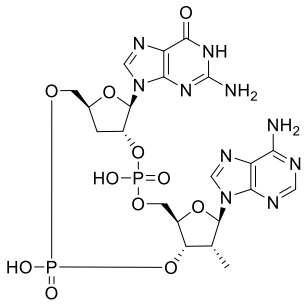
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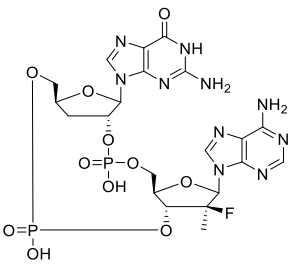
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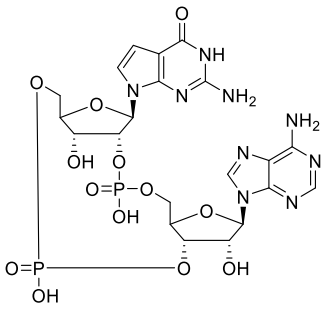
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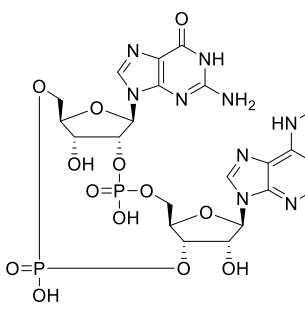
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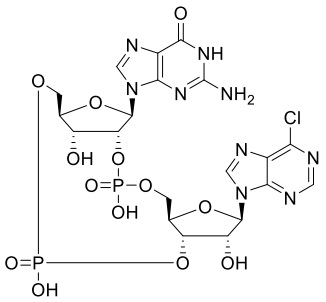
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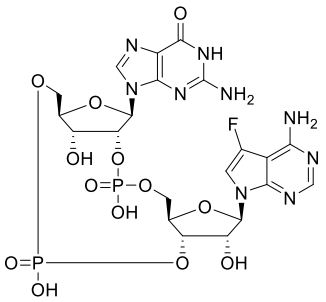
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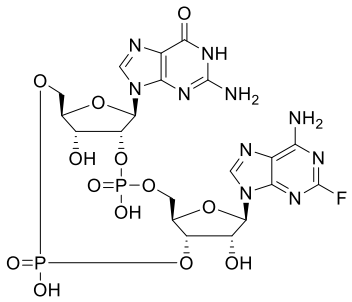
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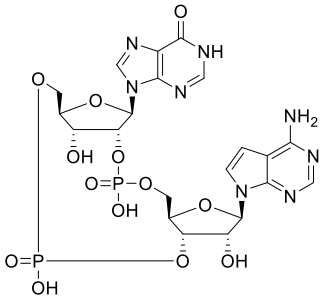
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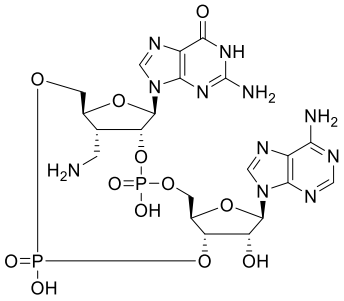
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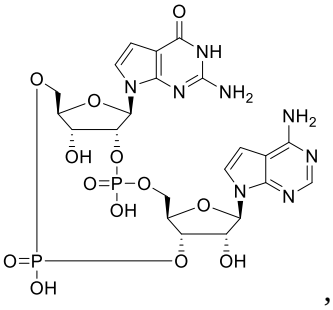
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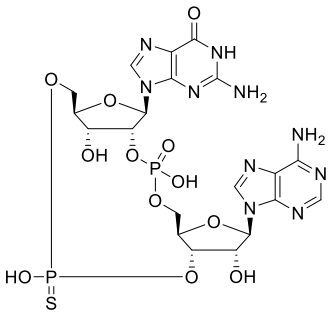
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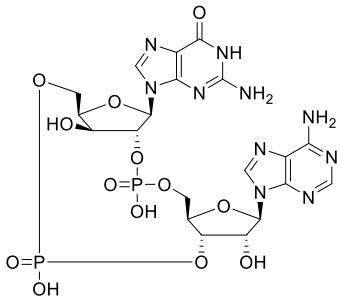
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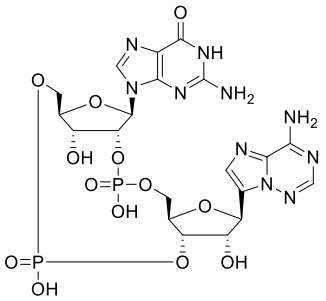
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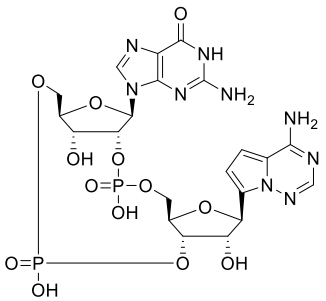
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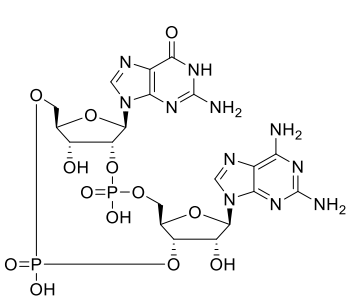
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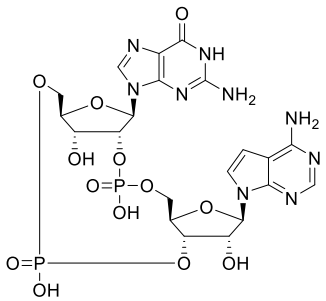
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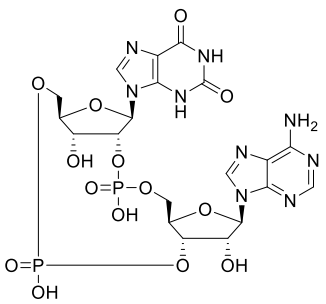
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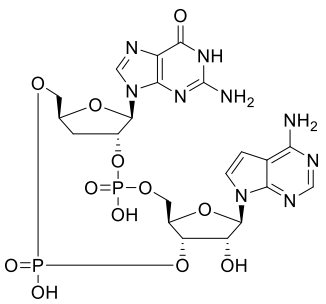
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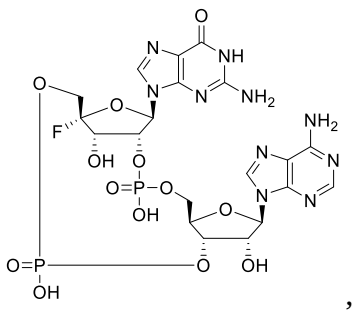
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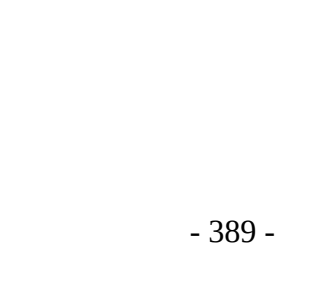
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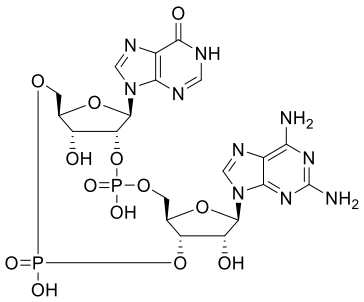
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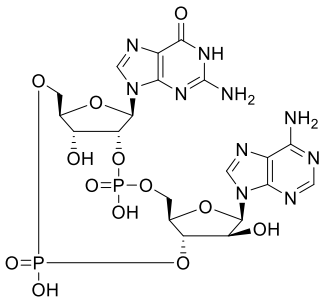
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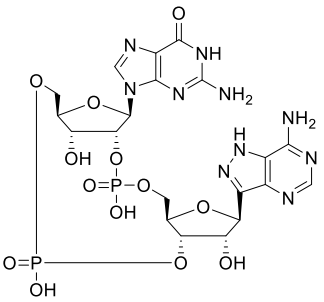
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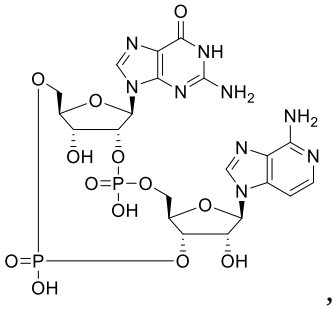
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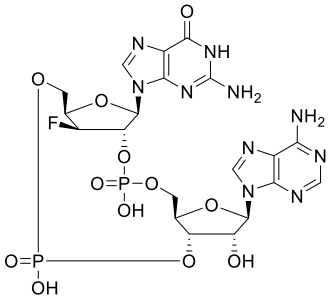
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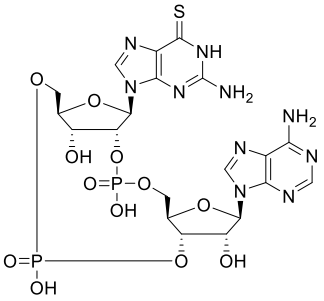
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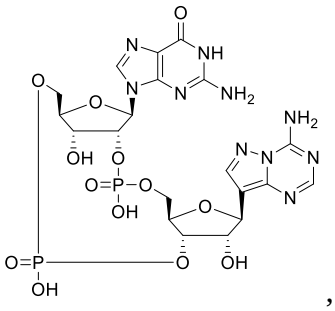
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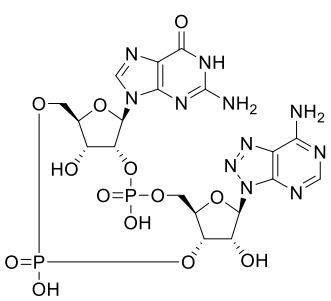
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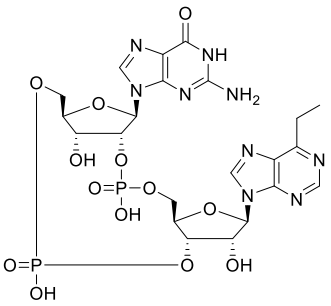
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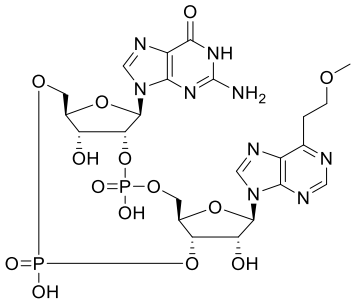
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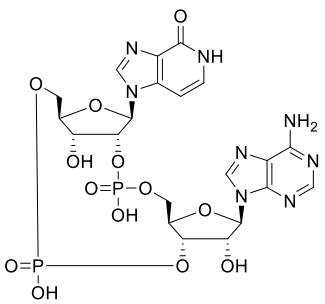
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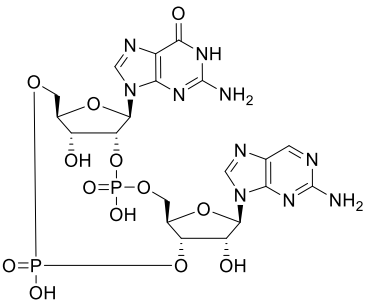
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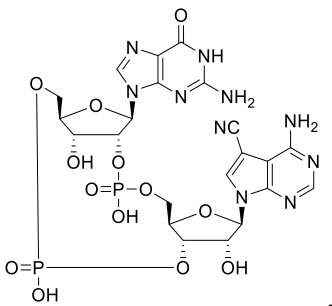
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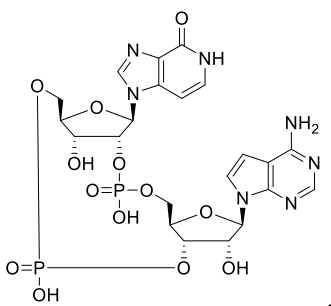
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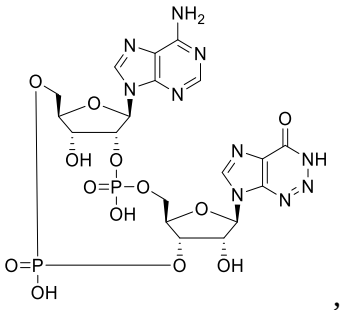
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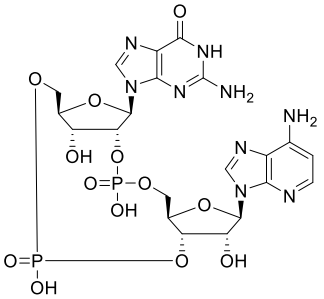
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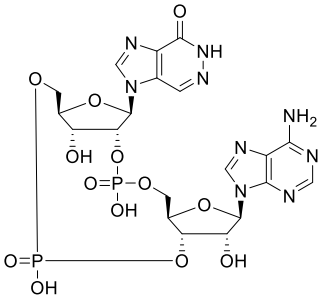
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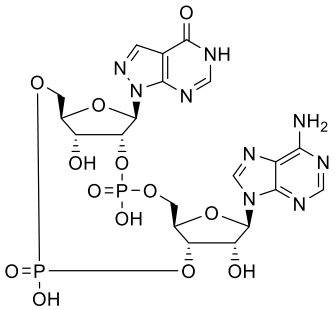
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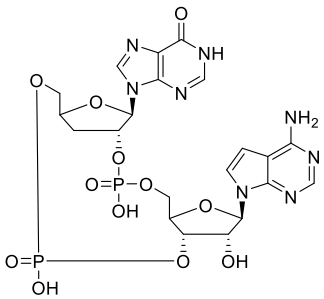
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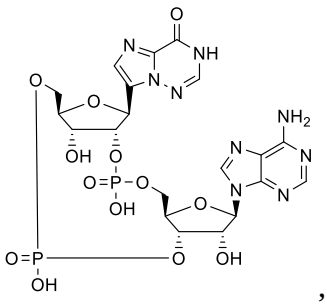
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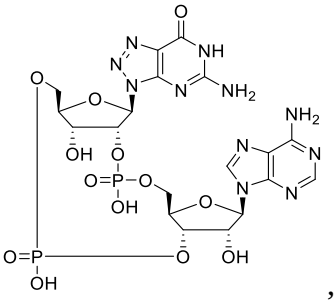
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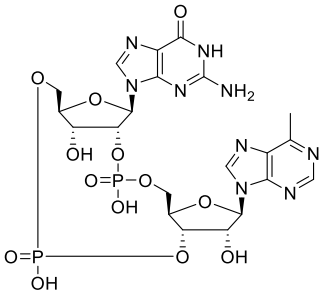
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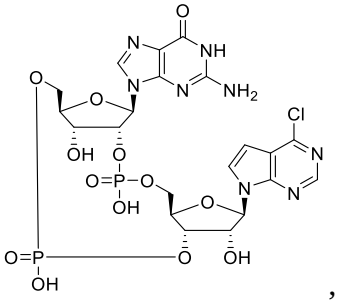
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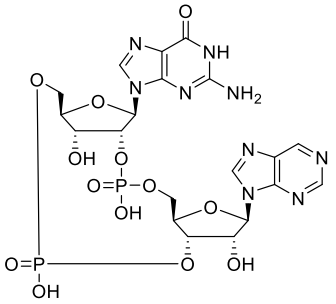
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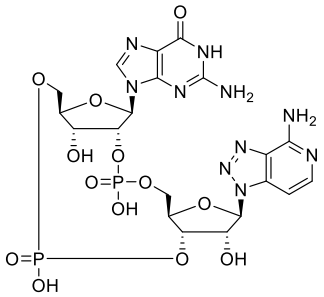
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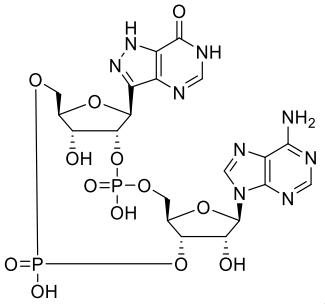
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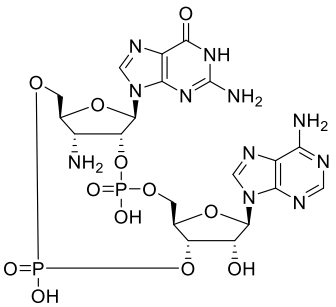
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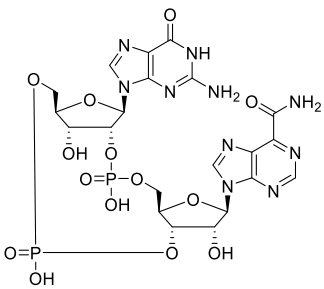
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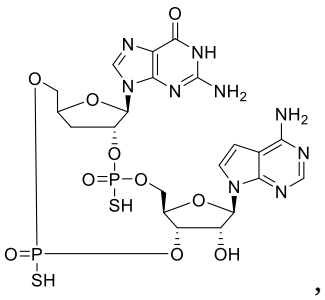
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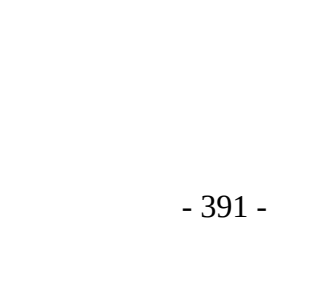
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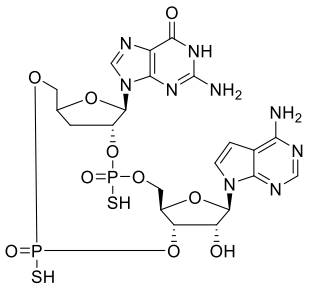
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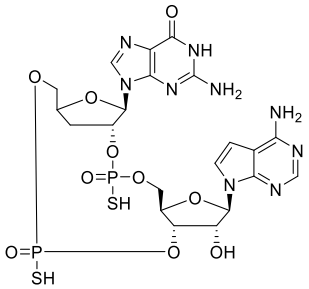
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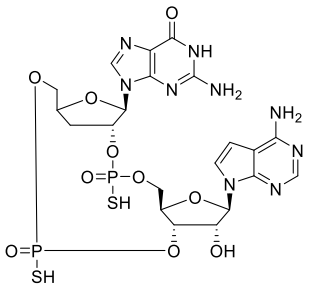
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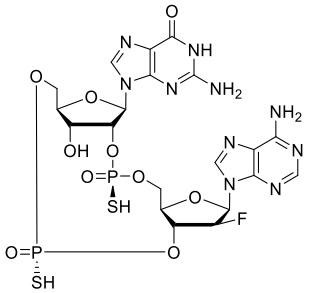
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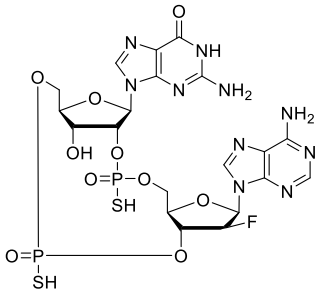
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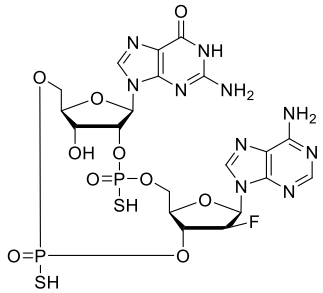
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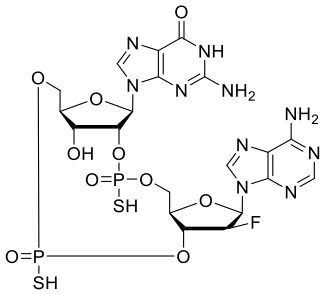
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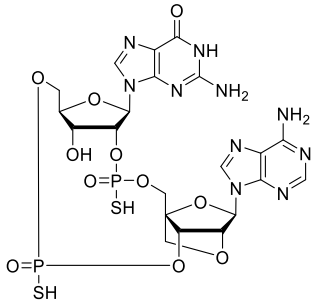
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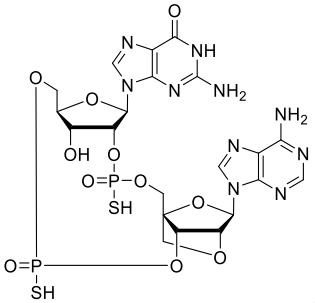
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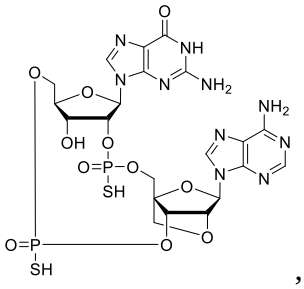
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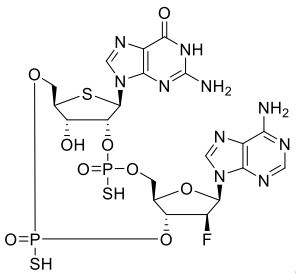
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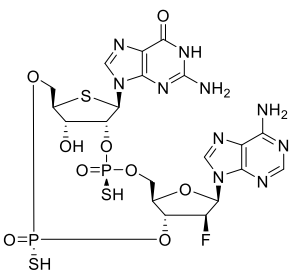
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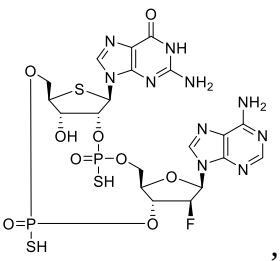
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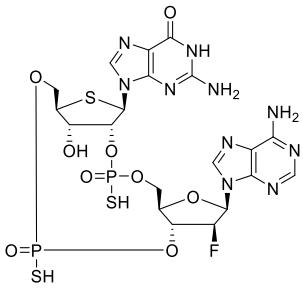
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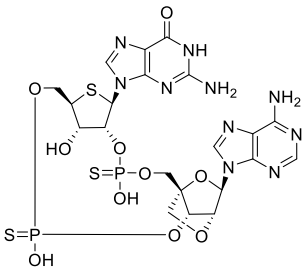
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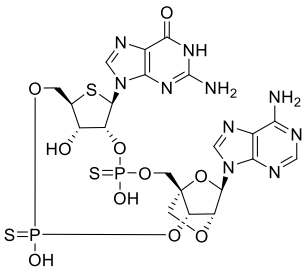
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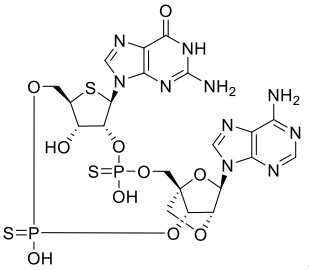
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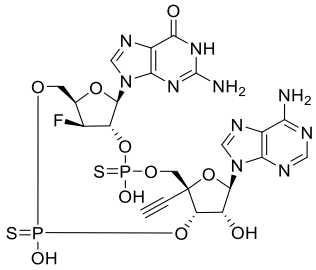
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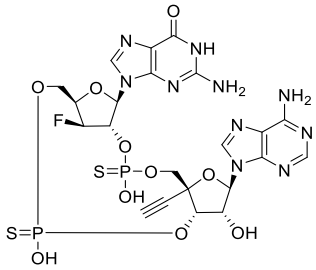
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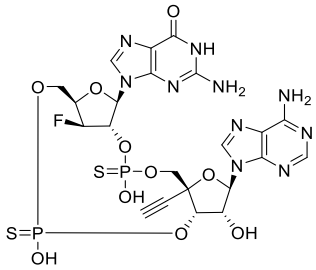
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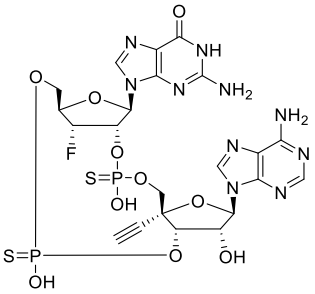
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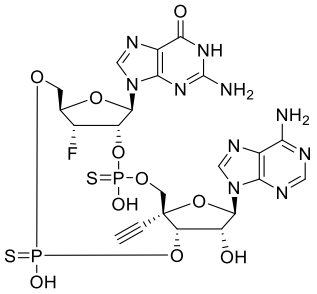
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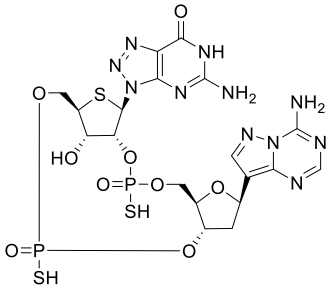
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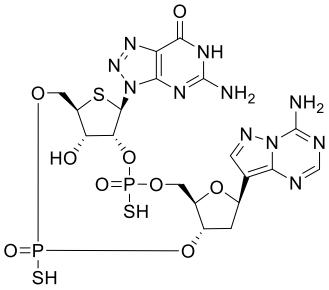
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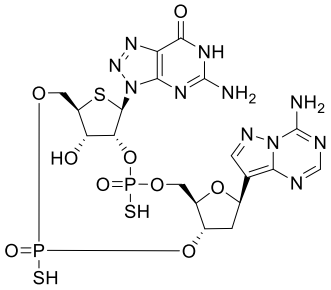
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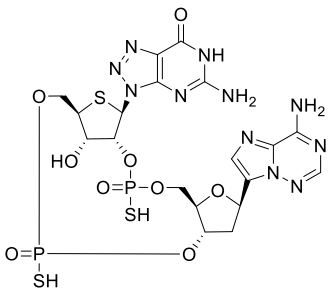
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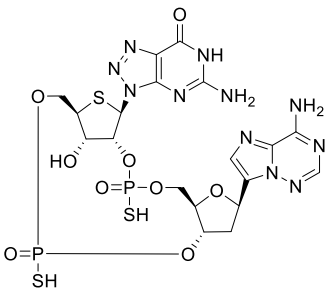
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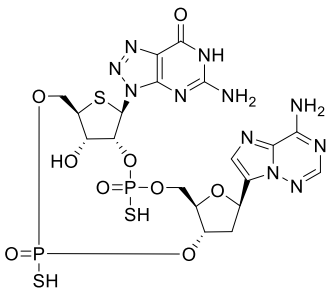
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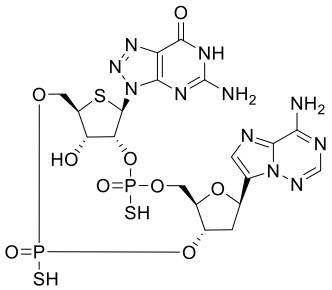
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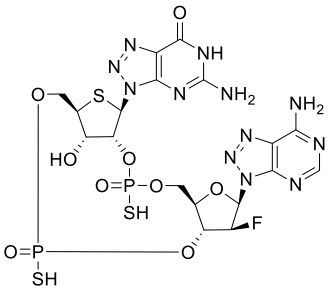
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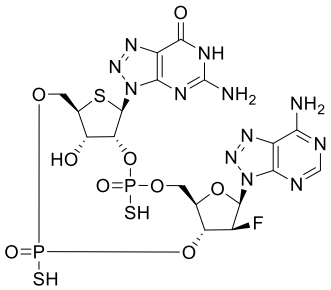
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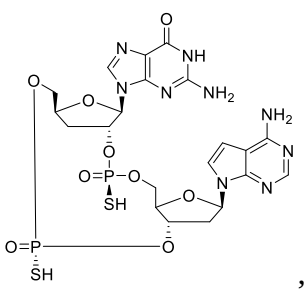
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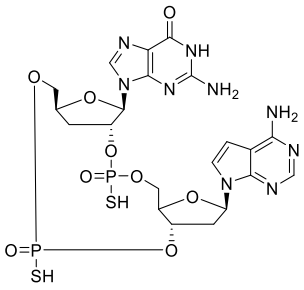
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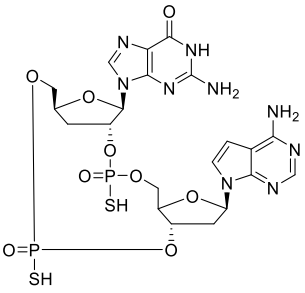
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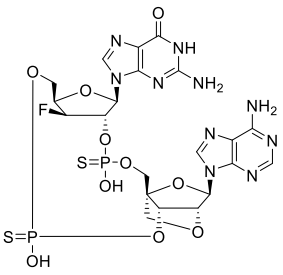
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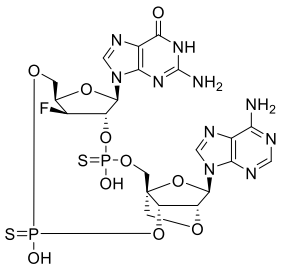
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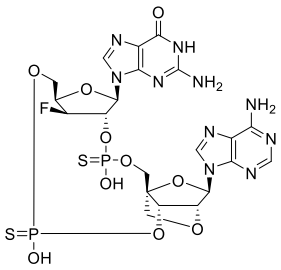
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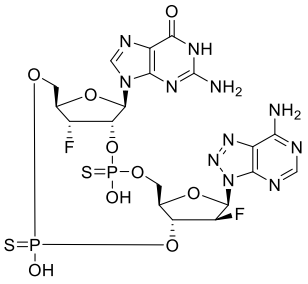
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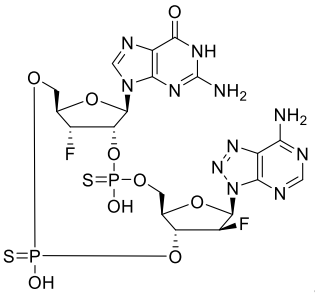
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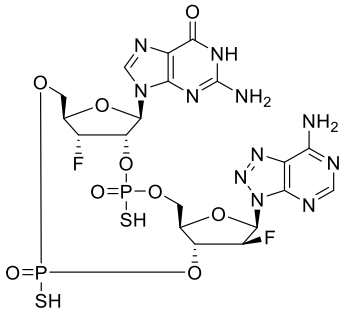
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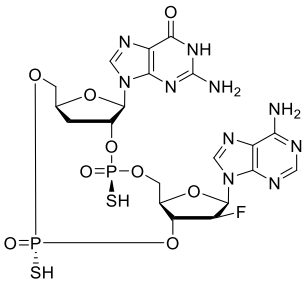
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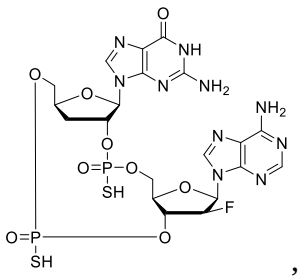
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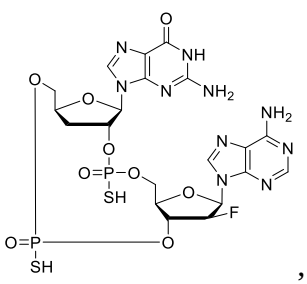
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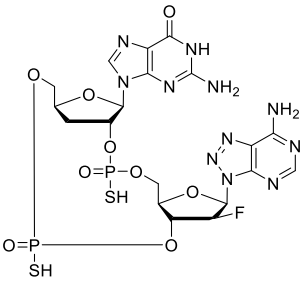
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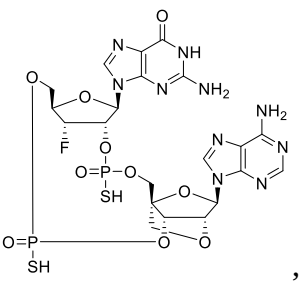
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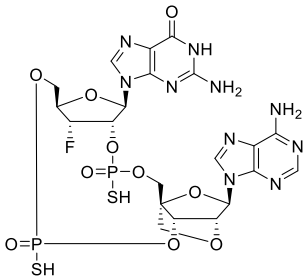
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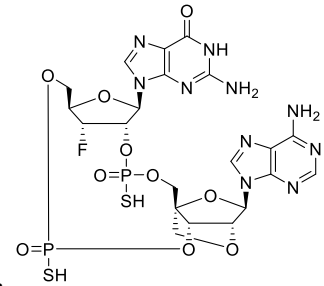
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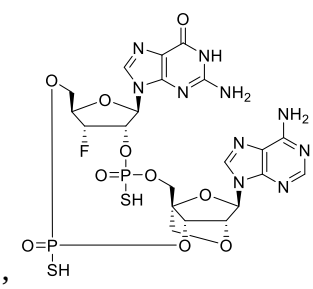
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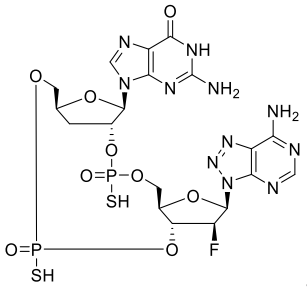
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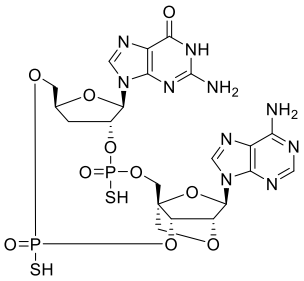
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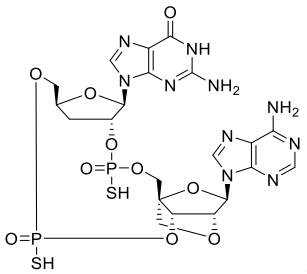
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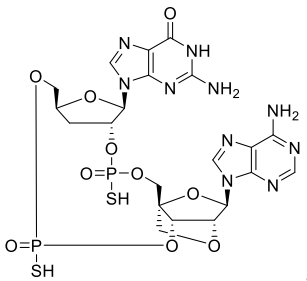
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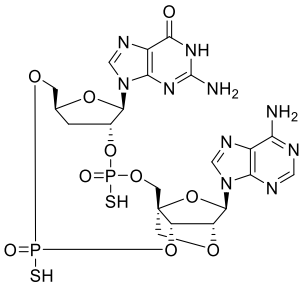
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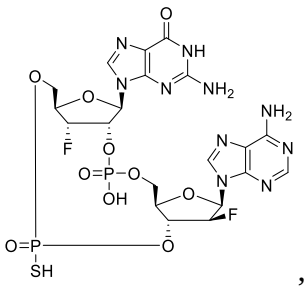
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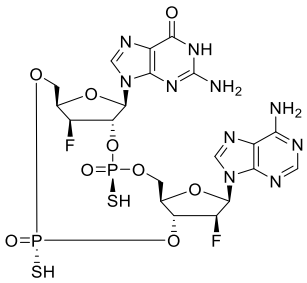
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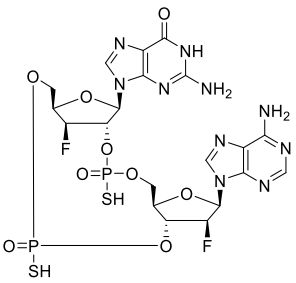
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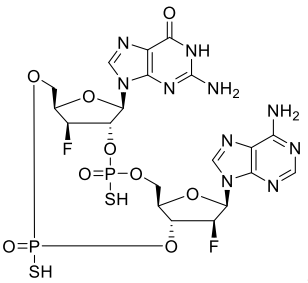
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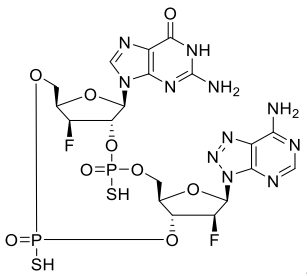
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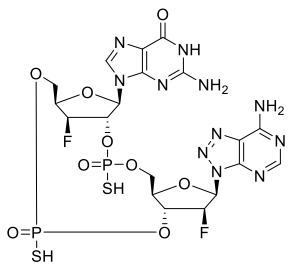
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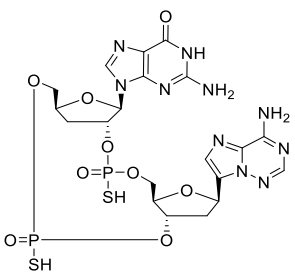
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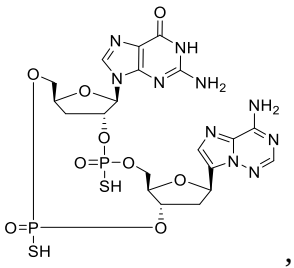
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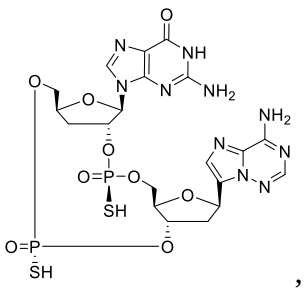
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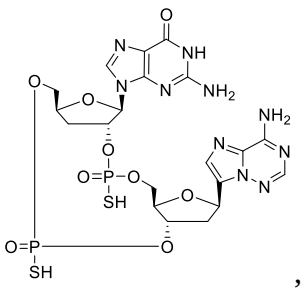
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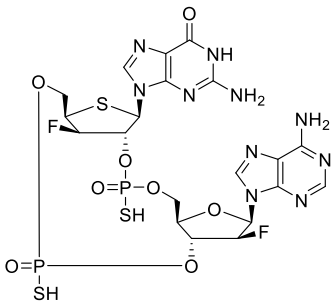
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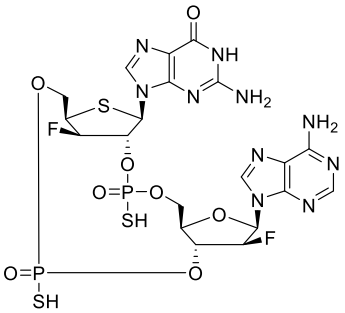
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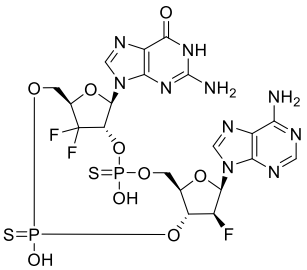
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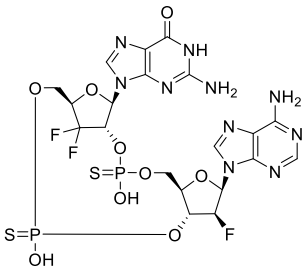
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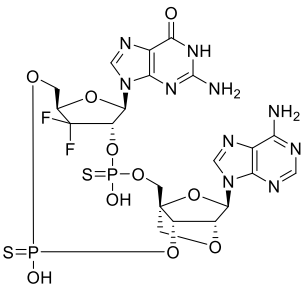
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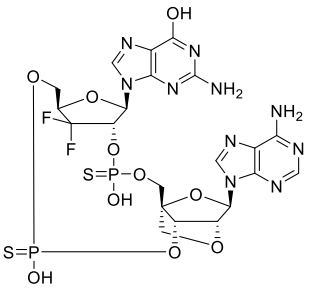
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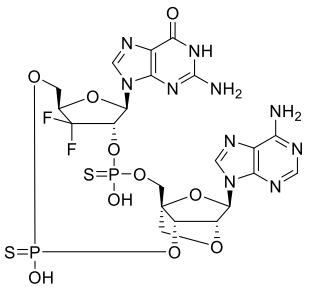
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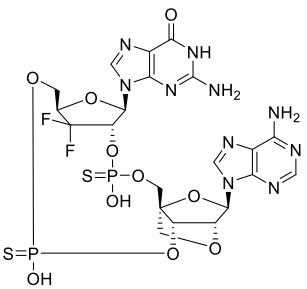
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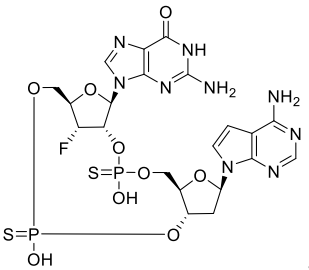
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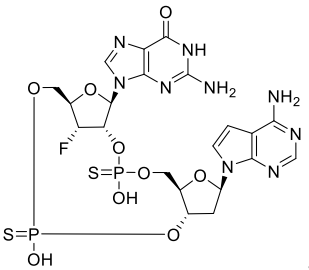
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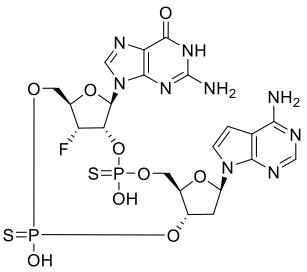
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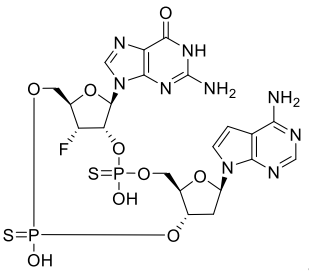
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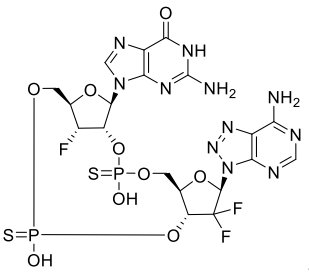
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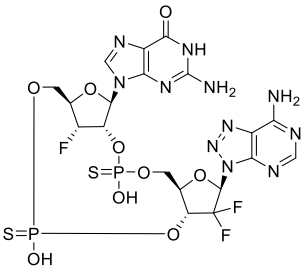
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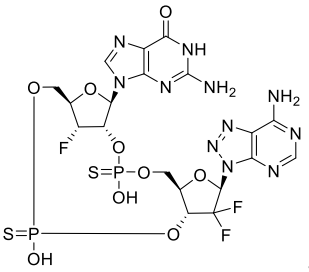
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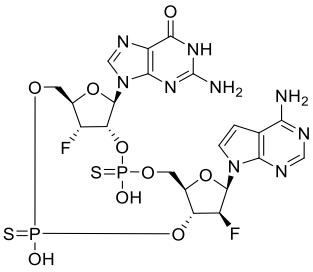
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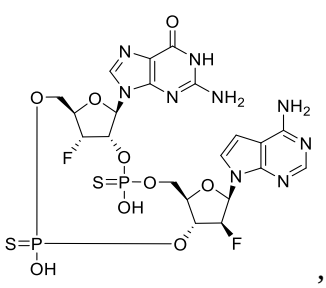
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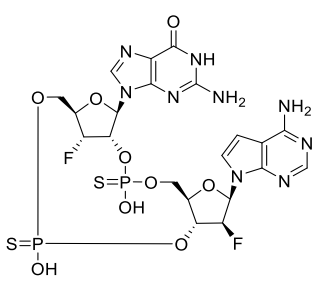
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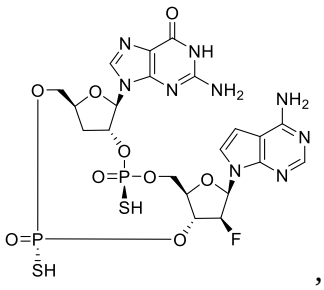
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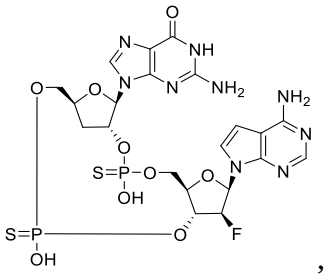
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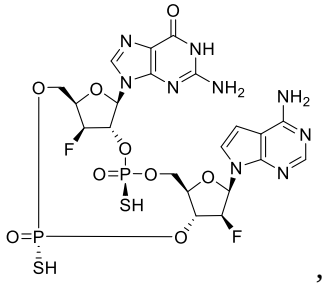
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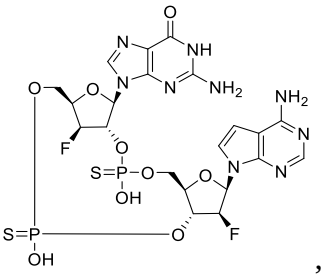
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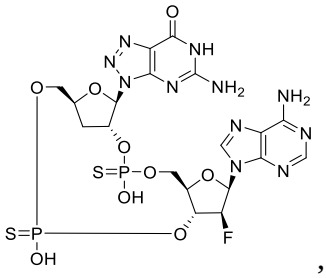
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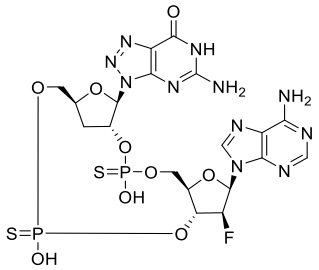
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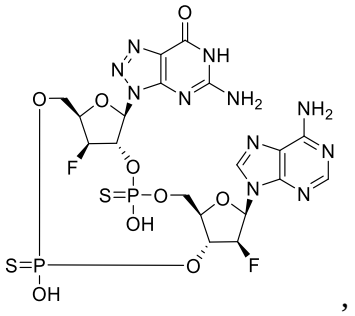
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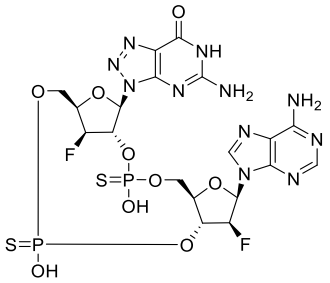
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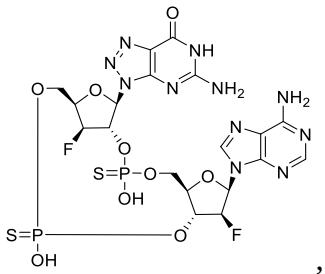
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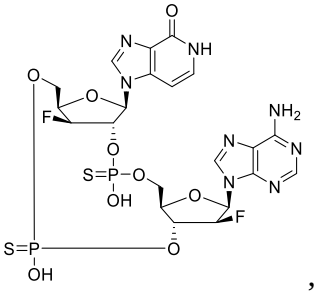
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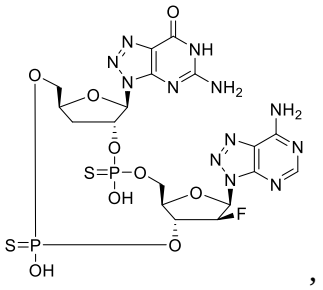
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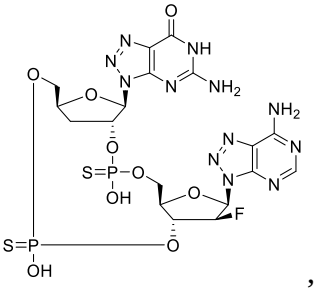
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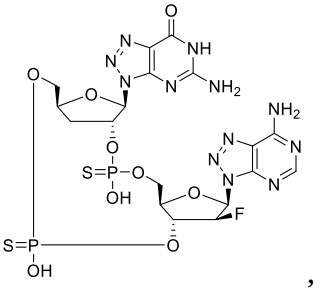
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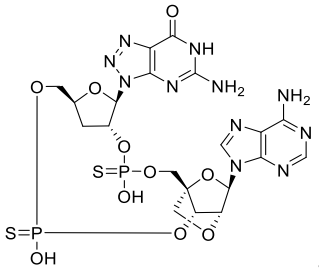
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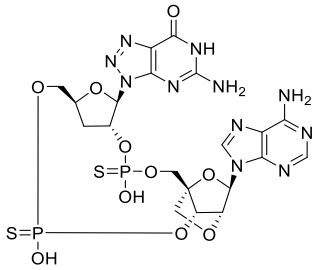
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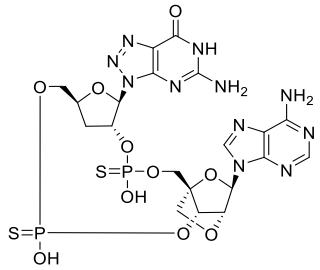
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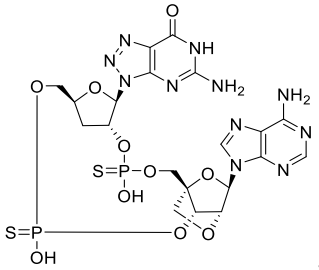
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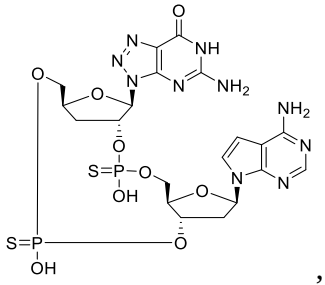
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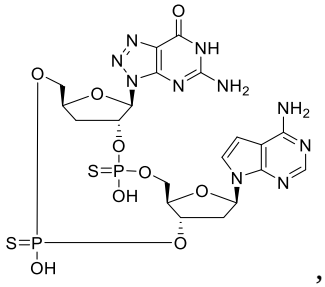
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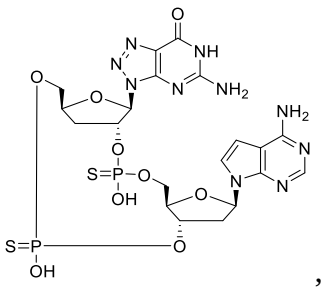
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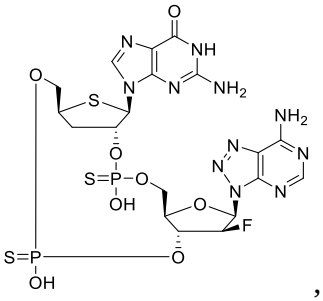
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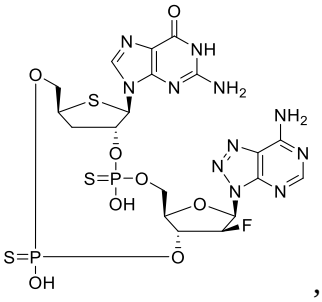
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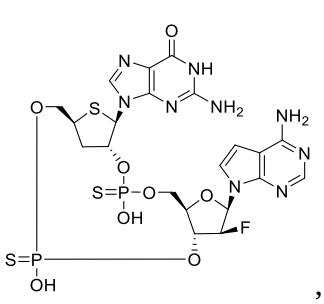
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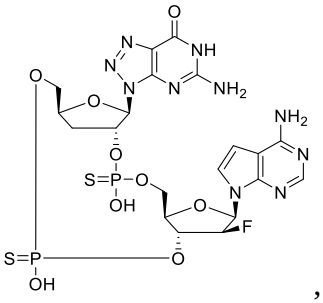
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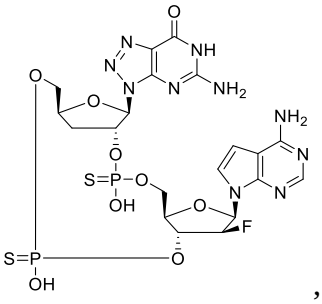
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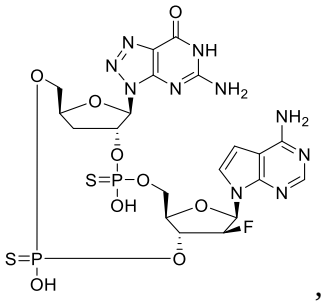
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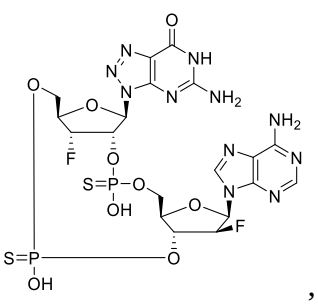
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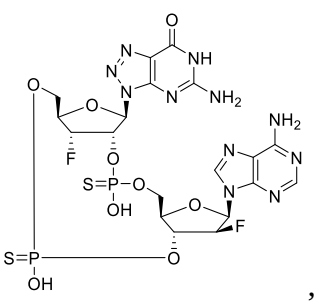
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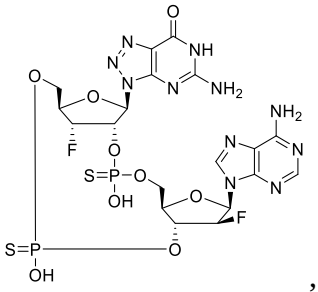
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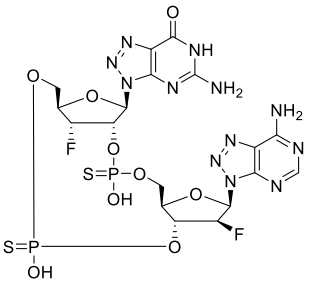
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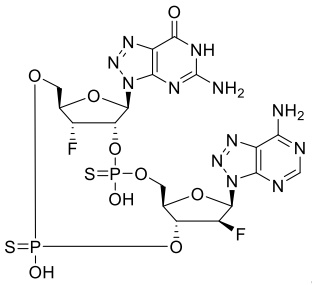
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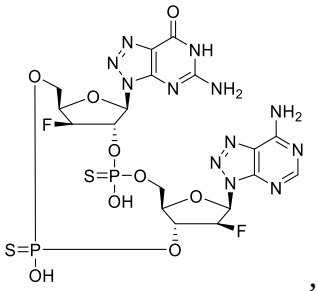
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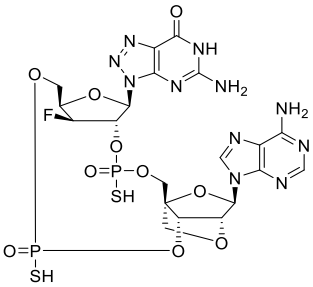
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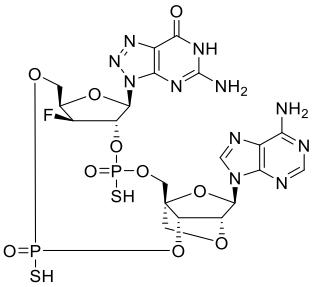
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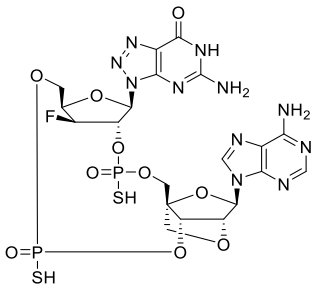
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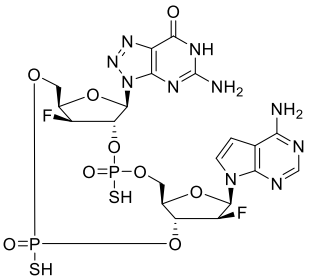
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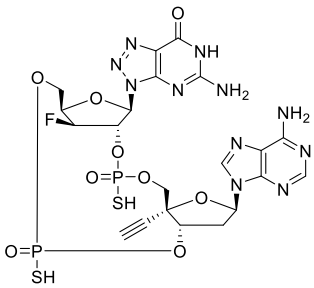
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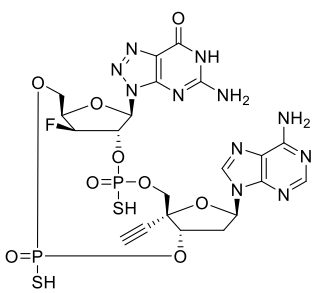
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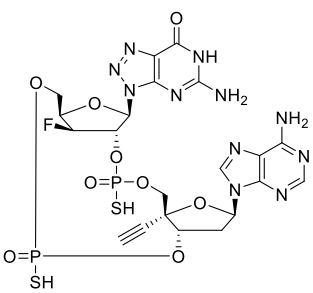
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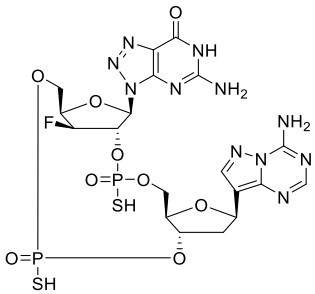
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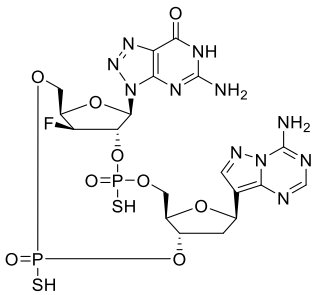
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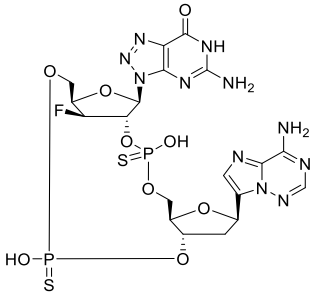
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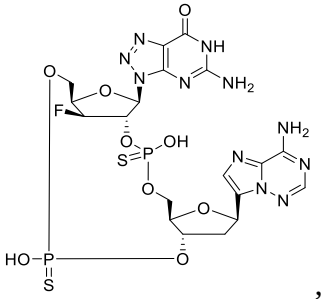
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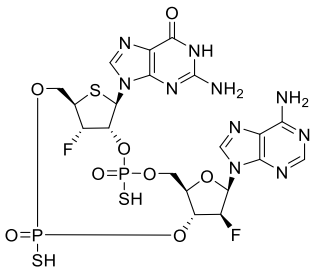
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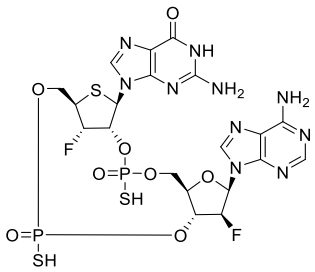
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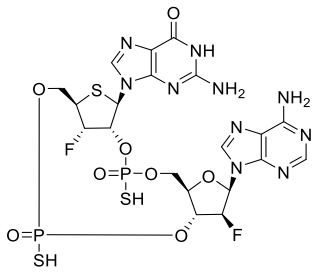
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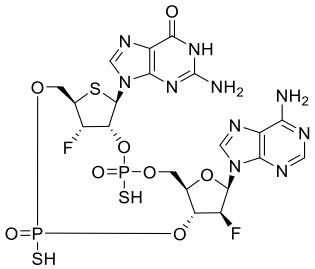
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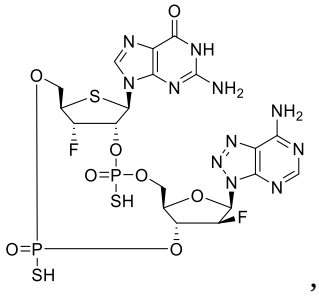
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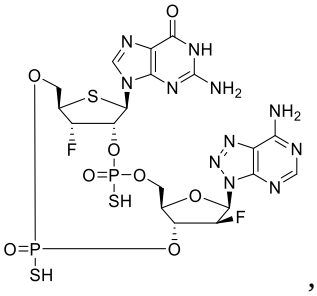
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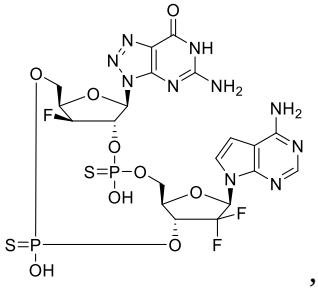
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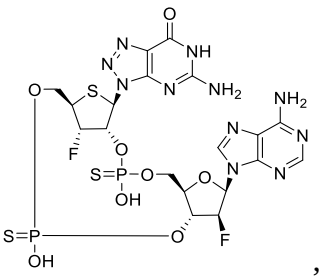
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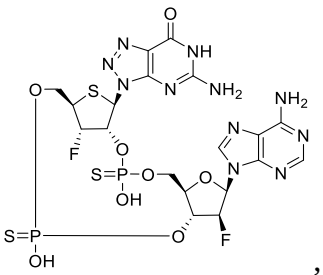
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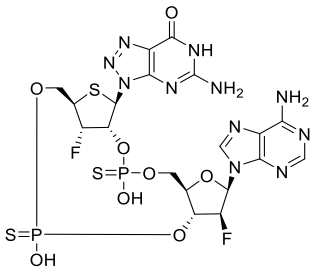
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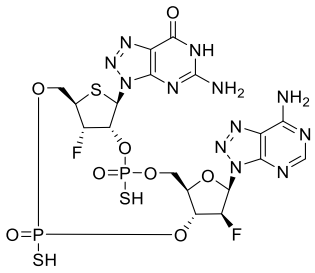
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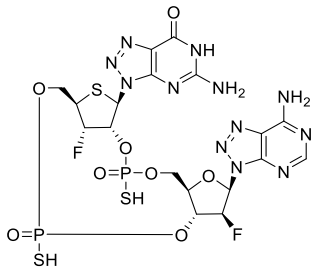
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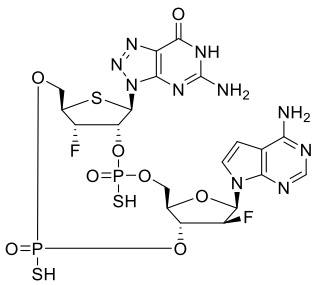
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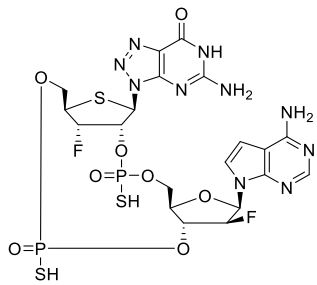
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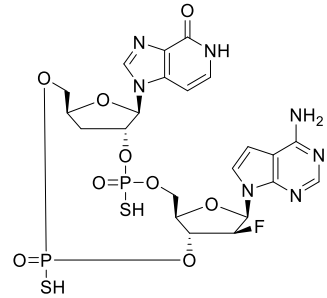
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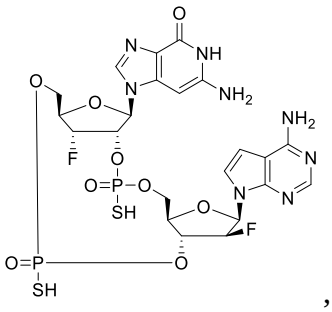
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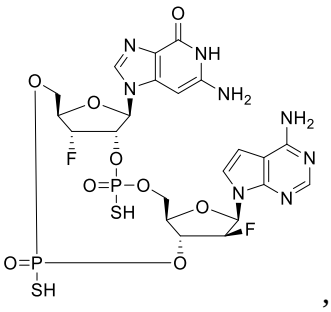
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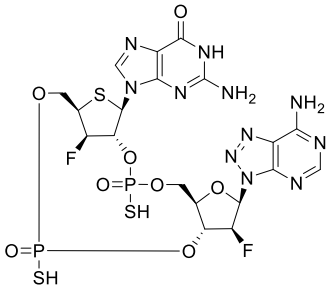
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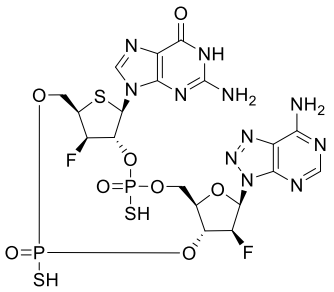
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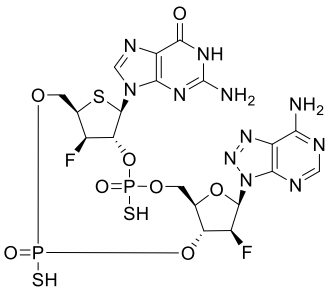
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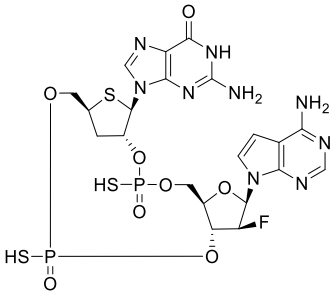
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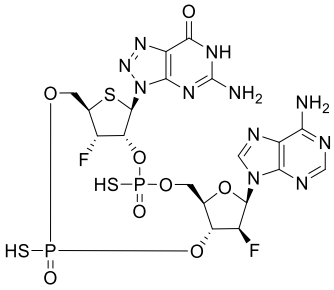
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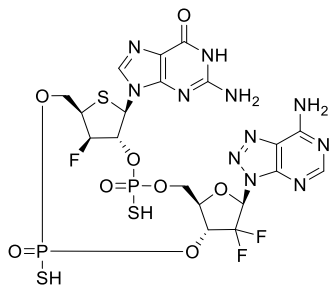
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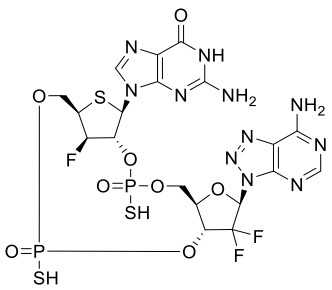
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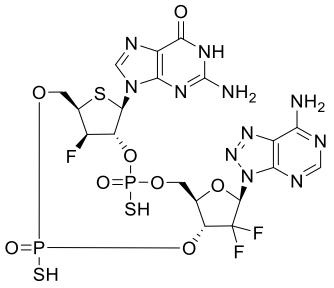
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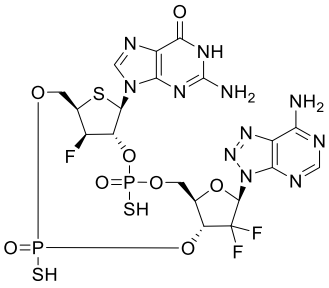
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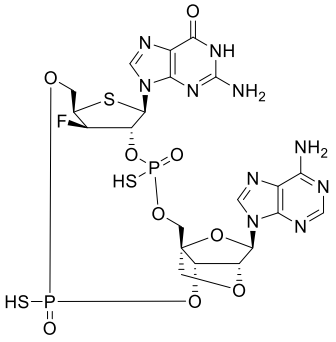
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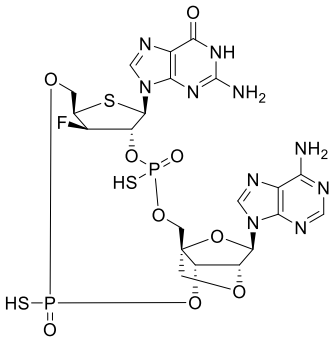
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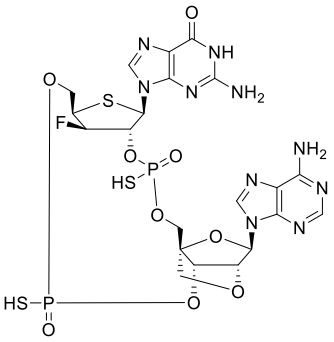
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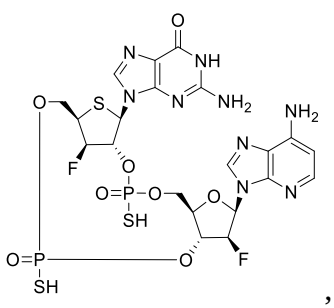
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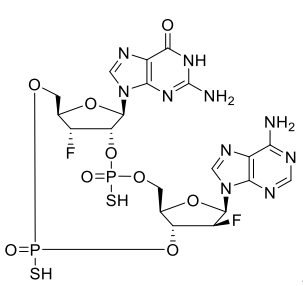
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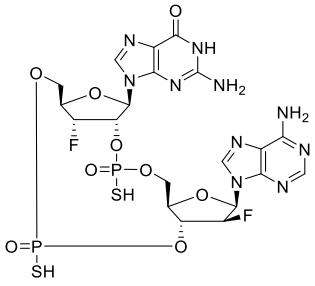
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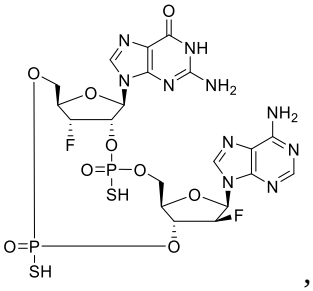
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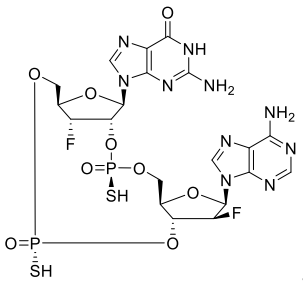
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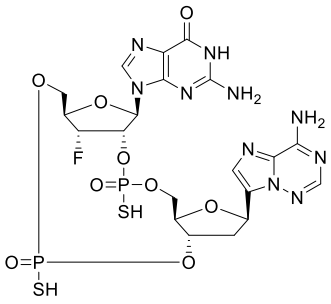
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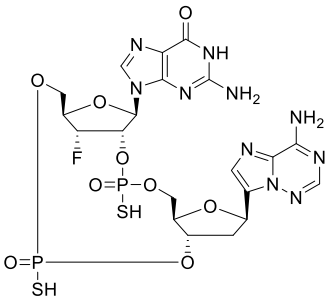
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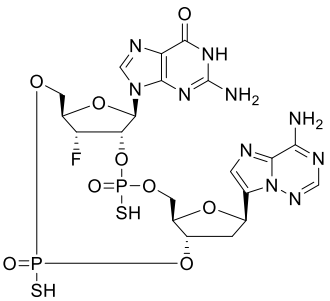
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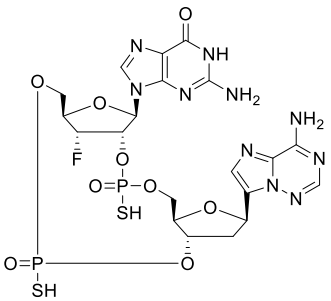
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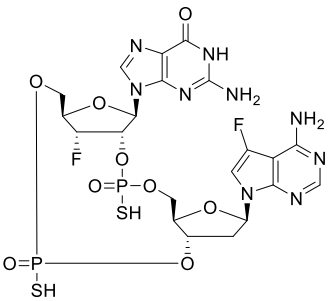
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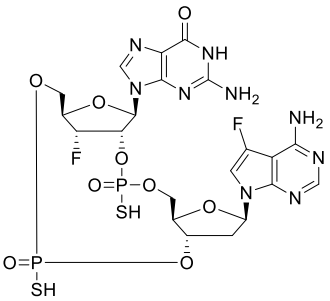
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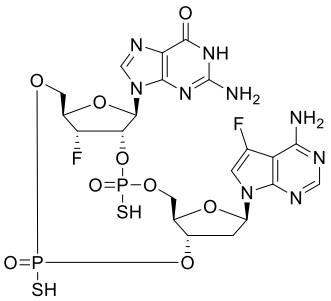
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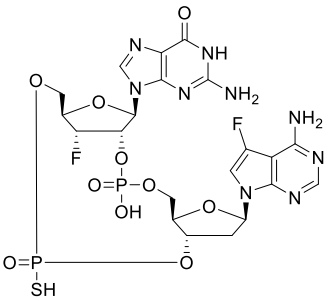
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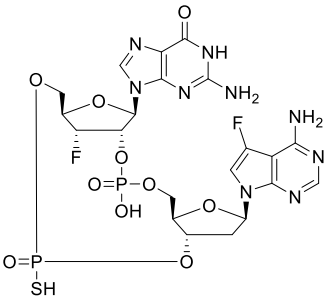
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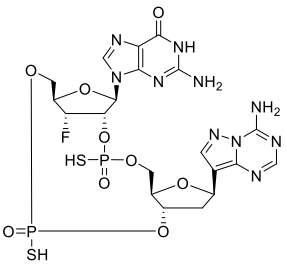
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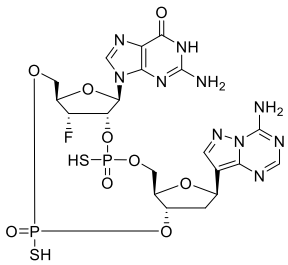
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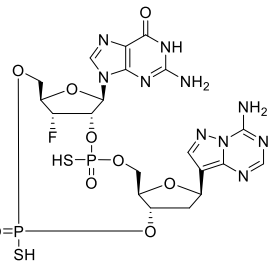

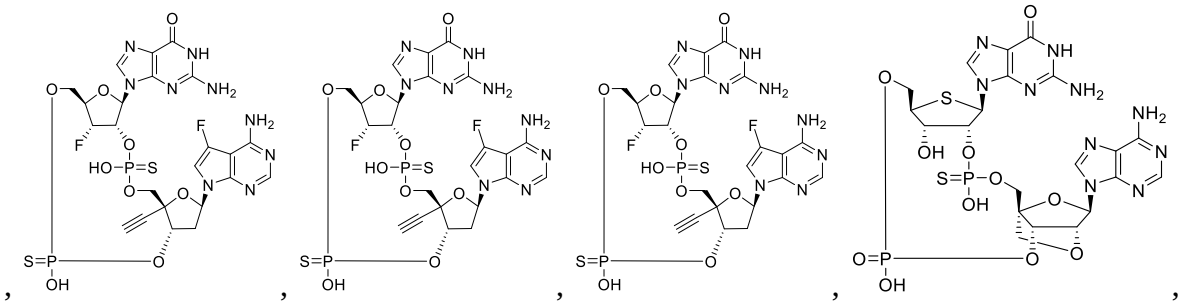

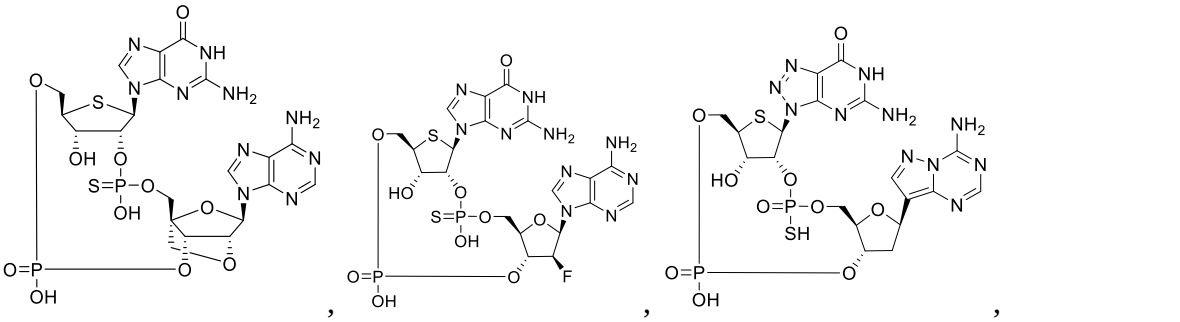

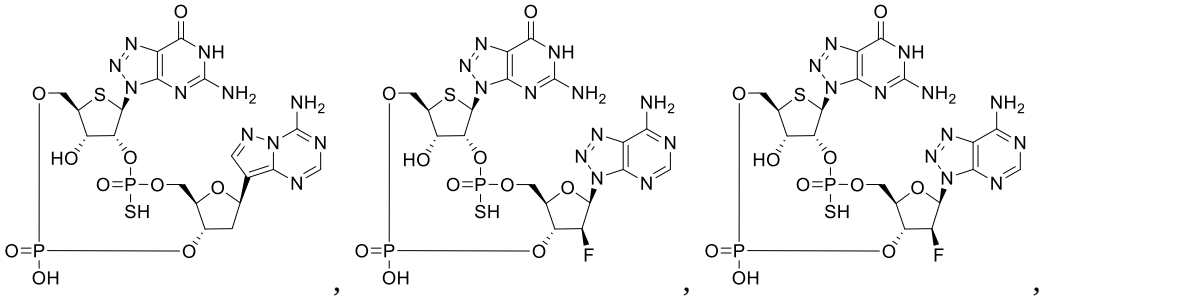

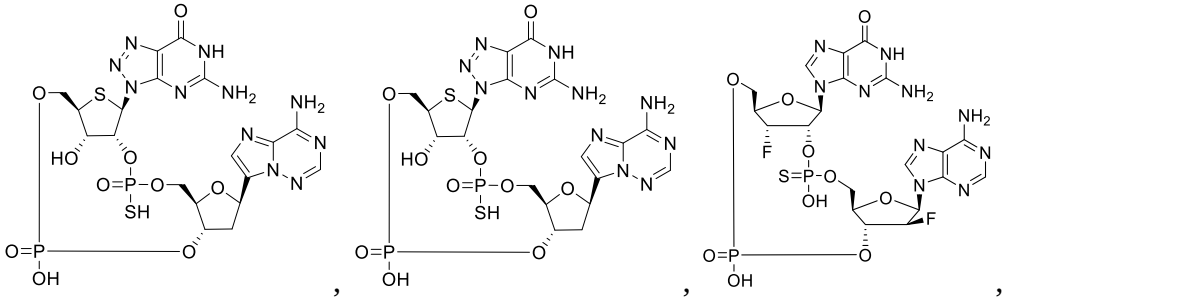

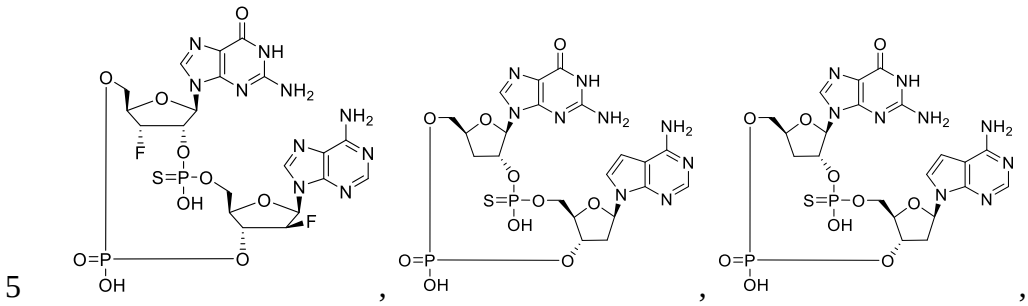

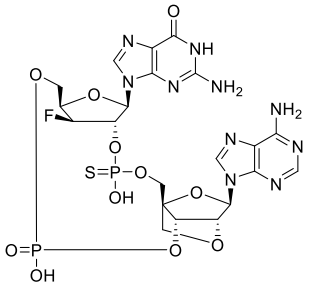
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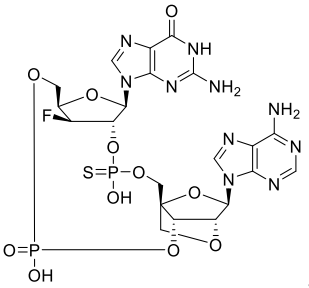
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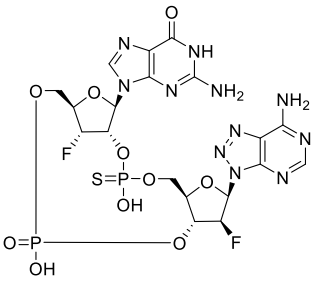
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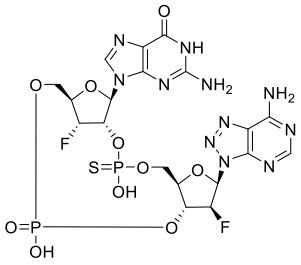
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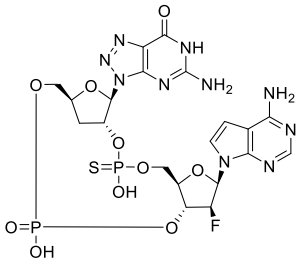
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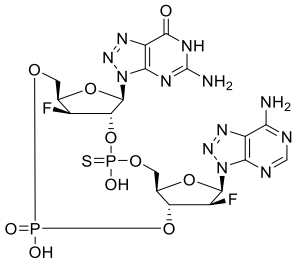
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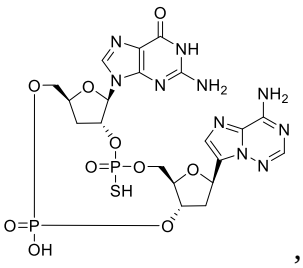
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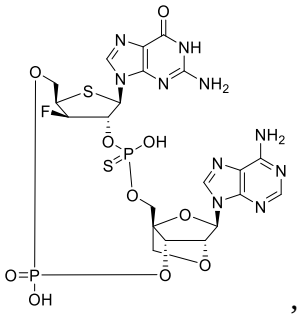
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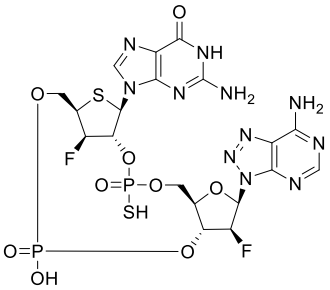
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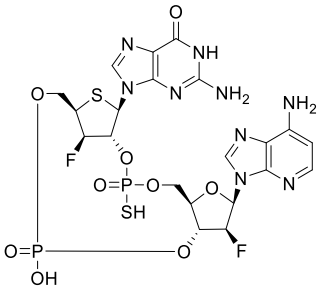
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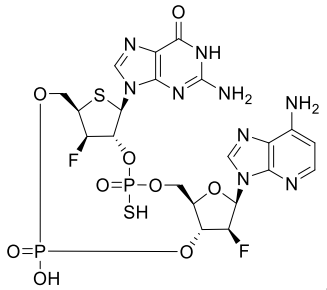
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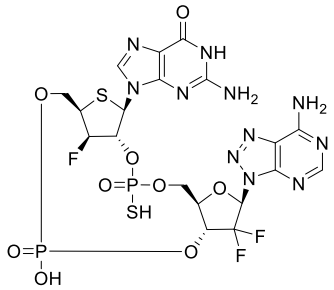
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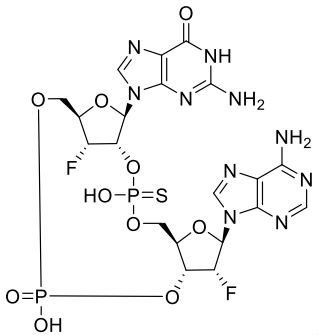
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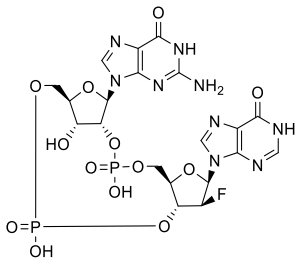
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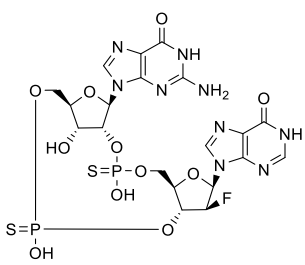
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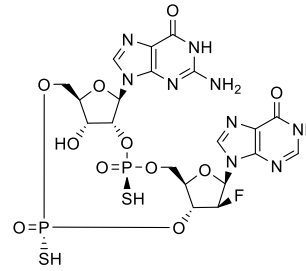
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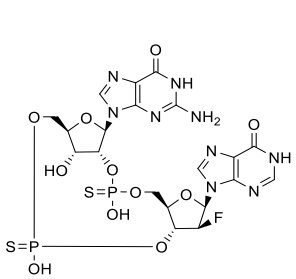
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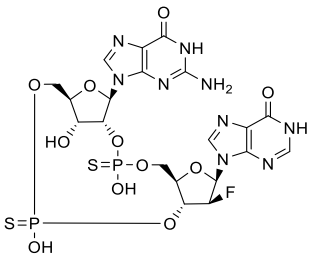
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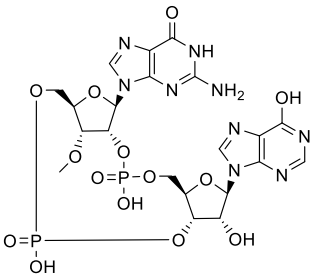
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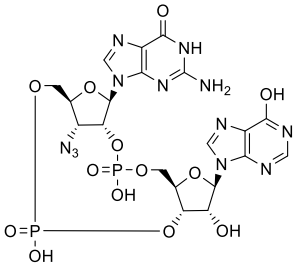
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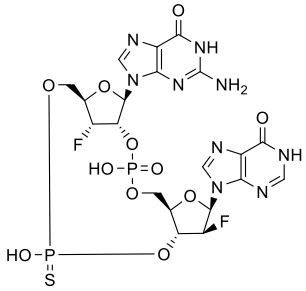
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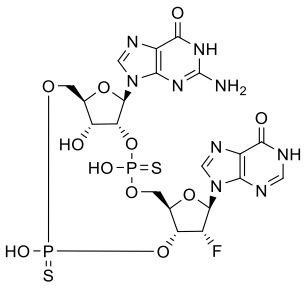
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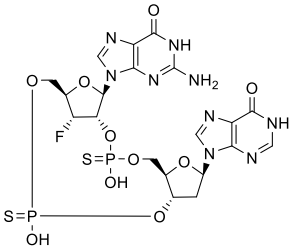
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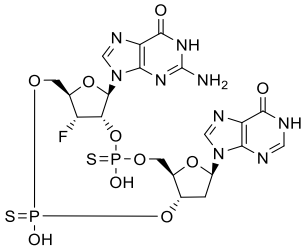
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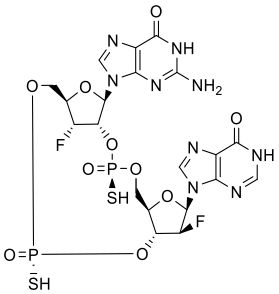
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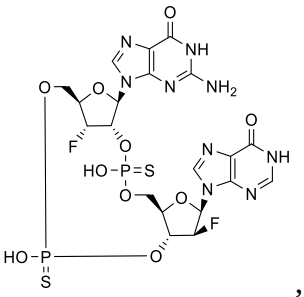
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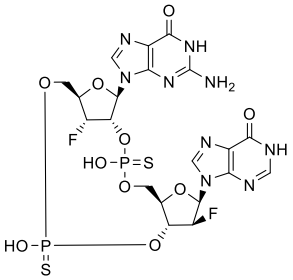
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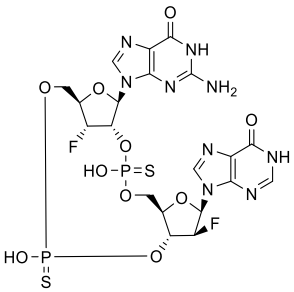
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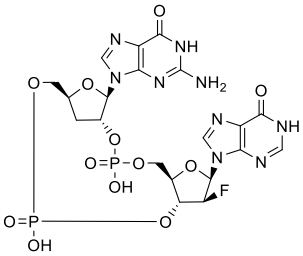
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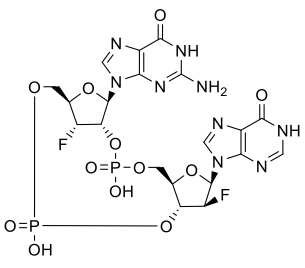
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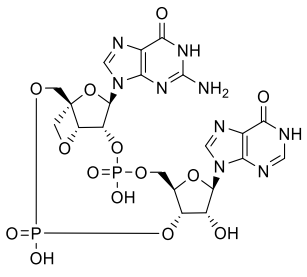
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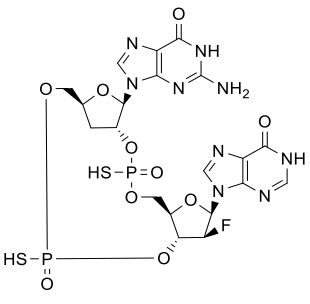
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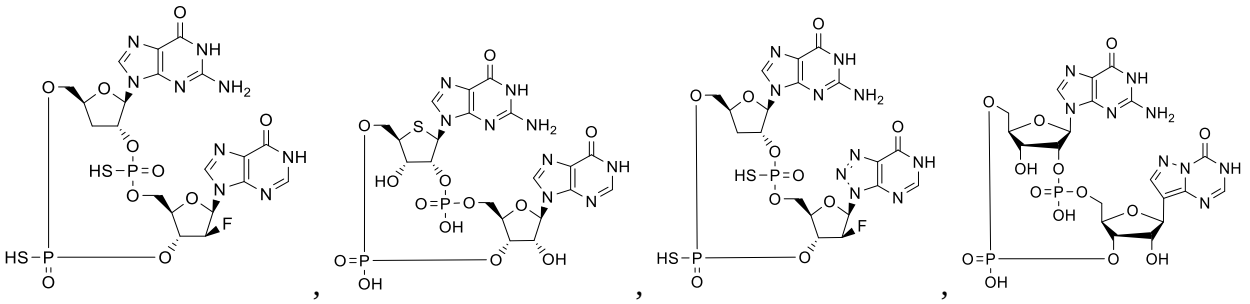

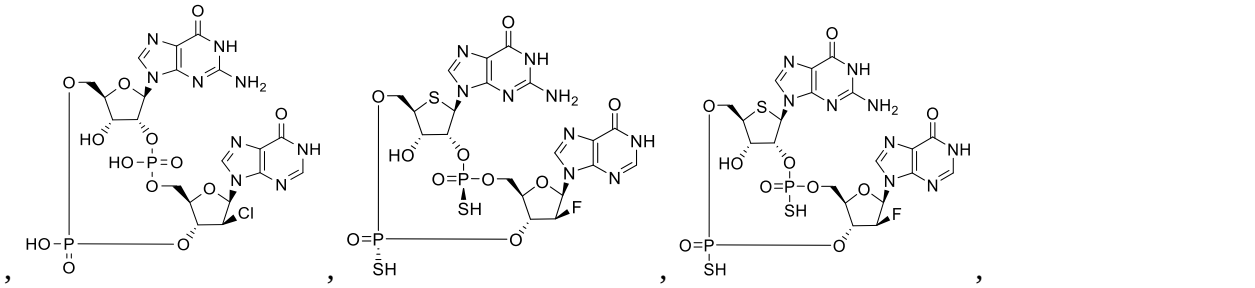

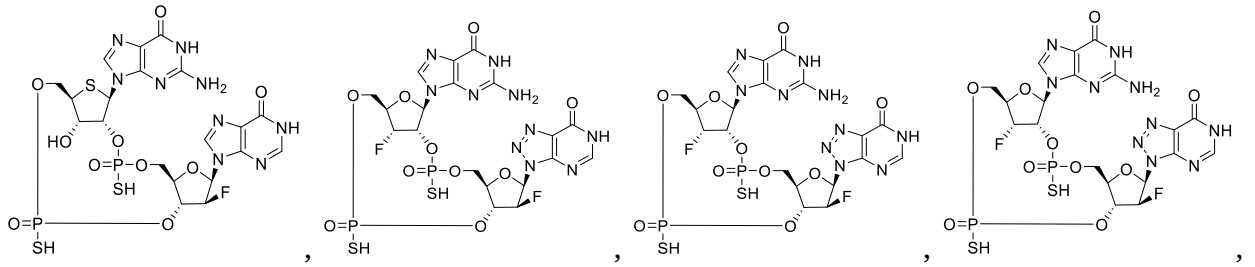

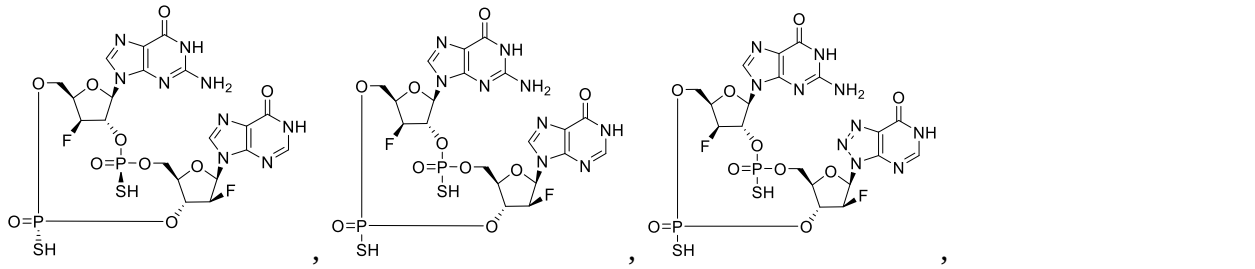

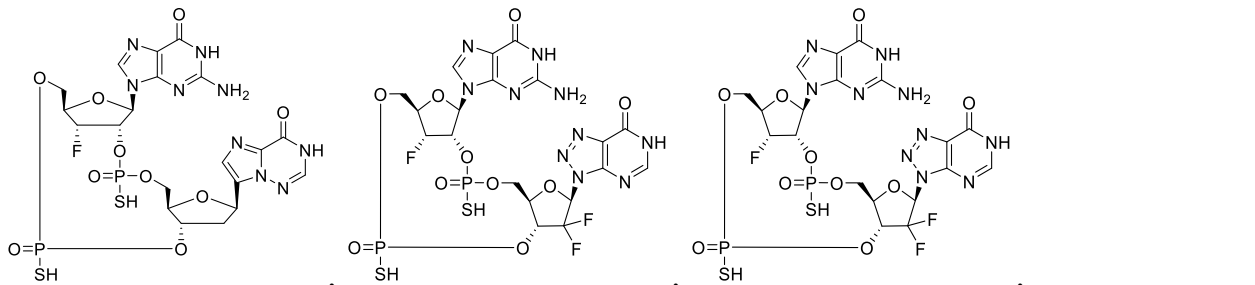

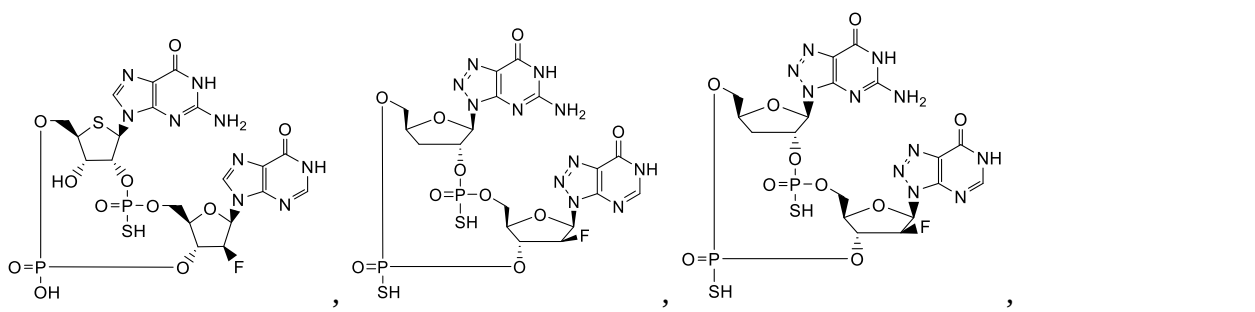

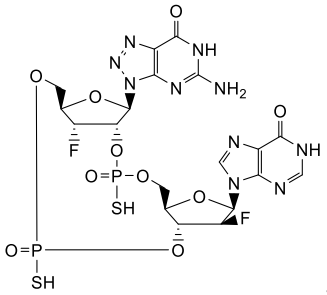
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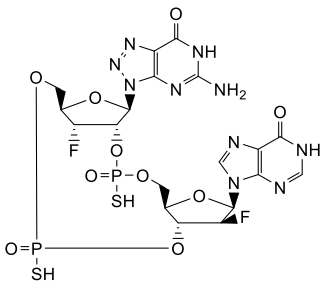
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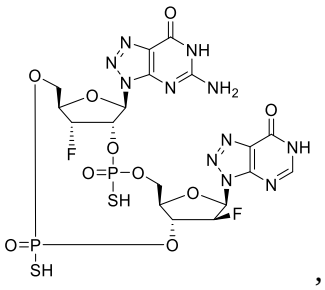
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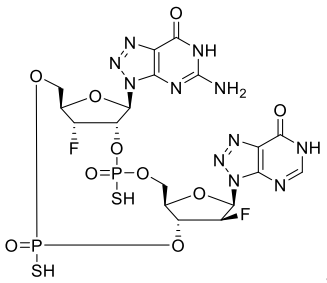
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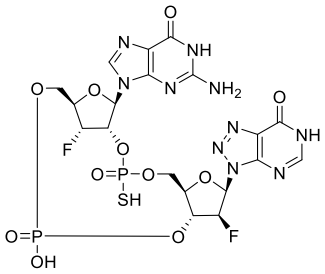
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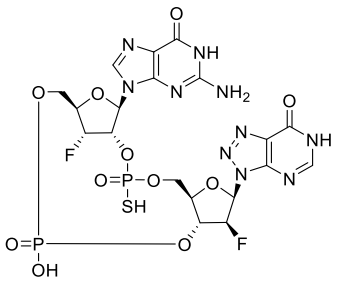
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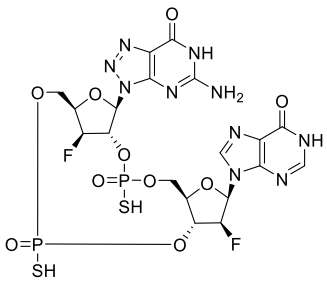
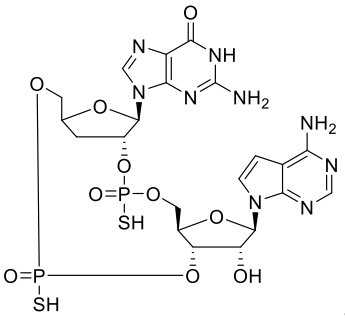

, and pharmaceutically acceptable salts, hydrates, solvates, or prodrugs thereof.

23. The compound according to claim 22, wherein the compound is selected from the group consisting of: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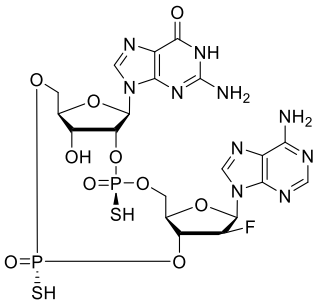
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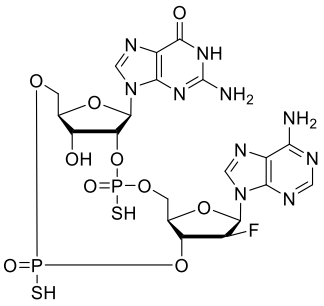
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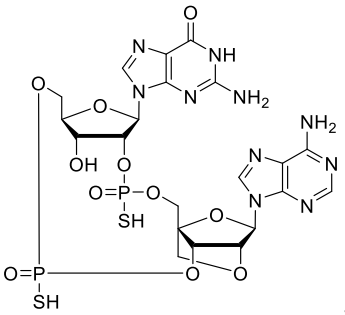
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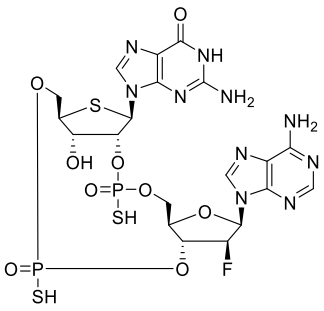
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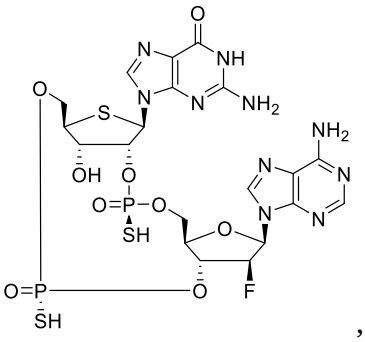
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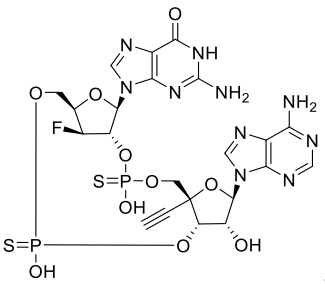
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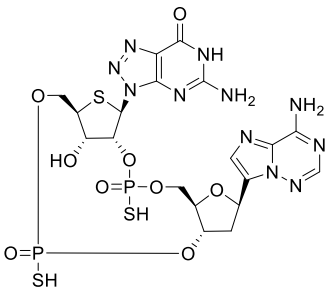
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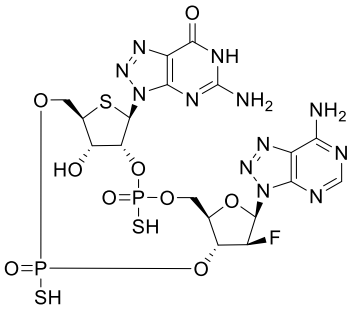
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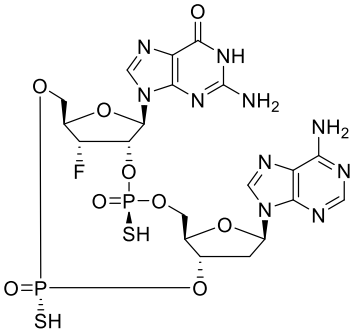
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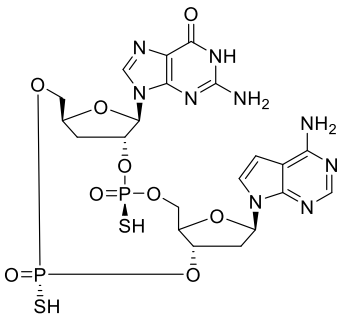
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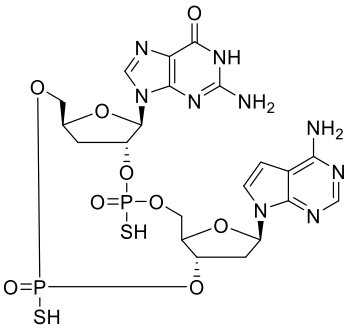
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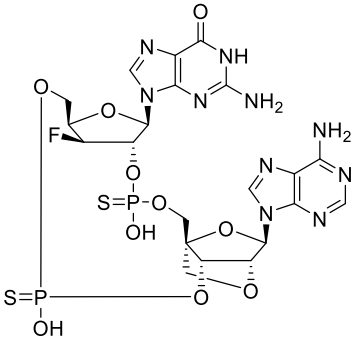
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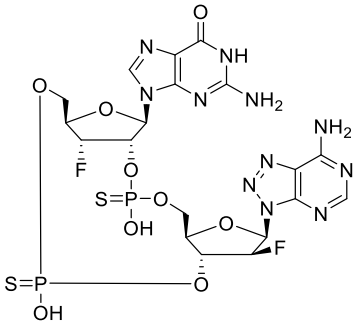
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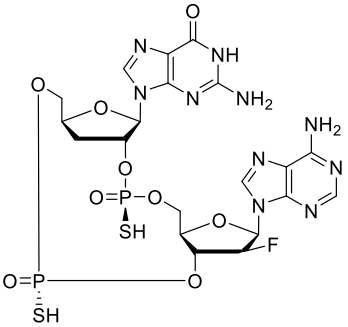
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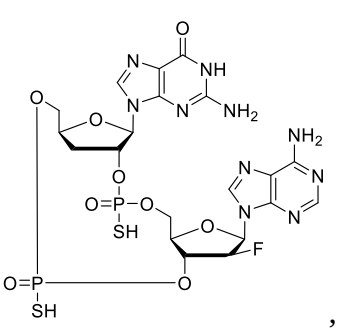
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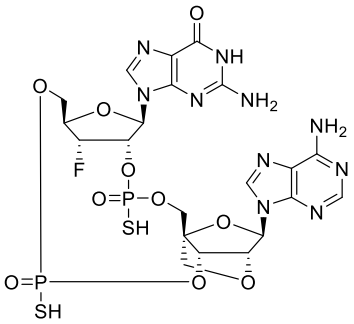
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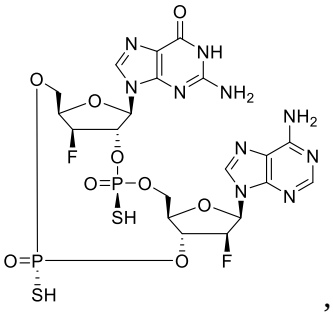
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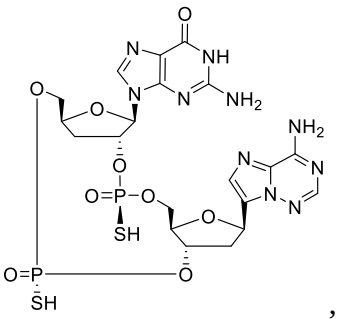
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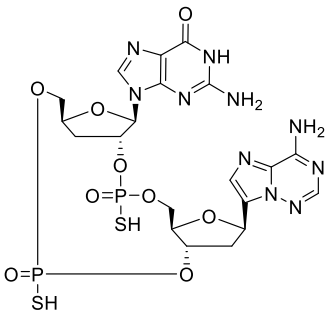
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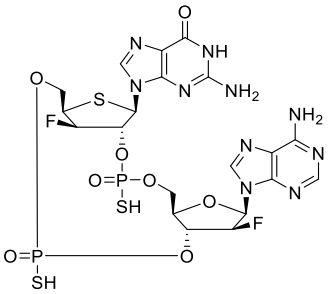
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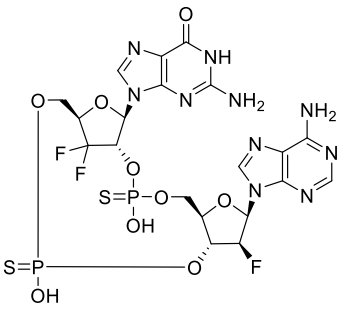
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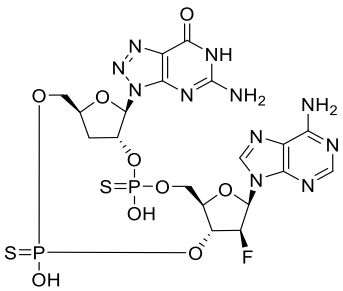
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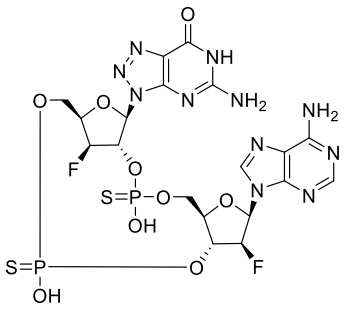
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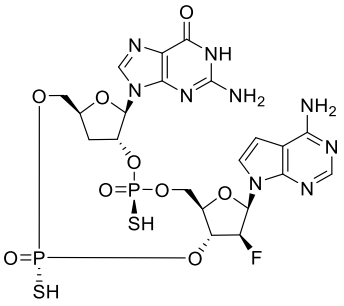
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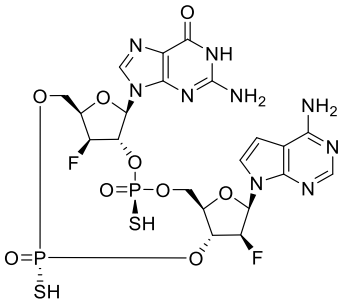
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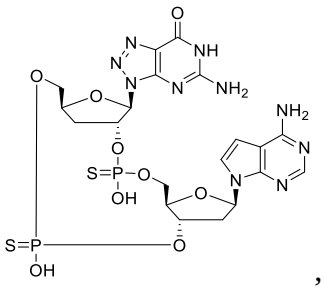
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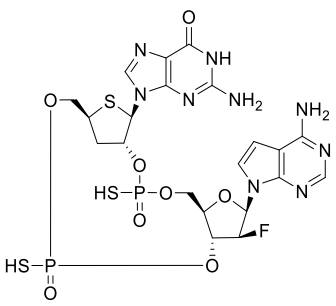
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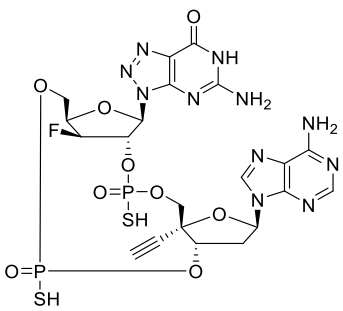
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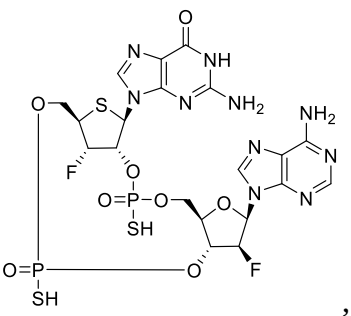
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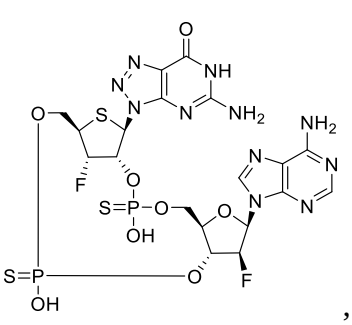
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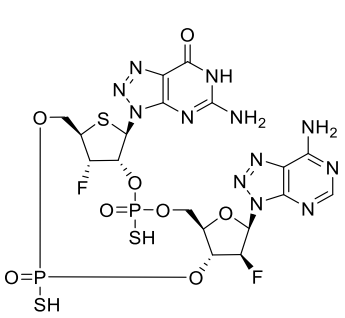
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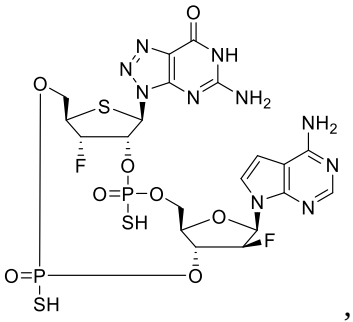
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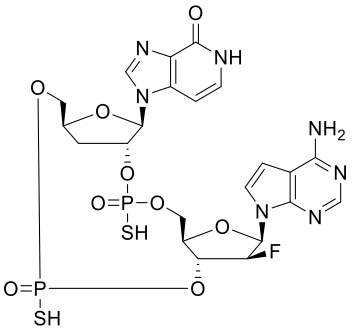
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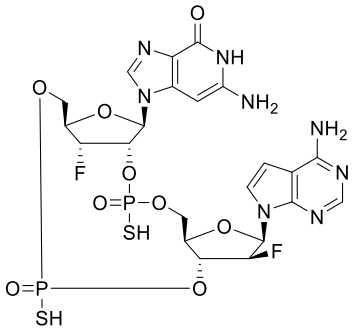
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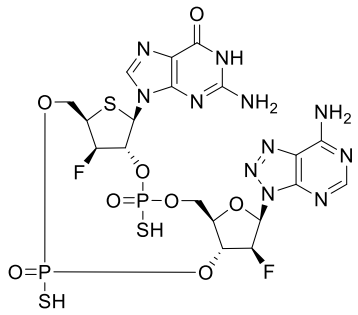
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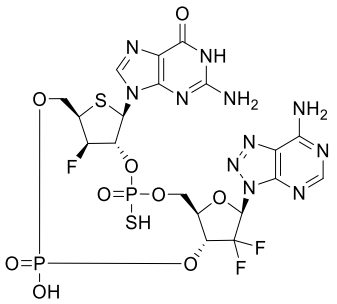
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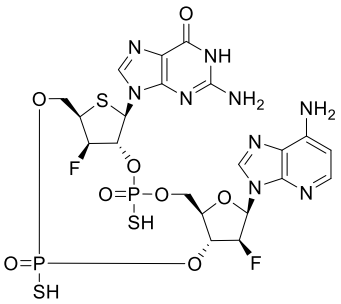
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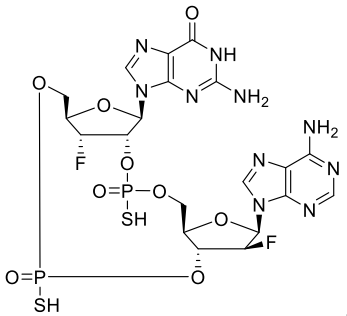
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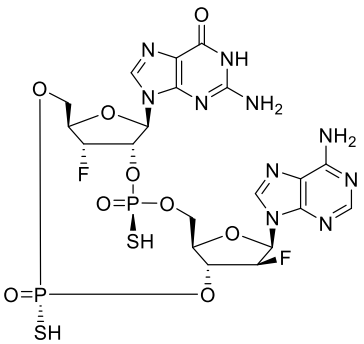
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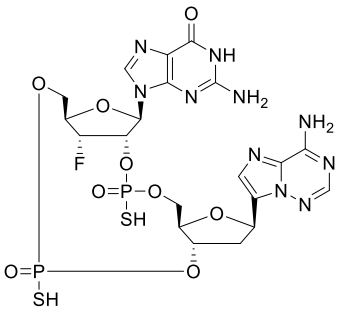
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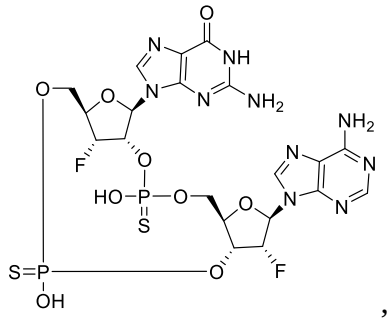
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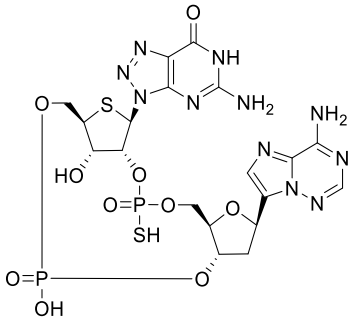
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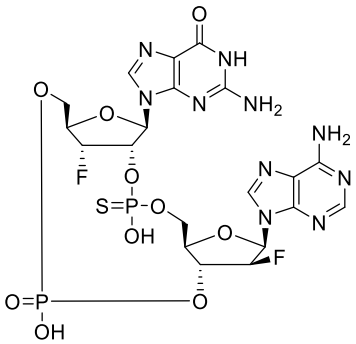
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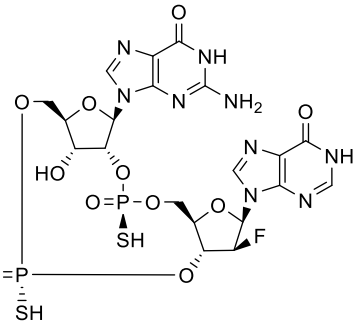
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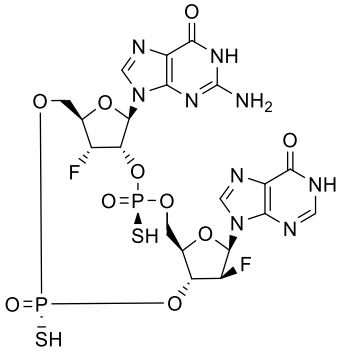
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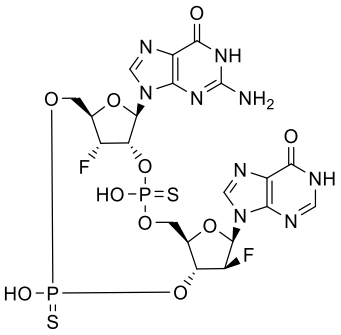
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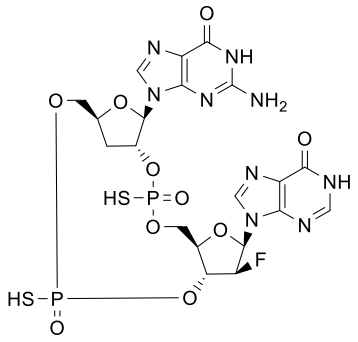
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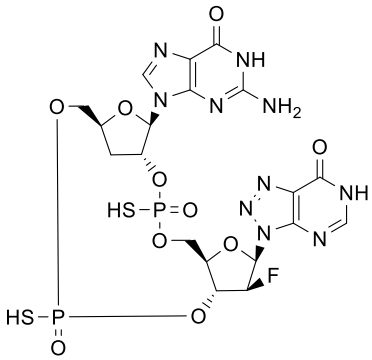
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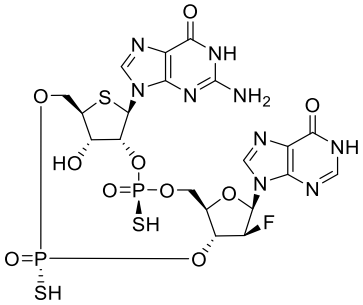
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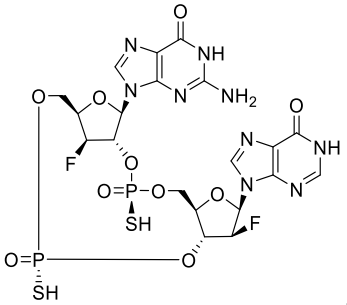
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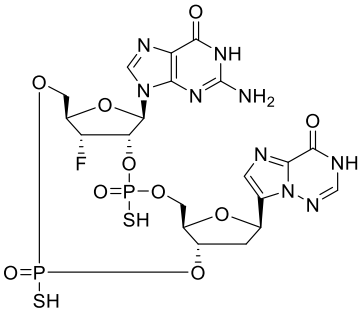
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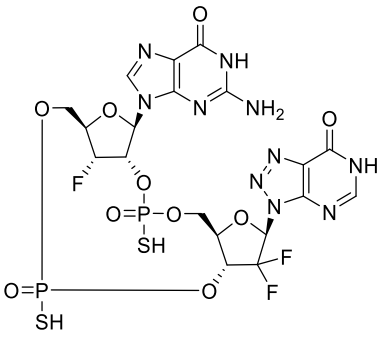
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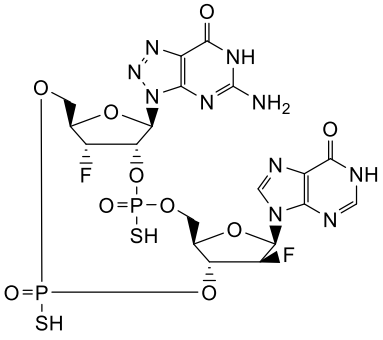
,

and pharmaceutically acceptable salts, hydrates, solvates, or prodrugs thereof.

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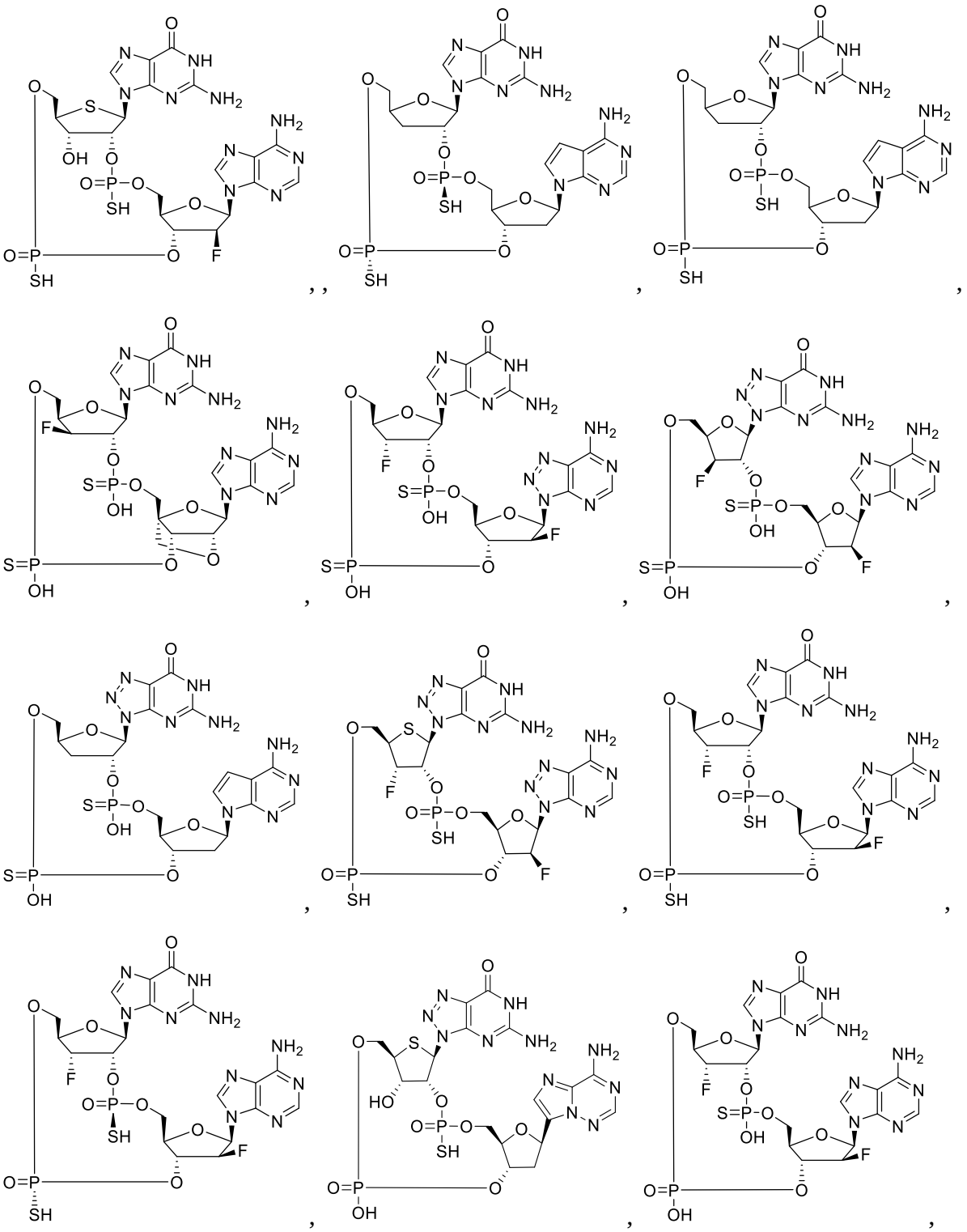
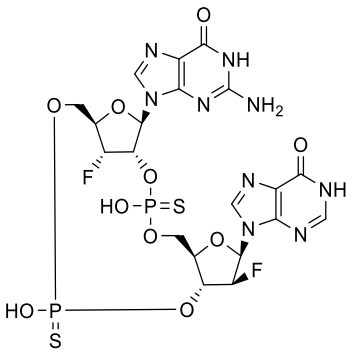
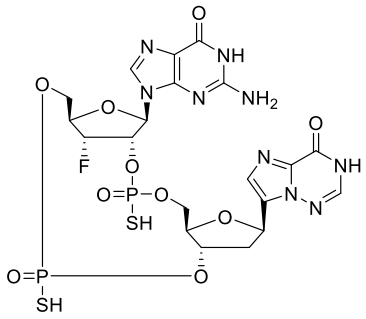
24. The compound according to claim 22, wherein the compound is selected from the group consisting of:





, and 

, and pharmaceutically acceptable salts, hydrates, solvates, or prodrugs thereof.

25. A pharmaceutical composition, said pharmaceutical composition comprising:

(a) a compound according to any one of claims 11 to 24 or a pharmaceutically acceptable salt, hydrate, solvate, or prodrug thereof; and

(b) a pharmaceutically acceptable carrier.

26. Use of a compound according to any one of claims 11 to 24 in the manufacture of a medicament for ~~A method of~~ inducing an immune response ~~in a subject, said method comprising administering a therapeutically effective amount of a compound according to any one of claims 11 to 24 to the subject~~.

27. Use of a pharmaceutical composition according to claim 25 in the manufacture of a medicament for ~~A method of~~ inducing an immune response ~~in a subject, said method comprising administering a therapeutically effective amount of a pharmaceutical composition according to claim 25 to the subject~~.

28. Use of a compound according to any one of claims 11 to 24 in the manufacture of a medicament for ~~A method of~~ inducing a STING-dependent type I interferon production ~~in a subject, said method comprising administering a therapeutically effective amount of a compound according to any one of claims 11 to 24 to the subject~~.

29. Use of a pharmaceutical composition according to claim 25 in the manufacture of a medicament for ~~A method of~~ inducing a STING-dependent type I interferon production ~~in a subject, said method comprising administering a therapeutically effective amount of a pharmaceutical composition according to claim 25 to the subject~~.

30. Use of a compound according to any one of claims 11 to 24 in the manufacture of a medicament for ~~A method of~~ treating a cell proliferation disorder ~~in a subject, said method comprising administering a therapeutically effective amount of a compound according to any one of claims 11 to 24 to the subject~~.

31. The ~~method~~ use of claim 30, wherein the cell proliferation disorder is cancer.

32. Use of a pharmaceutical composition according to claim 25 in the manufacture of a medicament for ~~A method of~~ treating a cell proliferation disorder ~~in a subject, said method comprising administering a therapeutically effective amount of a pharmaceutical composition according to claim 25 to the subject~~.

33. The ~~method~~ use of claim 32, wherein the cell proliferation disorder is cancer.