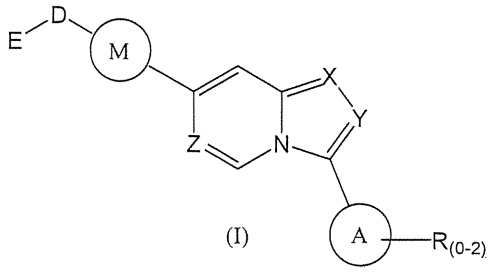
We claim:

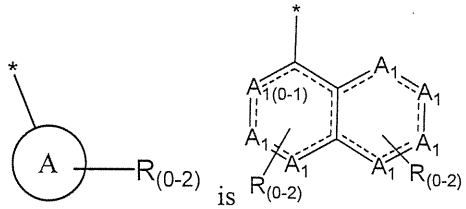
1. A compound having a structure represented by the following formula (I):



(I)

wherein:

X, Y, and Z are independently N or CH;



each A_1 is independently O, S, CR_1R_2, or NR_1;

R is selected from CF_3, halogen, CN, alkyl, aryl, heteroaryl, NR_1R_2, $S(O)_{0-2}NR_1R_2$, or $S(O)_{0-2}R_1R_2$;

M is substituted or unsubstituted and is selected from aryl or heteroaryl;

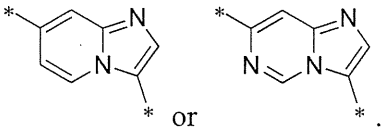
D is selected from a bond, O, CR_1R_2 or NH or NR_1 or NR_1R_2 or $S(O)_{0-2}R_1R_2$;

E is absent or selected from H, CF_3, halogen, CN, alkyl, aryl, heteroaryl, C_3-C_{12} cycloalkyl or C_3-C_{12} cycloheteroalkyl or $-(CH_2)_x-C_3$-C_{12} cycloalkyl or $-(CH_2)_x-C_3$-C_{12} cycloheteroalkyl;

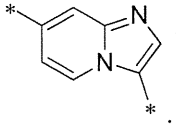
R_1 is absent or selected from H, alkyl, aryl, or heteraryl; and

R_2 is selected from H, alkyl, aryl, heteroaryl, or COR_1, or R_1 and R_2 form a C_3-C_{12} cycloalkyl or C_3-C_{12} cycloheteroalkyl containing O, N and/or S; or a pharmaceutically acceptable salt thereof.

2. The compound of claim 1, wherein X, Y and Z are selected to form:



3. The compound of claim 1, wherein X, Y and Z are selected to form:

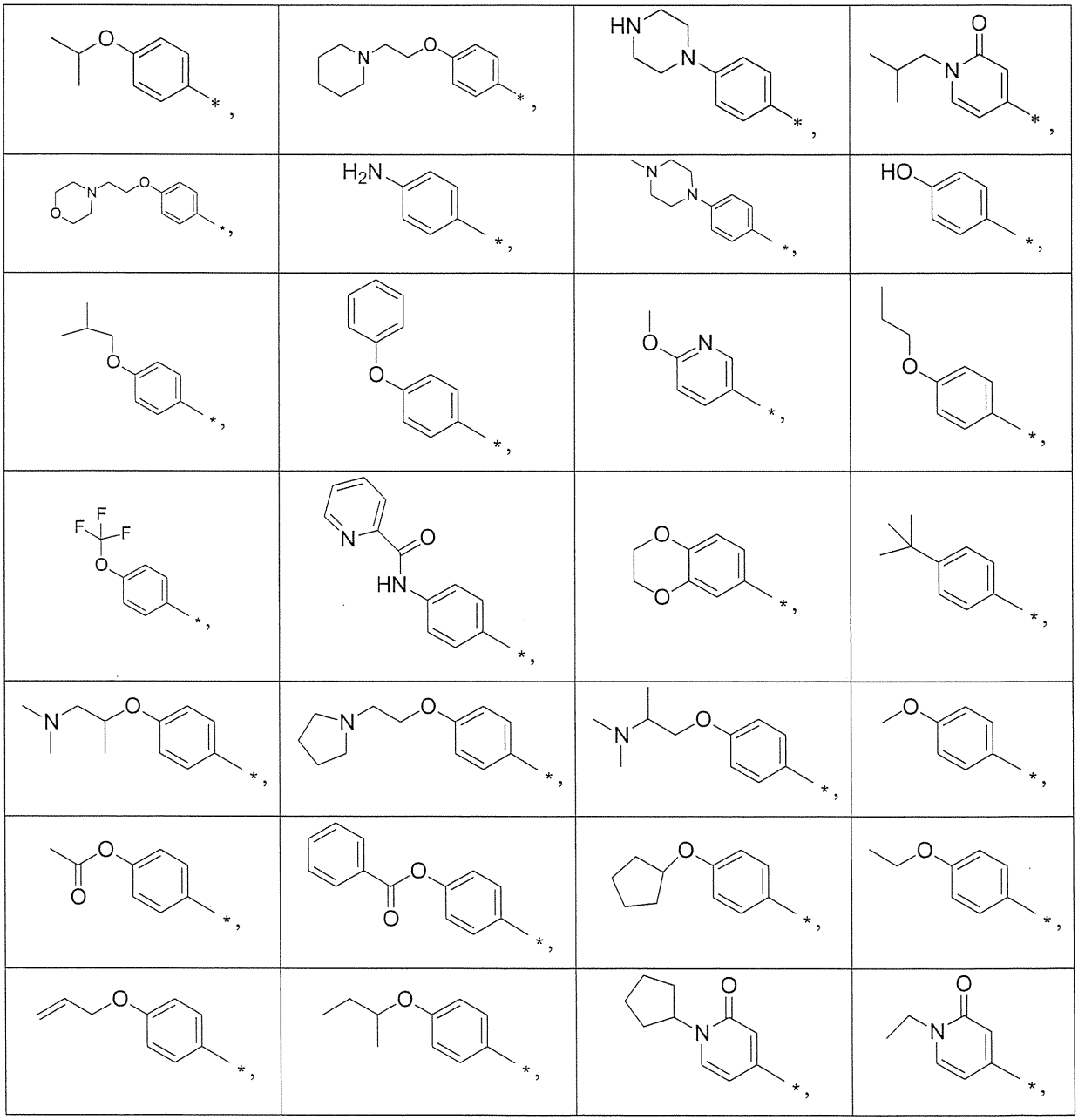


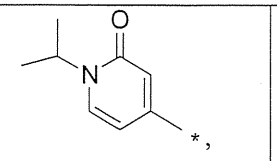
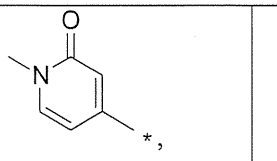
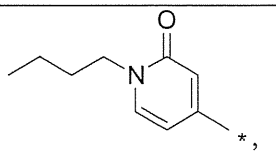
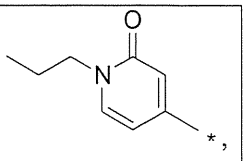
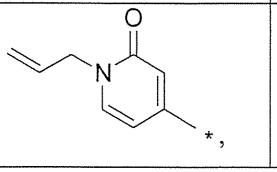
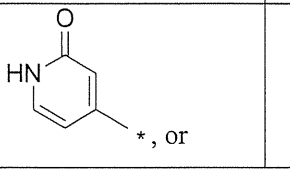
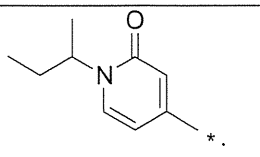
4. The compound of claim 1, wherein M is optionally substituted with one or more R, and is selected from C_3-C_{12} cycloalkyl or C_3-C_{12} cycloalkenyl or aryl or heteroaryl or C_3-C_{12}

heterocycloalkyl or C_3-C_{12} heterocycloalkenyl or 3-8 membered ring comprising C, O, S, and/or N.

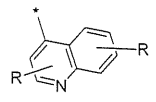
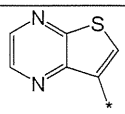
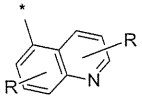
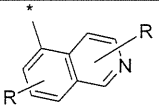
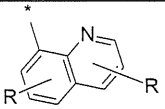
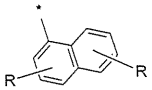
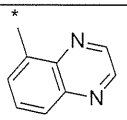
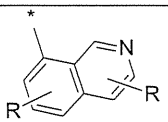
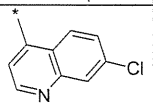
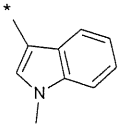
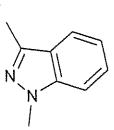
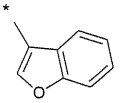
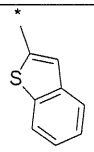
5. The compound of claim 4, wherein M is optionally substituted phenyl or pyridine.

6. The compound of claim 1, wherein M, D, and E together form:

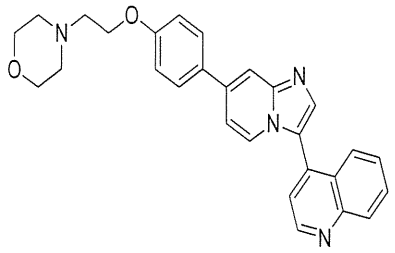
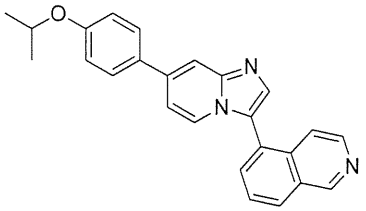
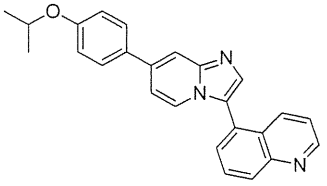
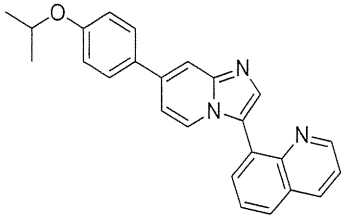
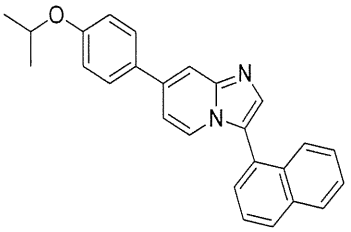
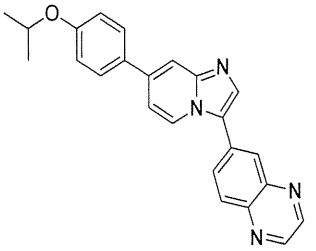
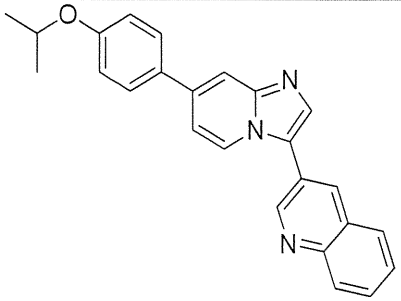
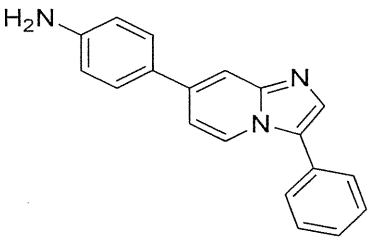
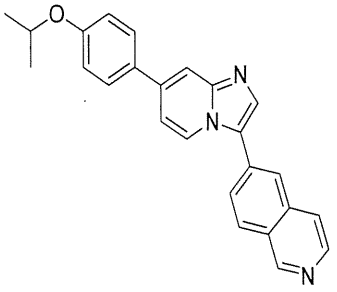
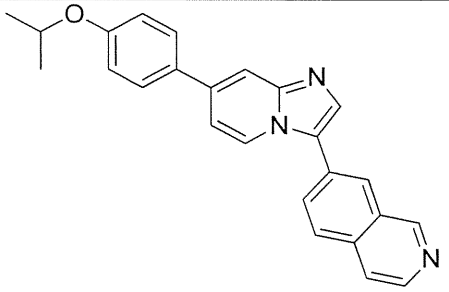
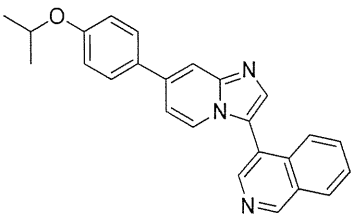
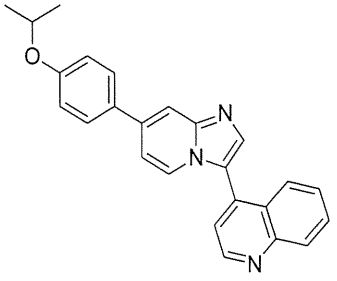
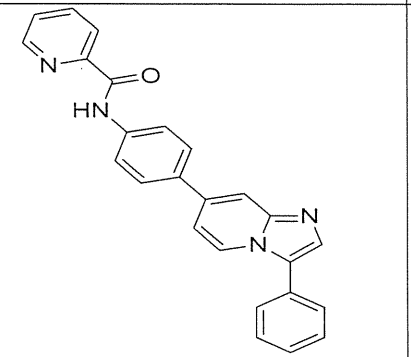


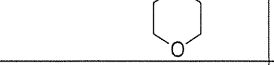
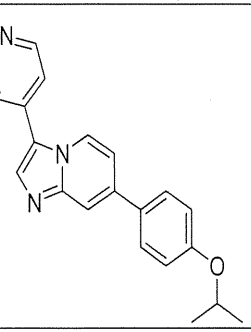
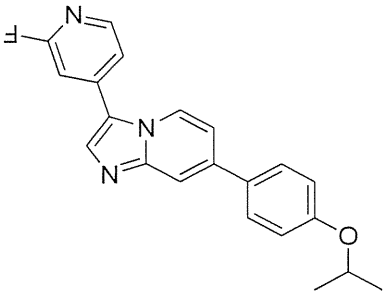
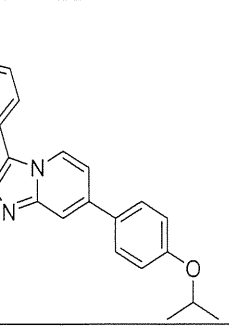
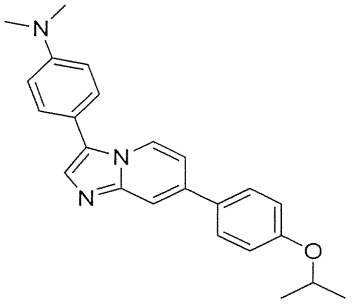
			
			

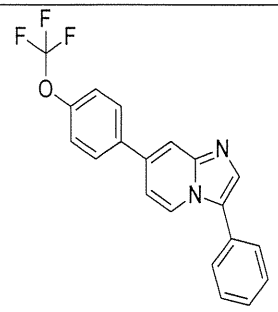
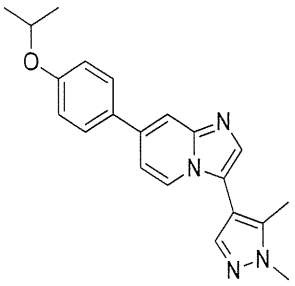
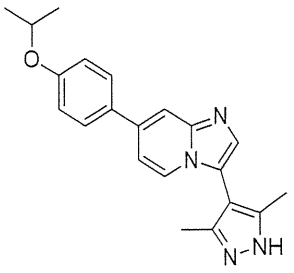
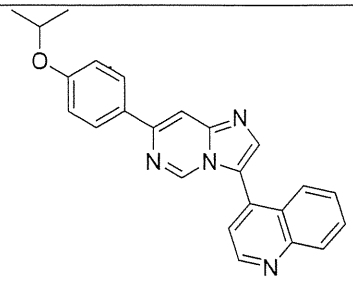
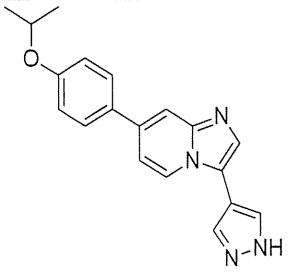
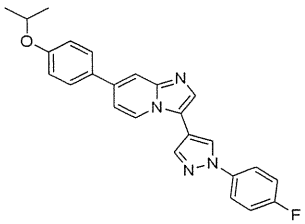
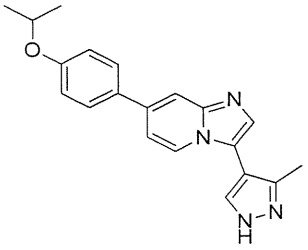
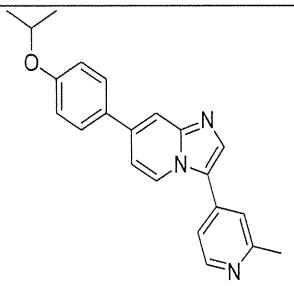
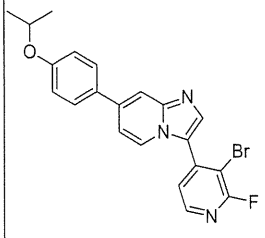
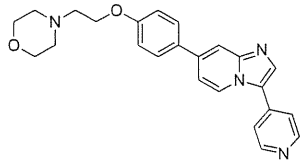
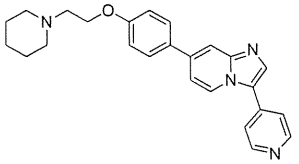
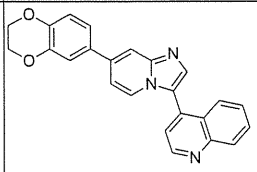
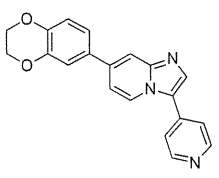
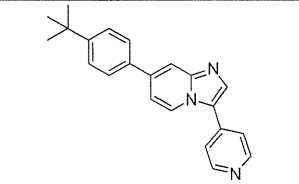
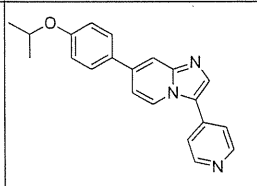
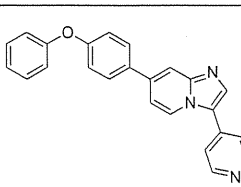
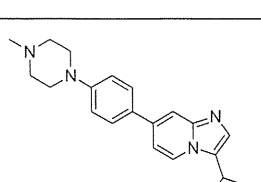
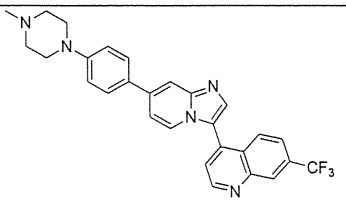
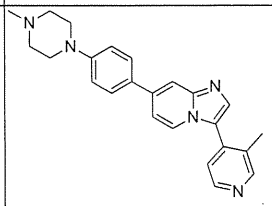
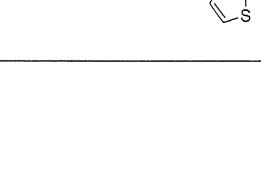
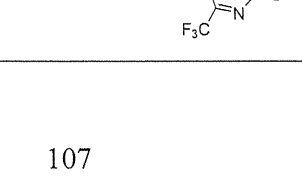
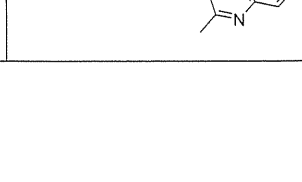
7. The compound of claim 1, wherein A is chosen from the following:

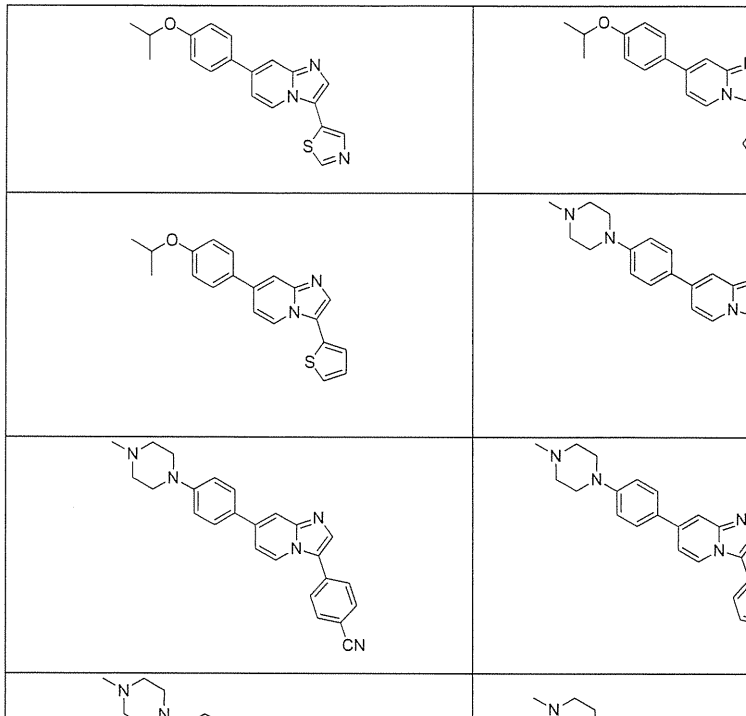
						
						
						
						
						
or						

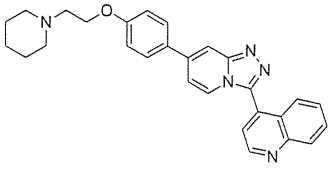
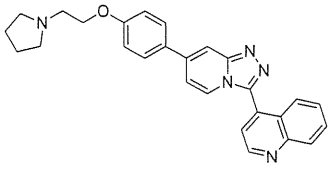
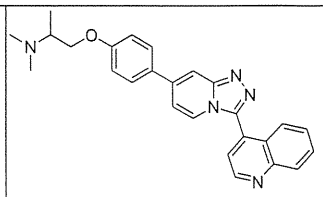
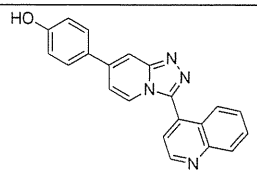
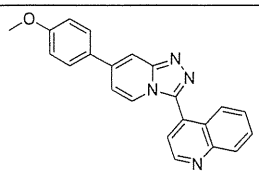
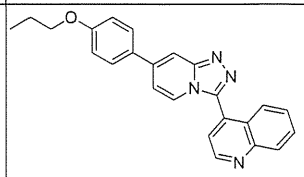
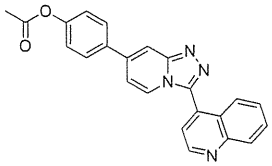
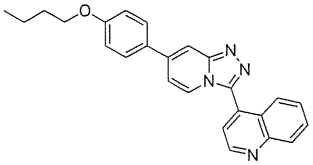
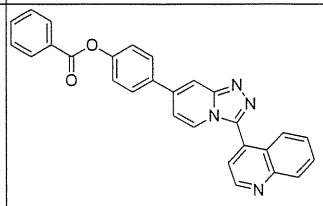
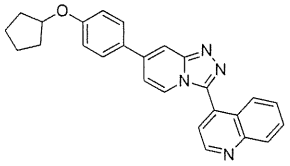
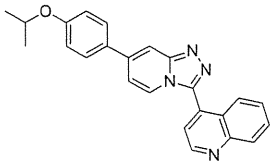
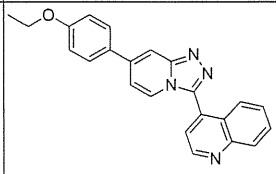
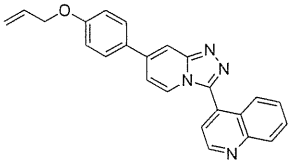
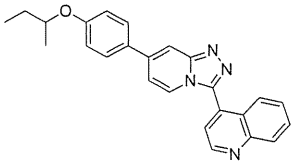
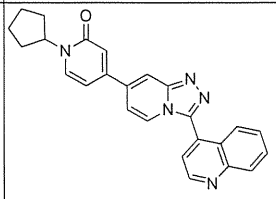
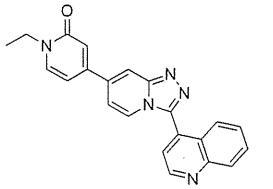
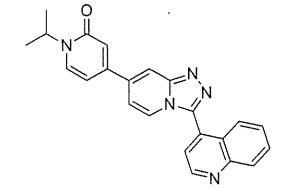
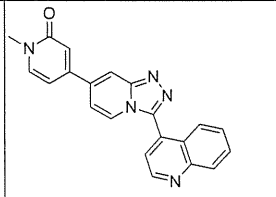
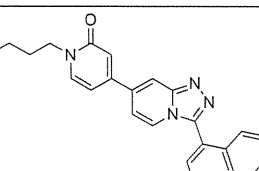
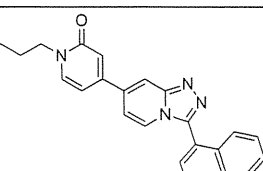
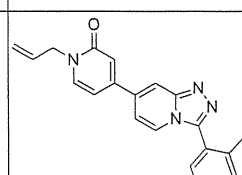
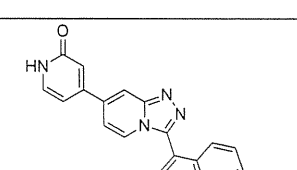
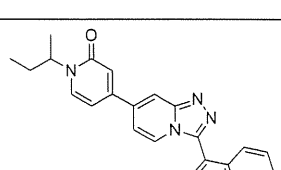
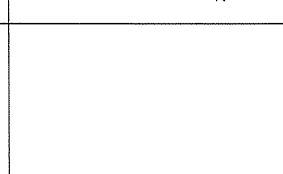
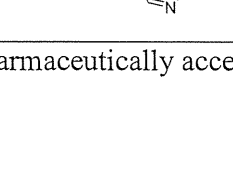
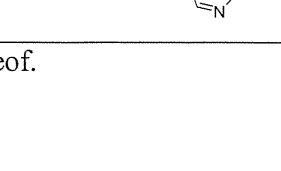
8. A compound of one of the following structures:



		
		
		
		
		
		
		
		
 or		

or a pharmaceutically acceptable salt thereof.

9. The compound of claim 1, wherein X is N and Y is CH.

10. A compound of any one of claims 1-9 for use in therapy.

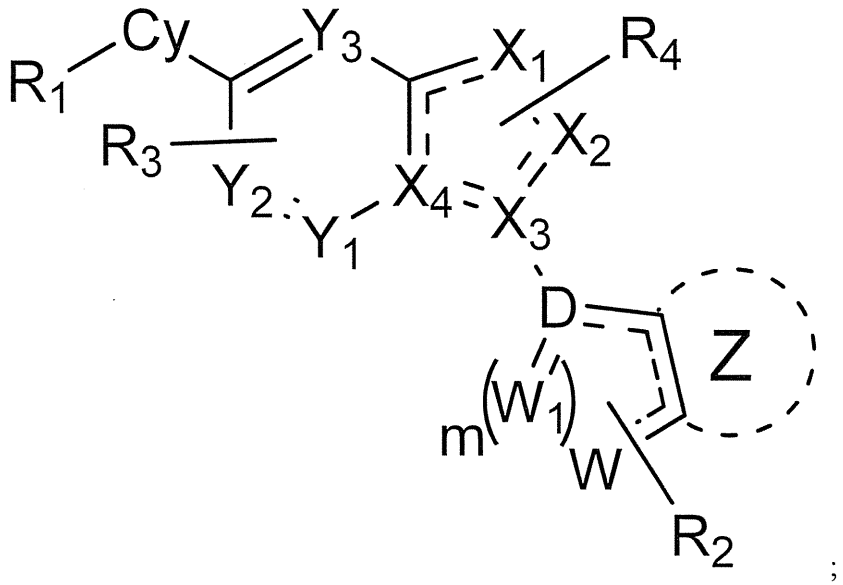
11. The compound of claim 10, wherein the therapy is associated with modulating the BMP signaling pathway.

12. Use of a compound of any one of claims 1-9 in the manufacture of a medicament for treating at least one disease state selected from anemia, iron deficiency anemia, anemia of chronic disease, fibrodysplasia ossificans progressiva (FOP), cancer, inflammation, pathologic bone function, ectopic or maladaptive bone formation, a skin disease, hypertension, ventricular hypertrophy, atherosclerosis, spinal cord injury and neuropathy, heart disease, heart damage, liver damage, and liver disease.

13. The use of claim 12, wherein the cancer is breast cancer, prostate cancer, bone cancer, lung cancer, renal cell cancer, or acute megakaryoblastic leukemia.

14. An *in vitro* method for at least one of propagation, engraftment, and differentiation of progenitor cells, the method comprising contacting a progenitor cell with a compound of any one of claims 1-9 in a dosage and amount effective to propagate a cell.

15. A compound having a structure represented by the following formula:



;

wherein:

X_1 is N or CR_1;

X_2, and X_4 are independently N or CR_1;

X_3 is C;

Y_1, Y_2, and Y_3 are independently N or CR_1;

D is C or N;

W is N or O;

W_1 is N, O or C;

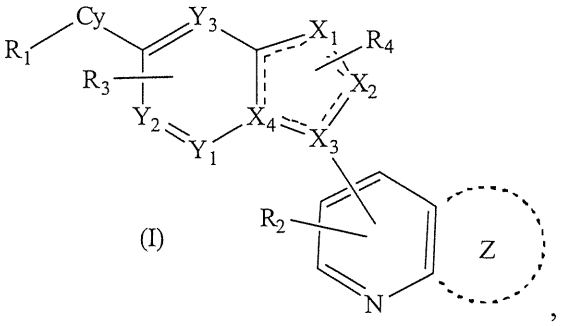
Cy is optionally substituted with one or more R_1, and is selected from C_3-C_{12} cycloalkyl or C_3-C_{12} cycloalkenyl or aryl or heteroaryl or C_3-C_{12} heterocycloalkyl or C_3-C_{12} heterocycloalkenyl or 3-8 membered ring comprising C, O, S, and/or N.

R_1–R_4 are independently selected from hydrogen, halogen, $C_{1\text{-}10}$ alkyl, $C_{3\text{-}10}$ cycloalkyl, $OC_{1\text{-}10}$ alkyl (which may contain a $C_{3\text{-}8}$ membered ring containing C, O, S or N, optionally

substituted with one or more R^4), NR_1C_{1-10} alkyl (which may contain a C_{3-8} membered ring containing C, O, S or N, optionally substituted with one or more R^4), CN or CF_3;

Z is optionally substituted with one or more R_1, and is selected from C_3-C_{12} cycloalkyl or C_3-C_{12} cycloalkenyl or aryl or heteroaryl or C_3-C_{12} heterocycloalkyl or C_3-C_{12} heterocycloalkenyl or 3-8 membered ring comprising C, O, S, and/or N.

16. A compound having a structure represented by the following formula:



(I)

,

wherein:

X_1 is N or CR_1;

X_2, and X_4 are independently N or CR_1;

X_3 is C;

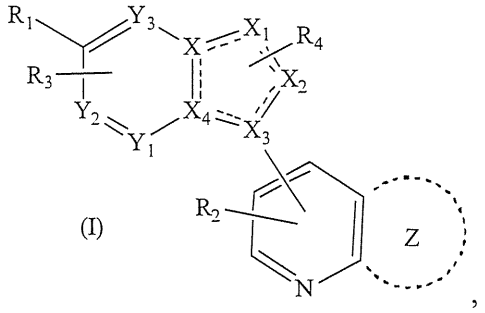
Y_1, Y_2, and Y_3 are independently N or CR_1;

Cy is a bond, or forms a ring that is optionally substituted with one or more R_1, and is selected from C_3-C_{12} cycloalkyl or C_3-C_{12} cycloalkenyl or aryl or heteroaryl or C_3-C_{12} heterocycloalkyl or C_3-C_{12} heterocycloalkenyl or 3-8 membered ring comprising C, O, S, and/or N.

R_1–R_4 are independently selected from hydrogen, halogen, C_{1-10} alkyl, C_{3-10} cycloalkyl, OC_{1-10} alkyl (which may contain a C_{3-8} membered ring containing C, O, S or N, optionally substituted with one or more R^4), NR_1C_{1-10} alkyl (which may contain a C_{3-8} membered ring containing C, O, S or N, optionally substituted with one or more R^4), CN or CF_3;

Z is optionally substituted with one or more R_1, and is selected from C_3-C_{12} cycloalkyl or C_3-C_{12} cycloalkenyl or aryl or heteroaryl or C_3-C_{12} heterocycloalkyl or C_3-C_{12} heterocycloalkenyl or 3-8 membered ring comprising C, O, S, and/or N.

17. A compound having a structure represented by the following formula:



(I)

wherein:

X_1, X_2, X_3 and X_4 are independently N or CR_1;

X is CR_1;

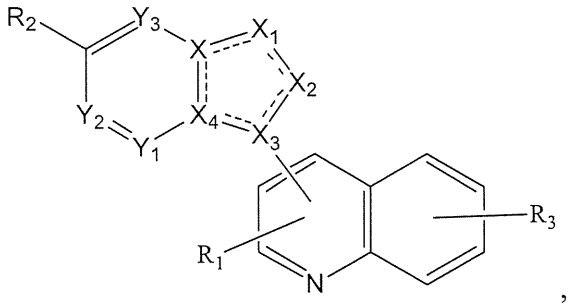
X_3 is C or N;

Y_1, Y_2, and Y_3 are independently N or CR_1;

R_1-R_4 are absent or independently selected from hydrogen, halogen, C_{1-10} alkyl, C_{3-10} cycloalkyl, OC_{1-10} alkyl (which may contain a C_{3-8} membered ring containing C, O, S or N, optionally substituted with one or more R^4), CN or CF_3;

Z is optionally substituted with one or more R_1, and is selected from C_3-C_{12} cycloalkyl or C_3-C_{12} cycloalkenyl or aryl or heteroaryl or C_3-C_{12} heterocycloalkyl or C_3-C_{12} heterocycloalkenyl or 3-8 membered ring comprising C, O, S, and/or N.

18. The compound of claim 17, wherein the compound is of the following formula:



wherein:

X_1, X_2, X_3 and X_4 are independently N or CR_1;

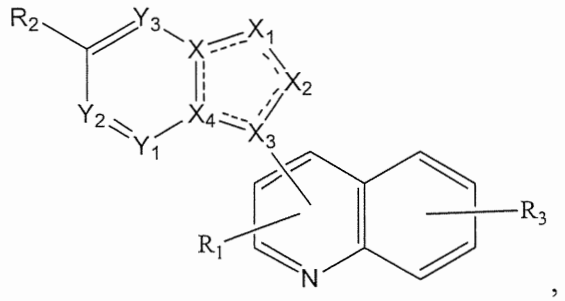
X is CR_1;

X_3 is C or N;

Y_1, Y_2, and Y_3 are independently N or CR_1;

R_1-R_4 are absent or independently selected from hydrogen, halogen, C_{1-10} alkyl, C_{3-10} cycloalkyl, OC_{1-10} alkyl (which may contain a C_{3-8} membered ring containing C, O, S or N, optionally substituted with one or more R^4), CN or CF_3;

19. The compound of claim 17, wherein the compound is of the following formula:



,

wherein

(i) X_1 is N, X_4 is N, and X_2, X_3, X_4, Y_1, Y_2, and Y_3 are independently C or CR_1;

(ii) X_1 is N, X_2 is N, Y_1 is N, and X, X_3, X_4, Y_2, and Y_3 are independently C or CR_1;

(iii) X_1 is N, X_2 is N, Y_2 is N, and X, X_3, X_4, Y_2, and Y_3 are independently C or CR_1;

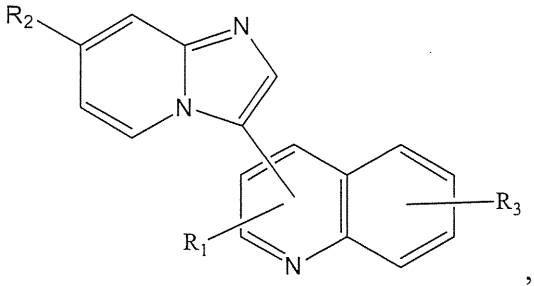
or

(iv) X_1 is N, X_3 is N, and X_2, X_3, X_4, Y_1, Y_2, and Y_3 are independently C or CR_1;

Y_1, Y_2, and Y_3 are independently N or CR_1;

R_1-R_4 are independently selected from hydrogen, halogen, C_{1-10} alkyl, C_{3-10} cycloalkyl, OC_{1-10} alkyl (which may contain a C_{3-8} membered ring containing C, O, S or N, optionally substituted with one or more R^4), CN or CF_3.

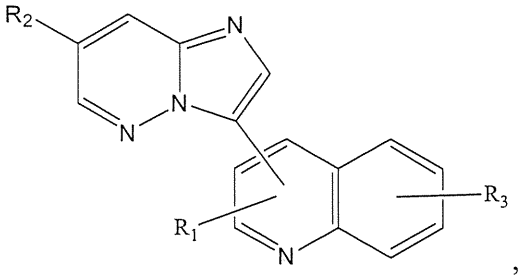
20. The compound of claim 17, wherein the compound is of the following formula:



,

wherein R_1-R_4 are independently selected from hydrogen, halogen, C_{1-10} alkyl, C_{3-10} cycloalkyl, OC_{1-10} alkyl (which may contain a C_{3-8} membered ring containing C, O, S or N, optionally substituted with one or more R^4), CN or CF_3.

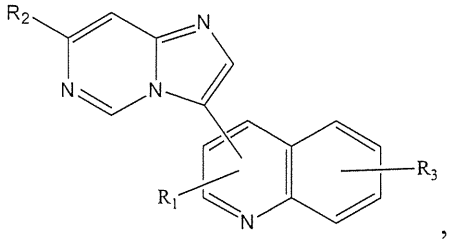
21. The compound of claim 17, wherein the compound is of the following formula:



,

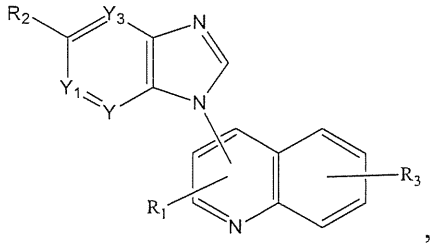
wherein R_1-R_4 are independently selected from hydrogen, halogen, C_{1-10} alkyl, C_{3-10} cycloalkyl, OC_{1-10} alkyl (which may contain a C_{3-8} membered ring containing C, O, S or N, optionally substituted with one or more R^4), CN or CF_3.

22. The compound of claim 17, wherein the compound is of the following formula:



wherein R_1-R_4 are independently selected from hydrogen, halogen, C_{1-10} alkyl, C_{3-10} cycloalkyl, OC_{1-10} alkyl (which may contain a C_{3-8} membered ring containing C, O, S or N, optionally substituted with one or more R^4), CN or CF_3.

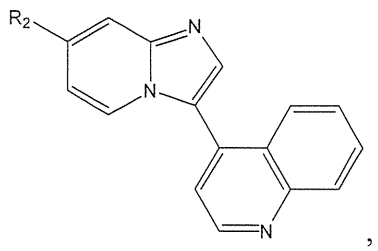
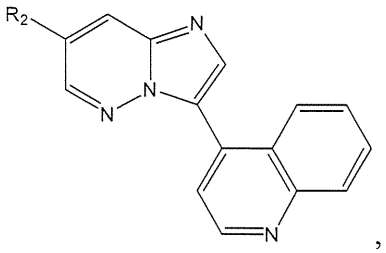
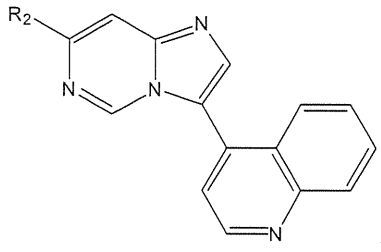
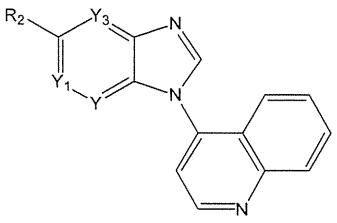
23. The compound of claim 17, wherein the compound is of the following formula:



wherein Y_1 and Y_3 are independently N or CR_1; R_1-R_4 are independently selected from hydrogen, halogen, C_{1-10} alkyl, C_{3-10} cycloalkyl, OC_{1-10} alkyl (which may contain a C_{3-8}

membered ring containing C, O, S or N, optionally substituted with one or more R^4), CN or CF_3.

24. The compound of claim 17, wherein the compound is of the following formula:


,

,

, and


wherein Y_1 and Y_3 are independently N or CR_1; R_1-R_4 are independently selected from hydrogen, halogen, C_{1-10} alkyl, C_{3-10} cycloalkyl, OC_{1-10} alkyl (which may contain a C_{3-8} membered ring containing C, O, S or N, optionally substituted with one or more R^4), CN or CF_3.

25. A compound of any one of claims 15-24 for use in therapy.

26. Use of a compound of any one of claims 15-24 in the manufacture of a medicament for modulating the BMP signaling pathway.

27. Use of a compound of any one of claims 1-9 in the manufacture of a medicament for promoting, inducing, or enhancing modulation of epicardial activation and epithelial-to-mesenchyme transition; or inducing, enhancing, or promoting cardiomyocyte formation.

28. A method for modulating the BMP signaling pathway comprising administering to at least one cell *in vitro* a compound of any one of claims 1-9 in an amount effective to modulate BMP signaling.

29. The method of claim 28, wherein modulating the BMP signaling pathway enhances keratinocyte proliferation.

30. The method of claim 28, wherein the at least one cell is a stem cell.

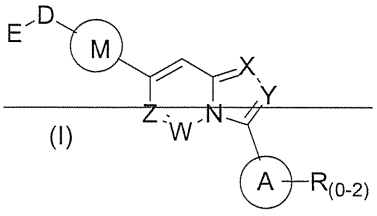
31. The method of claim 28, wherein modulating the BMP signaling pathway regulates the differentiation and regeneration of precursor and stem cell populations.

32. The method of claim 28, wherein mutilating the BMP signaling pathway maintains a pluripotential state in stem cell or multipotent cell populations *in vitro*.

33. The method of claim 28, wherein mutilating the BMP signaling pathway expands stem cell or multipotent cell populations *in vitro*.

We claim:

1. A compound for use in the treatment of a disease state associated with modulating the BMP signaling pathway in a subject, the compound having a structure represented by the following formula (I):



(I)

wherein:

W, X, Y, and Z are independently N or CH;

A is substituted or unsubstituted and selected from cycloalkyl, heterocycloalkyl, aryl or heteroaryl;

R is selected from H, CF_3, halogen, CN, alkyl, aryl, heteroaryl, NR_1R_2, COR_1R_2, CR_1R_2, $S(O)_{0-2}NR_1R_2$; or $S(O)_{0-2}R_1R_2$;

M is substituted or unsubstituted and is selected from aryl or heteroaryl;

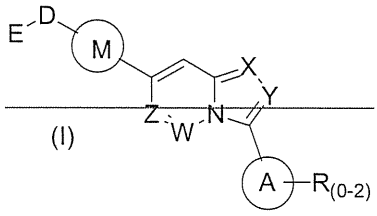
D is selected from a bond, O, CR_1R_2 or NH or NR_1 or NR_1R_2 or $S(O)_{0-2}R_1R_2$;

E is selected from H, CF_3, halogen, CN, alkyl, aryl, heteroaryl, C_3-C_{12} cycloalkyl or C_3-C_{12} cycloheteroalkyl or $-(CH_2)_x$-C_3-C_{12} cycloalkyl or $-(CH_2)_x$-C_3-C_{12} cycloheteroalkyl;

R_1 is selected from H, alkyl, aryl, heteraryl, or COR_4; and

R_2 is selected from H, alkyl, aryl, heteraryl, COR_4, and further, R_1 and R_2 can form a C_3-C_{12} cycloalkyl or C_3-C_{12} cycloheteroalkyl containing O, N or S; or a pharmaceutically acceptable salt thereof, or a pharmaceutically acceptable derivative thereof.

2. A compound for use as a medicament in modulating the BMP signaling pathway, the compound having a structure represented by the formula (I):



(I)

wherein:

W, X, Y, and Z are independently N or CH;

A is substituted or unsubstituted and selected from cycloalkyl, heterocycloalkyl, aryl or heteroaryl;

R is selected from H, CF_3, halogen, CN, alkyl, aryl, heteroaryl, NR_1R_2, COR_1R_2, CR_1R_2, $S(O)_{0-2}NR_1R_2$; or $S(O)_{0-2}R_1R_2$;

M is substituted or unsubstituted and is selected from aryl or heteroaryl;

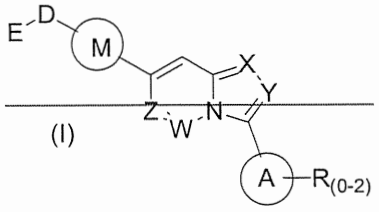
D is selected from a bond, O, CR_1R_2 or NH or NR_1 or NR_1R_2 or $S(O)_{0-2}R_1R_2$;

E is selected from H, CF_3, halogen, CN, alkyl, aryl, heteroaryl, C_3-C_{12} cycloalkyl or C_3-C_{12} cycloheteroalkyl or $(CH_2)_x$-C_3-C_{12} cycloalkyl or $(CH_2)_x$-C_3-C_{12} cycloheteroalkyl;

R_1 is selected from H, alkyl, aryl, heteraryl, or COR_1; and

R_2 is selected from H, alkyl, aryl, heteraryl, COR_1, and further, R_1 and R_2 can form a C_3-C_{12} cycloalkyl or C_3-C_{12} cycloheteroalkyl containing O, N or S; or a pharmaceutically acceptable salt thereof, or a pharmaceutically acceptable derivative thereof.

3. A compound for use in treating at least one of anemia, including iron deficiency, and anemia of chronic disease, the compound having a structure represented by the following formula (I):



(I)

wherein:

W, X, Y, and Z are independently N or CH;

A is substituted or unsubstituted and selected from cycloalkyl, heterocycloalkyl, aryl or heteroaryl;

R is selected from H, CF_3, halogen, CN, alkyl, aryl, heteroaryl, NR_1R_2, COR_1R_2, CR_1R_2, $S(O)_{0-2}NR_1R_2$; or $S(O)_{0-2}R_1R_2$;

M is substituted or unsubstituted and is selected from aryl or heteroaryl;

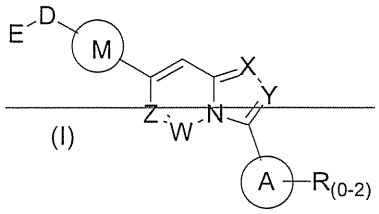
D is selected from a bond, O, CR_1R_2 or NH or NR_1 or NR_1R_2 or $S(O)_{0-2}R_1R_2$;

E is selected from H, CF_3, halogen, CN, alkyl, aryl, heteroaryl, C_3-C_{12} cycloalkyl or C_3-C_{12} cycloheteroalkyl or $(CH_2)_x$-C_3-C_{12} cycloalkyl or $(CH_2)_x$-C_3-C_{12} cycloheteroalkyl;

R_1 is selected from H, alkyl, aryl, heteraryl, or COR_1; and

~~R_2 is selected from H, alkyl, aryl, heteraryl, COR_1, and further, R_1 and R_2 can form a C_3-C_{12} cycloalkyl or C_3-C_{12} cycloheteroalkyl containing O, N or S; or a pharmaceutically acceptable salt thereof, or a pharmaceutically acceptable derivative thereof.~~

~~4. A compound for use in the treatment of fibrodysplasia ossificans progressiva (FOP), the compound having a structure represented by the following formula (I):~~



(I)

~~wherein:~~

~~W, X, Y, and Z are independently N or CH;~~

~~A is substituted or unsubstituted and selected from cycloalkyl, heterocycloalkyl, aryl or heteroaryl;~~

~~R is selected from H, CF_3, halogen, CN, alkyl, aryl, heteroaryl, NR_1R_2, COR_1R_2, CR_1R_2, $S(O)_{0-2}NR_1R_2$; or $S(O)_{0-2}R_1R_2$;~~

~~M is substituted or unsubstituted and is selected from aryl or heteroaryl;~~

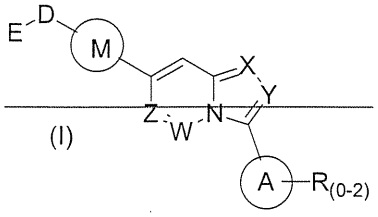
~~D is selected from a bond, O, CR_1R_2 or NH or NR_1 or NR_1R_2 or $S(O)_{0-2}R_1R_2$;~~

~~E is selected from H, CF_3, halogen, CN, alkyl, aryl, heteroaryl, C_3-C_{12} cycloalkyl or C_3-C_{12} cycloheteroalkyl or $(CH_2)_x$-C_3-C_{12} cycloalkyl or $(CH_2)_x$-C_3-C_{12} cycloheteroalkyl;~~

~~R_1 is selected from H, alkyl, aryl, heteraryl, or COR_1; and~~

~~R_2 is selected from H, alkyl, aryl, heteraryl, COR_1, and further, R_1 and R_2 can form a C_3-C_{12} cycloalkyl or C_3-C_{12} cycloheteroalkyl containing O, N or S; or a pharmaceutically acceptable salt thereof, or a pharmaceutically acceptable derivative thereof.~~

~~5. A compound for use as a medicament in inhibiting the ontogenesis, growth, or metastasis of solid tumors, including breast, prostate carcinomas, bone, lung, and renal cell carcinomas, the compound having a structure represented by the following formula (I):~~



(I)

~~wherein:~~

~~W, X, Y, and Z are independently N or CH;~~

~~A is substituted or unsubstituted and selected from cycloalkyl, heterocycloalkyl, aryl or heteroaryl;~~

~~R is selected from H, CF_3, halogen, CN, alkyl, aryl, heteroaryl, NR_1R_2, COR_1R_2, CR_1R_2, $S(O)_{0-2}NR_1R_2$; or $S(O)_{0-2}R_1R_2$;~~

~~M is substituted or unsubstituted and is selected from aryl or heteroaryl;~~

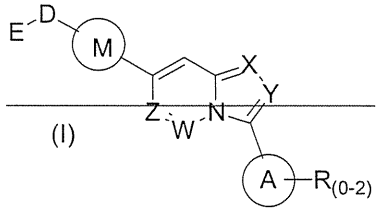
~~D is selected from a bond, O, CR_1R_2 or NH or NR_1 or NR_1R_2 or $S(O)_{0-2}R_1R_2$;~~

~~E is selected from H, CF_3, halogen, CN, alkyl, aryl, heteroaryl, C_3-C_{12} cycloalkyl or C_3-C_{12} cycloheteroalkyl or $(CH_2)_x$-C_3-C_{12} cycloalkyl or $(CH_2)_x$-C_3-C_{12} cycloheteroalkyl;~~

~~R_1 is selected from H, alkyl, aryl, heteraryl, or COR_1; and~~

~~R_2 is selected from H, alkyl, aryl, heteraryl, COR_1, and further, R_1 and R_2 can form a C_3-C_{12} cycloalkyl or C_3-C_{12} cycloheteroalkyl containing O, N or S; or a pharmaceutically acceptable salt thereof, or a pharmaceutically acceptable derivative thereof.~~

~~6. A compound for use as a medicament for augmenting the inflammatory or immune response, the compound having a structure represented by the following formula (I):~~



(I)

~~wherein:~~

~~W, X, Y, and Z are independently N or CH;~~

~~A is substituted or unsubstituted and selected from cycloalkyl, heterocycloalkyl, aryl or heteroaryl;~~

~~R is selected from H, CF_3, halogen, CN, alkyl, aryl, heteroaryl, NR_1R_2, COR_1R_2, CR_1R_2, $S(O)_{0-2}NR_1R_2$; or $S(O)_{0-2}R_1R_2$;~~

~~M is substituted or unsubstituted and is selected from aryl or heteroaryl;~~

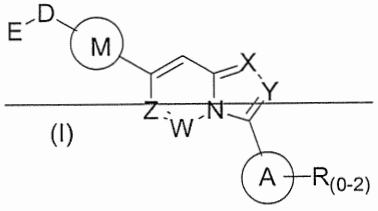
~~D is selected from a bond, O, CR_1R_2 or NH or NR_1 or NR_1R_2 or $S(O)_{0-2}R_1R_2$;~~

~~E is selected from H, CF_3, halogen, CN, alkyl, aryl, heteroaryl, C_3-C_{12} cycloalkyl or C_3-C_{12} cycloheteroalkyl or $(CH_2)_x$-C_3-C_{12} cycloalkyl or $(CH_2)_x$-C_3-C_{12} cycloheteroalkyl;~~

~~R_1 is selected from H, alkyl, aryl, heteraryl, or COR_1; and~~

~~R_2 is selected from H, alkyl, aryl, heteraryl, COR_1, and further, R_1 and R_2 can form a C_3-C_{12} cycloalkyl or C_3-C_{12} cycloheteroalkyl containing O, N or S; or a pharmaceutically acceptable salt thereof, or a pharmaceutically acceptable derivative thereof.~~

~~7. A compound for use as a medicament for treating pathologic bone function, the compound having a structure represented by the following formula (I):~~



(I)

~~wherein:~~

~~W, X, Y, and Z are independently N or CH;~~

~~A is substituted or unsubstituted and selected from cycloalkyl, heterocycloalkyl, aryl or heteroaryl;~~

~~R is selected from H, CF_3, halogen, CN, alkyl, aryl, heteroaryl, NR_1R_2, COR_1R_2, CR_1R_2, $S(O)_{0-2}NR_1R_2$; or $S(O)_{0-2}R_1R_2$;~~

~~M is substituted or unsubstituted and is selected from aryl or heteroaryl;~~

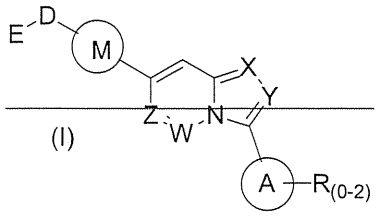
~~D is selected from a bond, O, CR_1R_2 or NH or NR_1 or NR_1R_2 or $S(O)_{0-2}R_1R_2$;~~

~~E is selected from H, CF_3, halogen, CN, alkyl, aryl, heteroaryl, C_3-C_{12} cycloalkyl or C_3-C_{12} cycloheteroalkyl or $(CH_2)_x$-C_3-C_{12} cycloalkyl or $(CH_2)_x$-C_3-C_{12} cycloheteroalkyl;~~

~~R_1 is selected from H, alkyl, aryl, heteraryl, or COR_1; and~~

~~R_2 is selected from H, alkyl, aryl, heteraryl, COR_1, and further, R_1 and R_2 can form a C_3-C_{12} cycloalkyl or C_3-C_{12} cycloheteroalkyl containing O, N or S; or a pharmaceutically acceptable salt thereof, or a pharmaceutically acceptable derivative thereof.~~

~~8. A compound for use as a medicament for treating ectopic or maladaptive bone formation in a subject in need thereof, the compound having a structure represented by the following formula (I):~~



~~wherein:~~

~~W, X, Y, and Z are independently N or CH;~~

~~A is substituted or unsubstituted and selected from cycloalkyl, heterocycloalkyl, aryl or heteroaryl;~~

~~R is selected from H, CF_3, halogen, CN, alkyl, aryl, heteroaryl, NR_1R_2, COR_1R_2, CR_1R_2, $S(O)_{0-2}NR_1R_2$; or $S(O)_{0-2}R_1R_2$;~~

~~M is substituted or unsubstituted and is selected from aryl or heteroaryl;~~

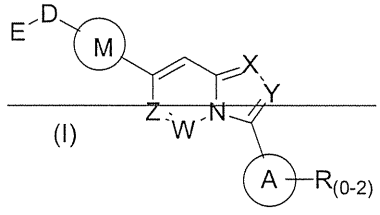
~~D is selected from a bond, O, CR_1R_2 or NH or NR_1 or NR_1R_2 or $S(O)_{0-2}R_1R_2$;~~

~~E is selected from H, CF_3, halogen, CN, alkyl, aryl, heteroaryl, C_3-C_{12} cycloalkyl or C_3-C_{12} cycloheteroalkyl or $(CH_2)_x$-C_3-C_{12} cycloalkyl or $(CH_2)_x$-C_3-C_{12} cycloheteroalkyl;~~

~~R_1 is selected from H, alkyl, aryl, heteraryl, or COR_1; and~~

~~R_2 is selected from H, alkyl, aryl, heteraryl, COR_1, and further, R_1 and R_2 can form a C_3-C_{12} cycloalkyl or C_3-C_{12} cycloheteroalkyl containing O, N or S; or a pharmaceutically acceptable salt thereof, or a pharmaceutically acceptable derivative thereof.~~

~~9. A compound for use as a medicament for treating a skin disease in a subject in need thereof, the compound having a structure represented by the following formula (I):~~



~~wherein:~~

~~W, X, Y, and Z are independently N or CH;~~

~~A is substituted or unsubstituted and selected from cycloalkyl, heterocycloalkyl, aryl or heteroaryl;~~

~~R is selected from H, CF_3, halogen, CN, alkyl, aryl, heteroaryl, NR_1R_2, COR_1R_2, CR_1R_2, $S(O)_{0-2}NR_1R_2$; or $S(O)_{0-2}R_1R_2$;~~

~~M is substituted or unsubstituted and is selected from aryl or heteroaryl;~~

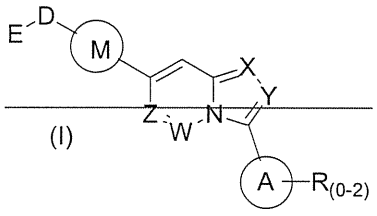
~~D is selected from a bond, O, CR_1R_2 or NH or NR_1 or NR_1R_2 or $S(O)_{0-2}R_1R_2$;~~

~~E is selected from H, CF_3, halogen, CN, alkyl, aryl, heteroaryl, C_3-C_{12} cycloalkyl or C_3-C_{12} cycloheteroalkyl or $(CH_2)_x$-C_3-C_{12} cycloalkyl or $(CH_2)_x$-C_3-C_{12} cycloheteroalkyl;~~

~~R_1 is selected from H, alkyl, aryl, heteraryl, or COR_1; and~~

~~R_2 is selected from H, alkyl, aryl, heteraryl, COR_1, and further, R_1 and R_2 can form a C_3-C_{12} cycloalkyl or C_3-C_{12} cycloheteroalkyl containing O, N or S; or a pharmaceutically acceptable salt thereof, or a pharmaceutically acceptable derivative thereof.~~

~~10. A compound for use as a medicament for treating hypertension in a subject in need thereof, the compound having a structure represented by the following formula (I):~~



(I)

~~wherein:~~

~~W, X, Y, and Z are independently N or CH;~~

~~A is substituted or unsubstituted and selected from cycloalkyl, heterocycloalkyl, aryl or heteroaryl;~~

~~R is selected from H, CF_3, halogen, CN, alkyl, aryl, heteroaryl, NR_1R_2, COR_1R_2, CR_1R_2, $S(O)_{0-2}NR_1R_2$; or $S(O)_{0-2}R_1R_2$;~~

~~M is substituted or unsubstituted and is selected from aryl or heteroaryl;~~

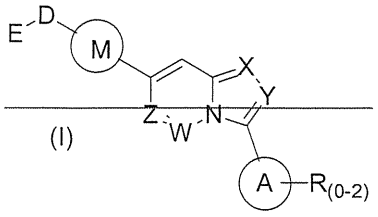
~~D is selected from a bond, O, CR_1R_2 or NH or NR_1 or NR_1R_2 or $S(O)_{0-2}R_1R_2$;~~

~~E is selected from H, CF_3, halogen, CN, alkyl, aryl, heteroaryl, C_3-C_{12} cycloalkyl or C_3-C_{12} cycloheteroalkyl or $(CH_2)_x$-C_3-C_{12} cycloalkyl or $(CH_2)_x$-C_3-C_{12} cycloheteroalkyl;~~

~~R_1 is selected from H, alkyl, aryl, heteraryl, or COR_1; and~~

~~R_2 is selected from H, alkyl, aryl, heteraryl, COR_1, and further, R_1 and R_2 can form a C_3-C_{12} cycloalkyl or C_3-C_{12} cycloheteroalkyl containing O, N or S; or a pharmaceutically acceptable salt thereof, or a pharmaceutically acceptable derivative thereof.~~

~~11. A compound for use as a medicament for treating ventricular hypertrophy in a subject in need thereof, the compound having a structure represented by the following formula (I):~~



(I)

wherein:

W, X, Y, and Z are independently N or CH;

A is substituted or unsubstituted and selected from cycloalkyl, heterocycloalkyl, aryl or heteroaryl;

R is selected from H, CF_3, halogen, CN, alkyl, aryl, heteroaryl, NR_1R_2, COR_1R_2, CR_1R_2, $S(O)_{0-2}NR_1R_2$; or $S(O)_{0-2}R_1R_2$;

M is substituted or unsubstituted and is selected from aryl or heteroaryl;

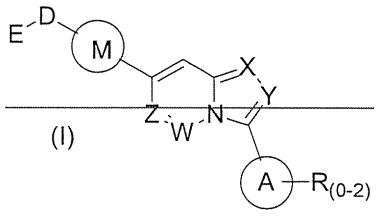
D is selected from a bond, O, CR_1R_2 or NH or NR_1 or NR_1R_2 or $S(O)_{0-2}R_1R_2$;

E is selected from H, CF_3, halogen, CN, alkyl, aryl, heteroaryl, C_3-C_{12} cycloalkyl or C_3-C_{12} cycloheteroalkyl or $(CH_2)_x$-C_3-C_{12} cycloalkyl or $(CH_2)_x$-C_3-C_{12} cycloheteroalkyl;

R_1 is selected from H, alkyl, aryl, heteraryl, or COR_1; and

R_2 is selected from H, alkyl, aryl, heteraryl, COR_1, and further, R_1 and R_2 can form a C_3-C_{12} cycloalkyl or C_3-C_{12} cycloheteroalkyl containing O, N or S; or a pharmaceutically acceptable salt thereof, or a pharmaceutically acceptable derivative thereof.

12. A compound for use as a medicament for treating spinal cord injury and neuropathy in a subject in need thereof, the compound having a structure represented by the following formula (I):



(I)

wherein:

W, X, Y, and Z are independently N or CH;

A is substituted or unsubstituted and selected from cycloalkyl, heterocycloalkyl, aryl or heteroaryl;

R is selected from H, CF_3, halogen, CN, alkyl, aryl, heteroaryl, NR_1R_2, COR_1R_2, CR_1R_2, $S(O)_{0-2}NR_1R_2$; or $S(O)_{0-2}R_1R_2$;

M is substituted or unsubstituted and is selected from aryl or heteroaryl;

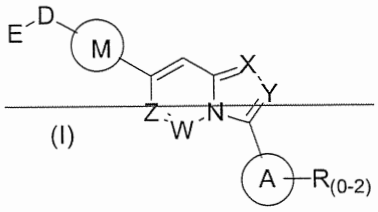
D is selected from a bond, O, CR_1R_2 or NH or NR_1 or NR_1R_2 or $S(O)_{0-2}R_1R_2$;

E is selected from H, CF_3, halogen, CN, alkyl, aryl, heteroaryl, C_3-C_{12} cycloalkyl or C_3-C_{12} cycloheteroalkyl or $(CH_2)_x$-C_3-C_{12} cycloalkyl or $(CH_2)_x$-C_3-C_{12} cycloheteroalkyl;

R_1 is selected from H, alkyl, aryl, heteraryl, or COR_1; and

R_2 is selected from H, alkyl, aryl, heteraryl, COR_1, and further, R_1 and R_2 can form a C_3-C_{12} cycloalkyl or C_3-C_{12} cycloheteroalkyl containing O, N or S; or a pharmaceutically acceptable salt thereof, or a pharmaceutically acceptable derivative thereof.

13. A compound for use as a medicament for treating atherosclerosis in a subject in need thereof, the compound having a structure represented by the following formula (I):



(I)

wherein:

W, X, Y, and Z are independently N or CH;

A is substituted or unsubstituted and selected from cycloalkyl, heterocycloalkyl, aryl or heteroaryl;

R is selected from H, CF_3, halogen, CN, alkyl, aryl, heteroaryl, NR_1R_2, COR_1R_2, CR_1R_2, $S(O)_{0-2}NR_1R_2$; or $S(O)_{0-2}R_1R_2$;

M is substituted or unsubstituted and is selected from aryl or heteroaryl;

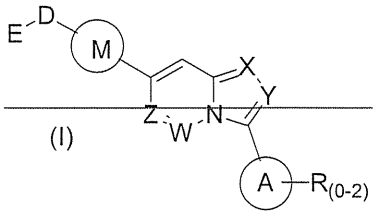
D is selected from a bond, O, CR_1R_2 or NH or NR_1 or NR_1R_2 or $S(O)_{0-2}R_1R_2$;

E is selected from H, CF_3, halogen, CN, alkyl, aryl, heteroaryl, C_3-C_{12} cycloalkyl or C_3-C_{12} cycloheteroalkyl or $(CH_2)_x$-C_3-C_{12} cycloalkyl or $(CH_2)_x$-C_3-C_{12} cycloheteroalkyl;

R_1 is selected from H, alkyl, aryl, heteraryl, or COR_1; and

R_2 is selected from H, alkyl, aryl, heteraryl, COR_1, and further, R_1 and R_2 can form a C_3-C_{12} cycloalkyl or C_3-C_{12} cycloheteroalkyl containing O, N or S; or a pharmaceutically acceptable salt thereof, or a pharmaceutically acceptable derivative thereof.

14. A compound for use in therapy for at least one of propagation, engraftment, and differentiation of progenitor cells, the compound having a structure represented by the following formula (I):



~~wherein:~~

~~W, X, Y, and Z are independently N or CH;~~

~~A is substituted or unsubstituted and selected from cycloalkyl, heterocycloalkyl, aryl or heteroaryl;~~

~~R is selected from H, CF_3, halogen, CN, alkyl, aryl, heteroaryl, NR_1R_2, COR_1R_2, CR_1R_2, $S(O)_{0-2}NR_1R_2$; or $S(O)_{0-2}R_1R_2$;~~

~~M is substituted or unsubstituted and is selected from aryl or heteroaryl;~~

~~D is selected from a bond, O, CR_1R_2 or NH or NR_1 or NR_1R_2 or $S(O)_{0-2}R_1R_2$;~~

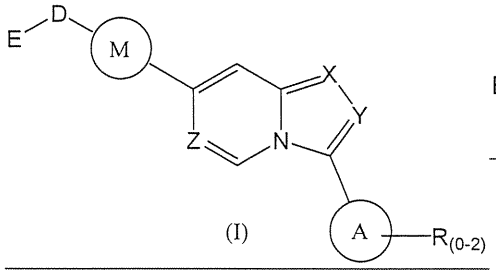
~~E is selected from H, CF_3, halogen, CN, alkyl, aryl, heteroaryl, C_3-C_{12} cycloalkyl or C_3-C_{12} cycloheteroalkyl or $(CH_2)_x$-C_3-C_{12} cycloalkyl or $(CH_2)_x$-C_3-C_{12} cycloheteroalkyl;~~

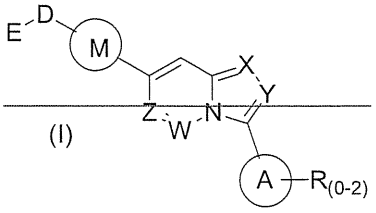
~~R_1 is selected from H, alkyl, aryl, heteraryl, or COR_1; and~~

~~R_2 is selected from H, alkyl, aryl, heteraryl, COR_1, and further, R_1 and R_2 can form a C_3-C_{12} cycloalkyl or C_3-C_{12} cycloheteroalkyl containing O, N or S; or a pharmaceutically acceptable salt thereof, or a pharmaceutically acceptable derivative thereof.~~

We claim:

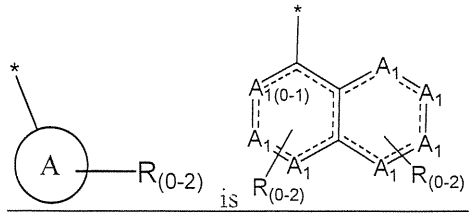
1~~15~~. A compound having a structure represented by the following formula (I):





wherein:

~~W,~~ X, Y, and Z are independently N or CH;



each A_1 is independently O, S, CR_1R_2, or NR_1;

~~A is substituted or unsubstituted and selected from cycloalkyl, heterocycloalkyl, aryl or heteroaryl;~~

R is selected from ~~H,~~ CF_3, halogen, CN, alkyl, aryl, heteroaryl, NR_1R_2, ~~COR_1R_2, CR_1R_2,~~ $S(O)_{0-2}NR_1R_2$, or $S(O)_{0-2}R_1R_2$;

M is substituted or unsubstituted and is selected from aryl or heteroaryl;

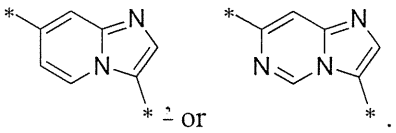
D is selected from a bond, O, CR_1R_2 or NH or NR_1 or NR_1R_2 or $S(O)_{0-2}R_1R_2$;

E is absent or selected from H, CF_3, halogen, CN, alkyl, aryl, heteroaryl, C_3-C_{12} cycloalkyl or C_3-C_{12} cycloheteroalkyl or $-(CH_2)_x-C_3$-C_{12} cycloalkyl or $-(CH_2)_x-C_3$-C_{12} cycloheteroalkyl;

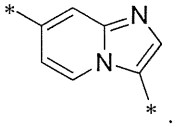
R_1 is absent or selected from H, alkyl, aryl, or heteraryl~~, or COR_1~~; and

R_2 is selected from H, alkyl, aryl, heteroaryl, or COR_1, ~~and further,~~ or R_1 and R_2 ~~can~~ form a C_3-C_{12} cycloalkyl or C_3-C_{12} cycloheteroalkyl containing O, N and/or S; or a pharmaceutically acceptable salt thereof~~, or a pharmaceutically acceptable derivative thereof~~.

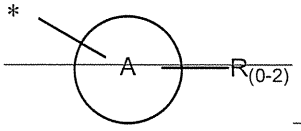
~~16~~2. ~~A~~ The compound of claim ~~15~~1, wherein ~~W,~~ X, Y and Z are selected to~~together help~~ form:



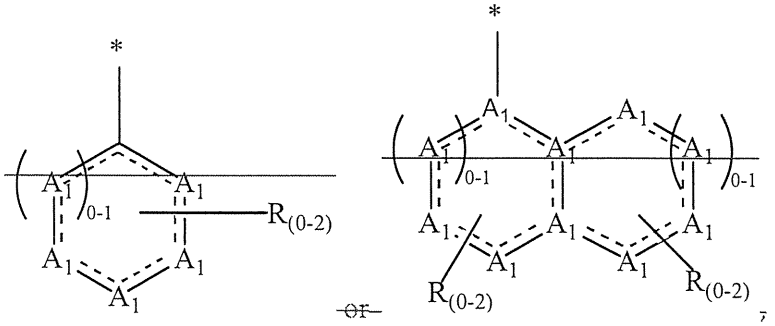
~~17~~3. ~~A~~ The compound of claim ~~15~~1, wherein ~~W,~~ X, Y and Z are selected to~~together help~~ form:



~~18. A compound of claim 15, wherein~~



~~is:~~



~~or~~

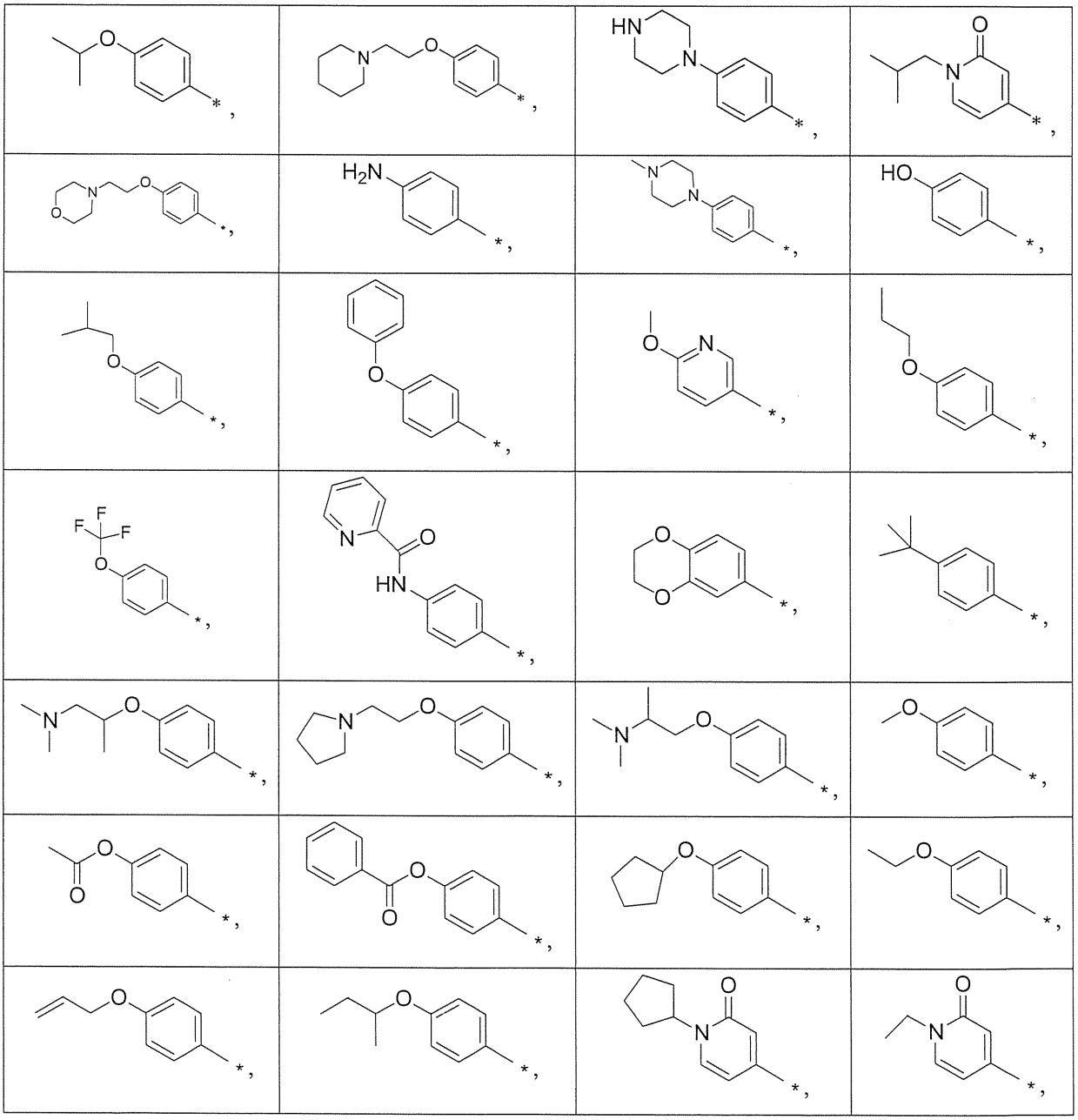
~~wherein A_1 is independently O, CR_1R_2 or NH or NR_1 or NR_1R_2, or can join with another A_1 to form C_3-C_{12} cycloalkyl or C_3-C_{12} cycloalkenyl or aryl or heteroaryl or C_3-C_{12} heterocycloalkyl or C_3-C_{12} heterocycloalkenyl or 3-8 membered ring comprising C, O, S, and/or N.~~

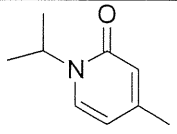
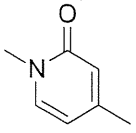
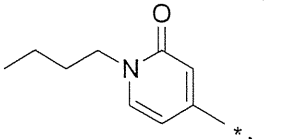
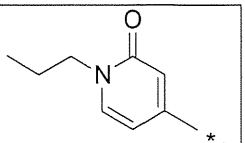
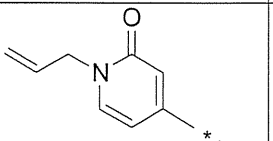
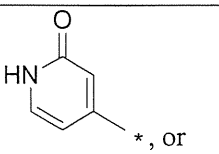
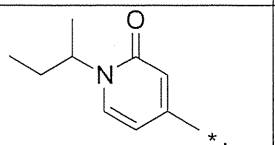
~~419~~. ~~A~~ The compound of claim ~~151~~, wherein M is optionally substituted with one or more R, and is selected from C_3-C_{12} cycloalkyl or C_3-C_{12} cycloalkenyl or aryl or heteroaryl or C_3-C_{12}

heterocycloalkyl or C_3-C_{12} heterocycloalkenyl or 3-8 membered ring comprising C, O, S, and/or N.

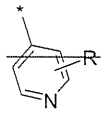
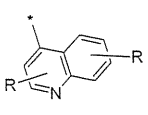
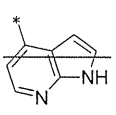
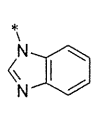
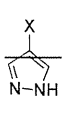
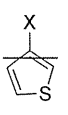
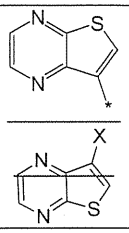
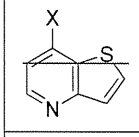
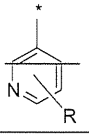
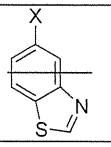
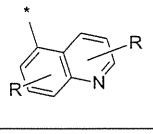
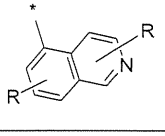
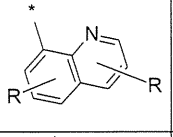
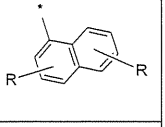
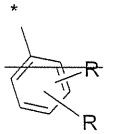
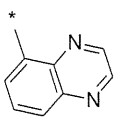
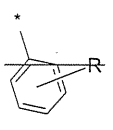
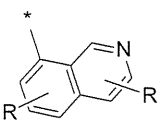
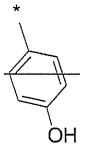
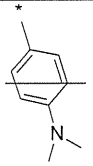
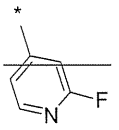
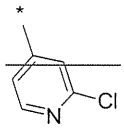
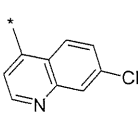
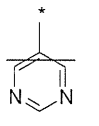
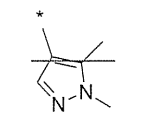
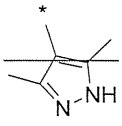
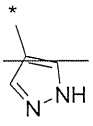
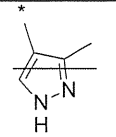
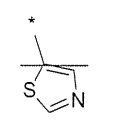
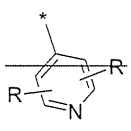
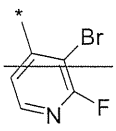
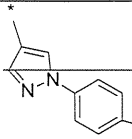
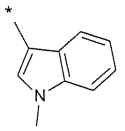
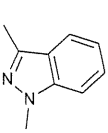
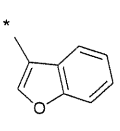
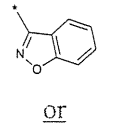
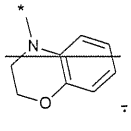
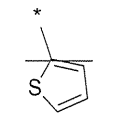
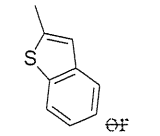
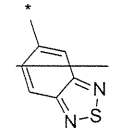
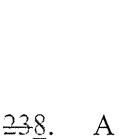
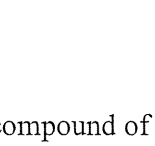
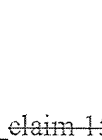
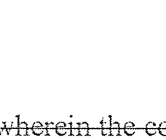
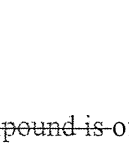
~~205~~. ~~A~~ The compound of claim ~~194~~, wherein M is optionally substituted phenyl or pyridine.

~~216~~. ~~A~~ The compound of claim ~~151~~, wherein M, D, and E together form:

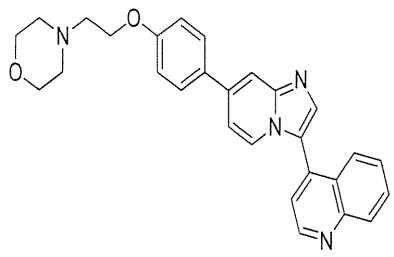
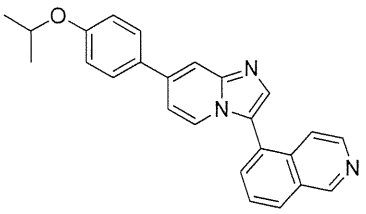
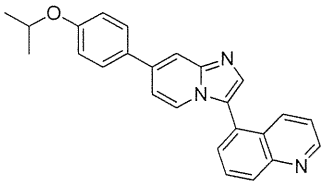
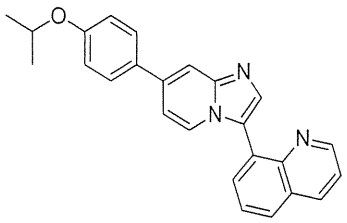
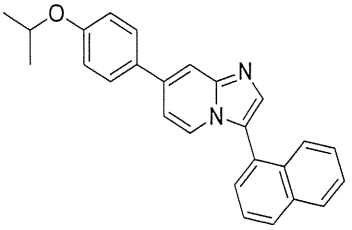
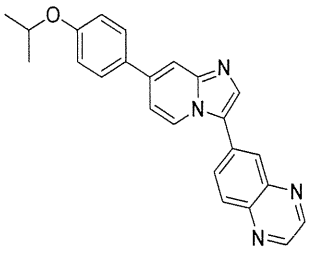
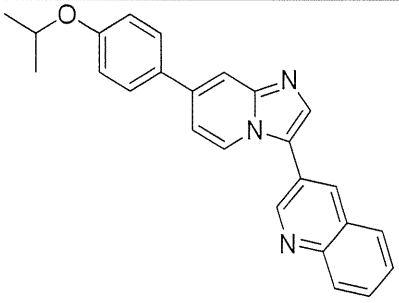
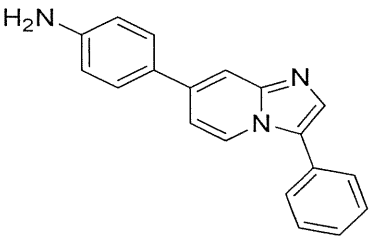
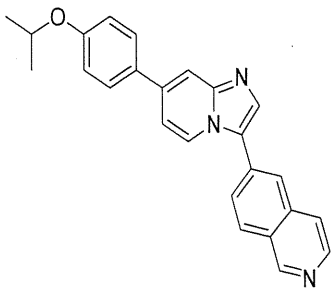
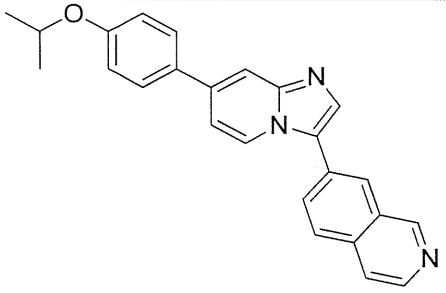
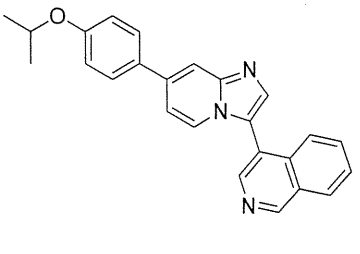
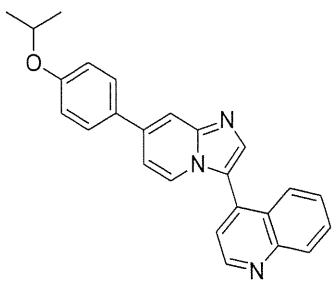
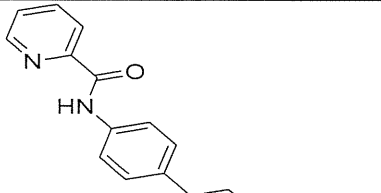
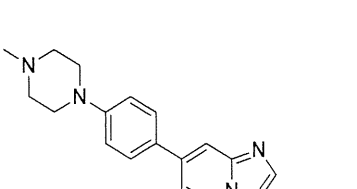
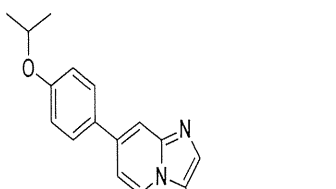


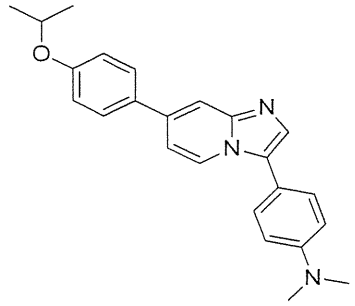
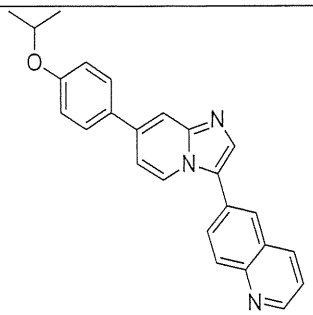
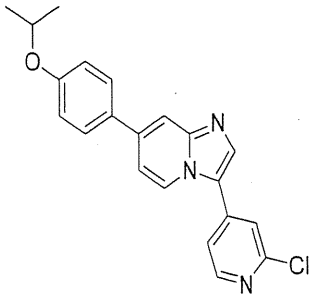
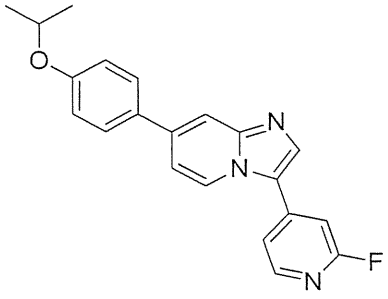
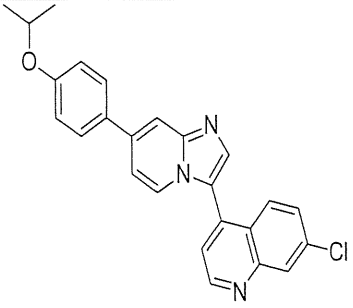
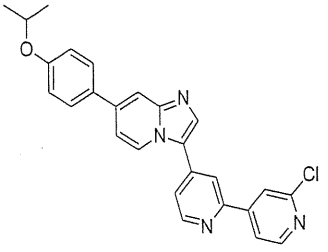
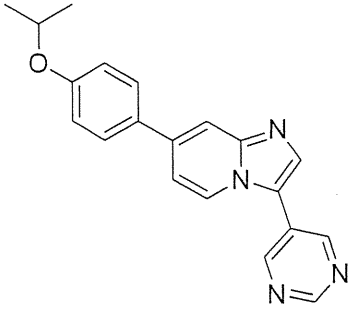
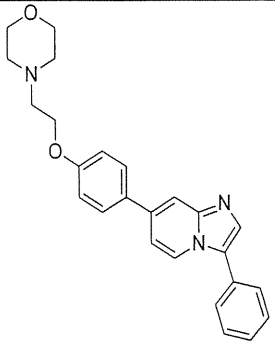
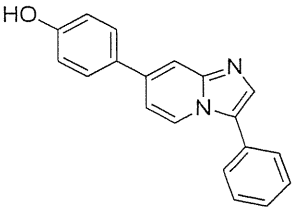
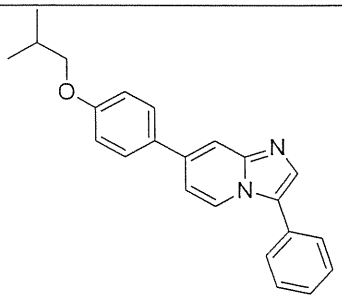
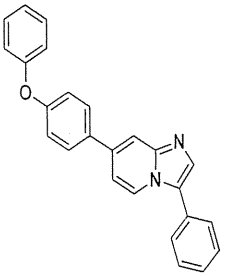
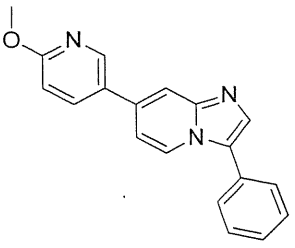
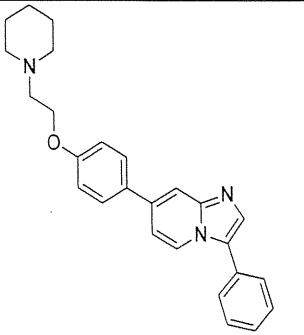
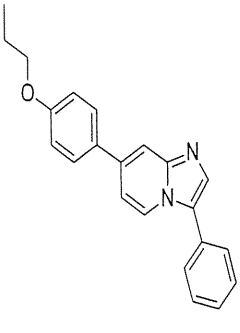
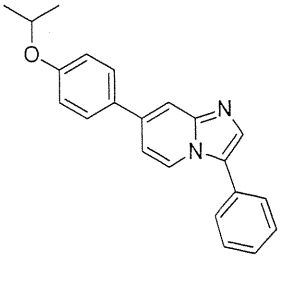
			
			

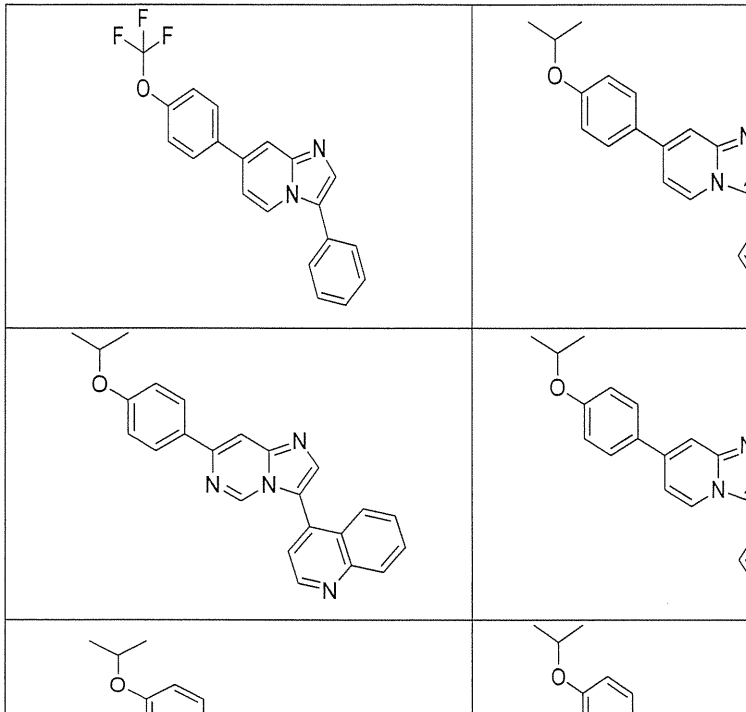
~~227~~. ~~A~~ The compound of claim ~~151~~, wherein A is chosen from the following:

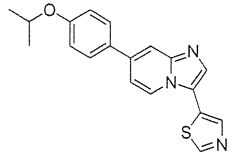
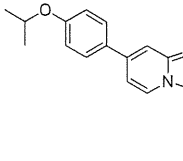
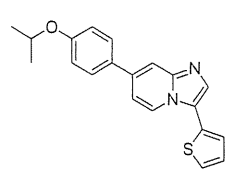
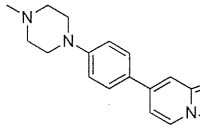
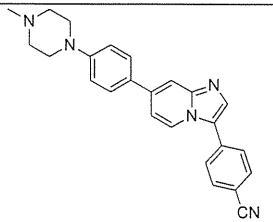
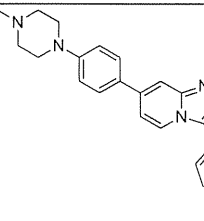
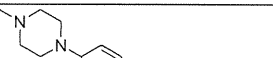
						
						
						
						
						
						
 or			 or			

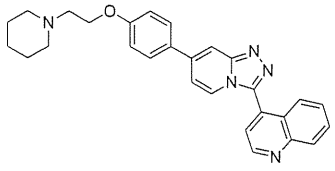
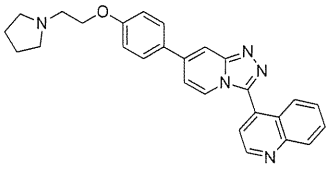
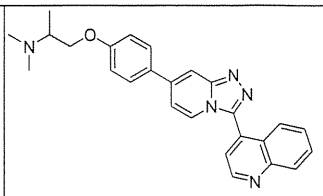
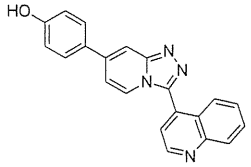
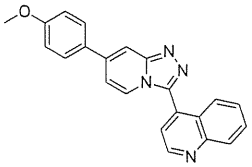
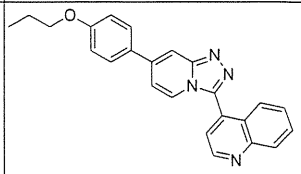
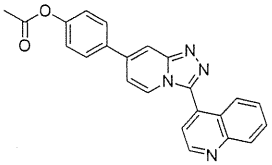
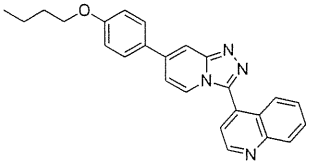
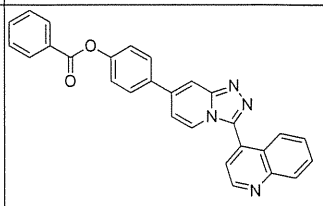
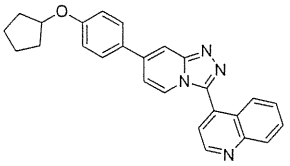
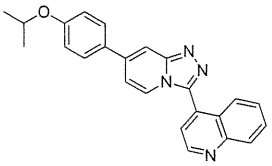
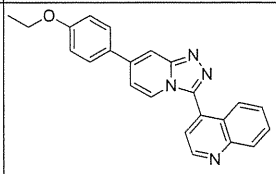
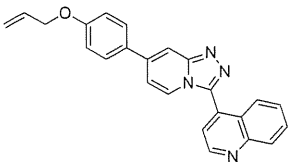
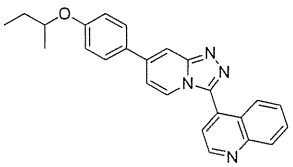
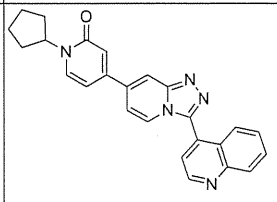
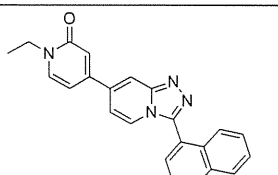
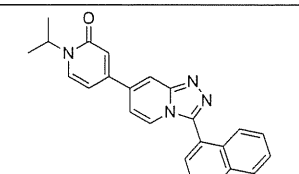
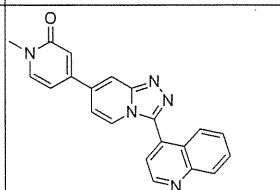
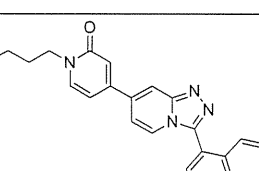
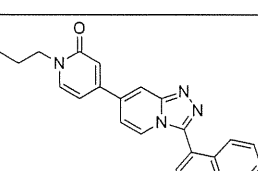
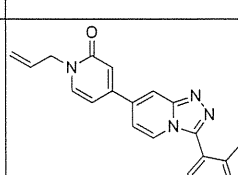
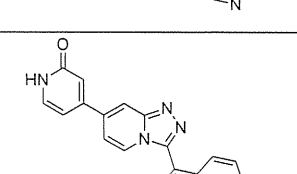
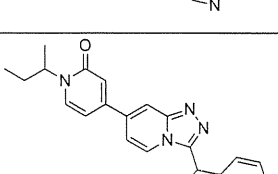
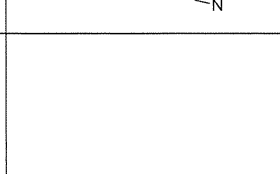
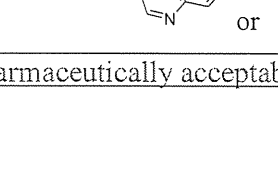
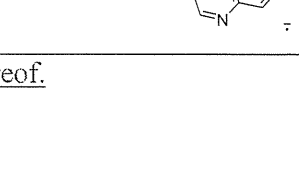
~~238~~. A compound of one ~~claim 15, wherein the compound is~~ of the following ~~formula~~structures:



		
		
		
		
		
		
		
		
 or	 .	

or a pharmaceutically acceptable salt thereof.

9. The compound of claim 1, wherein X is N and Y is CH.

10. A compound of any one of claims 1-9 for use in therapy.

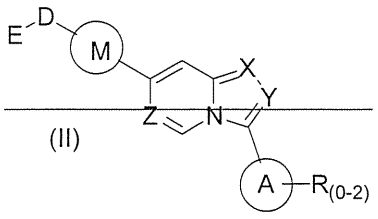
11. The compound of claim 10, wherein the therapy is associated with modulating the BMP signaling pathway.

12. Use of a compound of any one of claims 1-9 in the manufacture of a medicament for treating at least one disease state selected from anemia, iron deficiency anemia, anemia of chronic disease, fibrodysplasia ossificans progressiva (FOP), cancer, inflammation, pathologic bone function, ectopic or maladaptive bone formation, a skin disease, hypertension, ventricular hypertrophy, atherosclerosis, spinal cord injury and neuropathy, heart disease, heart damage, liver damage, and liver disease.

13. The use of claim 12, wherein the cancer is breast cancer, prostate cancer, bone cancer, lung cancer, renal cell cancer, or acute megakaryoblastic leukemia.

14. An *in vitro* method for at least one of propagation, engraftment, and differentiation of progenitor cells, the method comprising contacting a progenitor cell with a compound of any one of claims 1-9 in a dosage and amount effective to propagate a cell.

~~24. A compound having a structure represented by the following formula (II):~~



(II)

wherein:

X, Y, and Z are independently N or CH;

A is substituted or unsubstituted and selected from cycloalkyl, heterocycloalkyl, aryl or heteroaryl;

R is selected from H, CF_3, halogen, CN, alkyl, aryl, heteroaryl, NR_1R_2, COR_1R_2, CR_1R_2, $S(O)_{0-2}NR_1R_2$; or $S(O)_{0-2}R_1R_2$;

M is substituted or unsubstituted and is selected from aryl or heteroaryl;

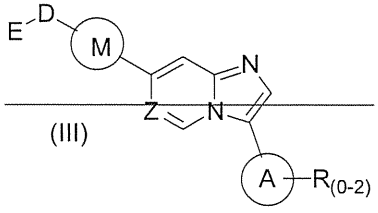
D is selected from a bond, O, CR_1R_2 or NH or NR_1 or NR_1R_2 or $S(O)_{0-2}R_1R_2$;

E is selected from H, CF_3, halogen, CN, alkyl, aryl, heteroaryl, C_3-C_{12} cycloalkyl or C_3-C_{12} cycloheteroalkyl or $(CH_2)_x$-C_3-C_{12} cycloalkyl or $(CH_2)_x$-C_3-C_{12} cycloheteroalkyl;

R_1 is selected from H, alkyl, aryl, heteraryl, or COR_1; and

R_2 is selected from H, alkyl, aryl, heteraryl, COR_1, and further, R_1 and R_2 can form a C_3-C_{12} cycloalkyl or C_3-C_{12} cycloheteroalkyl containing O, N or S; or a pharmaceutically acceptable salt thereof, or a pharmaceutically acceptable derivative thereof.

25. A compound having a structure represented by the following formula (III):



(III)

wherein:

Z is N or CH;

A is substituted or unsubstituted and is selected from cycloalkyl, heterocycloalkyl, aryl or heteroaryl;

R is selected from H, CF_3, halogen, CN, alkyl, aryl, heteroaryl, NR_1R_2, COR_1R_2, CR_1R_2, $S(O)_{0-2}NR_1R_2$; or $S(O)_{0-2}R_1R_2$;

M is substituted or unsubstituted and selected from aryl or heteroaryl;

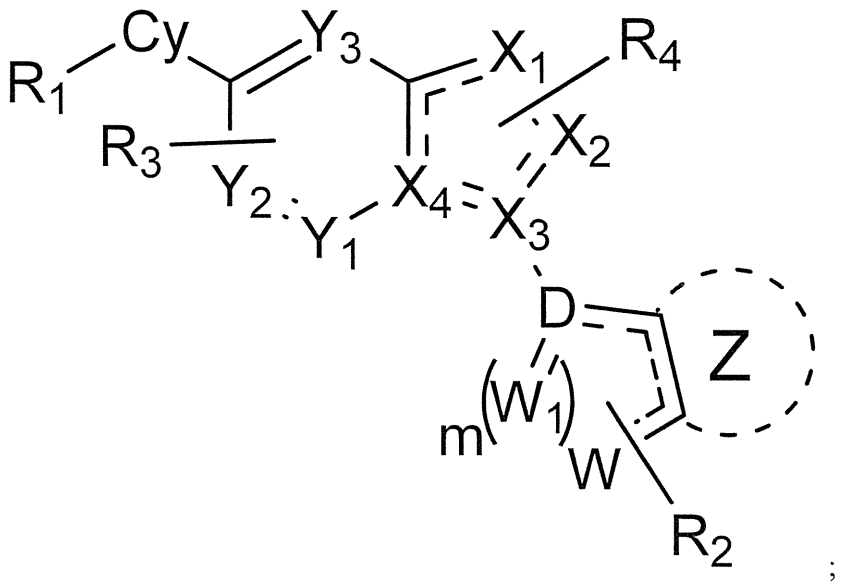
D is selected from a bond, O, CR_1R_2 or NH or NR_1 or NR_1R_2 or $S(O)_{0-2}R_1R_2$;

E is selected from H, CF_3, halogen, CN, alkyl, aryl, heteroaryl, C_3-C_{12} cycloalkyl or C_3-C_{12} cycloheteroalkyl or $(CH_2)_x$-C_3-C_{12} cycloalkyl or $(CH_2)_x$-C_3-C_{12} cycloheteroalkyl;

R_1 is selected from H, alkyl, aryl, heteraryl, or COR_1; and

~~R_2 is selected from H, alkyl, aryl, heteraryl, COR_1, and further, R_1 and R_2 can form a C_3-C_{12} cycloalkyl or C_3-C_{12} cycloheteroalkyl containing O, N or S; or a pharmaceutically acceptable salt thereof, or a pharmaceutically acceptable derivative thereof.~~

~~26~~15. A compound ~~for use as a medicament for modulating the BMP signaling pathway, the compound~~ having a structure represented by the following formula:



;

wherein:

X_1 is N~~, O,~~ or CR_1;

X_2, and X_4 are independently N or CR_1;

X_3 is C~~ or N~~;

Y_1, Y_2, and Y_3 are independently N or CR_1;

D is C or N;

W is N or O;

W_1 is N, O or C;

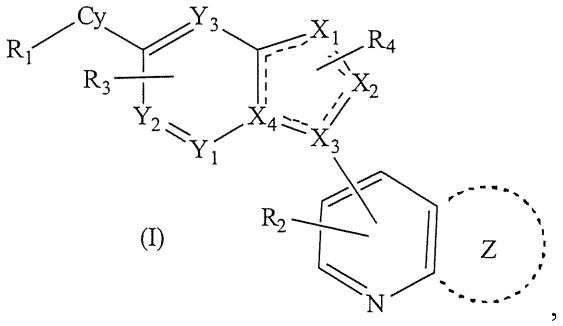
Cy is optionally substituted with one or more R_1, and is selected from C_3-C_{12} cycloalkyl or C_3-C_{12} cycloalkenyl or aryl or heteroaryl or C_3-C_{12} heterocycloalkyl or C_3-C_{12} heterocycloalkenyl or 3-8 membered ring comprising C, O, S, and/or N.

R_1–R_4 are independently selected from hydrogen, halogen, $C_{1\text{-}10}$ alkyl, $C_{3\text{-}10}$ cycloalkyl, $OC_{1\text{-}10}$ alkyl (which may contain a $C_{3\text{-}8}$ membered ring containing C, O, S or N, optionally

substituted with one or more R^4), NR_1C_{1-10} alkyl (which may contain a C_{3-8} membered ring containing C, O, S or N, optionally substituted with one or more R^4), CN or CF_3;

Z is optionally substituted with one or more R_1, and is selected from C_3-C_{12} cycloalkyl or C_3-C_{12} cycloalkenyl or aryl or heteroaryl or C_3-C_{12} heterocycloalkyl or C_3-C_{12} heterocycloalkenyl or 3-8 membered ring comprising C, O, S, and/or N.

~~27~~16. A compound ~~for use as a medicament for modulating the BMP signaling pathway, the compound~~ having a structure represented by the following formula:



(I)

wherein:

X_1 is N, ~~O,~~ or CR_1;

X_2, and X_4 are independently N or CR_1;

X_3 is C ~~or N~~;

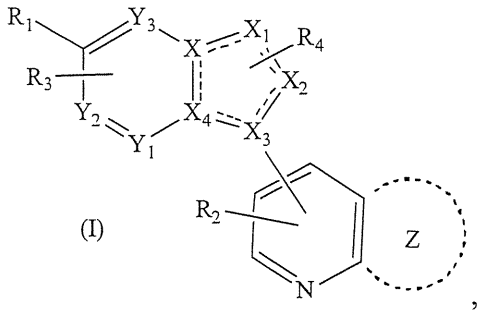
Y_1, Y_2, and Y_3 are independently N or CR_1;

Cy is a bond, or forms a ring that is optionally substituted with one or more R_1, and is selected from C_3-C_{12} cycloalkyl or C_3-C_{12} cycloalkenyl or aryl or heteroaryl or C_3-C_{12} heterocycloalkyl or C_3-C_{12} heterocycloalkenyl or 3-8 membered ring comprising C, O, S, and/or N.

R_1–R_4 are independently selected from hydrogen, halogen, C_{1-10} alkyl, C_{3-10} cycloalkyl, OC_{1-10} alkyl (which may contain a C_{3-8} membered ring containing C, O, S or N, optionally substituted with one or more R^4), NR_1C_{1-10} alkyl (which may contain a C_{3-8} membered ring containing C, O, S or N, optionally substituted with one or more R^4), CN or CF_3;

Z is optionally substituted with one or more R_1, and is selected from C_3-C_{12} cycloalkyl or C_3-C_{12} cycloalkenyl or aryl or heteroaryl or C_3-C_{12} heterocycloalkyl or C_3-C_{12} heterocycloalkenyl or 3-8 membered ring comprising C, O, S, and/or N.

~~28~~17. A compound ~~for use as a medicament for modulating the BMP signaling pathway, the compound~~ having a structure represented by the following formula:



(I)

wherein:

X_1, X_2, X_3 and X_4 are independently N or CR_1;

X is ~~N, O, or~~ CR_1;

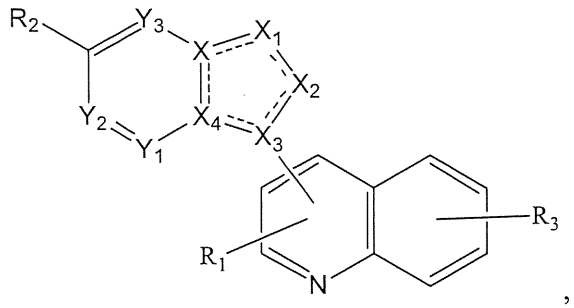
X_3 is C or N;

Y_1, Y_2, and Y_3 are independently N or CR_1;

R_1-R_4 are absent or independently selected from hydrogen, halogen, C_{1-10} alkyl, C_{3-10} cycloalkyl, OC_{1-10} alkyl (which may contain a C_{3-8} membered ring containing C, O, S or N, optionally substituted with one or more R^4), CN or CF_3;

Z is optionally substituted with one or more R_1, and is selected from C_3-C_{12} cycloalkyl or C_3-C_{12} cycloalkenyl or aryl or heteroaryl or C_3-C_{12} heterocycloalkyl or C_3-C_{12} heterocycloalkenyl or 3-8 membered ring comprising C, O, S, and/or N.

18~~29~~. The compound of claim 17~~28~~, wherein the compound is of the following formula:



wherein:

X_1, X_2, X_3 and X_4 are independently N or CR_1;

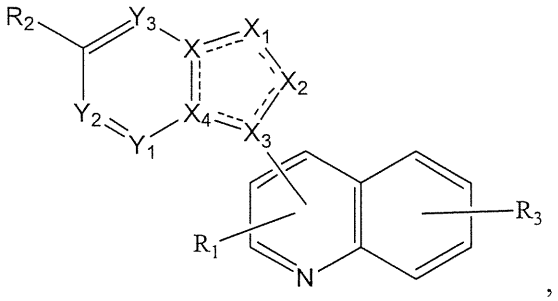
X is ~~N, O, or~~ CR_1;

X_3 is C or N;

Y_1, Y_2, and Y_3 are independently N or CR_1;

R_1-R_4 are absent or independently selected from hydrogen, halogen, C_{1-10} alkyl, C_{3-10} cycloalkyl, OC_{1-10} alkyl (which may contain a C_{3-8} membered ring containing C, O, S or N, optionally substituted with one or more R^4), CN or CF_3;

~~30~~19. The compound of claim ~~28~~17, wherein the compound is of the following formula:



,

wherein

~~(i) X_1 is O, X_2 is N, and X, X_3, X_4, Y_1, Y_2, and Y_3 are independently C or CR_1;~~

~~(ii) X_1 is O, X_2 is N, Y_1 is N, and X, X_3, X_4, Y_2, and Y_3 are independently C or CR_1;~~

(~~iii~~) X_1 is N, X_4 is N, and X_2, X_3, X_4, Y_1, Y_2, and Y_3 are independently C or CR_1;

(~~iv~~ii) X_1 is N, X_2 is N, Y_1 is N, and X, X_3, X_4, Y_2, and Y_3 are independently C or CR_1;

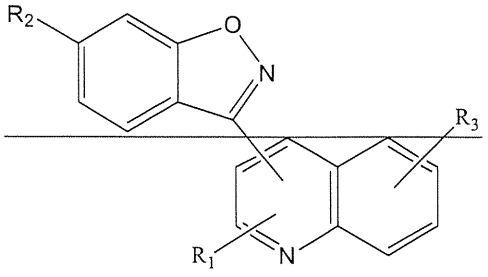
(~~v~~iii) X_1 is N, X_2 is N, Y_2 is N, and X, X_3, X_4, Y_2, and Y_3 are independently C or CR_1; or

(~~vi~~iv) X_1 is N, X_3 is N, and X_2, X_3, X_4, Y_1, Y_2, and Y_3 are independently C or CR_1;

Y_1, Y_2, and Y_3 are independently N or CR_1;

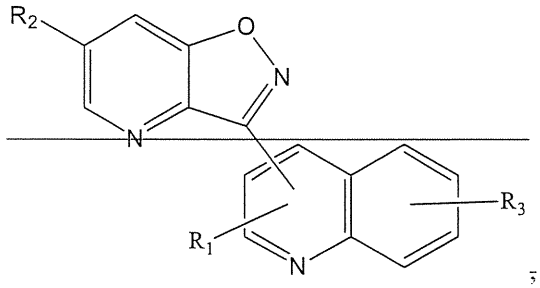
R_1-R_4 are independently selected from hydrogen, halogen, C_{1-10} alkyl, C_{3-10} cycloalkyl, OC_{1-10} alkyl (which may contain a C_{3-8} membered ring containing C, O, S or N, optionally substituted with one or more R^4), CN or CF_3.

~~31. The compound of claim 28, of the following formula:~~



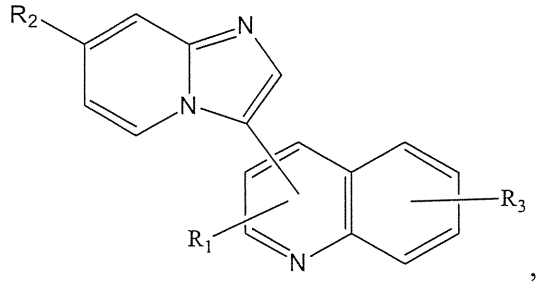
~~wherein R_1-R_4 are independently selected from hydrogen, halogen, C_{1-10} alkyl, C_{3-10} cycloalkyl, OC_{1-10} alkyl (which may contain a C_{3-8} membered ring containing C, O, S or N, optionally substituted with one or more R^4), CN or CF_3.~~

~~32. The compound of claim 28, wherein the compound is of the following formula:~~



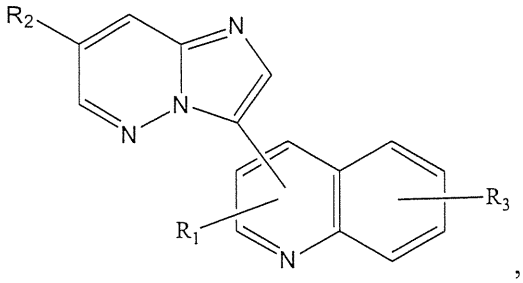
~~wherein R_1-R_4 are independently selected from hydrogen, halogen, C_{1-10} alkyl, C_{3-10} cycloalkyl, OC_{1-10} alkyl (which may contain a C_{3-8} membered ring containing C, O, S or N, optionally substituted with one or more R^4), CN or CF_3.~~

2033. The compound of claim 1728, wherein the compound is of the following formula:



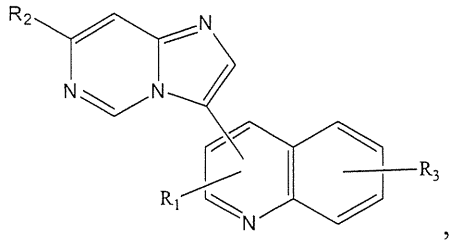
wherein R_1-R_4 are independently selected from hydrogen, halogen, C_{1-10} alkyl, C_{3-10} cycloalkyl, OC_{1-10} alkyl (which may contain a C_{3-8} membered ring containing C, O, S or N, optionally substituted with one or more R^4), CN or CF_3.

3421. The compound of claim 2817, wherein the compound is of the following formula:



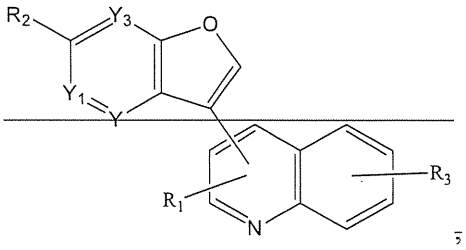
wherein R_1-R_4 are independently selected from hydrogen, halogen, C_{1-10} alkyl, C_{3-10} cycloalkyl, OC_{1-10} alkyl (which may contain a C_{3-8} membered ring containing C, O, S or N, optionally substituted with one or more R^4), CN or CF_3.

~~35~~22. The compound of claim ~~28~~17, wherein the compound is of the following formula:



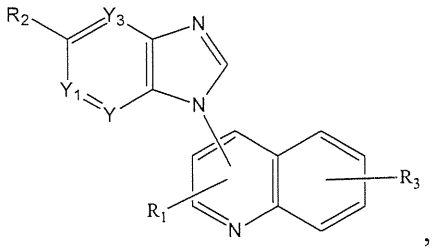
wherein R_1-R_4 are independently selected from hydrogen, halogen, C_{1-10} alkyl, C_{3-10} cycloalkyl, OC_{1-10} alkyl (which may contain a C_{3-8} membered ring containing C, O, S or N, optionally substituted with one or more R^4), CN or CF_3.

~~36. The compound of claim 28, wherein the compound is of the following formula:~~



~~wherein Y_1 and Y_3 are independently N or CR_1; R_1-R_4 are independently selected from hydrogen, halogen, C_{1-10} alkyl, C_{3-10} cycloalkyl, OC_{1-10} alkyl (which may contain a C_{3-8} membered ring containing C, O, S or N, optionally substituted with one or more R^4), CN or CF_3.~~

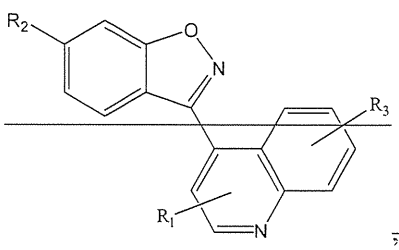
~~37~~23. The compound of claim ~~28~~17, wherein the compound is of the following formula:



wherein Y_1 and Y_3 are independently N or CR_1; R_1-R_4 are independently selected from hydrogen, halogen, C_{1-10} alkyl, C_{3-10} cycloalkyl, OC_{1-10} alkyl (which may contain a C_{3-8}

membered ring containing C, O, S or N, optionally substituted with one or more R^4), CN or CF_3.

~~38~~24. The compound of claim ~~28~~17, wherein the compound is of the following formula:



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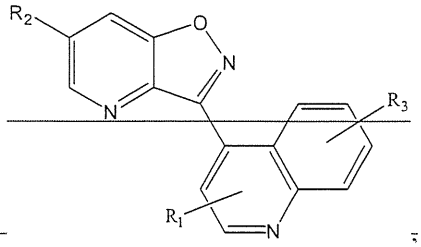
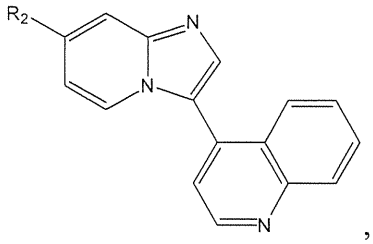


;



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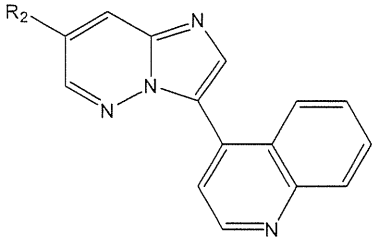

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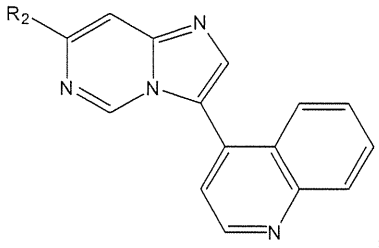
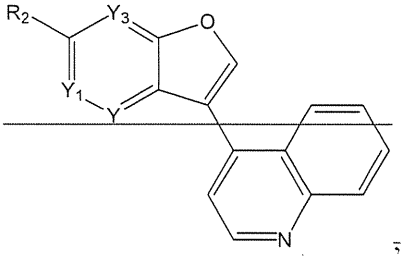
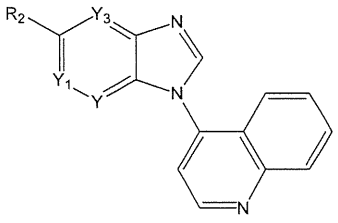


,



; and

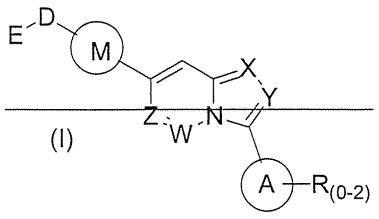


wherein Y_1 and Y_3 are independently N or CR_1; R_1-R_4 are independently selected from hydrogen, halogen, C_{1-10} alkyl, C_{3-10} cycloalkyl, OC_{1-10} alkyl (which may contain a C_{3-8} membered ring containing C, O, S or N, optionally substituted with one or more R^4), CN or CF_3.

25. A compound of any one of claims 15-24 for use in therapy.

26. Use of a compound of any one of claims 15-24 in the manufacture of a medicament for modulating the BMP signaling pathway.

~~39. A compound for use as a medicament for treating acute megakaryoblastic leukemia, the compound having a structure represented by the following formula (I):~~



(I)

~~wherein:~~

~~W, X, Y, and Z are independently N or CH;~~

~~A is substituted or unsubstituted and selected from cycloalkyl, heterocycloalkyl, aryl or heteroaryl;~~

~~R is selected from H, CF_3, halogen, CN, alkyl, aryl, heteroaryl, NR_1R_2, COR_1R_2, CR_1R_2, $S(O)_{0-2}NR_1R_2$; or $S(O)_{0-2}R_1R_2$;~~

~~M is substituted or unsubstituted and is selected from aryl or heteroaryl;~~

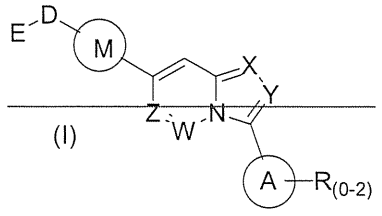
~~D is selected from a bond, O, CR_1R_2 or NH or NR_1 or NR_1R_2 or $S(O)_{0-2}R_1R_2$;~~

~~E is selected from H, CF_3, halogen, CN, alkyl, aryl, heteroaryl, C_3-C_{12} cycloalkyl or C_3-C_{12} cycloheteroalkyl or $(CH_2)_x$-C_3-C_{12} cycloalkyl or $(CH_2)_x$-C_3-C_{12} cycloheteroalkyl;~~

~~R_1 is selected from H, alkyl, aryl, heteraryl, or COR_1; and~~

~~R_2 is selected from H, alkyl, aryl, heteraryl, COR_1, and further, R_1 and R_2 can form a C_3-C_{12} cycloalkyl or C_3-C_{12} cycloheteroalkyl containing O, N or S; or a pharmaceutically acceptable salt thereof, or a pharmaceutically acceptable derivative thereof.~~

~~40~~27. Use of ~~A~~ a compound of any one of claims 1-9 in the manufacture of a medicament~~for use in therapy~~ for ~~at least one of treating heart disease, treating heart damage,~~ promoting, inducing, or enhancing modulation of epicardial activation and epithelial-to-mesenchyme transition; or ~~a method of~~ inducing, enhancing, or promoting cardiomyocyte formation. ~~, the compound having a structure represented by the following formula (I):~~



(I)

~~wherein:~~

~~W, X, Y, and Z are independently N or CH;~~

~~A is substituted or unsubstituted and selected from cycloalkyl, heterocycloalkyl, aryl or heteroaryl;~~

~~R is selected from H, CF_3, halogen, CN, alkyl, aryl, heteroaryl, NR_1R_2, COR_1R_2, CR_1R_2, $S(O)_{0-2}NR_1R_2$; or $S(O)_{0-2}R_1R_2$;~~

M is substituted or unsubstituted and is selected from aryl or heteroaryl;

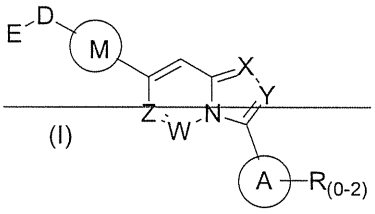
D is selected from a bond, O, CR_1R_2 or NH or NR_1 or NR_1R_2 or $S(O)_{0-2}R_1R_2$;

E is selected from H, CF_3, halogen, CN, alkyl, aryl, heteroaryl, C_3-C_{12} cycloalkyl or C_3-C_{12} cycloheteroalkyl or $(CH_2)_x$-C_3-C_{12} cycloalkyl or $(CH_2)_x$-C_3-C_{12} cycloheteroalkyl;

R_1 is selected from H, alkyl, aryl, heteraryl, or COR_1; and

R_2 is selected from H, alkyl, aryl, heteraryl, COR_1, and further, R_1 and R_2 can form a C_3-C_{12} cycloalkyl or C_3-C_{12} cycloheteroalkyl containing O, N or S; or a pharmaceutically acceptable salt thereof, or a pharmaceutically acceptable derivative thereof.

41. A compound for use in therapy for at least one of promoting or enhancing liver restoration of liver mass, treating liver damage, treating liver disease, or treating acetaminophen overdose in a subject in need thereof, the compound having a structure represented by the following formula (I):



(I)

wherein:

W, X, Y, and Z are independently N or CH;

A is substituted or unsubstituted and selected from cycloalkyl, heterocycloalkyl, aryl or heteroaryl;

R is selected from H, CF_3, halogen, CN, alkyl, aryl, heteroaryl, NR_1R_2, COR_1R_2, CR_1R_2, $S(O)_{0-2}NR_1R_2$; or $S(O)_{0-2}R_1R_2$;

M is substituted or unsubstituted and is selected from aryl or heteroaryl;

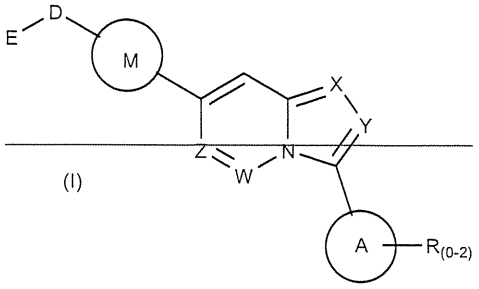
D is selected from a bond, O, CR_1R_2 or NH or NR_1 or NR_1R_2 or $S(O)_{0-2}R_1R_2$;

E is selected from H, CF_3, halogen, CN, alkyl, aryl, heteroaryl, C_3-C_{12} cycloalkyl or C_3-C_{12} cycloheteroalkyl or $(CH_2)_x$-C_3-C_{12} cycloalkyl or $(CH_2)_x$-C_3-C_{12} cycloheteroalkyl;

R_1 is selected from H, alkyl, aryl, heteraryl, or COR_1; and

R_2 is selected from H, alkyl, aryl, heteraryl, COR_1, and further, R_1 and R_2 can form a C_3-C_{12} cycloalkyl or C_3-C_{12} cycloheteroalkyl containing O, N or S; or a pharmaceutically acceptable salt thereof, or a pharmaceutically acceptable derivative thereof.

~~42~~28. A method for modulating the BMP signaling pathway comprising administering ~~*in vitro* administration~~ to at least one cell *in vitro* a compound of any one of claims 1-9 in an amount effective to modulate BMP signaling. ~~, the compound having a structure represented by the formula (I):~~



(I)

~~wherein:~~

~~W, X, Y, and Z are independently N or CH;~~

~~A is substituted or unsubstituted and selected from cycloalkyl, heterocycloalkyl, aryl or heteroaryl;~~

~~R is selected from H, CF_3, halogen, CN, alkyl, aryl, heteroaryl, NR_1R_2, COR_1R_2, CR_1R_2, $S(O)_{0-2}NR_1R_2$; or $S(O)_{0-2}R_1R_2$;~~

~~M is substituted or unsubstituted and is selected from aryl or heteroaryl;~~

~~D is selected from a bond, O, CR_1R_2 or NH or NR_1 or NR_1R_2 or $S(O)_{0-2}R_1R_2$;~~

~~E is selected from H, CF_3, halogen, CN, alkyl, aryl, heteroaryl, C_3-C_{12} cycloalkyl or C_3-C_{12} cycloheteroalkyl or $(CH_2)_x$ C_3-C_{12} cycloalkyl or $(CH_2)_x$ C_3-C_{12} cycloheteroalkyl;~~

~~R_1 is selected from H, alkyl, aryl, heteraryl, or COR_1; and~~

~~R_2 is selected from H, alkyl, aryl, heteraryl, COR_1, and further, R_1 and R_2 can form a C_3-C_{12} cycloalkyl or C_3-C_{12} cycloheteroalkyl containing O, N or S; or a pharmaceutically acceptable salt thereof, or a pharmaceutically acceptable derivative thereof.~~

~~43~~29. The method of claim ~~42~~28, wherein modulating the BMP signaling pathway enhances keratinocyte proliferation.

~~44~~30. The method of claim ~~42~~28, wherein the at least one cell is a stem cell.

~~45~~31. The method of claim ~~44~~28, wherein modulating the BMP signaling pathway regulates the differentiation and regeneration of precursor and stem cell populations.

~~46~~32. The method of claim ~~42~~28, wherein mutilating the BMP signaling pathway maintains a pluripotential state in stem cell or multipotent cell populations *in vitro*.

~~47~~33. The method of claim ~~42~~28, wherein mutilating the BMP signaling pathway expands stem cell or multipotent cell populations *in vitro*.