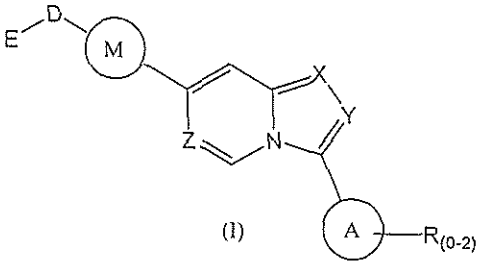
We claim:

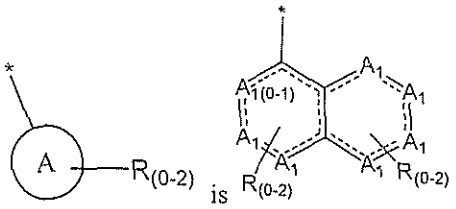
1. A compound having a structure represented by the following formula (I):



(I)

wherein:

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



is

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

R is selected from CF_3, halogen, CN, alkyl, aryl, heteroaryl, or NR_1R_2;

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

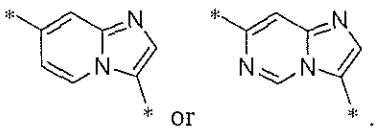
D is selected from a bond, O, CR_1R_2, NH, NR_1 or NR_1R_2;

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

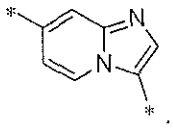
R_1 is absent or selected from H, alkyl, aryl, or heteraryl; and

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:

 or .

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

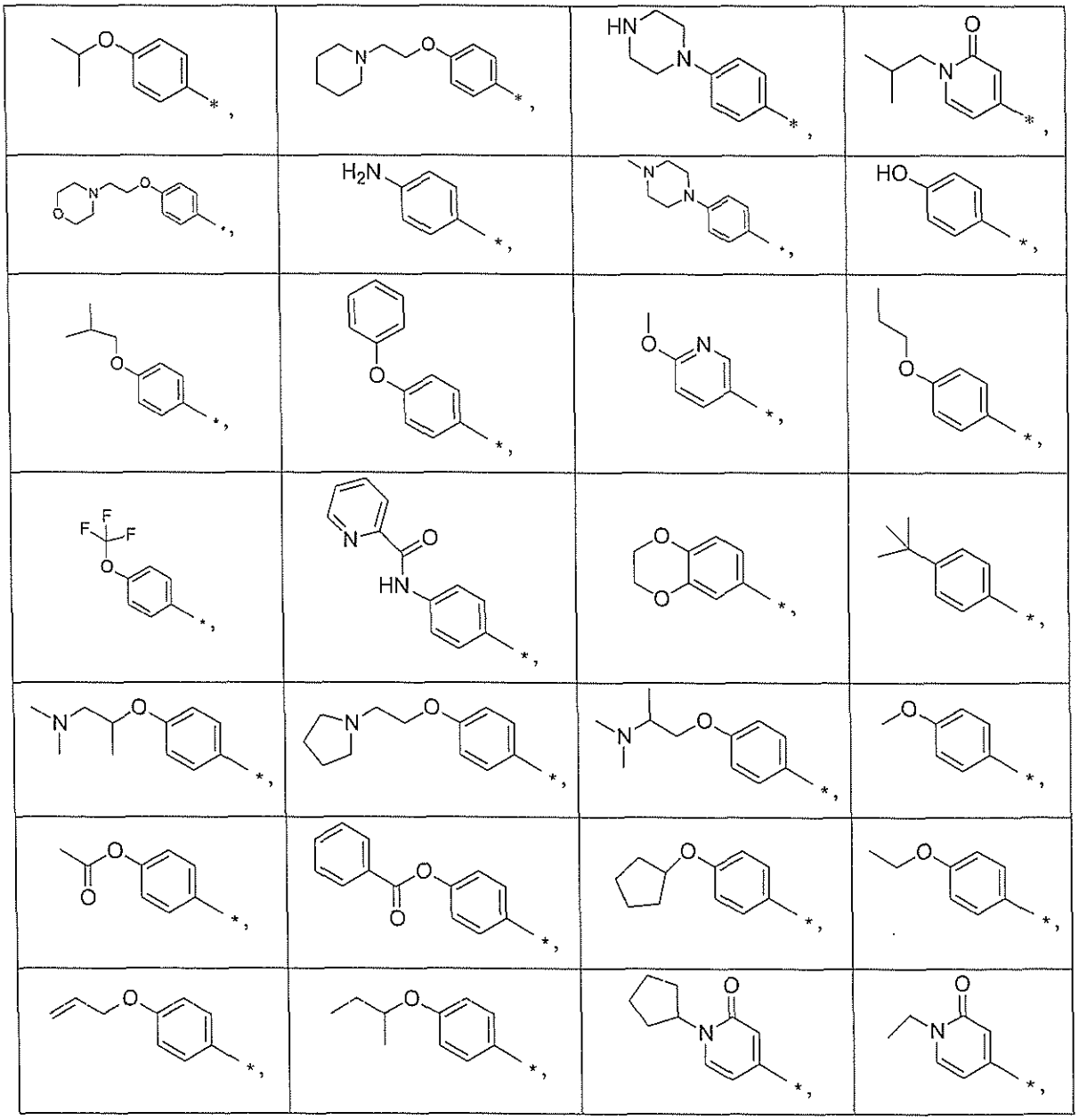
.

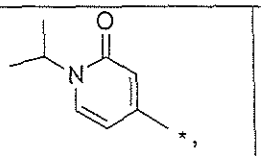
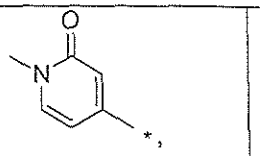
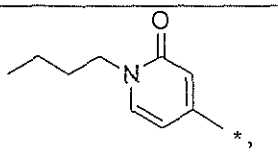
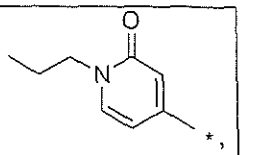
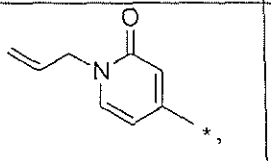
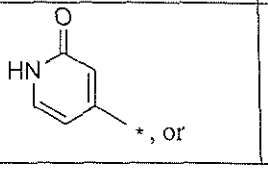
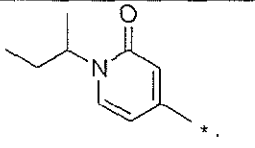
4. The compound of claim 1, wherein M is optionally substituted with one or more R, and is selected from C_3-C_{12} cycloalkyl, C_3-C_{12} cycloalkenyl, aryl, heteroaryl, C_3-C_{12}

heterocycloalkyl, or C_3-C_{12} heterocycloalkenyl.

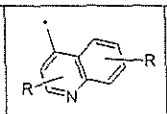
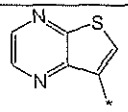
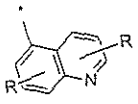
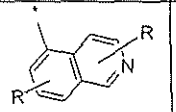
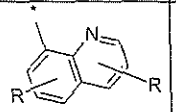
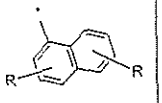
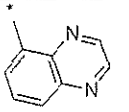
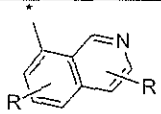
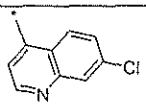
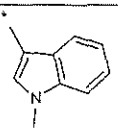
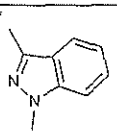
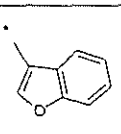
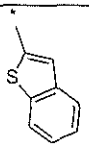
5. The compound of claim 4, wherein M is optionally substituted phenyl or pyridine.

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

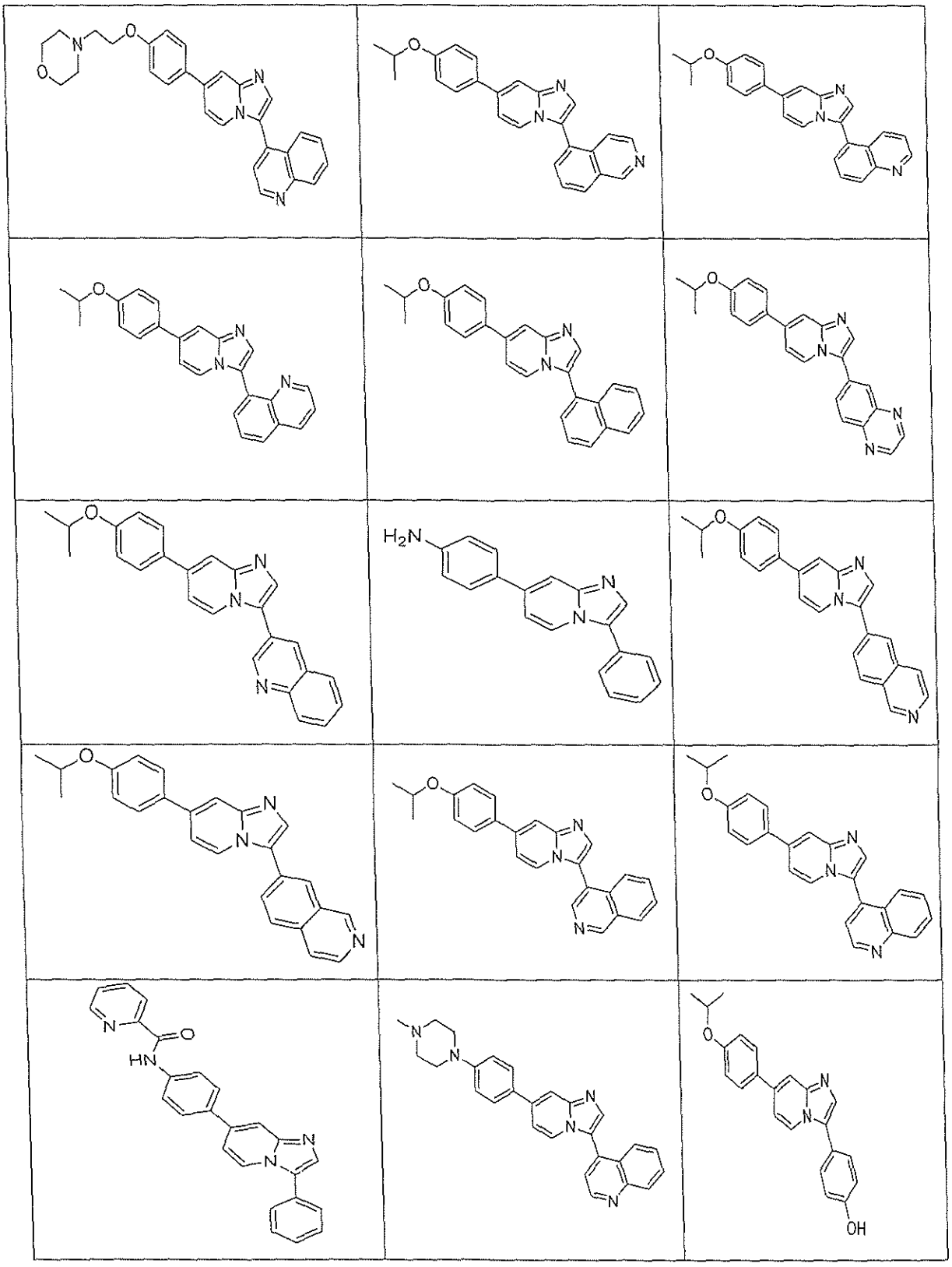


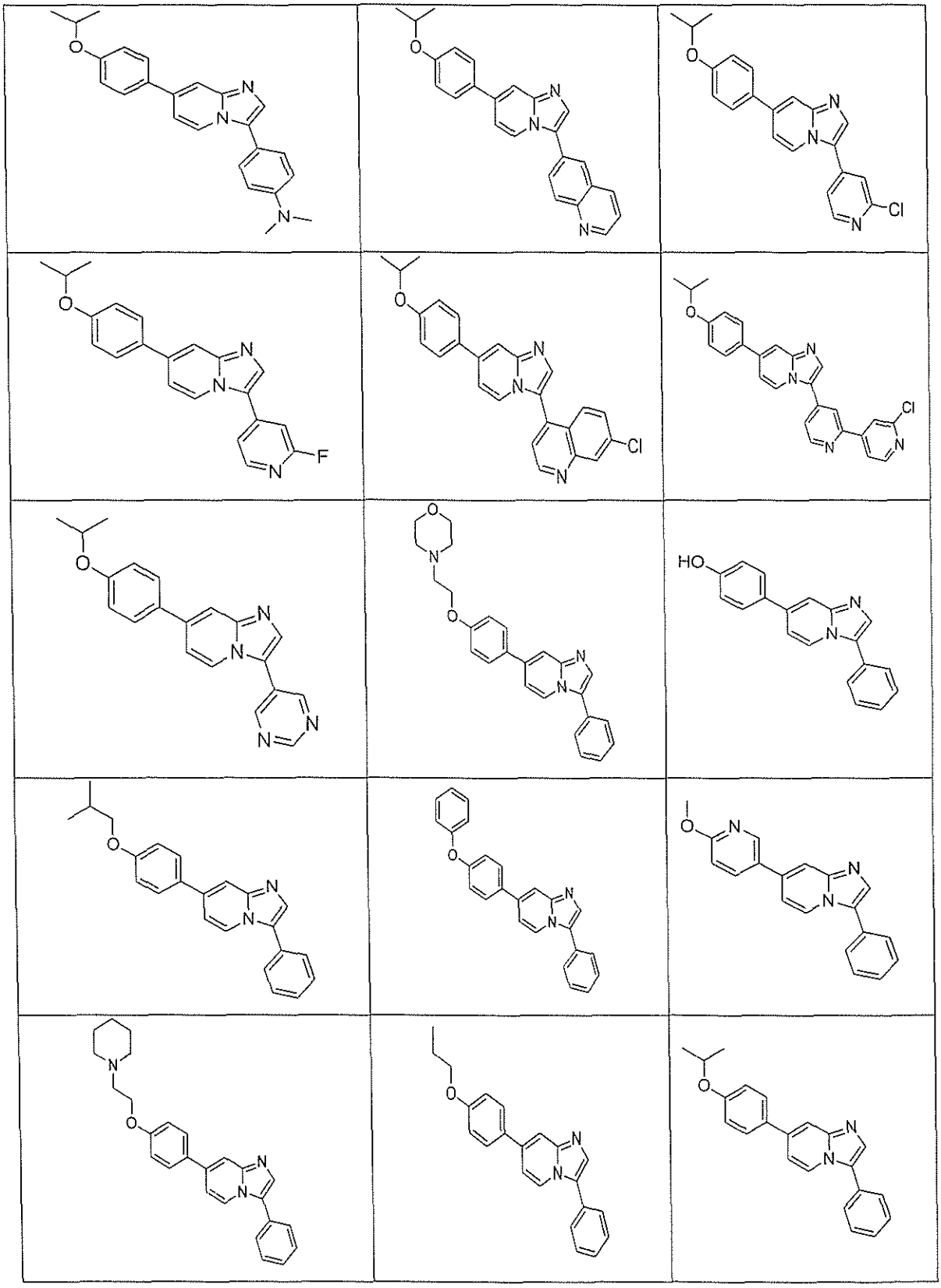
			
			

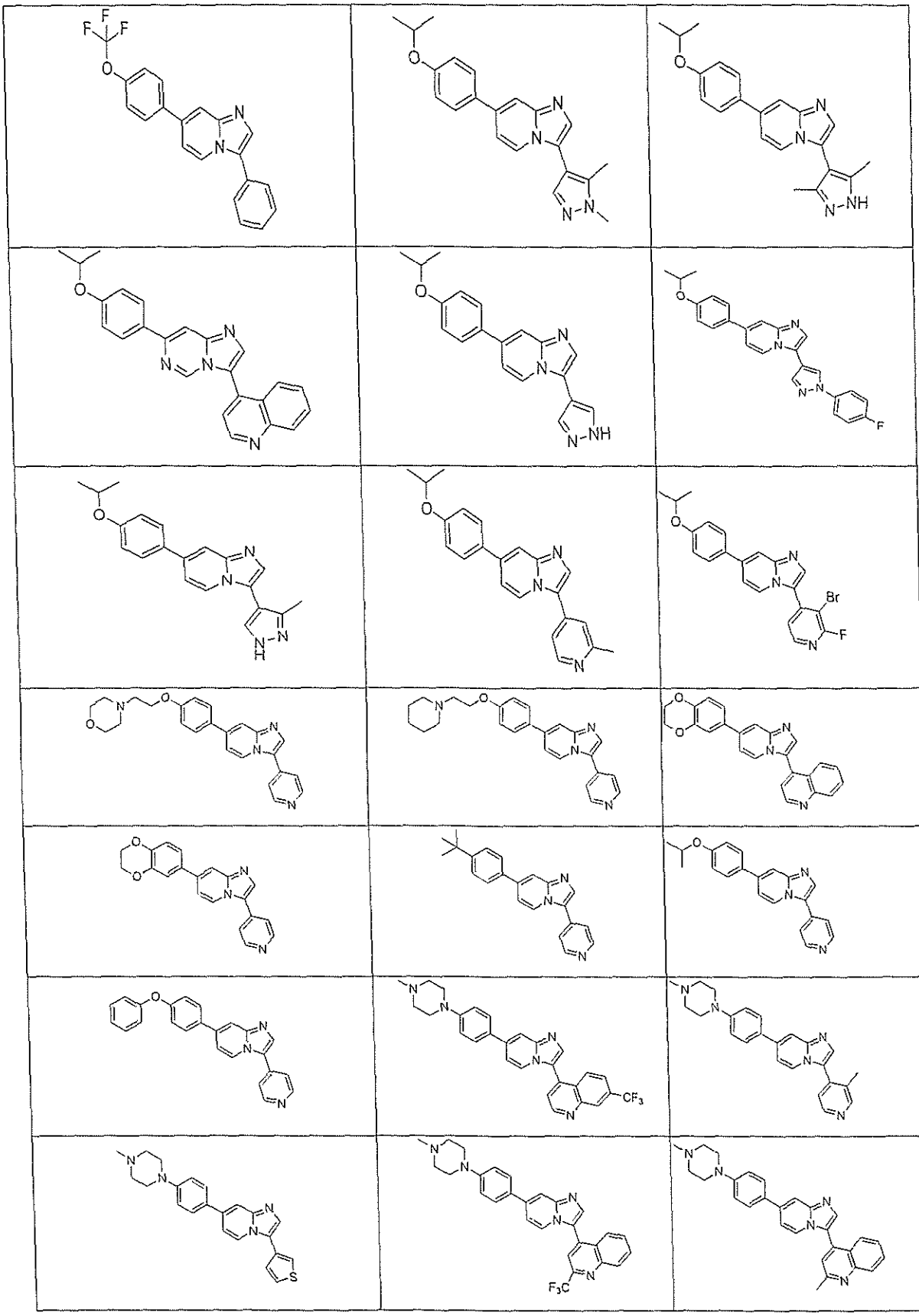
7. The compound of claim 1, wherein A is chosen from the following:

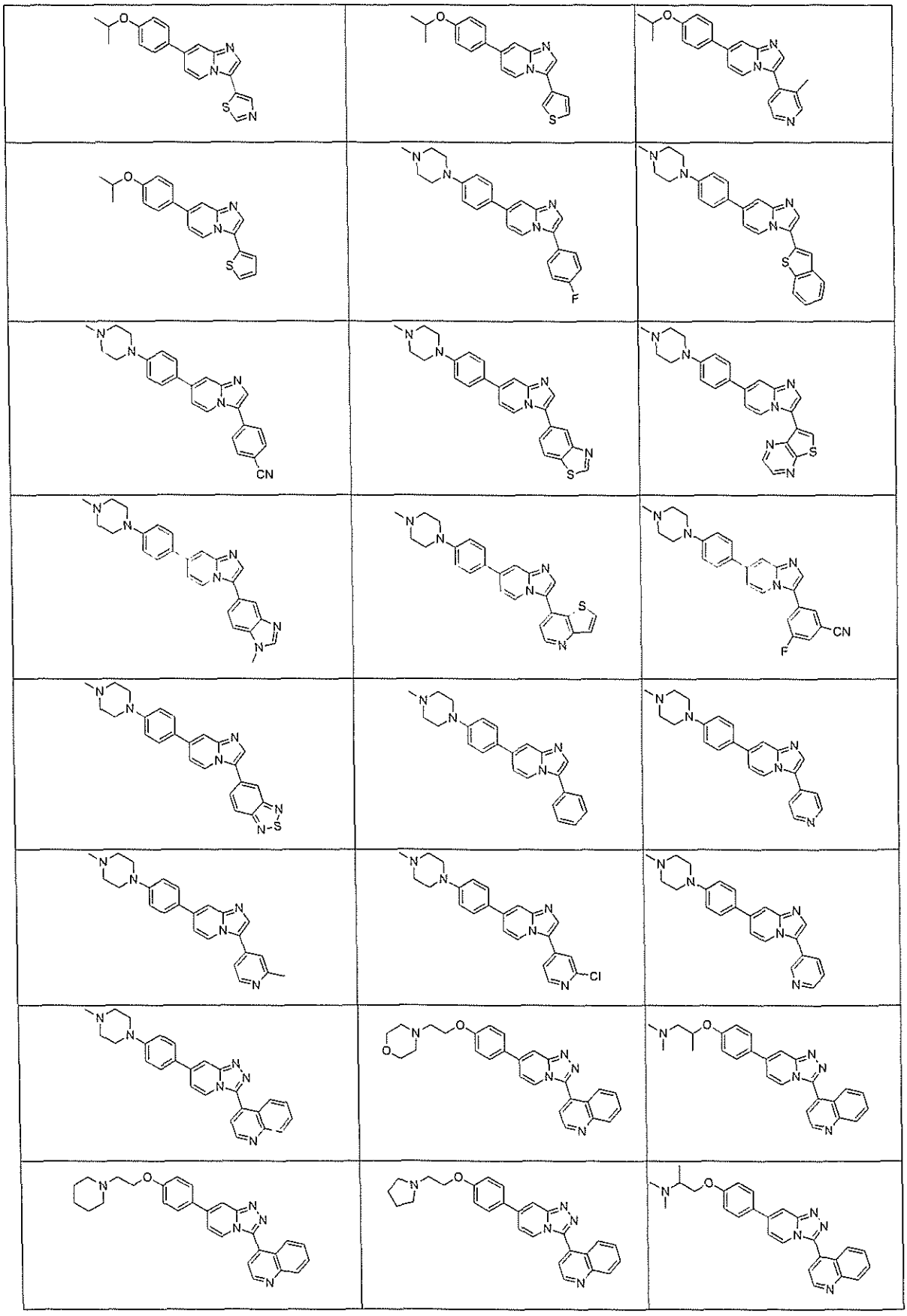
						
						
						
						
						
or						

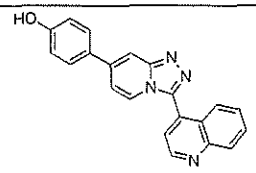
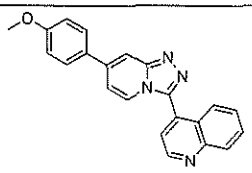
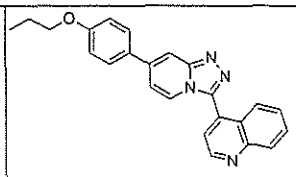
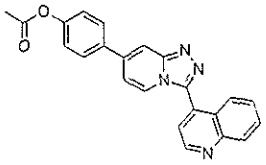
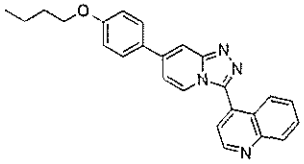
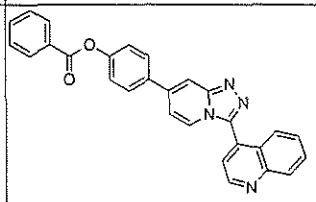
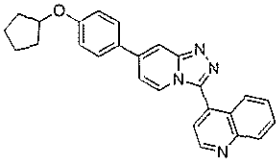
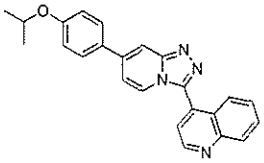
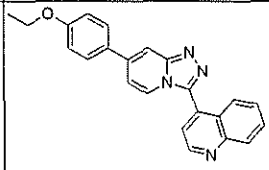
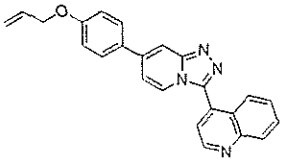
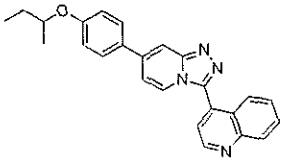
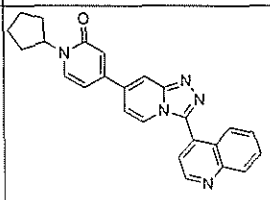
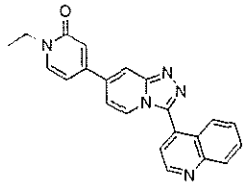
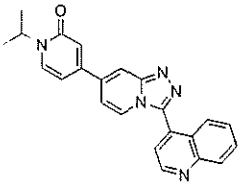
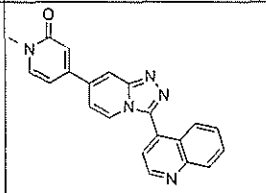
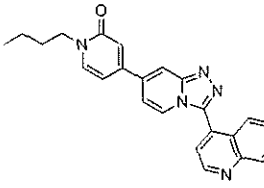
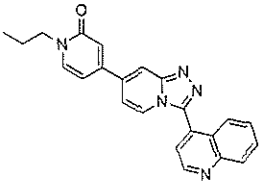
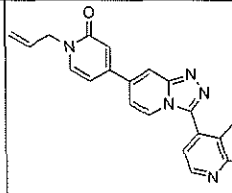
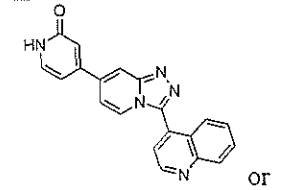
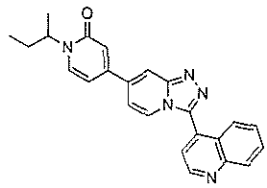
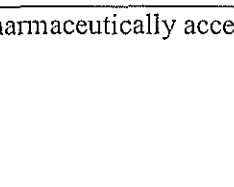
8. A compound of one of the following structures:









		
		
		
		
		
		
		
 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.

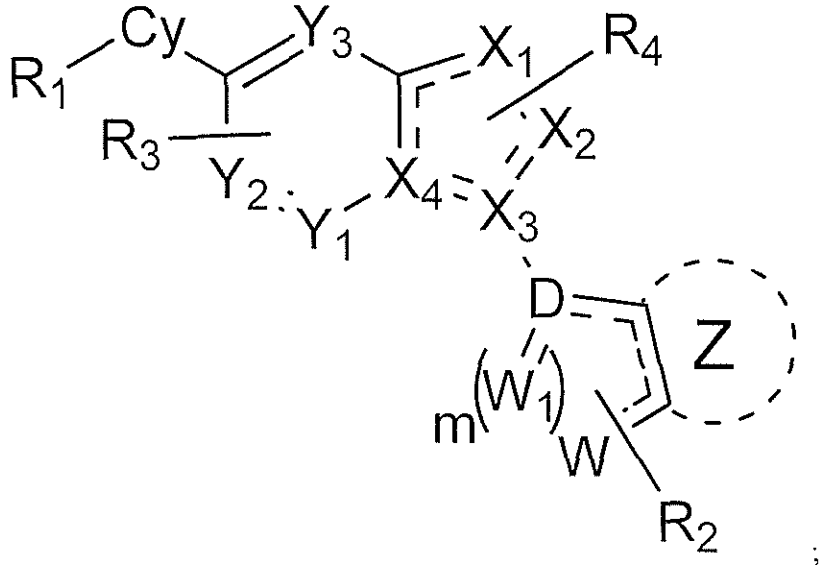
11. The compound of claim 10, wherein the therapy is associated with modulating the BMP signaling pathway.

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;

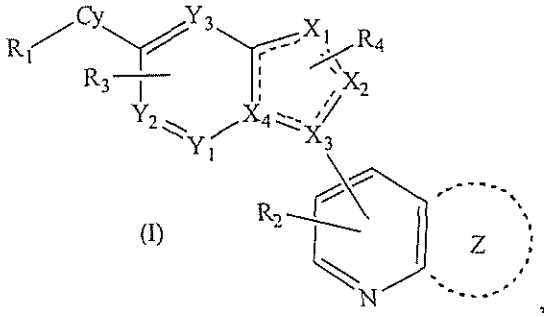
Cy is optionally substituted with one or more R_1, and is selected from C_3-C_{12} cycloalkyl or C_3-C_{12} cycloalkenyl or aryl or heteroaryl or C_3-C_{12} heterocycloalkyl or C_3-C_{12} heterocycloalkenyl or 3-8 membered ring comprising C, O, S, and/or N.

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;

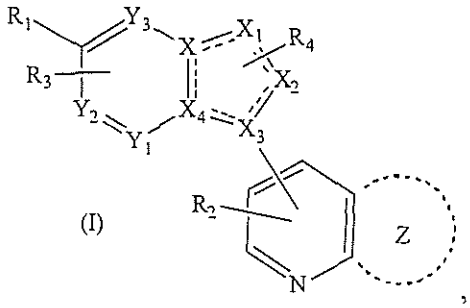
Y_1, Y_2, and Y_3 are independently N or CR_1;

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;

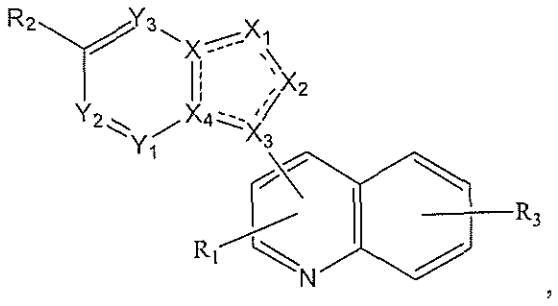
Y_1, Y_2, and Y_3 are independently N or CR_1;

R_1 is 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;

R_2-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;

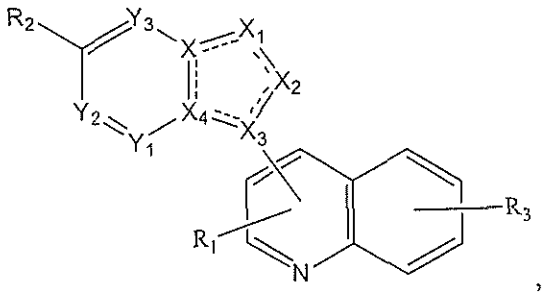
X is CR_1;

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;

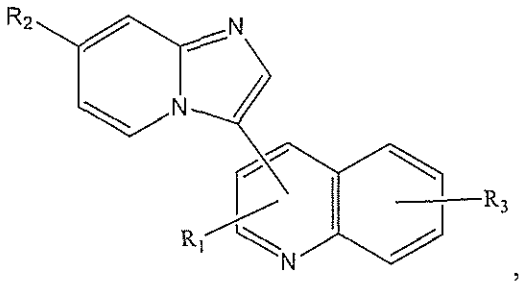
or

(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.

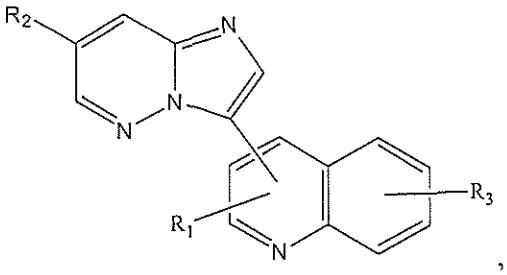
20. The compound of claim 17, wherein the compound is of the following formula:



,

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.

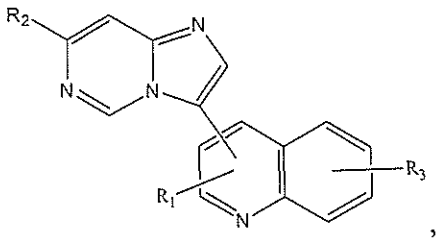
21. The compound of claim 17, wherein the compound is of the following formula:



,

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.

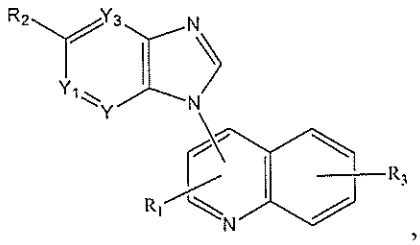
22. The compound of claim 17, wherein the compound is of the following formula:



,

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:

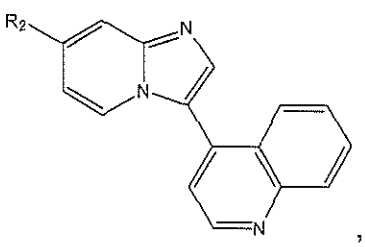
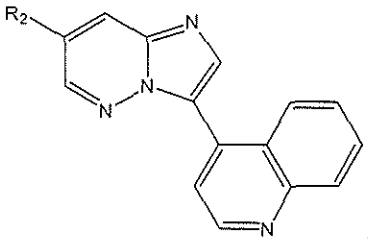
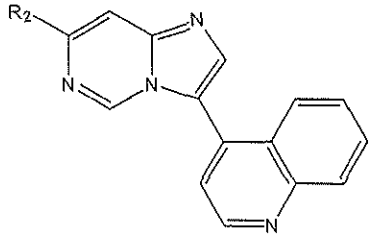
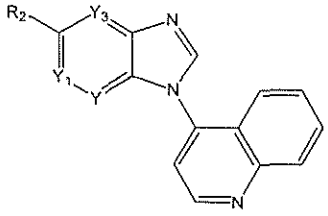


,

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 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.

27. The use of claim 26, wherein the cancer is breast cancer, prostate cancer, bone cancer, lung cancer, renal cell cancer, or acute megakaryoblastic leukemia.

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*.