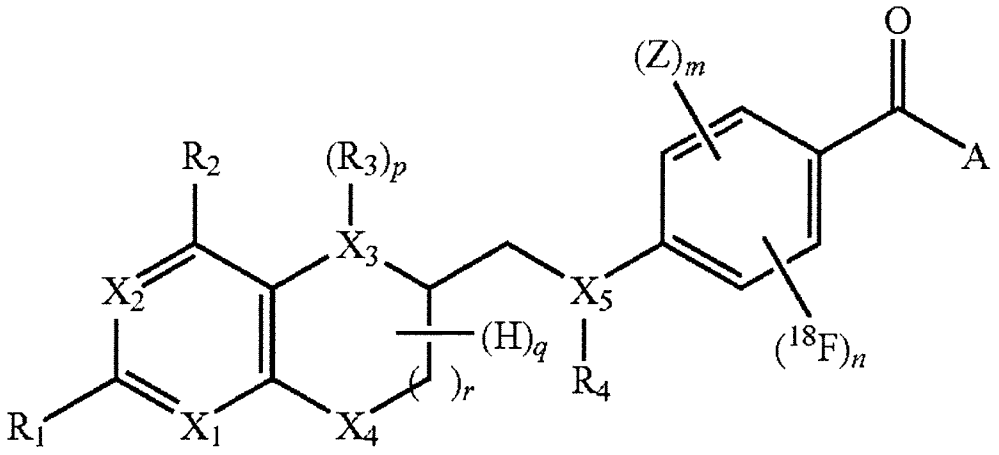
The invention claimed is:

1. A folate compound of formula I

I



wherein

A is an amino acid,

X_1 to X_5 are each N,

Z is an electron-withdrawing group,

R_1, R_2 are independently of each other H, Hal, O, —OR", —NHR", C1-C12 alkyl, C1-C12 alkoxy, C1-C12 alkanoyl, C2-C12 alkenyl, C2-C12 alkynyl, (C1-C12 alkoxy)carbonyl, or (C1-C12 alkylamino)carbonyl,

R" is H or C1-C6 alkyl,

R_3, R_4 are independently of each other H, formyl, iminomethyl, nitroso, C1-C12 alkyl, C1-C12 alkoxy, C1-C12 alkanoyl, or halosubstituted C1-C12 alkanoyl,

m is 0, 1, 2 or 3,

n is 1,

p is 0, 1 or 2,

q has a value of 1 to 7, and

r is 0 or 1.

2. A compound of claim **1**, wherein
m is 1, 2 or 3.

3. The compound of claim **1**, wherein the aminobenzoyl moiety of the compound of formula I is substituted with fluorine-18 in the 2'-position or the 6'-position.

4. The compound of claim **1**, wherein the aminobenzoyl moiety of the compound of formula I is substituted with at least one electron-withdrawing group Z in the 2'-position or the 6'-position.

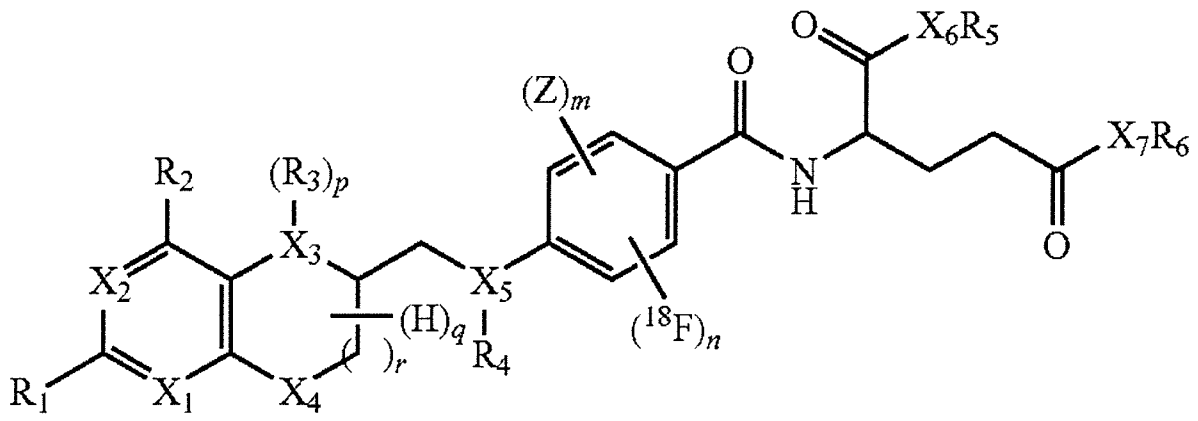
5. The compound of claim **1**, wherein the electron-withdrawing group Z is selected from the group consisting of —NO_2, —CN, —$N^+(CH_3)_3$, —SO_3R', —COOR', —COR', —Cl, —Br, —F, iodonium salts —$I^+(R')_2$, dialkyl/-aryl silanes —$SiOH(R')_2$, and silanols —$SiH(R')_2$, wherein R' is independently a straight-chain or branched $C_{(1-12)}$ alkyl group or an optionally substituted carbocyclic and heterocyclic group comprising five-, six- or ten-membered ring systems.

6. The compound of claim **1**, wherein the aminobenzoyl moiety of the compound of formula I is substituted in the 2'- or the 6'-position with fluorine-18 and in the 6'- or the 2'-position with an electron-withdrawing group selected from the group consisting of —NO_2, —CN, —$N^+(CH_3)_3$, —SO_3R', —COOR', —COR', —Cl, —Br, —F, iodonium salts —$I^+(R')_2$, dialkyl/-aryl silanes —$SiOH(R')_2$, and silanols —$SiH(R')_2$, wherein R' is independently a straight-chain or branched $C_{(1-12)}$ alkyl group or an optionally substituted carbocyclic and heterocyclic group comprising five-, six- or ten-membered ring systems.

7. The compound according to claim **1**, wherein A is an amino acid selected from the group consisting of glutamic acid, aspartic acid, glutamine, aspartine, lysine, arginine, cysteine, and homopolymers thereof.

8. The compound of claim **1** having formula II,

II



wherein

X_1 to X_5 are each N,

X_6, X_7 are independently of each other C, N or O,

Z is a electron-withdrawing group selected from the group consisting of —NO_2, —CN, —$N^+(CH_3)_3$, —SO_3R', —COOR', —COR', —Cl, —Br, —F, iodonium salts —$I^+(R')_2$, dialkyl/-aryl silanes —$SiOH(R')_2$, and silanols —$SiH(R')_2$,

R' is independently a straight-chain or branched $C_{(1-12)}$ alkyl group or an optionally substituted carbocyclic and heterocyclic group comprising five-, six- or ten-membered ring systems,

R_1, R_2 are independently of each other H, Hal, O, —OR", —NHR", C1-C12 alkyl, C1-C12 alkoxy, C1-C12 alkanoyl, C2-C12 alkenyl, C2-C12 alkynyl, (C1-C12 alkoxy)carbonyl, or (C1-C12 alkylamino)carbonyl,

R" is H or C1-C6 alkyl,

R_3, R_4 are independently of each other H, formyl, iminomethyl, nitroso, C1-C12 alkyl, C1-C12 alkoxy, C1-C12 alkanoyl, or halosubstituted C1-C12 alkanoyl,

R_5, R_6 are independently of each other H or straight chain or branched C_1-C_{12} alkyl, which is unsubstituted or substituted by at least one CN, Hal, or NO_2, and wherein one or more of embedded, non-adjacent CH2 groups may independently be replaced by —O—, —CO—, —CO—O—, —CO—NR'—, —CH=CH—, or —C≡C—,

m is 0, 1, 2 or 3,

n is 1,

r is 0 or 1,

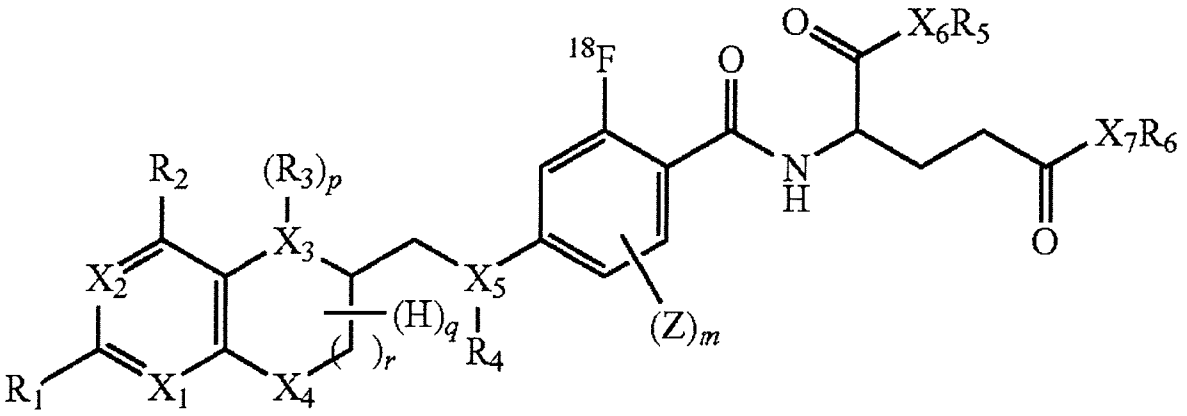
p is 0, 1 or 2, and

q has a value of 1 to 7.

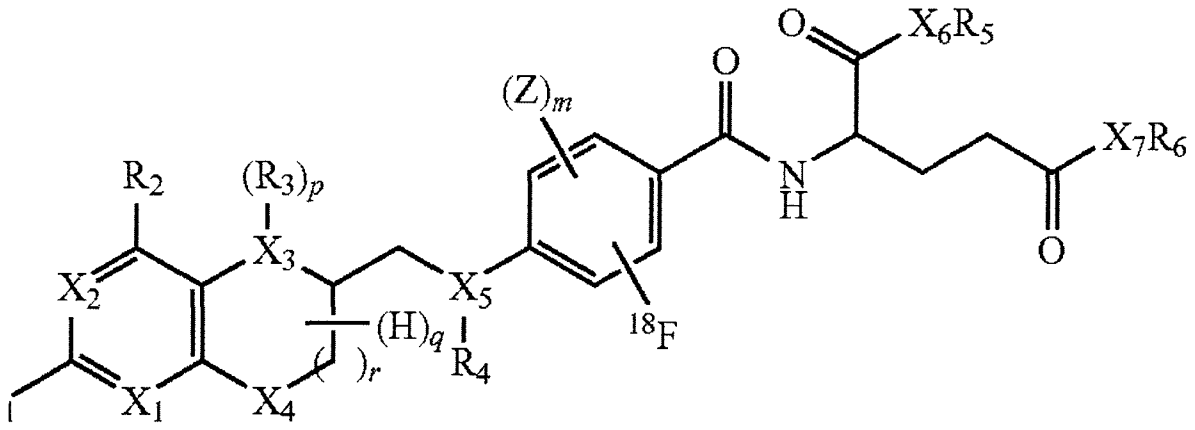
9. The compound of claim **8**, wherein the fluorine-18 is at the 2'- or 6'-position.

10. The compound of claim **1** having formulae III or IV,

III



IV



wherein

X_1 to X_5 are each N,

X_6, X_7 are independently of each other C, N or O,

Z is a electron-withdrawing group selected from the group consisting of —NO_2, —CN, —$N^+(CH_3)_3$, —SO_3R', —COOR', —COR', —Cl, —Br, —F, iodonium salts —$I^+(R')_2$, dialkyl/-aryl silanes —$SiOH(R')_2$, and silanols —$SiH(R')_2$,

R' is independently a straight-chain or branched $C_{(1-12)}$ alkyl group or an optionally substituted carbocyclic and heterocyclic group comprising five-, six- or ten-membered ring systems,

R_1, R_2 are independently of each other H, Hal, O, —OR", —NHR", C1-C12 alkyl, C1-C12 alkoxy, C1-C12 alkanoyl, C2-C12 alkenyl, C2-C12 alkynyl, (C1-C12 alkoxy)carbonyl, or (C1-C12 alkylamino)carbonyl,

R" is H or C1-C6 alkyl,

R_3, R_4 are independently of each other H, formyl, iminomethyl, nitroso, C1-C12 alkyl, C1-C12 alkoxy, C1-C12 alkanoyl, or halosubstituted C1-C12 alkanoyl,

R_5, R_6 are independently of each other H or straight chain or branched C_1-C_{12} alkyl, which is unsubstituted or substituted by at least one CN, Hal, or NO_2, and wherein one or more of embedded, non-adjacent CH2 groups may independently be replaced by —O—, —CO—, —CO—O—, —CO—NR'—, —CH=CH—, or —C≡C—,

m is 0, 1, 2, or 3,

r is 0 or 1,

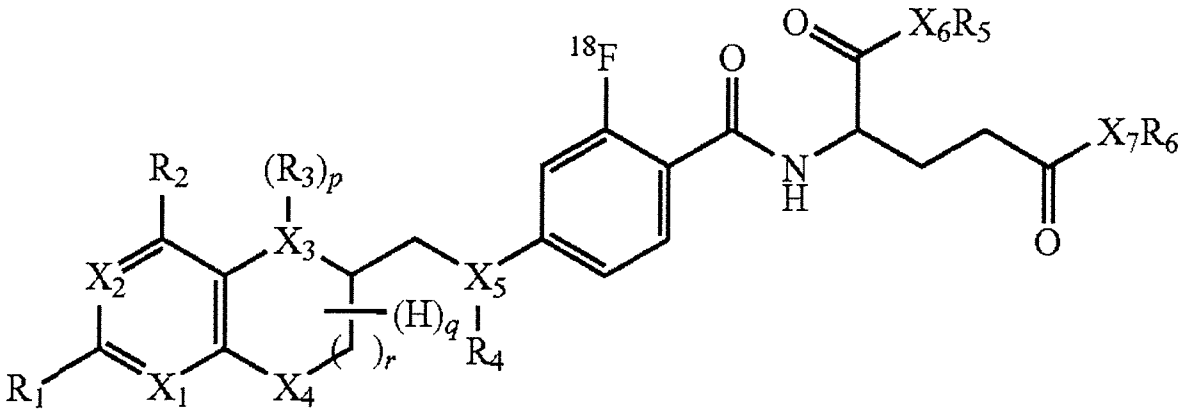
p is 0, 1 or 2, and

q has a value of 1 to 7.

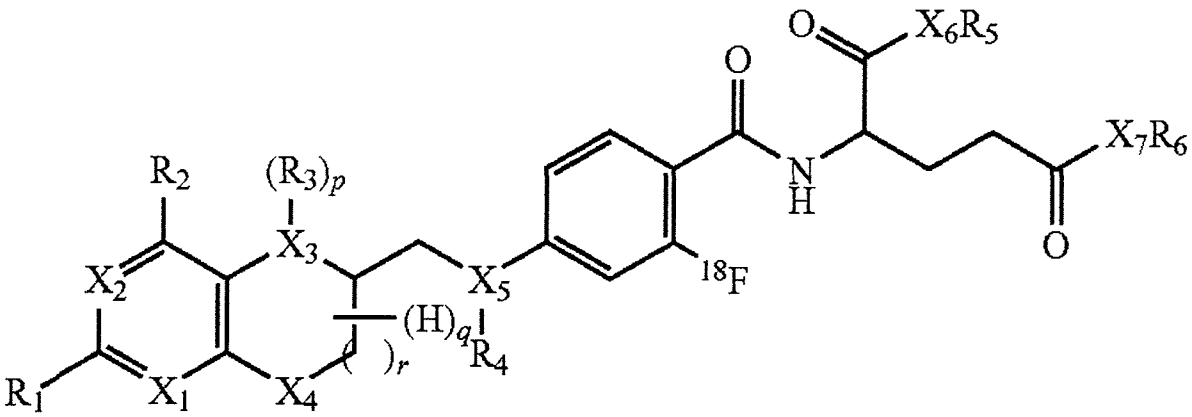
11. The compound of claim **10**, wherein m is 0.

12. The compound of claim **1** having formulae V or VI,

V



VI



wherein

X_1 to X_5 are each N,

X_6, X_7 are independently of each other C, N or O,

R_1, R_2 are independently of each other H, Hal, O, —OR", —NHR", C1-C12 alkyl, C1-C12 alkoxy, C1-C12 alkanoyl, C2-C12 alkenyl, C2-C12 alkynyl, (C1-C12 alkoxy)carbonyl, or (C1-C12 alkylamino)carbonyl,

R" is H or C1-C6 alkyl,

R_3, R_4 are independently of each other H, formyl, iminomethyl, nitroso, C1-C12 alkyl, C1-C12 alkoxy, C1-C12 alkanoyl, or halosubstituted C1-C12 alkanoyl,

R_5, R_6 are independently of each other H or straight chain or branched C_1-C_{12} alkyl, which is unsubstituted or substituted by at least one CN, Hal, or NO_2, and wherein one or more of embedded, non-adjacent CH2 groups may independently be replaced by —O—, —CO—, —CO—O—, —CO—NR'—, —CH=CH—, or —C≡C—,

r is 0 or 1,

p is 0, 1 or 2, and

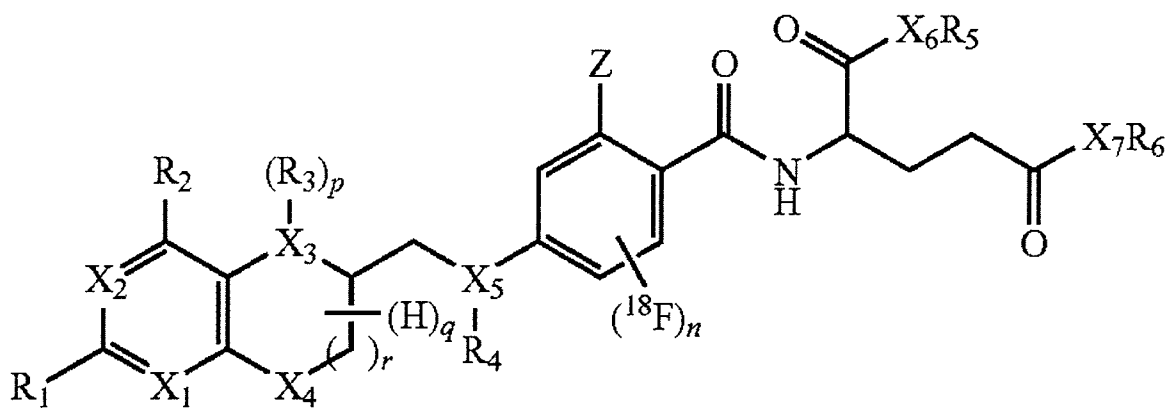
q has a value of 1 to 7.

13. The compound of claim **10**, wherein m is 1 or 2.

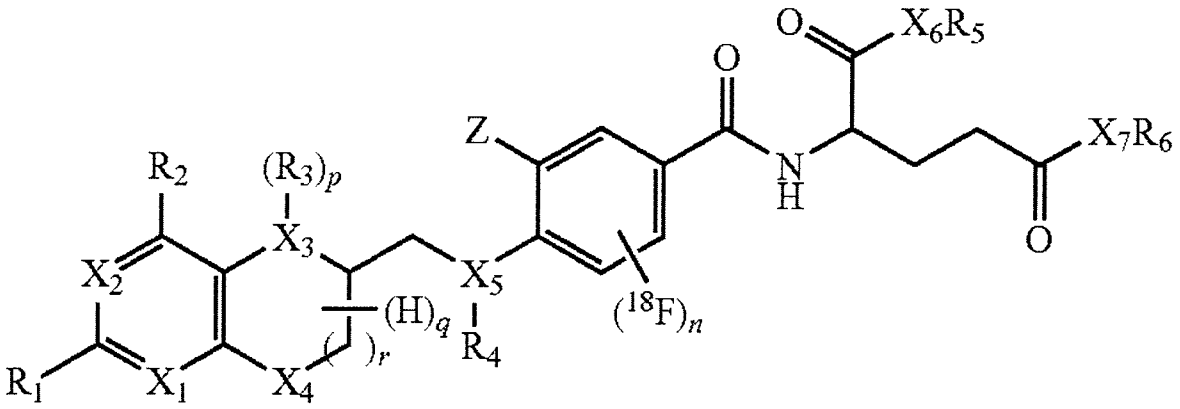
14. The compound of claim **10**, wherein Z is located at the 2'- and/or 6'-position.

15. The compound of claim **1** having formulae VII, VIII, IX, X or XI,

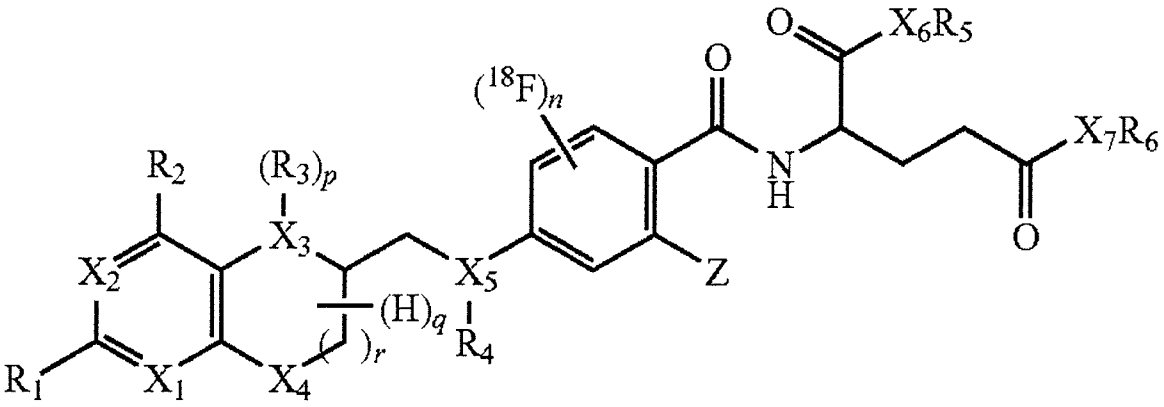
VII



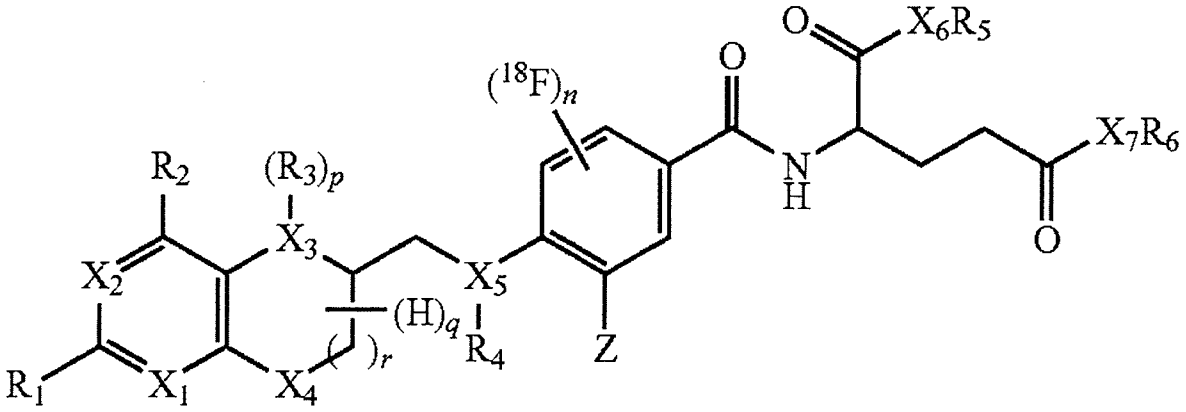
VIII



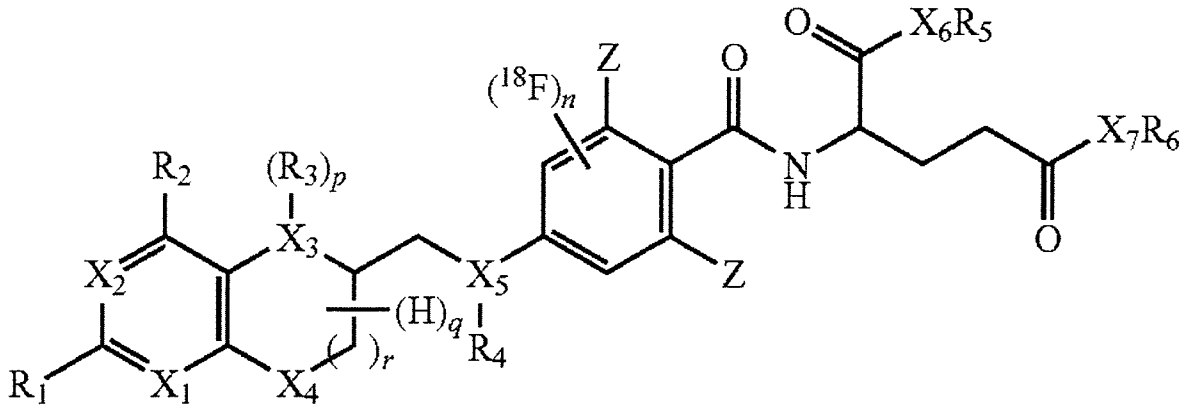
IX



X



XI



wherein

X_1 to X_5 are each N,

X_6, X_7 are independently of each other C, N or O,

Z is a electron-withdrawing group selected from the group consisting of —NO_2, —CN, —$N^+(CH_3)_3$, —SO_3R', —COOR', —COR', —Cl, —Br, —F, iodonium salts —$I^+(R')_2$, dialkyl/-aryl silanes —$SiOH(R')_2$, and silanols —$SiH(R')_2$,

R' is independently a straight-chain or branched $C_{(1-12)}$ alkyl group or an optionally substituted carbocyclic and heterocyclic group comprising five-, six- or ten-membered ring systems,

R_1, R_2 are independently of each other H, Hal, O, —OR", —NHR", C1-C12 alkyl, C1-C12 alkoxy, C1-C12 alkanoyl, C2-C12 alkenyl, C2-C12 alkynyl, (C1-C12 alkoxy)carbonyl, or (C1-C12 alkylamino)carbonyl,

R" is H or C1-C6 alkyl,

R_3, R_4 are independently of each other H, formyl, iminomethyl, nitroso, C1-C12 alkyl, C1-C12 alkoxy, C1-C12 alkanoyl, or halosubstituted C1-C12 alkanoyl,

R_5, R_6 are independently of each other H or straight chain or branched C_1-C_{12} alkyl, which is unsubstituted or substituted by at least one CN, Hal, or NO_2, and wherein one or more of embedded, non-adjacent CH2 groups may independently be replaced by —O—, —CO—, —CO—O—, —CO—NR'—, —CH=CH—, or —C≡C—,

n is 1,

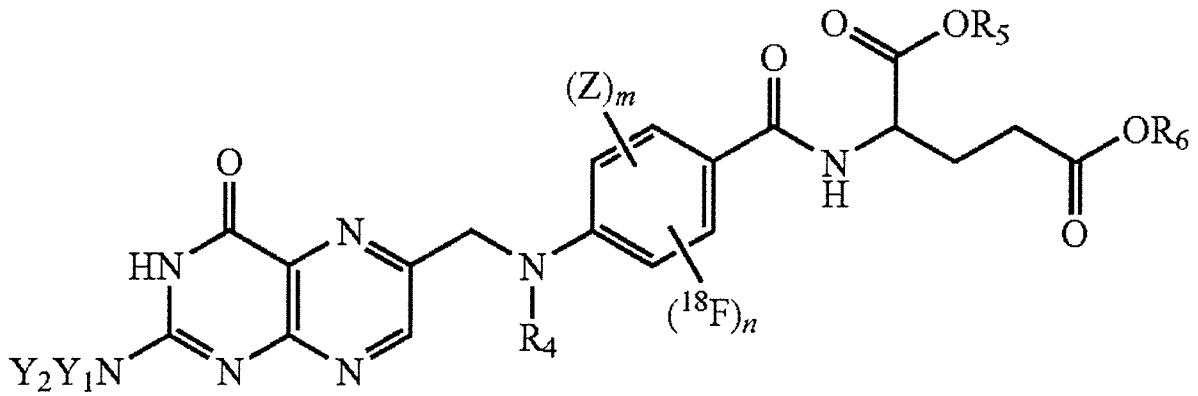
r is 0 or 1,

p is 0, 1 or 2, and

q has a value of 1 to 7.

16. The compound of claim **1** having formula XV,

XV



wherein

Z is a electron-withdrawing group selected from the group consisting of —NO_2, —CN, —$N^+(CH_3)_3$, —SO_3R', —COOR', —COR', —Cl, —Br, —F, iodonium salts —$I^+(R')_2$, dialkyl/-aryl silanes —$SiOH(R')_2$, and silanols —$SiH(R')_2$,

R' is independently a straight-chain or branched $C_{(1-12)}$ alkyl group or an optionally substituted carbocyclic and heterocyclic group containing a five-, six- or ten-membered ring system,

R_5, R_6 are independently of each other H or straight chain or branched C_1-C_{12} alkyl, which is unsubstituted or substituted by at least one CN, Hal, or NO_2, and wherein one or more of embedded, non-adjacent CH2 groups may independently be replaced by —O—, —CO—, —CO—O—, —CO—NR'—, —CH=CH—, or —C≡C—,

Y_1, Y_2 are independently of each other H, or a straight chain or branched C_1-C_6 alkyl,

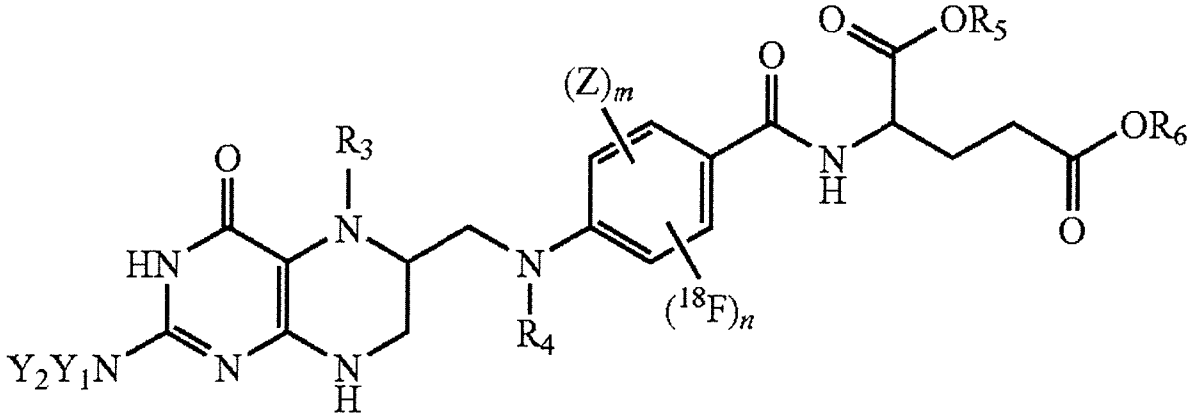
R_4 is H, nitroso, C_1-C_{12} alkyl, C_1-C_{12} alkoxy, C_1-C_{12} alkanoyl, or halosubstituted C_1-C_{12} alkanoyl,

m is 0, 1, 2 or 3, and

n is 1.

17. The compound of claim **1** having formula XVI,

XVI



wherein

Z is a electron-withdrawing group selected from the group consisting of —NO_2, —CN, —$N^+(CH_3)_3$, —SO_3R', —COOR', —COR', —Cl, —Br, —F, iodonium salts —$I^+(R')_2$, dialkyl/-aryl silanes —$SiOH(R')_2$, and silanols —$SiH(R')_2$,

R' is independently a straight-chain or branched $C_{(1-12)}$ alkyl group or an optionally substituted carbocyclic and heterocyclic group comprising five-, six- or ten-membered ring systems,

R_3, R_4 are independently of each other H, formyl, iminomethyl, nitroso, C1-C12 alkyl, C1-C12 alkoxy, C1-C12 alkanoyl, or halosubstituted C1-C12 alkanoyl,

R_5, R_6 are independently of each other H or straight chain or branched C_1-C_{12} alkyl, which is unsubstituted or substituted by at least one CN, Hal, or NO_2, and wherein one or more of embedded, non-adjacent CH2 groups may independently be replaced by —O—, —CO—, —CO—O—, —CO—NR'—, —CH=CH—, or —C≡C—,

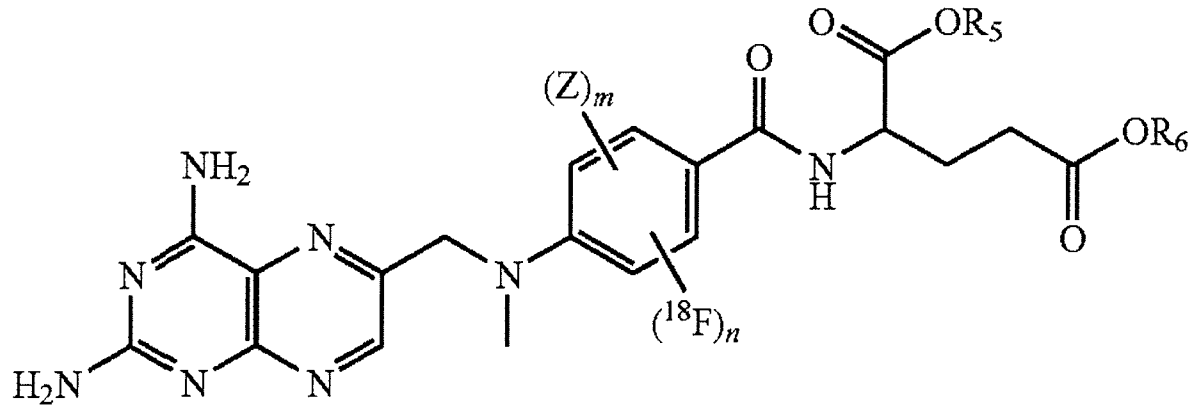
Y_1, Y_2 are independently of each other H, a or straight chain or branched C_1-C_6 alkyl,

m is 0, 1, 2 or 3, and

n is 1.

18. The compound of claim **1** having formula XVII,

XVII



wherein

Z is an electron-withdrawing group selected from the group consisting of —NO_2, —CN, —$N^+(CH_3)_3$, —SO_3R', —COOR', —COR', —Cl, —Br, —F, iodonium salts —$I^+(R')_2$, dialkyl/-aryl silanes —$SiOH(R')_2$, and silanols —$SiH(R')_2$,

R' is independently a straight-chain or branched $C_{(1-12)}$ alkyl group or an optionally substituted carbocyclic and heterocyclic group comprising five-, six- or ten-membered ring systems

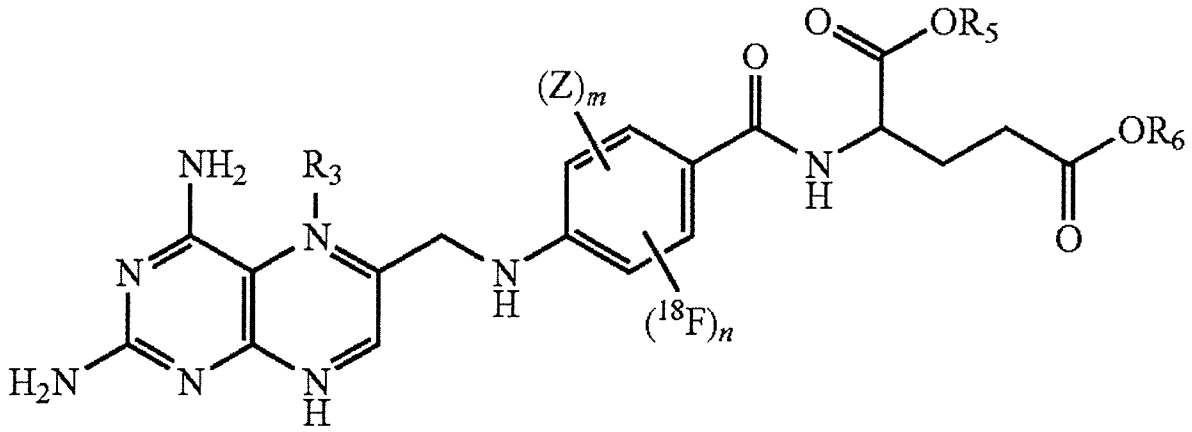
R_5, R_6 are independently of each other H or straight chain or branched C_1-C_{12} alkyl, which is unsubstituted or substituted by at least one CN, Hal, or NO_2, and wherein one or more of embedded, non-adjacent CH2 groups may independently be replaced by —O—, —CO—, —CO—O—, —CO—NR'—, —CH=CH—, or —C≡C—,

m is 0, 1, 2 or 3, and

n is 1.

19. The compound of claim **1** having formula XVIII,

XVIII



wherein,

Z is an electron-withdrawing group selected from the group consisting of —NO_2, —CN, —$N^+(CH_3)_3$, —SO_3R', —COOR', —COR', —Cl, —Br, —F, iodonium salts —$I^+(R')_2$, dialkyl/-aryl silanes —$SiOH(R')_2$, and silanols —$SiH(R')_2$,

R' is independently a straight-chain or branched $C_{(1-12)}$ alkyl group or an optionally substituted carbocyclic and heterocyclic group comprising five-, six- or ten-membered ring systems,

R_3 is H, methyl- or formyl-,

R_5, R_6 are independently of each other H or straight chain or branched C_1-C_{12} alkyl, which is unsubstituted or substituted by at least one CN, Hal, or NO_2, and wherein one or more of embedded, non-adjacent CH2 groups may independently be replaced by —O—, —CO—, —CO—O—, —CO—NR'—, —CH=CH—, or —C≡C—,

m is 0, 1, 2 or 3, and

n is 1.

20. A method of production of a compound according to claim **1**, comprising direct radiolabeling with [^{18}F]fluoride of the aminobenzoyl moiety of the compound of formula I.

21. A method of production of a compound according to claim **20**, comprising providing a compound that is with the exception of n being 0 is a compound of formula I and reacting said compound with [^{18}F] fluoride to give a compound of formula I wherein n=1.

22. The compound of claim **1**, wherein R_1 is H, Hal, —OR", —NHR", C1-C12 alkyl, C1-C12 alkoxy, C1-C12 alkanoyl, C2-C12 alkenyl, C2-C12 alkynyl, (C1-C12 alkoxy) carbonyl, or (C1-C12 alkylamino)carbonyl.

23. The compound of claim **8**, wherein R_1 is H, Hal, —OR", —NHR", C1-C12 alkyl, C1-C12 alkoxy, C1-C12 alkanoyl, C2-C12 alkenyl, C2-C12 alkynyl, (C1-C12 alkoxy) carbonyl, or (C1-C12 alkylamino)carbonyl.

24. The compound of claim **10**, wherein R_1 is H, Hal, —OR", —NHR", C1-C12 alkyl, C1-C12 alkoxy, C1-C12 alkanoyl, C2-C12 alkenyl, C2-C12 alkynyl, (C1-C12 alkoxy) carbonyl, and (C1-C12 alkylamino)carbonyl.

25. The compound of claim **12**, wherein R_1 is H, Hal, —OR", —NHR", C1-C12 alkyl, C1-C12 alkoxy, C1-C12 alkanoyl, C2-C12 alkenyl, C2-C12 alkynyl, (C1-C12 alkoxy) carbonyl, or (C1-C12 alkylamino)carbonyl.

26. The compound of claim **15**, wherein R_1 is H, Hal, —OR", —NHR", C1-C12 alkyl, C1-C12 alkoxy, C1-C12 alkanoyl, C2-C12 alkenyl, C2-C12 alkynyl, (C1-C12 alkoxy) carbonyl, or (C1-C12 alkylamino)carbonyl.