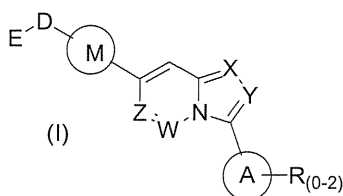


the BMP signaling pathway, methods of making same, pharmaceutical compositions comprising same, and methods of treating disorders associated with BMP signaling.

Disclosed is a ~~compound for use in method for the treatment of a disease state associated with modulating the BMP signaling pathway in a subject comprising administering to a subject in need thereof at least one compound in a dosage and amount effective to treat the disease state in the subject,~~ 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, CF₃, halogen, CN, alkyl, aryl, heteroaryl, NR₁R₂, COR₁R₂, CR₁R₂, S(O)₀₋₂NR₁R₂; or S(O)₀₋₂R₁R₂;

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

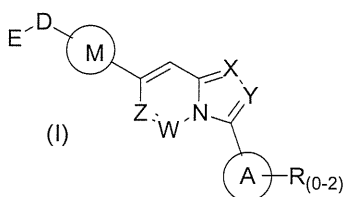
D is selected from a bond, O, CR₁R₂ or NH or NR₁ or NR₁R₂ or S(O)₀₋₂R₁R₂;

E is selected from H, CF₃, halogen, CN, alkyl, aryl, heteroaryl, C₃-C₁₂ cycloalkyl or C₃-C₁₂ cycloheteroalkyl or -(CH₂)_x-C₃-C₁₂ cycloalkyl or -(CH₂)_x-C₃-C₁₂ cycloheteroalkyl;

R₁ is selected from H, alkyl, aryl, heteraryl, COR₁; and

R₂ is selected from H, alkyl, aryl, heteraryl, COR₁, and further, R₁ and R₂ can form a C₃-C₁₂ cycloalkyl or C₃-C₁₂ cycloheteroalkyl containing O, N or S; or a pharmaceutically acceptable salt thereof, or a pharmaceutically acceptable derivative thereof.

Also disclosed is a ~~compound for use as a medicament in are methods for modulating the BMP signaling pathway comprising administering to a subject in need thereof at least one compound in a dosage and amount effective to modulate BMP signaling,~~ 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, CF₃, halogen, CN, alkyl, aryl, heteroaryl, NR₁R₂, COR₁R₂, CR₁R₂, S(O)₀₋₂NR₁R₂; S(O)₀₋₂R₁R₂;

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

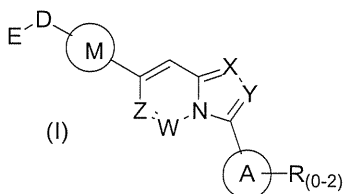
D is selected from a bond, O, CR₁R₂ or NH or NR₁ or NR₁R₂ or S(O)₀₋₂R₁R₂;

E is selected from H, CF₃, halogen, CN, alkyl, aryl, heteroaryl, C₃-C₁₂ cycloalkyl or C₃-C₁₂ cycloheteroalkyl or -(CH₂)_x-C₃-C₁₂ cycloalkyl or -(CH₂)_x-C₃-C₁₂ cycloheteroalkyl;

R₁ is selected from H, alkyl, aryl, heteraryl, COR₁; and

R₂ is selected from H, alkyl, aryl, heteraryl, COR₁, and further, R₁ and R₂ can form a C₃-C₁₂ cycloalkyl or C₃-C₁₂ cycloheteroalkyl containing O, N or S; or a pharmaceutically acceptable salt thereof, or a pharmaceutically acceptable derivative thereof.

Also disclosed ~~is a compound for use in~~ are methods for the treatment of anemia, including iron deficiency, and anemia of chronic disease, comprising administering to a subject in need thereof at least one compound in a dosage and amount effective to treat the anemia, 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, CF₃, halogen, CN, alkyl, aryl, heteroaryl, NR₁R₂, COR₁R₂, CR₁R₂, S(O)₀₋₂NR₁R₂; or S(O)₀₋₂R₁R₂;

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

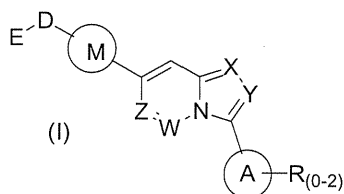
D is selected from a bond, O, CR₁R₂ or NH or NR₁ or NR₁R₂ or S(O)₀₋₂R₁R₂;

E is selected from H, CF₃, halogen, CN, alkyl, aryl, heteroaryl, C₃-C₁₂ cycloalkyl or C₃-C₁₂ cycloheteroalkyl or -(CH₂)_x-C₃-C₁₂ cycloalkyl or -(CH₂)_x-C₃-C₁₂ cycloheteroalkyl;

R₁ is selected from H, alkyl, aryl, heteraryl, COR₁; and

R₂ is selected from H, alkyl, aryl, heteraryl, COR₁, and further, R₁ and R₂ can form a C₃-C₁₂ cycloalkyl or C₃-C₁₂ cycloheteroalkyl containing O, N or S; or a pharmaceutically acceptable salt thereof, or a pharmaceutically acceptable derivative thereof.

Also disclosed is a compound for use in methods for the treatment of fibrodysplasia ossificans progressiva (FOP), comprising administering to a subject in need thereof at least one compound in a dosage and amount effective to treat FOP, 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, CF₃, halogen, CN, alkyl, aryl, heteroaryl, NR₁R₂, COR₁R₂, CR₁R₂, S(O)₀₋₂NR₁R₂; or S(O)₀₋₂R₁R₂;

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

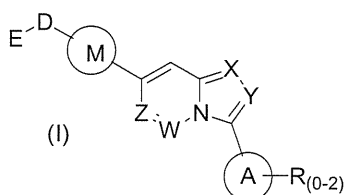
D is selected from a bond, O, CR₁R₂ or NH or NR₁ or NR₁R₂ or S(O)₀₋₂R₁R₂;

E is selected from H, CF₃, halogen, CN, alkyl, aryl, heteroaryl, C₃-C₁₂ cycloalkyl or C₃-C₁₂ cycloheteroalkyl or -(CH₂)_x-C₃-C₁₂ cycloalkyl or -(CH₂)_x-C₃-C₁₂ cycloheteroalkyl;

R₁ is selected from H, alkyl, aryl, heteraryl, COR₁; and

R₂ is selected from H, alkyl, aryl, heteraryl, COR₁, and further, R₁ and R₂ can form a C₃-C₁₂ cycloalkyl or C₃-C₁₂ cycloheteroalkyl containing O, N or S; or a pharmaceutically acceptable salt thereof, or a pharmaceutically acceptable derivative thereof.

Also disclosed is a compound for use as a medicament in ~~are methods of inhibiting~~ the oncogenesis, growth, or metastasis of solid tumors, including breast, prostate carcinomas, bone, lung, and renal cell carcinomas, ~~comprising administering to a subject in need thereof at least one compound in a dosage and amount effective to inhibit ontogenesis;~~ 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, CF₃, halogen, CN, alkyl, aryl, heteroaryl, NR₁R₂, COR₁R₂, CR₁R₂, S(O)₀₋₂NR₁R₂; ~~or~~ S(O)₀₋₂R₁R₂;

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

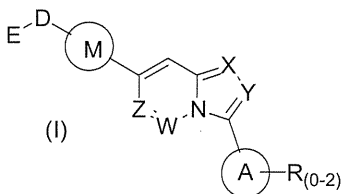
D is selected from a bond, O, CR₁R₂ or NH or NR₁ or NR₁R₂ or S(O)₀₋₂R₁R₂;

E is selected from H, CF₃, halogen, CN, alkyl, aryl, heteroaryl, C₃-C₁₂ cycloalkyl or C₃-C₁₂ cycloheteroalkyl or -(CH₂)_x-C₃-C₁₂ cycloalkyl or -(CH₂)_x-C₃-C₁₂ cycloheteroalkyl;

R₁ is selected from H, alkyl, aryl, heteraryl, COR₁; and

R₂ is selected from H, alkyl, aryl, heteraryl, COR₁, and further, R₁ and R₂ can form a C₃-C₁₂ cycloalkyl or C₃-C₁₂ cycloheteroalkyl containing O, N or S; or a pharmaceutically acceptable salt thereof, or a pharmaceutically acceptable derivative thereof.

Also disclosed is a compound for use as a medicament for ~~are methods of augmenting~~ the inflammatory or immune response ~~administering to a subject in need thereof at least one compound in a dosage and amount effective to augment the response;~~ 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, CF₃, halogen, CN, alkyl, aryl, heteroaryl, NR₁R₂, COR₁R₂, CR₁R₂, S(O)₀₋₂NR₁R₂; or S(O)₀₋₂R₁R₂;

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

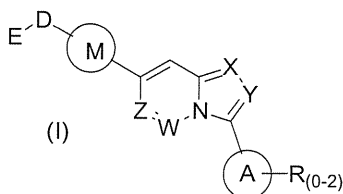
D is selected from a bond, O, CR₁R₂ or NH or NR₁ or NR₁R₂ or S(O)₀₋₂R₁R₂;

E is selected from H, CF₃, halogen, CN, alkyl, aryl, heteroaryl, C₃-C₁₂ cycloalkyl or C₃-C₁₂ cycloheteroalkyl or -(CH₂)_x-C₃-C₁₂ cycloalkyl or -(CH₂)_x-C₃-C₁₂ cycloheteroalkyl;

R₁ is selected from H, alkyl, aryl, heteraryl, COR₁; and

R₂ is selected from H, alkyl, aryl, heteraryl, COR₁, and further, R₁ and R₂ can form a C₃-C₁₂ cycloalkyl or C₃-C₁₂ cycloheteroalkyl containing O, N or S; or a pharmaceutically acceptable salt thereof, or a pharmaceutically acceptable derivative thereof.

Also disclosed is a compound for use as a medicament for ~~are methods of treating~~ pathologic bone function ~~administering to a subject in need thereof at least one compound in~~ a dosage and amount effective to treat pathologic bone function, the compound having a structure represented by the 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, CF₃, halogen, CN, alkyl, aryl, heteroaryl, NR₁R₂, COR₁R₂, CR₁R₂, S(O)₀₋₂NR₁R₂; or S(O)₀₋₂R₁R₂;

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

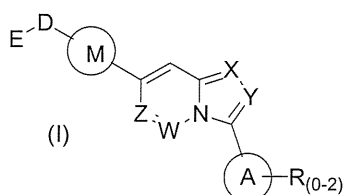
D is selected from a bond, O, CR₁R₂ or NH or NR₁ or NR₁R₂ or S(O)₀₋₂R₁R₂;

E is selected from H, CF₃, halogen, CN, alkyl, aryl, heteroaryl, C₃-C₁₂ cycloalkyl or C₃-C₁₂ cycloheteroalkyl or -(CH₂)_x-C₃-C₁₂ cycloalkyl or -(CH₂)_x-C₃-C₁₂ cycloheteroalkyl;

R₁ is selected from H, alkyl, aryl, heteraryl, COR₁; and

R₂ is selected from H, alkyl, aryl, heteraryl, COR₁, and further, R₁ and R₂ can form a C₃-C₁₂ cycloalkyl or C₃-C₁₂ cycloheteroalkyl containing O, N or S; or a pharmaceutically acceptable salt thereof, or a pharmaceutically acceptable derivative thereof.

Also disclosed ~~is a compound for use as a medicament~~ ~~are methods for treating~~ ectopic or maladaptive bone formation in a subject in need thereof, ~~comprising administering to a subject in need thereof at least one compound in a dosage and amount effective to treat ectopic or maladaptive bone formation;~~ 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, CF₃, halogen, CN, alkyl, aryl, heteroaryl, NR₁R₂, COR₁R₂, CR₁R₂, S(O)₀₋₂NR₁R₂; or S(O)₀₋₂R₁R₂;

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

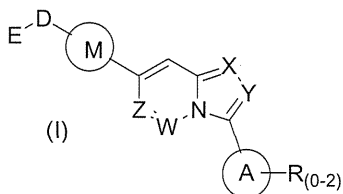
D is selected from a bond, O, CR₁R₂ or NH or NR₁ or NR₁R₂ or S(O)₀₋₂R₁R₂;

E is selected from H, CF₃, halogen, CN, alkyl, aryl, heteroaryl, C₃-C₁₂ cycloalkyl or C₃-C₁₂ cycloheteroalkyl or -(CH₂)_x-C₃-C₁₂ cycloalkyl or -(CH₂)_x-C₃-C₁₂ cycloheteroalkyl;

R₁ is selected from H, alkyl, aryl, heteraryl, COR₁; and

R₂ is selected from H, alkyl, aryl, heteraryl, COR₁, and further, R₁ and R₂ can form a C₃-C₁₂ cycloalkyl or C₃-C₁₂ cycloheteroalkyl containing O, N or S; or a pharmaceutically acceptable salt thereof, or a pharmaceutically acceptable derivative thereof.

Also disclosed ~~are compounds for use as a medicament~~ ~~for are methods of treating a~~ skin disease in a subject in need thereof, ~~comprising administering to a subject in need thereof at least one compound in a dosage and amount effective to treat the skin disease;~~ 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, CF₃, halogen, CN, alkyl, aryl, heteroaryl, NR₁R₂, COR₁R₂, CR₁R₂, S(O)₀₋₂NR₁R₂; or S(O)₀₋₂R₁R₂;

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

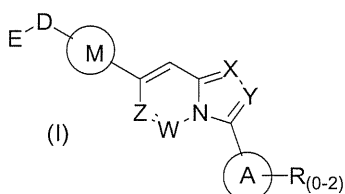
D is selected from a bond, O, CR₁R₂ or NH or NR₁ or NR₁R₂ or S(O)₀₋₂R₁R₂;

E is selected from H, CF₃, halogen, CN, alkyl, aryl, heteroaryl, C₃-C₁₂ cycloalkyl or C₃-C₁₂ cycloheteroalkyl or -(CH₂)_x-C₃-C₁₂ cycloalkyl or -(CH₂)_x-C₃-C₁₂ cycloheteroalkyl;

R₁ is selected from H, alkyl, aryl, heteraryl, COR₁; and

R₂ is selected from H, alkyl, aryl, heteraryl, COR₁, and further, R₁ and R₂ can form a C₃-C₁₂ cycloalkyl or C₃-C₁₂ cycloheteroalkyl containing O, N or S; or a pharmaceutically acceptable salt thereof, or a pharmaceutically acceptable derivative thereof.

Also disclosed is a compound for use as a medicament for are methods of treating hypertension in a subject in need thereof, comprising administering to a subject in need thereof at least one compound in a dosage and amount effective to treat hypertension, 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, CF₃, halogen, CN, alkyl, aryl, heteroaryl, NR₁R₂, COR₁R₂, CR₁R₂, S(O)₀₋₂NR₁R₂; or S(O)₀₋₂R₁R₂;

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

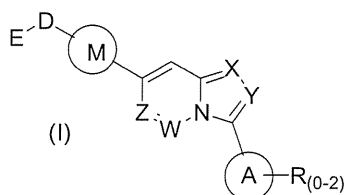
D is selected from a bond, O, CR₁R₂ or NH or NR₁ or NR₁R₂ or S(O)₀₋₂R₁R₂;

E is selected from H, CF₃, halogen, CN, alkyl, aryl, heteroaryl, C₃-C₁₂ cycloalkyl or C₃-C₁₂ cycloheteroalkyl or -(CH₂)_x-C₃-C₁₂ cycloalkyl or -(CH₂)_x-C₃-C₁₂ cycloheteroalkyl;

R₁ is selected from H, alkyl, aryl, heteraryl, COR₁; and

R₂ is selected from H, alkyl, aryl, heteraryl, COR₁, and further, R₁ and R₂ can form a C₃-C₁₂ cycloalkyl or C₃-C₁₂ cycloheteroalkyl containing O, N or S; or a pharmaceutically acceptable salt thereof, or a pharmaceutically acceptable derivative thereof.

Also disclosed is a compound for use as a medicament for are methods of treating ventricular hypertrophy in a subject in need thereof, comprising administering to a subject in need thereof at least one compound in a dosage and amount effective to treat ventricular hypertrophy, 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, CF₃, halogen, CN, alkyl, aryl, heteroaryl, NR₁R₂, COR₁R₂, CR₁R₂, S(O)₀₋₂, NR₁R₂; or S(O)₀₋₂R₁R₂;

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

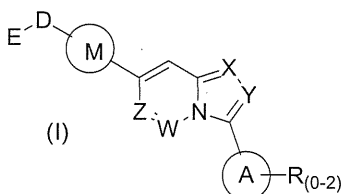
D is selected from a bond, O, CR₁R₂ or NH or NR₁ or NR₁R₂ or S(O)₀₋₂R₁R₂;

E is selected from H, CF₃, halogen, CN, alkyl, aryl, heteroaryl, C₃-C₁₂ cycloalkyl or C₃-C₁₂ cycloheteroalkyl or -(CH₂)_x-C₃-C₁₂ cycloalkyl or -(CH₂)_x-C₃-C₁₂ cycloheteroalkyl;

R₁ is selected from H, alkyl, aryl, heteraryl, COR₁; and

R₂ is selected from H, alkyl, aryl, heteraryl, COR₁, and further, R₁ and R₂ can form a C₃-C₁₂ cycloalkyl or C₃-C₁₂ cycloheteroalkyl containing O, N or S; or a pharmaceutically acceptable salt thereof, or a pharmaceutically acceptable derivative thereof.

Also disclosed is a compound for use as a medicament for are methods of treating spinal cord injury and neuropathy in a subject in need thereof, comprising administering to a subject in need thereof at least one compound in a dosage and amount effective to treat spinal cord, 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, CF₃, halogen, CN, alkyl, aryl, heteroaryl, NR₁R₂, COR₁R₂, CR₁R₂, S(O)₀₋₂NR₁R₂; or S(O)₀₋₂R₁R₂;

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

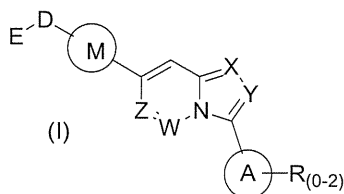
D is selected from a bond, O, CR₁R₂ or NH or NR₁ or NR₁R₂ or S(O)₀₋₂R₁R₂;

E is selected from H, CF₃, halogen, CN, alkyl, aryl, heteroaryl, C₃-C₁₂ cycloalkyl or C₃-C₁₂ cycloheteroalkyl or -(CH₂)_x-C₃-C₁₂ cycloalkyl or -(CH₂)_x-C₃-C₁₂ cycloheteroalkyl;

R₁ is selected from H, alkyl, aryl, heteraryl, COR₁; and

R₂ is selected from H, alkyl, aryl, heteraryl, COR₁, and further, R₁ and R₂ can form a C₃-C₁₂ cycloalkyl or C₃-C₁₂ cycloheteroalkyl containing O, N or S; or a pharmaceutically acceptable salt thereof, or a pharmaceutically acceptable derivative thereof.

Also disclosed is a compound for use as a medicament for are methods of treating atherosclerosis in a subject in need thereof, comprising administering to a subject in need thereof at least one compound in a dosage and amount effective to modulate BMP signaling, 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, CF₃, halogen, CN, alkyl, aryl, heteroaryl, NR₁R₂, COR₁R₂, CR₁R₂, S(O)₀₋₂NR₁R₂; or S(O)₀₋₂R₁R₂;

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

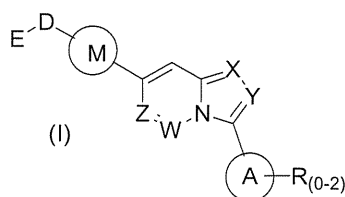
D is selected from a bond, O, CR₁R₂ or NH or NR₁ or NR₁R₂ or S(O)₀₋₂R₁R₂;

E is selected from H, CF₃, halogen, CN, alkyl, aryl, heteroaryl, C₃-C₁₂ cycloalkyl or C₃-C₁₂ cycloheteroalkyl or -(CH₂)_x-C₃-C₁₂ cycloalkyl or -(CH₂)_x-C₃-C₁₂ cycloheteroalkyl;

R₁ is selected from H, alkyl, aryl, heteraryl, COR₁; and

R₂ is selected from H, alkyl, aryl, heteraryl, COR₁, and further, R₁ and R₂ can form a C₃-C₁₂ cycloalkyl or C₃-C₁₂ cycloheteroalkyl containing O, N or S; or a pharmaceutically acceptable salt thereof, or a pharmaceutically acceptable derivative thereof.

Also disclosed ~~is a compound for use as a medicament for are methods for treating~~ acute megakaryoblastic leukemia, ~~comprising administering to a subject in need thereof at least one compound in a dosage and amount effective to propagate a cell, 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, CF₃, halogen, CN, alkyl, aryl, heteroaryl, NR₁R₂, COR₁R₂, CR₁R₂, S(O)₀₋₂NR₁R₂; or S(O)₀₋₂R₁R₂;

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

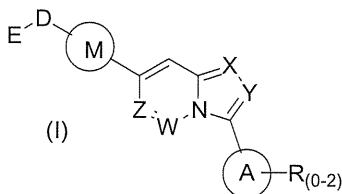
D is selected from a bond, O, CR₁R₂ or NH or NR₁ or NR₁R₂ or S(O)₀₋₂R₁R₂;

E is selected from H, CF₃, halogen, CN, alkyl, aryl, heteroaryl, C₃-C₁₂ cycloalkyl or C₃-C₁₂ cycloheteroalkyl or -(CH₂)_x-C₃-C₁₂ cycloalkyl or -(CH₂)_x-C₃-C₁₂ cycloheteroalkyl;

R₁ is selected from H, alkyl, aryl, heteraryl, COR₁; and

R₂ is selected from H, alkyl, aryl, heteraryl, COR₁, and further, R₁ and R₂ can form a C₃-C₁₂ cycloalkyl or C₃-C₁₂ cycloheteroalkyl containing O, N or S; or a pharmaceutically acceptable salt thereof, or a pharmaceutically acceptable derivative thereof.

Also disclosed ~~is a compound for use as a medicament are methods 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, ~~comprising administering to a subject in need thereof at least one compound in a dosage and amount effective to propagate a cell, 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, CF₃, halogen, CN, alkyl, aryl, heteroaryl, NR₁R₂, COR₁R₂, CR₁R₂, S(O)₀₋₂NR₁R₂; or S(O)₀₋₂R₁R₂;

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

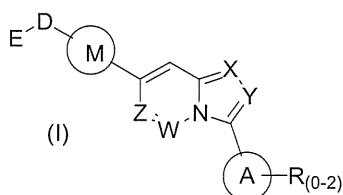
D is selected from a bond, O, CR₁R₂ or NH or NR₁ or NR₁R₂ or S(O)₀₋₂R₁R₂;

E is selected from H, CF₃, halogen, CN, alkyl, aryl, heteroaryl, C₃-C₁₂ cycloalkyl or C₃-C₁₂ cycloheteroalkyl or -(CH₂)_x-C₃-C₁₂ cycloalkyl or -(CH₂)_x-C₃-C₁₂ cycloheteroalkyl;

R₁ is selected from H, alkyl, aryl, heteraryl, COR₁; and

R₂ is selected from H, alkyl, aryl, heteraryl, COR₁, and further, R₁ and R₂ can form a C₃-C₁₂ cycloalkyl or C₃-C₁₂ cycloheteroalkyl containing O, N or S; or a pharmaceutically acceptable salt thereof, or a pharmaceutically acceptable derivative thereof.

Also disclosed ~~is a compound for use as a medicament~~ ~~are methods~~ 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; ~~comprising administering to a subject in need thereof at least one compound in a dosage and amount effective to propagate a cell,~~ 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, CF₃, halogen, CN, alkyl, aryl, heteroaryl, NR₁R₂, COR₁R₂, CR₁R₂, S(O)₀₋₂NR₁R₂; or S(O)₀₋₂R₁R₂;

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

D is selected from a bond, O, CR₁R₂ or NH or NR₁ or NR₁R₂ or S(O)₀₋₂R₁R₂;

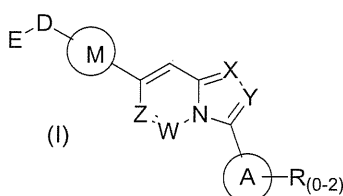
E is selected from H, CF₃, halogen, CN, alkyl, aryl, heteroaryl, C₃-C₁₂ cycloalkyl or C₃-C₁₂ cycloheteroalkyl or -(CH₂)_x-C₃-C₁₂ cycloalkyl or -(CH₂)_x-C₃-C₁₂ cycloheteroalkyl;

R₁ is selected from H, alkyl, aryl, heteraryl, COR₁; and

R₂ is selected from H, alkyl, aryl, heteraryl, COR₁, and further, R₁ and R₂ can form a C₃-C₁₂

cycloalkyl or C₃-C₁₂ cycloheteroalkyl containing O, N or S; or a pharmaceutically acceptable salt thereof, or a pharmaceutically acceptable derivative thereof.

Also disclosed ~~is a compound for use in therapy are methods for at least one of~~ propagation, engraftment, and differentiation of progenitor cells, ~~comprising administering to a subject in need thereof at least one compound in a dosage and amount effective to propagate a cell,~~ 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, CF₃, halogen, CN, alkyl, aryl, heteroaryl, NR₁R₂, COR₁R₂, CR₁R₂, S(O)₀₋₂NR₁R₂; or S(O)₀₋₂R₁R₂;

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

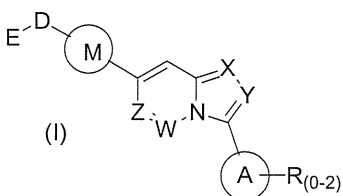
D is selected from a bond, O, CR₁R₂ or NH or NR₁ or NR₁R₂ or S(O)₀₋₂R₁R₂;

E is selected from H, CF₃, halogen, CN, alkyl, aryl, heteroaryl, C₃-C₁₂ cycloalkyl or C₃-C₁₂ cycloheteroalkyl or -(CH₂)_x-C₃-C₁₂ cycloalkyl or -(CH₂)_x-C₃-C₁₂ cycloheteroalkyl;

R₁ is selected from H, alkyl, aryl, heteraryl, COR₁; and

R₂ is selected from H, alkyl, aryl, heteraryl, COR₁, and further, R₁ and R₂ can form a C₃-C₁₂ cycloalkyl or C₃-C₁₂ cycloheteroalkyl containing O, N or S; or a pharmaceutically acceptable salt thereof, or a pharmaceutically acceptable derivative thereof.

Also disclosed are also disclosed are compounds and compositions that comprises the compounds disclosed herein. The compounds disclosed herein include those having a structure represented by the 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, CF₃, halogen, CN, alkyl, aryl, heteroaryl, NR₁R₂, COR₁R₂, CR₁R₂, S(O)₀₋₂NR₁R₂; S(O)₀₋₂R₁R₂;

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

D is selected from a bond, O, CR₁R₂ or NH or NR₁ or NR₁R₂ or S(O)₀₋₂R₁R₂;

E is selected from H, CF₃, halogen, CN, alkyl, aryl, heteroaryl, C₃-C₁₂ cycloalkyl or C₃-C₁₂ cycloheteroalkyl or -(CH₂)_x-C₃-C₁₂ cycloalkyl or -(CH₂)_x-C₃-C₁₂ cycloheteroalkyl;

R₁ is selected from H, alkyl, aryl, heteraryl, COR₁; and

R₂ is selected from H, alkyl, aryl, heteraryl, COR₁, and further, R₁ and R₂ can form a C₃-C₁₂ cycloalkyl or C₃-C₁₂ cycloheteroalkyl containing O, N or S; or a pharmaceutically acceptable salt thereof, or a pharmaceutically acceptable derivative thereof.

Other embodiments of the present invention include a compound for use as a medicament for methods of treating at least one of myocardial ischemic injury, retinopathy of prematurity, diabetic retinopathy, and wet macular degeneration, aortic valve calcification (both native and prosthetic), vascular calcification, diabetic nephropathy and renal fibrosis, hereditary spastic paraplegias, dystrophic phenotype in Duchenne Muscular Dystrophy, inflammatory bowel disease, childhood leukemias, cancer metastasis by targeting lymphatics and primary tumor growth; and methods of promoting liver regeneration and healing following acute injury, including hepatotoxin exposure such as Tylenol overdose: by administering an effective amount of a compound of the present invention to a subject in need thereof.

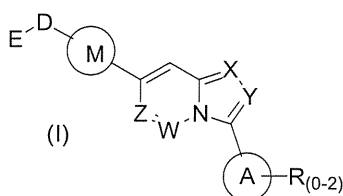
Additional advantages of the invention will be set forth in part in the description which follows, and in part will be obvious from the description, or can be learned by practice of the invention. The advantages of the invention will be realized and attained by means of the elements and combinations particularly pointed out in the appended claims. It is to be understood that both the foregoing general description and the following detailed description are exemplary and explanatory only and are not restrictive of the invention, as claimed.

DESCRIPTION

The present invention can be understood more readily by reference to the following detailed description of the invention and the Examples included therein.

We claim:

1. ~~A method for~~ A compound for use in the treatment of a disease state associated with modulating the BMP signaling pathway in a subject comprising administering to a subject in need thereof at least one compound in a dosage and amount effective to treat the disease state in the subject, 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, CF₃, halogen, CN, alkyl, aryl, heteroaryl, NR₁R₂, COR₁R₂, CR₁R₂, S(O)₀

~~2NR₁R₂; or S(O)₀₋₂R₁R₂;~~

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

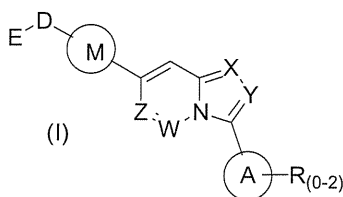
D is selected from a bond, O, CR₁R₂ or NH or NR₁ or NR₁R₂ or S(O)₀₋₂R₁R₂;

E is selected from H, CF₃, halogen, CN, alkyl, aryl, heteroaryl, C₃-C₁₂ cycloalkyl or C₃-C₁₂ cycloheteroalkyl or -(CH₂)_x-C₃-C₁₂ cycloalkyl or -(CH₂)_x-C₃-C₁₂ cycloheteroalkyl;

R₁ is selected from H, alkyl, aryl, heteraryl, ~~or~~ COR₁; and

R₂ is selected from H, alkyl, aryl, heteraryl, COR₁, and further, R₁ and R₂ can form a C₃-C₁₂ cycloalkyl or C₃-C₁₂ cycloheteroalkyl containing O, N or S; or a pharmaceutically acceptable salt thereof, or a pharmaceutically acceptable derivative thereof.

2. ~~A method for~~ A compound for use as a medicament in modulating the BMP signaling pathway comprising administering to a subject in need thereof at least one compound in a dosage and amount effective to modulate BMP signaling, the compound having a structure represented by the 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, CF₃, halogen, CN, alkyl, aryl, heteroaryl, NR₁R₂, COR₁R₂, CR₁R₂, S(O)₀₋₂NR₁R₂; or S(O)₀₋₂R₁R₂;

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

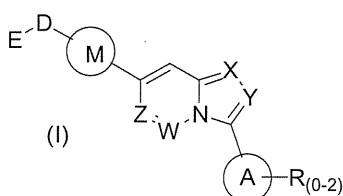
D is selected from a bond, O, CR₁R₂ or NH or NR₁ or NR₁R₂ or S(O)₀₋₂R₁R₂;

E is selected from H, CF₃, halogen, CN, alkyl, aryl, heteroaryl, C₃-C₁₂ cycloalkyl or C₃-C₁₂ cycloheteroalkyl or -(CH₂)_x-C₃-C₁₂ cycloalkyl or -(CH₂)_x-C₃-C₁₂ cycloheteroalkyl;

R₁ is selected from H, alkyl, aryl, heteraryl, or COR₁; and

R₂ is selected from H, alkyl, aryl, heteraryl, COR₁, and further, R₁ and R₂ can form a C₃-C₁₂ cycloalkyl or C₃-C₁₂ cycloheteroalkyl containing O, N or S; or a pharmaceutically acceptable salt thereof, or a pharmaceutically acceptable derivative thereof.

3. ~~A method for A compound for use in treating at least one of anemia, including iron deficiency, and anemia of chronic disease, comprising administering to a subject in need thereof at least one compound in a dosage and amount effective to treat the anemia, 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, CF₃, halogen, CN, alkyl, aryl, heteroaryl, NR₁R₂, COR₁R₂, CR₁R₂, S(O)₀₋₂NR₁R₂; or S(O)₀₋₂R₁R₂;

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

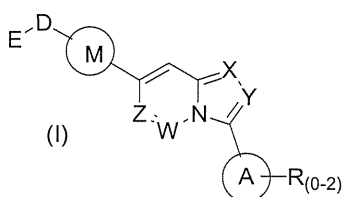
D is selected from a bond, O, CR₁R₂ or NH or NR₁ or NR₁R₂ or S(O)₀₋₂R₁R₂;

E is selected from H, CF₃, halogen, CN, alkyl, aryl, heteroaryl, C₃-C₁₂ cycloalkyl or C₃-C₁₂ cycloheteroalkyl or -(CH₂)_x-C₃-C₁₂ cycloalkyl or -(CH₂)_x-C₃-C₁₂ cycloheteroalkyl;

R₁ is selected from H, alkyl, aryl, heteraryl, or COR₁; and

R₂ is selected from H, alkyl, aryl, heteraryl, COR₁, and further, R₁ and R₂ can form a C₃-C₁₂ cycloalkyl or C₃-C₁₂ cycloheteroalkyl containing O, N or S; or a pharmaceutically acceptable salt thereof, or a pharmaceutically acceptable derivative thereof.

4. ~~A method for~~ A compound for use in the treatment of fibrodysplasia ossificans progressiva (FOP), comprising administering to a subject in need thereof at least one compound in a dosage and amount effective to treat FOP, 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, CF₃, halogen, CN, alkyl, aryl, heteroaryl, NR₁R₂, COR₁R₂, CR₁R₂, S(O)₀₋₂NR₁R₂; or S(O)₀₋₂R₁R₂;

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

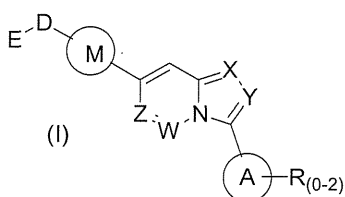
D is selected from a bond, O, CR₁R₂ or NH or NR₁ or NR₁R₂ or S(O)₀₋₂R₁R₂;

E is selected from H, CF₃, halogen, CN, alkyl, aryl, heteroaryl, C₃-C₁₂ cycloalkyl or C₃-C₁₂ cycloheteroalkyl or -(CH₂)_x-C₃-C₁₂ cycloalkyl or -(CH₂)_x-C₃-C₁₂ cycloheteroalkyl;

R₁ is selected from H, alkyl, aryl, heteraryl, or COR₁; and

R₂ is selected from H, alkyl, aryl, heteraryl, COR₁, and further, R₁ and R₂ can form a C₃-C₁₂ cycloalkyl or C₃-C₁₂ cycloheteroalkyl containing O, N or S; or a pharmaceutically acceptable salt thereof, or a pharmaceutically acceptable derivative thereof.

5. ~~A method for~~ 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, ~~comprising administering to a subject in need thereof at least one compound in a dosage and amount effective to inhibit the ontogenesis,~~ 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, CF₃, halogen, CN, alkyl, aryl, heteroaryl, NR₁R₂, COR₁R₂, CR₁R₂, S(O)₀₋₂NR₁R₂; ~~or~~ S(O)₀₋₂R₁R₂;

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

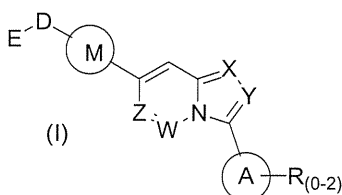
D is selected from a bond, O, CR₁R₂ or NH or NR₁ or NR₁R₂ or S(O)₀₋₂R₁R₂;

E is selected from H, CF₃, halogen, CN, alkyl, aryl, heteroaryl, C₃-C₁₂ cycloalkyl or C₃-C₁₂ cycloheteroalkyl or -(CH₂)_x-C₃-C₁₂ cycloalkyl or -(CH₂)_x-C₃-C₁₂ cycloheteroalkyl;

R₁ is selected from H, alkyl, aryl, heteraryl, ~~or~~ COR₁; and

R₂ is selected from H, alkyl, aryl, heteraryl, COR₁, and further, R₁ and R₂ can form a C₃-C₁₂ cycloalkyl or C₃-C₁₂ cycloheteroalkyl containing O, N or S; or a pharmaceutically acceptable salt thereof, or a pharmaceutically acceptable derivative thereof.

6. ~~A method of~~ A compound for use as a medicament for augmenting the inflammatory or immune response ~~administering to a subject in need thereof at least one compound in a dosage and amount effective to augment the response,~~ 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, CF₃, halogen, CN, alkyl, aryl, heteroaryl, NR₁R₂, COR₁R₂, CR₁R₂, S(O)₀₋₂NR₁R₂; or S(O)₀₋₂R₁R₂;

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

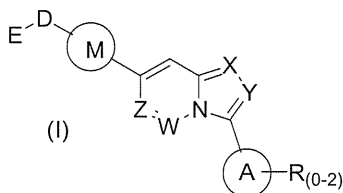
D is selected from a bond, O, CR₁R₂ or NH or NR₁ or NR₁R₂ or S(O)₀₋₂R₁R₂;

E is selected from H, CF₃, halogen, CN, alkyl, aryl, heteroaryl, C₃-C₁₂ cycloalkyl or C₃-C₁₂ cycloheteroalkyl or -(CH₂)_x-C₃-C₁₂ cycloalkyl or -(CH₂)_x-C₃-C₁₂ cycloheteroalkyl;

R₁ is selected from H, alkyl, aryl, heteraryl, or COR₁; and

R₂ is selected from H, alkyl, aryl, heteraryl, COR₁, and further, R₁ and R₂ can form a C₃-C₁₂ cycloalkyl or C₃-C₁₂ cycloheteroalkyl containing O, N or S; or a pharmaceutically acceptable salt thereof, or a pharmaceutically acceptable derivative thereof.

7. ~~A method of A compound for use as a medicament for treating pathologic bone function-administering to a subject in need thereof at least one compound in a dosage and amount effective to treat pathologic bone function,~~ 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, CF₃, halogen, CN, alkyl, aryl, heteroaryl, NR₁R₂, COR₁R₂, CR₁R₂, S(O)₀₋₂NR₁R₂; or S(O)₀₋₂R₁R₂;

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

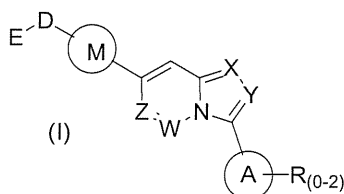
D is selected from a bond, O, CR₁R₂ or NH or NR₁ or NR₁R₂ or S(O)₀₋₂R₁R₂;

E is selected from H, CF₃, halogen, CN, alkyl, aryl, heteroaryl, C₃-C₁₂ cycloalkyl or C₃-C₁₂ cycloheteroalkyl or -(CH₂)_x-C₃-C₁₂ cycloalkyl or -(CH₂)_x-C₃-C₁₂ cycloheteroalkyl;

R₁ is selected from H, alkyl, aryl, heteraryl, or COR₁; and

R₂ is selected from H, alkyl, aryl, heteraryl, COR₁, and further, R₁ and R₂ can form a C₃-C₁₂ cycloalkyl or C₃-C₁₂ cycloheteroalkyl containing O, N or S; or a pharmaceutically acceptable salt thereof, or a pharmaceutically acceptable derivative thereof.

8. ~~A method for~~ A compound for use as a medicament for treating ectopic or maladaptive bone formation in a subject in need thereof, ~~comprising administering to a subject in need thereof at least one compound in a dosage and amount effective to treat ectopic or maladaptive bone formation.~~ 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, CF₃, halogen, CN, alkyl, aryl, heteroaryl, NR₁R₂, COR₁R₂, CR₁R₂, S(O)₀,
2NR₁R₂; or S(O)₀₋₂R₁R₂;

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

D is selected from a bond, O, CR₁R₂ or NH or NR₁ or NR₁R₂ or S(O)₀₋₂R₁R₂;

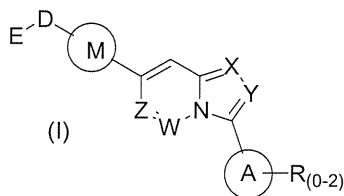
E is selected from H, CF₃, halogen, CN, alkyl, aryl, heteroaryl, C₃-C₁₂ cycloalkyl or C₃-C₁₂ cycloheteroalkyl or -(CH₂)_x-C₃-C₁₂ cycloalkyl or -(CH₂)_x-C₃-C₁₂ cycloheteroalkyl;

R₁ is selected from H, alkyl, aryl, heteraryl, or COR₁; and

R₂ is selected from H, alkyl, aryl, heteraryl, COR₁, and further, R₁ and R₂ can form a C₃-C₁₂ cycloalkyl or C₃-C₁₂ cycloheteroalkyl containing O, N or S; or a pharmaceutically acceptable salt thereof, or a pharmaceutically acceptable derivative thereof.

9. ~~A method of~~ A compound for use as a medicament for treating a skin disease in a subject in need thereof, ~~comprising administering to a subject in need thereof at least one~~

~~compound in a dosage and amount effective to treat the skin disease, 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, CF₃, halogen, CN, alkyl, aryl, heteroaryl, NR₁R₂, COR₁R₂, CR₁R₂, S(O)₀₋₂NR₁R₂; or S(O)₀₋₂R₁R₂;

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

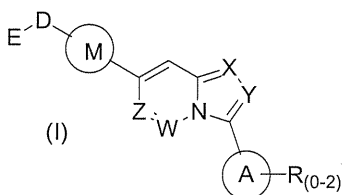
D is selected from a bond, O, CR₁R₂ or NH or NR₁ or NR₁R₂ or S(O)₀₋₂R₁R₂;

E is selected from H, CF₃, halogen, CN, alkyl, aryl, heteroaryl, C₃-C₁₂ cycloalkyl or C₃-C₁₂ cycloheteroalkyl or -(CH₂)_x-C₃-C₁₂ cycloalkyl or -(CH₂)_x-C₃-C₁₂ cycloheteroalkyl;

R₁ is selected from H, alkyl, aryl, heteraryl, or COR₁; and

R₂ is selected from H, alkyl, aryl, heteraryl, COR₁, and further, R₁ and R₂ can form a C₃-C₁₂ cycloalkyl or C₃-C₁₂ cycloheteroalkyl containing O, N or S; or a pharmaceutically acceptable salt thereof, or a pharmaceutically acceptable derivative thereof.

10. ~~A method of A compound for use as a medicament for treating hypertension in a subject in need thereof, comprising administering to a subject in need thereof at least one compound in a dosage and amount effective to treat hypertension, 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, CF₃, halogen, CN, alkyl, aryl, heteroaryl, NR₁R₂, COR₁R₂, CR₁R₂, S(O)₀₋₂NR₁R₂; or S(O)₀₋₂R₁R₂;

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

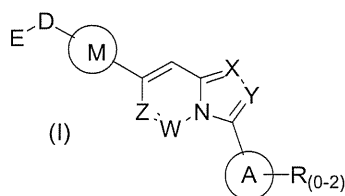
D is selected from a bond, O, CR₁R₂ or NH or NR₁ or NR₁R₂ or S(O)₀₋₂R₁R₂;

E is selected from H, CF₃, halogen, CN, alkyl, aryl, heteroaryl, C₃-C₁₂ cycloalkyl or C₃-C₁₂ cycloheteroalkyl or -(CH₂)_x-C₃-C₁₂ cycloalkyl or -(CH₂)_x-C₃-C₁₂ cycloheteroalkyl;

R₁ is selected from H, alkyl, aryl, heteraryl, or COR₁; and

R₂ is selected from H, alkyl, aryl, heteraryl, COR₁, and further, R₁ and R₂ can form a C₃-C₁₂ cycloalkyl or C₃-C₁₂ cycloheteroalkyl containing O, N or S; or a pharmaceutically acceptable salt thereof, or a pharmaceutically acceptable derivative thereof.

11. ~~A method for A compound for use as a medicament for treating ventricular hypertrophy in a subject in need thereof, comprising administering to a subject in need thereof at least one compound in a dosage and amount effective to treat ventricular hypertrophy, 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, CF₃, halogen, CN, alkyl, aryl, heteroaryl, NR₁R₂, COR₁R₂, CR₁R₂, S(O)₀₋₂NR₁R₂; or S(O)₀₋₂R₁R₂;

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

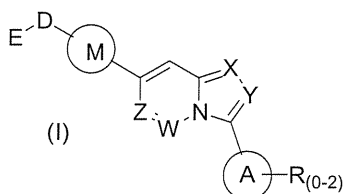
D is selected from a bond, O, CR₁R₂ or NH or NR₁ or NR₁R₂ or S(O)₀₋₂R₁R₂;

E is selected from H, CF₃, halogen, CN, alkyl, aryl, heteroaryl, C₃-C₁₂ cycloalkyl or C₃-C₁₂ cycloheteroalkyl or -(CH₂)_x-C₃-C₁₂ cycloalkyl or -(CH₂)_x-C₃-C₁₂ cycloheteroalkyl;

R₁ is selected from H, alkyl, aryl, heteraryl, or COR₁; and

R₂ is selected from H, alkyl, aryl, heteraryl, COR₁, and further, R₁ and R₂ can form a C₃-C₁₂ cycloalkyl or C₃-C₁₂ cycloheteroalkyl containing O, N or S; or a pharmaceutically acceptable salt thereof, or a pharmaceutically acceptable derivative thereof.

12. ~~A method of~~ A compound for use as a medicament for treating spinal cord injury and neuropathy in a subject in need thereof, comprising administering to a subject in need thereof at least one compound in a dosage and amount effective to treat spinal cord injury, 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, CF₃, halogen, CN, alkyl, aryl, heteroaryl, NR₁R₂, COR₁R₂, CR₁R₂, S(O)₀₋₂NR₁R₂; or S(O)₀₋₂R₁R₂;

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

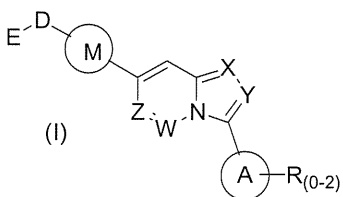
D is selected from a bond, O, CR₁R₂ or NH or NR₁ or NR₁R₂ or S(O)₀₋₂R₁R₂;

E is selected from H, CF₃, halogen, CN, alkyl, aryl, heteroaryl, C₃-C₁₂ cycloalkyl or C₃-C₁₂ cycloheteroalkyl or -(CH₂)_x-C₃-C₁₂ cycloalkyl or -(CH₂)_x-C₃-C₁₂ cycloheteroalkyl;

R₁ is selected from H, alkyl, aryl, heteraryl, or COR₁; and

R₂ is selected from H, alkyl, aryl, heteraryl, COR₁, and further, R₁ and R₂ can form a C₃-C₁₂ cycloalkyl or C₃-C₁₂ cycloheteroalkyl containing O, N or S; or a pharmaceutically acceptable salt thereof, or a pharmaceutically acceptable derivative thereof.

13. ~~A method for~~ A compound for use as a medicament for treating atherosclerosis in a subject in need thereof, comprising administering to a subject in need thereof at least one compound in a dosage and amount effective to treat atherosclerosis, 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, CF₃, halogen, CN, alkyl, aryl, heteroaryl, NR₁R₂, COR₁R₂, CR₁R₂, S(O)₀₋₂NR₁R₂; or S(O)₀₋₂R₁R₂;

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

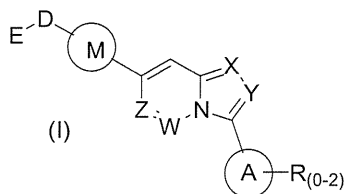
D is selected from a bond, O, CR₁R₂ or NH or NR₁ or NR₁R₂ or S(O)₀₋₂R₁R₂;

E is selected from H, CF₃, halogen, CN, alkyl, aryl, heteroaryl, C₃-C₁₂ cycloalkyl or C₃-C₁₂ cycloheteroalkyl or -(CH₂)_x-C₃-C₁₂ cycloalkyl or -(CH₂)_x-C₃-C₁₂ cycloheteroalkyl;

R₁ is selected from H, alkyl, aryl, heteraryl, or COR₁; and

R₂ is selected from H, alkyl, aryl, heteraryl, COR₁, and further, R₁ and R₂ can form a C₃-C₁₂ cycloalkyl or C₃-C₁₂ cycloheteroalkyl containing O, N or S; or a pharmaceutically acceptable salt thereof, or a pharmaceutically acceptable derivative thereof.

14. ~~A method for A compound for use in therapy for at least one of propagation, engraftment, and differentiation of progenitor cells, comprising administering to a subject in need thereof at least one compound in a dosage and amount effective to propagate a cell, 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, CF₃, halogen, CN, alkyl, aryl, heteroaryl, NR₁R₂, COR₁R₂, CR₁R₂, S(O)₀₋₂NR₁R₂; or S(O)₀₋₂R₁R₂;

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

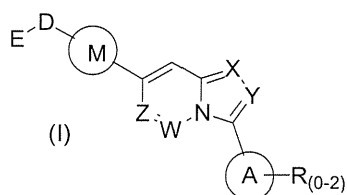
D is selected from a bond, O, CR₁R₂ or NH or NR₁ or NR₁R₂ or S(O)₀₋₂R₁R₂;

E is selected from H, CF₃, halogen, CN, alkyl, aryl, heteroaryl, C₃-C₁₂ cycloalkyl or C₃-C₁₂ cycloheteroalkyl or -(CH₂)_x-C₃-C₁₂ cycloalkyl or -(CH₂)_x-C₃-C₁₂ cycloheteroalkyl;

R₁ is selected from H, alkyl, aryl, heteraryl, or COR₁; and

R₂ is selected from H, alkyl, aryl, heteraryl, COR₁, and further, R₁ and R₂ can form a C₃-C₁₂ cycloalkyl or C₃-C₁₂ cycloheteroalkyl containing O, N or S; or a pharmaceutically acceptable salt thereof, or a pharmaceutically acceptable derivative thereof.

15. A 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, CF₃, halogen, CN, alkyl, aryl, heteroaryl, NR₁R₂, COR₁R₂, CR₁R₂, S(O)₀,
2NR₁R₂; or S(O)₀₋₂R₁R₂;

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

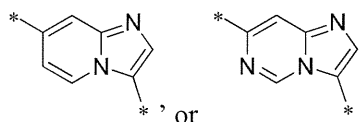
D is selected from a bond, O, CR₁R₂ or NH or NR₁ or NR₁R₂ or S(O)₀₋₂R₁R₂;

E is selected from H, CF₃, halogen, CN, alkyl, aryl, heteroaryl, C₃-C₁₂ cycloalkyl or C₃-C₁₂ cycloheteroalkyl or -(CH₂)_x-C₃-C₁₂ cycloalkyl or -(CH₂)_x-C₃-C₁₂ cycloheteroalkyl;

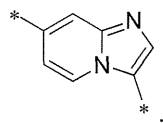
R₁ is selected from H, alkyl, aryl, heteraryl, or COR₁; and

R₂ is selected from H, alkyl, aryl, heteraryl, COR₁, and further, R₁ and R₂ can form a C₃-C₁₂ cycloalkyl or C₃-C₁₂ cycloheteroalkyl containing O, N or S; or a pharmaceutically acceptable salt thereof, or a pharmaceutically acceptable derivative thereof.

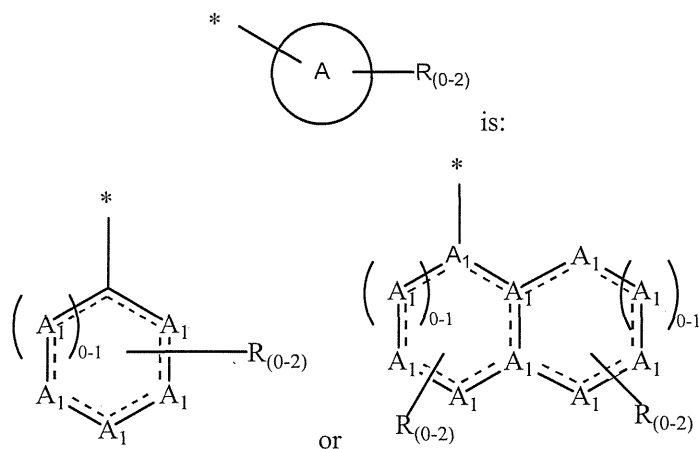
16. A compound of claim 15, wherein W, X, Y and Z together help form:



17. A compound of claim 15, wherein W, X, Y and Z together help form:



18. A compound of claim 15, wherein

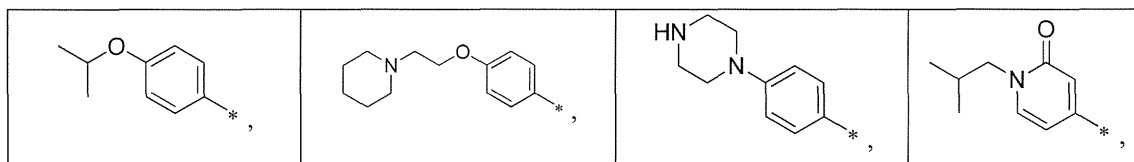


wherein A_1 is independently O, CR_1R_2 or NH or NR_1 or NR_1R_2 , or can join with another A_1 to form C_3 - C_{12} cycloalkyl or C_3 - C_{12} cycloalkenyl or aryl or heteroaryl or C_3 - C_{12} heterocycloalkyl or C_3 - C_{12} heterocycloalkenyl or 3-8 membered ring comprising C, O, S, and/or N.

19. A compound of claim 15, 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.

20. A compound of claim 19, wherein M is optionally substituted phenyl or pyridine.

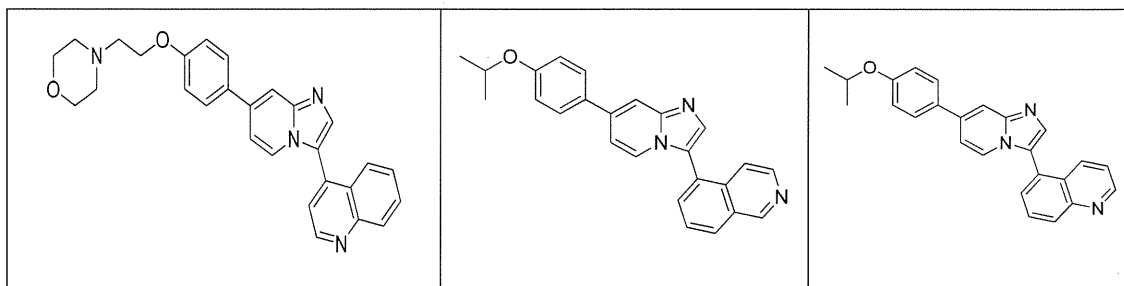
21. A compound of claim 15, wherein M, D, and E together form:

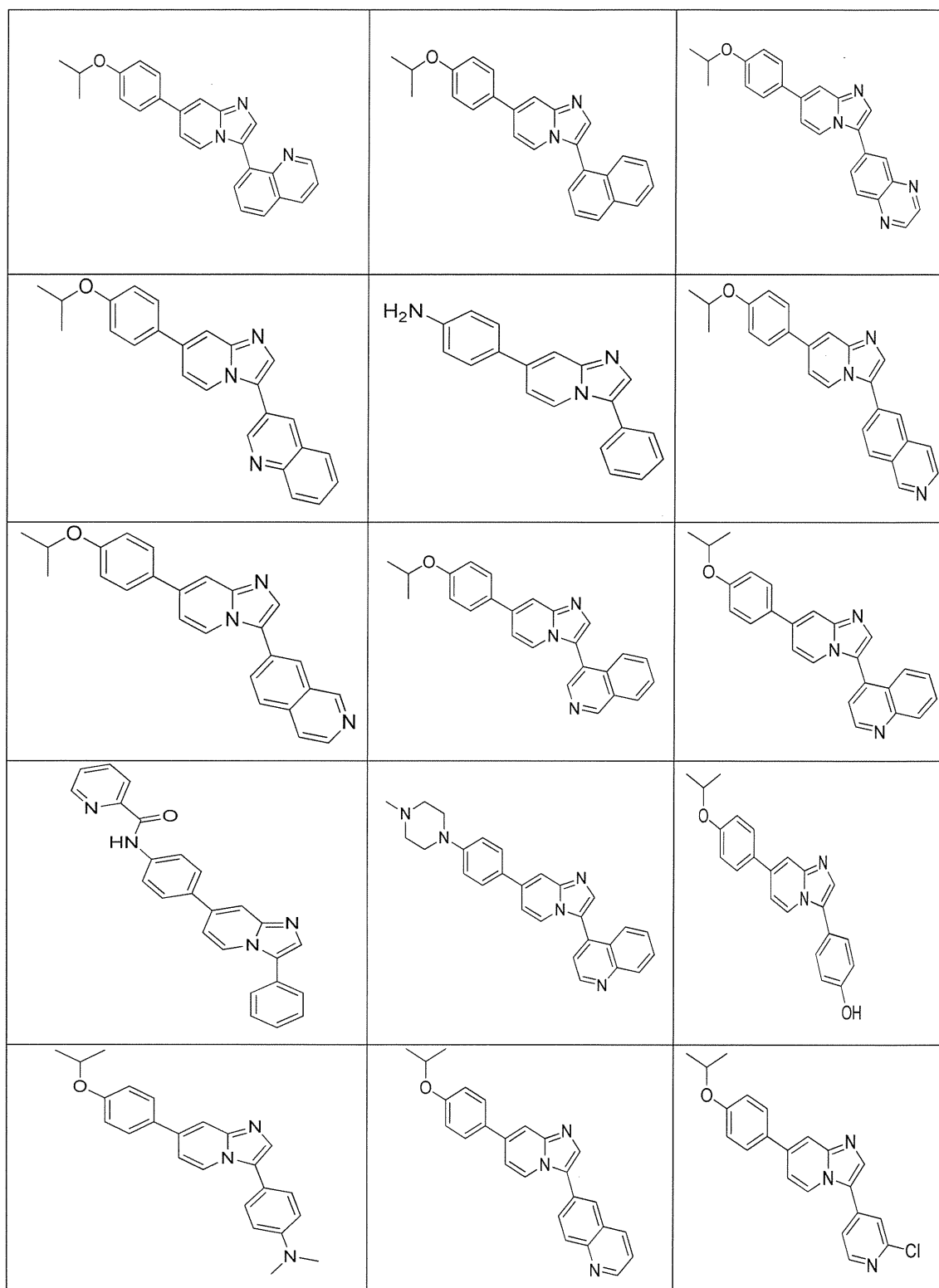


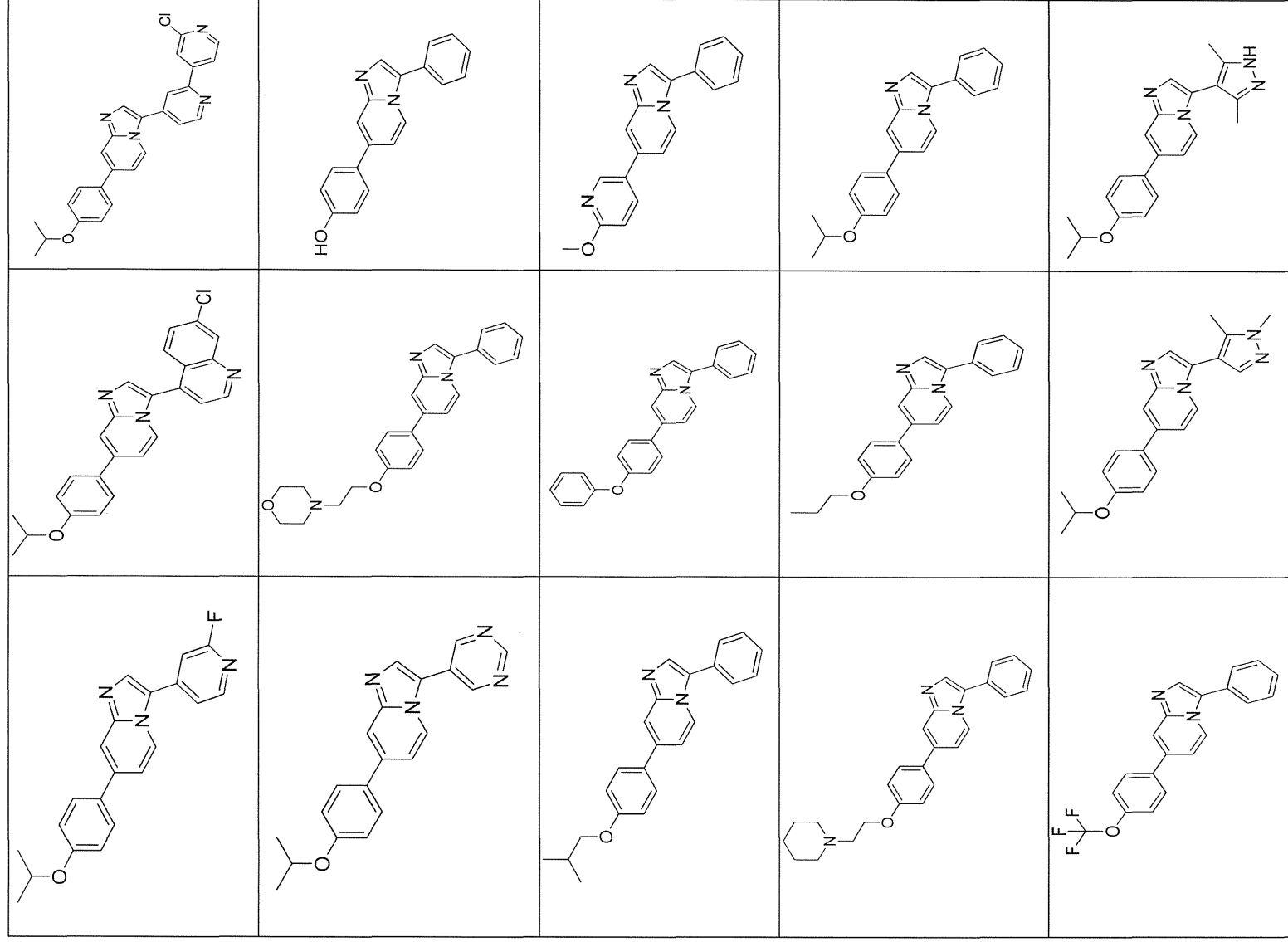
22. A compound of claim 15, wherein A is chosen from the following:

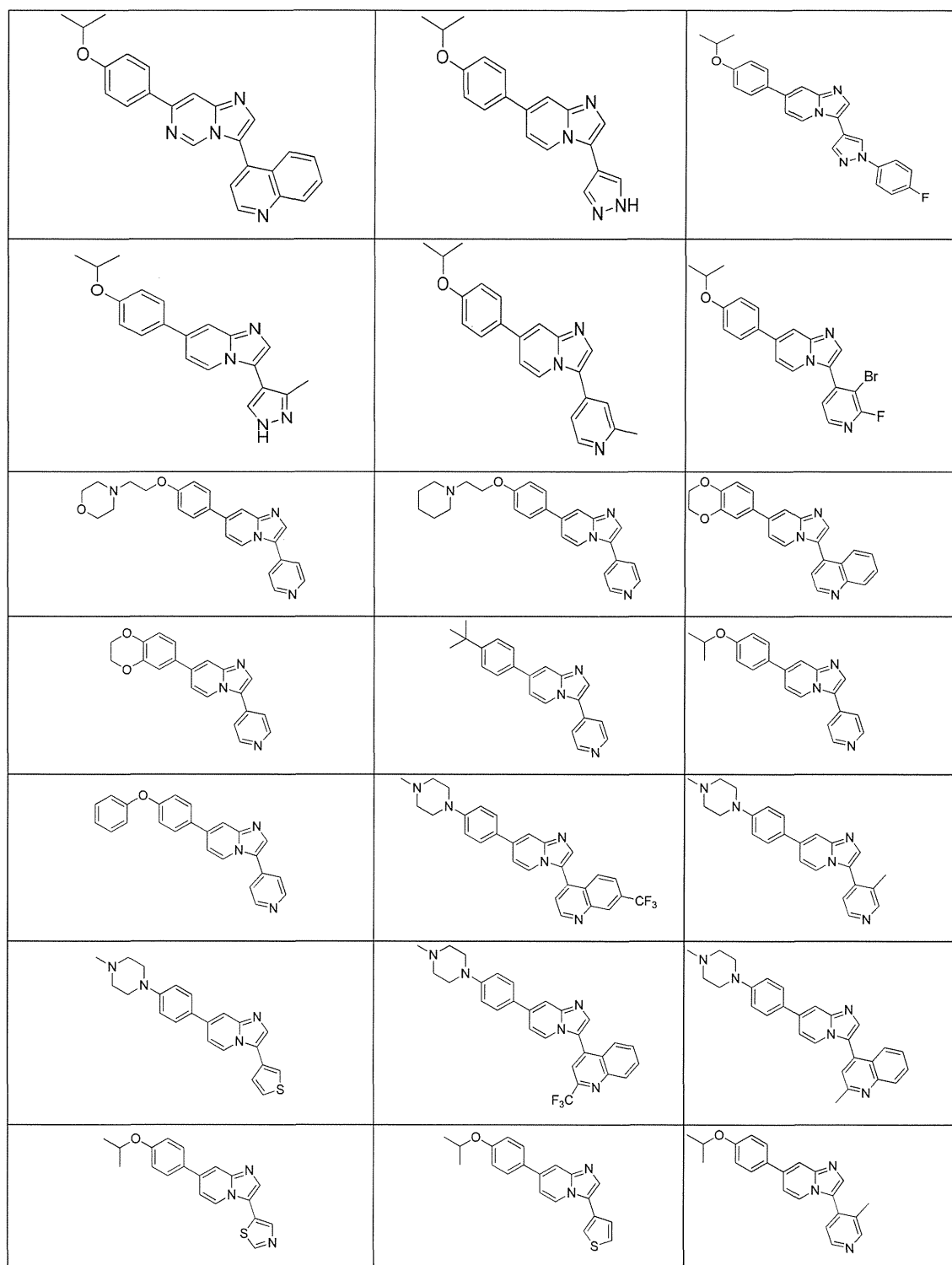
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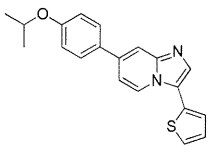
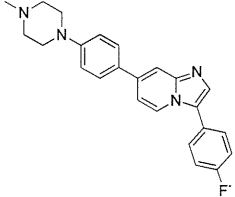
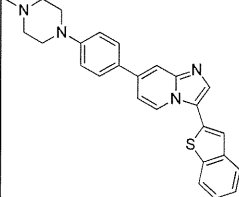
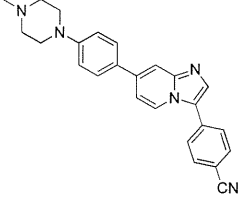
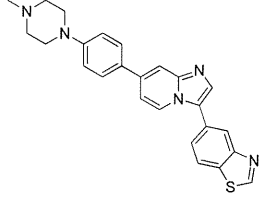
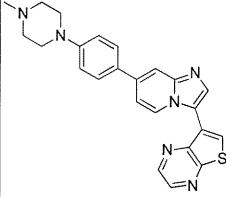
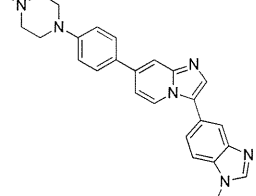
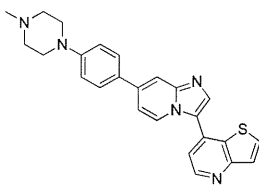
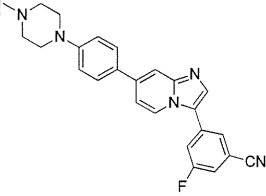
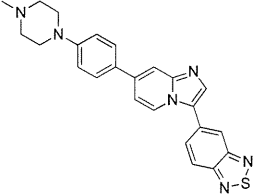
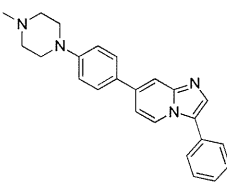
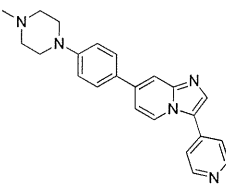
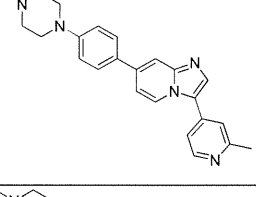
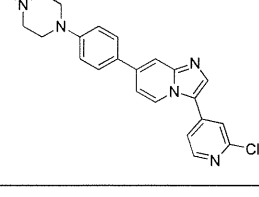
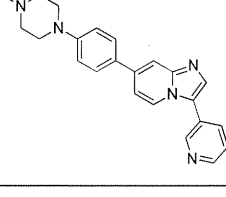
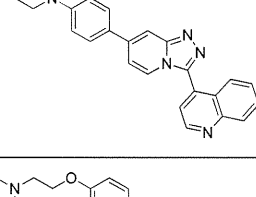
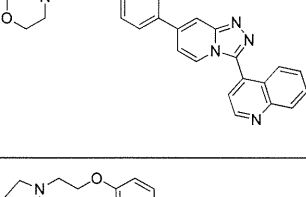
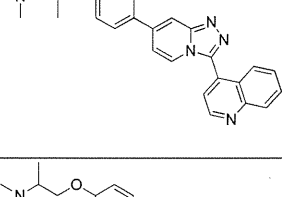
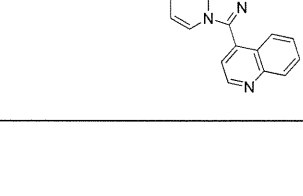
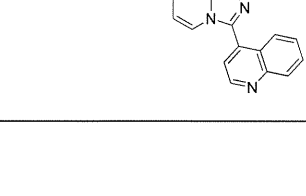
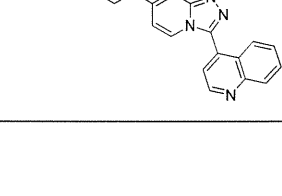
23. A compound of claim 15, wherein the compound is of the following formula:

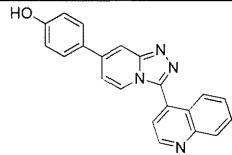
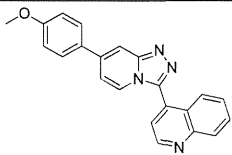
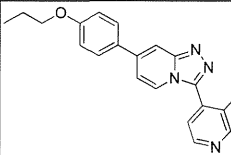
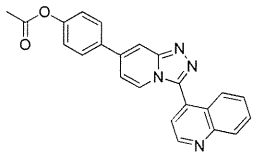
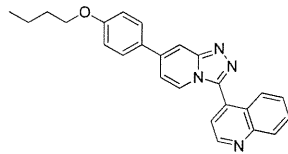
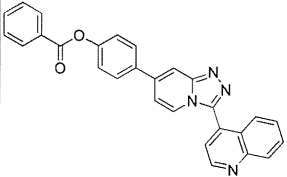
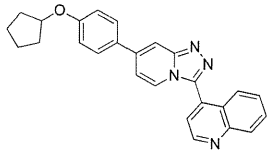
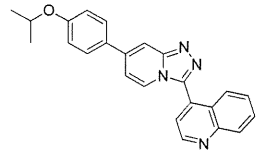
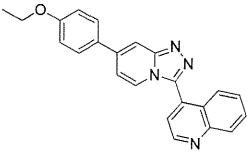
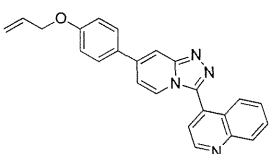
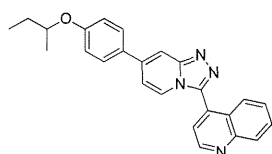
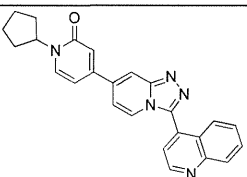
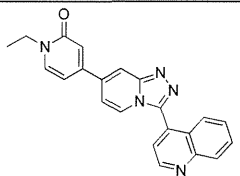
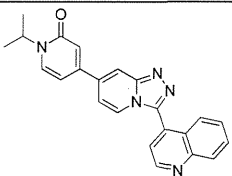
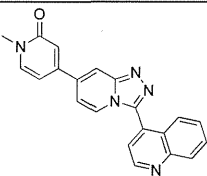
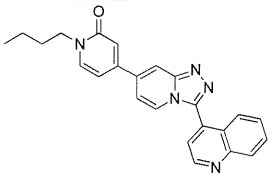
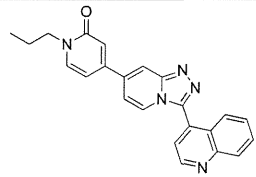
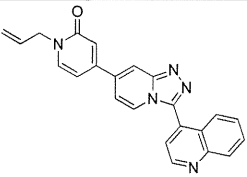
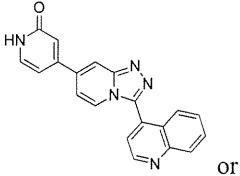
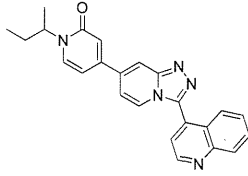




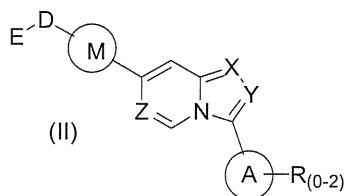




		
		
		
		
		
		
 or		

24. A compound having a structure represented by the following formula (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, CF₃, halogen, CN, alkyl, aryl, heteroaryl, NR₁R₂, COR₁R₂, CR₁R₂, S(O)₀₋₂NR₁R₂; or S(O)₀₋₂R₁R₂;

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

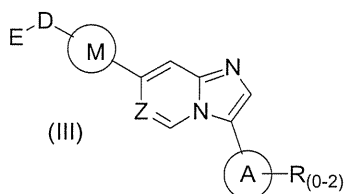
D is selected from a bond, O, CR₁R₂ or NH or NR₁ or NR₁R₂ or S(O)₀₋₂R₁R₂;

E is selected from H, CF₃, halogen, CN, alkyl, aryl, heteroaryl, C₃-C₁₂ cycloalkyl or C₃-C₁₂ cycloheteroalkyl or -(CH₂)_x-C₃-C₁₂ cycloalkyl or -(CH₂)_x-C₃-C₁₂ cycloheteroalkyl;

R₁ is selected from H, alkyl, aryl, heteraryl, or COR₁; and

R₂ is selected from H, alkyl, aryl, heteraryl, COR₁, and further, R₁ and R₂ can form a C₃-C₁₂ cycloalkyl or C₃-C₁₂ 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):



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, CF₃, halogen, CN, alkyl, aryl, heteroaryl, NR₁R₂, COR₁R₂, CR₁R₂, S(O)₀₋₂NR₁R₂; or S(O)₀₋₂R₁R₂;

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

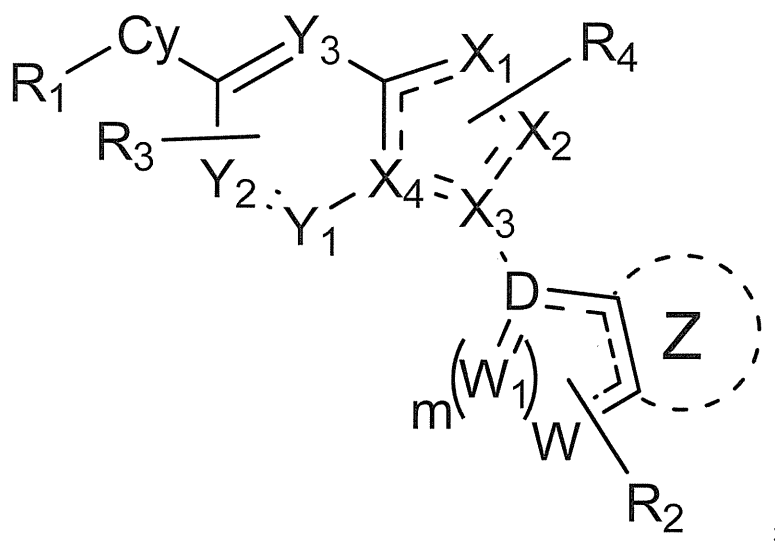
D is selected from a bond, O, CR₁R₂ or NH or NR₁ or NR₁R₂ or S(O)₀₋₂R₁R₂;

E is selected from H, CF₃, halogen, CN, alkyl, aryl, heteroaryl, C₃-C₁₂ cycloalkyl or C₃-C₁₂ cycloheteroalkyl or -(CH₂)_x-C₃-C₁₂ cycloalkyl or -(CH₂)_x-C₃-C₁₂ cycloheteroalkyl;

R₁ is selected from H, alkyl, aryl, heteraryl, or COR₁; and

R₂ is selected from H, alkyl, aryl, heteraryl, COR₁, and further, R₁ and R₂ can form a C₃-C₁₂ cycloalkyl or C₃-C₁₂ cycloheteroalkyl containing O, N or S; or a pharmaceutically acceptable salt thereof, or a pharmaceutically acceptable derivative thereof.

26. ~~A method of~~ A compound for use as a medicament for modulating the BMP signaling pathway, comprising administering to a subject in need thereof a BMP pathway modulating amount of ~~the~~ compound having a structure represented by the following formula:



wherein:

X₁ is N, O, or CR₁;

X₂, and X₄ are independently N or CR₁;

X₃ is C or N;

Y₁, Y₂, and Y₃ are independently N or CR₁;

D is C or N;

W is N or O;

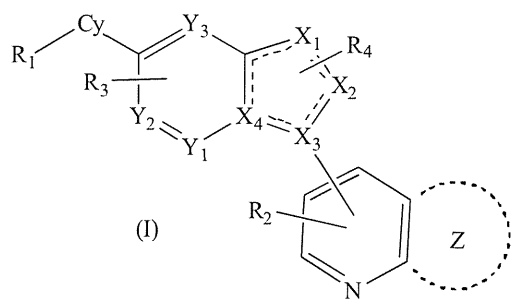
W₁ is N, O or C;

Cy is optionally substituted with one or more R₁, and is selected from C₃-C₁₂ cycloalkyl or C₃-C₁₂ cycloalkenyl or aryl or heteroaryl or C₃-C₁₂ heterocycloalkyl or C₃-C₁₂ heterocycloalkenyl or 3-8 membered ring comprising C, O, S, and/or N.

R₁-R₄ are independently selected from hydrogen, halogen, C₁₋₁₀ alkyl, C₃₋₁₀ cycloalkyl, OC₁₋₁₀ alkyl (which may contain a C₃₋₈ membered ring containing C, O, S or N, optionally substituted with one or more R⁴), NR₁C₁₋₁₀ alkyl (which may contain a C₃₋₈ membered ring containing C, O, S or N, optionally substituted with one or more R⁴), CN or CF₃;

Z is optionally substituted with one or more R₁, and is selected from C₃-C₁₂ cycloalkyl or C₃-C₁₂ cycloalkenyl or aryl or heteroaryl or C₃-C₁₂ heterocycloalkyl or C₃-C₁₂ heterocycloalkenyl or 3-8 membered ring comprising C, O, S, and/or N.

27. ~~A method of~~ A compound for use as a medicament for modulating the BMP signaling pathway, ~~comprising administering to a subject in need thereof a BMP pathway modulating amount of the~~ compound having a structure represented by the following formula:



wherein:

X₁ is N, O, or CR₁;

X₂, and X₄ are independently N or CR₁;

X₃ is C or N;

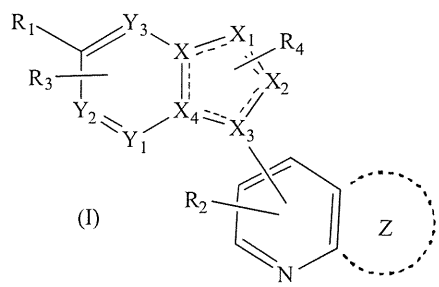
Y₁, Y₂, and Y₃ are independently N or CR₁;

Cy is a bond, or forms a ring that is optionally substituted with one or more R₁, and is selected from C₃-C₁₂ cycloalkyl or C₃-C₁₂ cycloalkenyl or aryl or heteroaryl or C₃-C₁₂ heterocycloalkyl or C₃-C₁₂ heterocycloalkenyl or 3-8 membered ring comprising C, O, S, and/or N.

R₁-R₄ are independently selected from hydrogen, halogen, C₁₋₁₀ alkyl, C₃₋₁₀ cycloalkyl, OC₁₋₁₀ alkyl (which may contain a C₃₋₈ membered ring containing C, O, S or N, optionally substituted with one or more R⁴), NR₁C₁₋₁₀ alkyl (which may contain a C₃₋₈ membered ring containing C, O, S or N, optionally substituted with one or more R⁴), CN or CF₃;

Z is optionally substituted with one or more R₁, and is selected from C₃-C₁₂ cycloalkyl or C₃-C₁₂ cycloalkenyl or aryl or heteroaryl or C₃-C₁₂ heterocycloalkyl or C₃-C₁₂ heterocycloalkenyl or 3-8 membered ring comprising C, O, S, and/or N.

28. ~~A method of~~ A compound for use as a medicament for modulating the BMP signaling pathway, comprising administering to a subject in need thereof a BMP pathway modulating amount of ~~the~~ compound having a structure represented by 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 ;

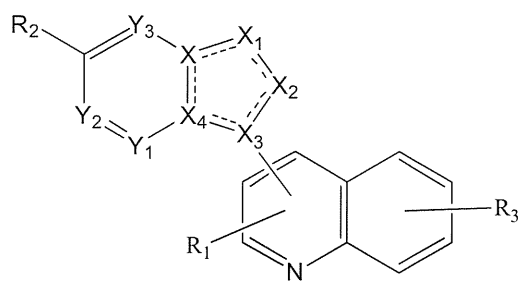
X_3 is C or N;

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

R_1 - R_4 are 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.

29. ~~The method compound~~ of claim 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 ;

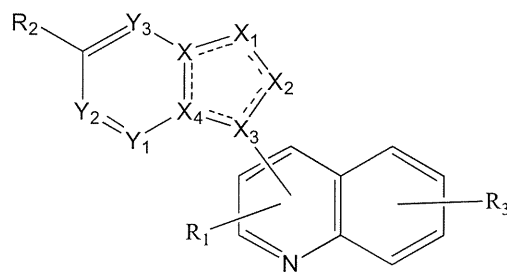
X is N, O, or CR_1 ;

X_3 is C or N;

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

R_1 - R_4 are 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. The ~~method compound~~ of claim 28, wherein the compound is of the following formula:



wherein

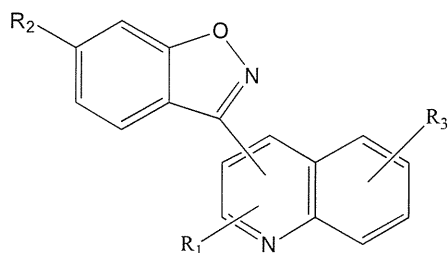
- (i) X_1 is O, X_2 is N, and X, X_3, X_4, Y_1, Y_2 , and Y_3 are independently C or CR_1 ;
- (ii) X_1 is O, X_2 is N, Y_1 is N, and X, X_3, X_4, Y_2 , and Y_3 are independently C or CR_1 ;
- (iii) X_1 is N, X_4 is N, and X_2, X_3, X_4, Y_1, Y_2 , and Y_3 are independently C or CR_1 ;
- (iv) X_1 is N,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

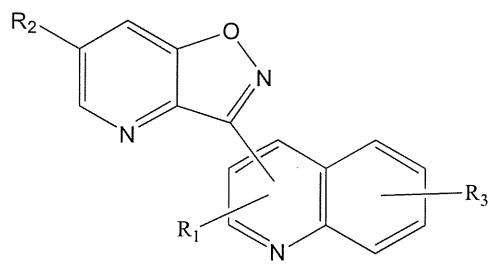
R_1 - R_4 are independently selected from hydrogen, halogen, C_{1-10} alkyl, C_{3-10} cycloalkyl, OC_{1-10} alkyl (which may contain a C_{3-8} membered ring containing C, O, S or N, optionally substituted with one or more R^4), CN or CF_3 .

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



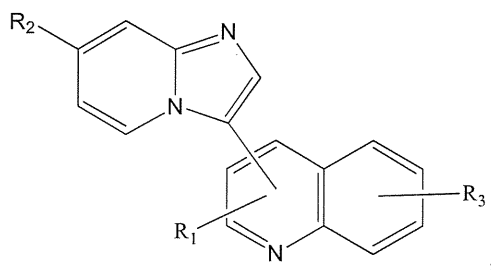
wherein R₁-R₄ are independently selected from hydrogen, halogen, C₁₋₁₀ alkyl, C₃₋₁₀ cycloalkyl, OC₁₋₁₀ alkyl (which may contain a C₃₋₈ membered ring containing C, O, S or N, optionally substituted with one or more R⁴), CN or CF₃.

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



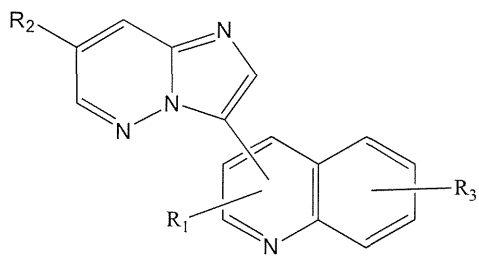
wherein R₁-R₄ are independently selected from hydrogen, halogen, C₁₋₁₀ alkyl, C₃₋₁₀ cycloalkyl, OC₁₋₁₀ alkyl (which may contain a C₃₋₈ membered ring containing C, O, S or N, optionally substituted with one or more R⁴), CN or CF₃.

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



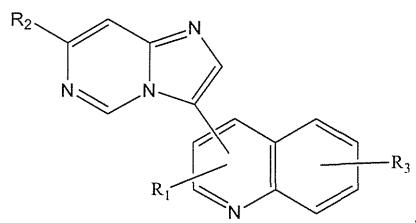
wherein R₁-R₄ are independently selected from hydrogen, halogen, C₁₋₁₀ alkyl, C₃₋₁₀ cycloalkyl, OC₁₋₁₀ alkyl (which may contain a C₃₋₈ membered ring containing C, O, S or N, optionally substituted with one or more R⁴), CN or CF₃.

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



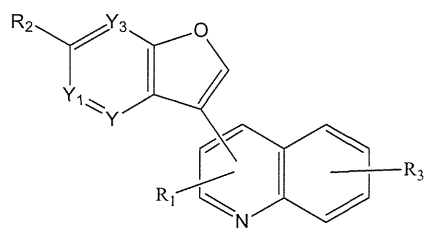
wherein R₁-R₄ are independently selected from hydrogen, halogen, C₁₋₁₀ alkyl, C₃₋₁₀ cycloalkyl, OC₁₋₁₀ alkyl (which may contain a C₃₋₈ membered ring containing C, O, S or N, optionally substituted with one or more R⁴), CN or CF₃.

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



wherein R₁-R₄ are independently selected from hydrogen, halogen, C₁₋₁₀ alkyl, C₃₋₁₀ cycloalkyl, OC₁₋₁₀ alkyl (which may contain a C₃₋₈ membered ring containing C, O, S or N, optionally substituted with one or more R⁴), CN or CF₃.

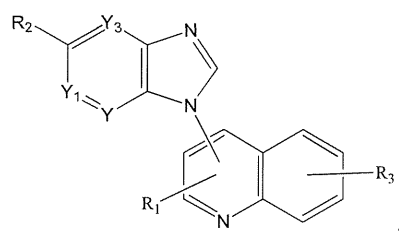
36. The ~~method compound~~ of claim 28, wherein the compound is of the following formula:



wherein Y₁ and Y₃ are independently N or CR₁; R₁-R₄ are independently selected from hydrogen, halogen, C₁₋₁₀ alkyl, C₃₋₁₀ cycloalkyl, OC₁₋₁₀ alkyl (which may contain a C₃₋₈

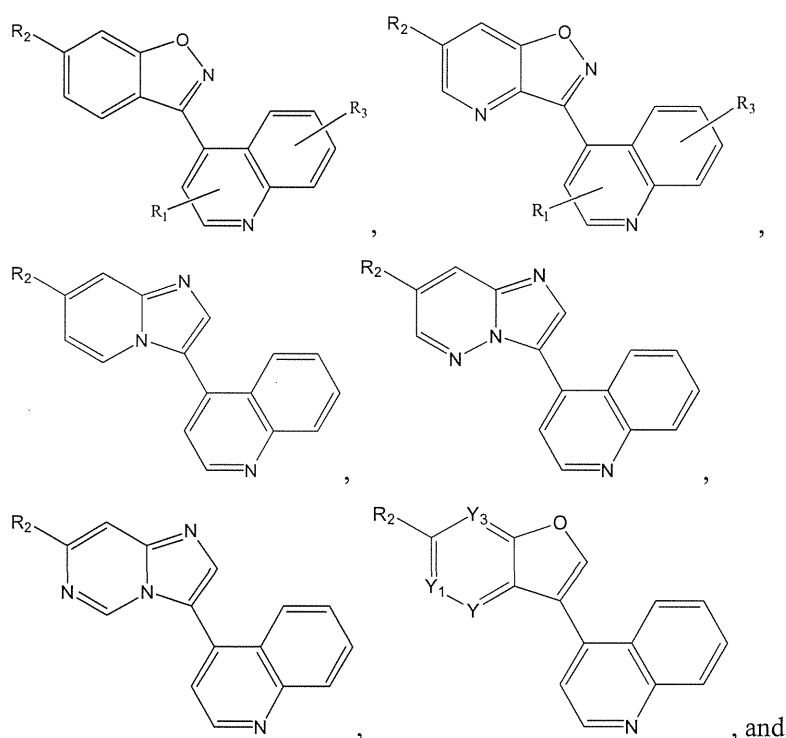
membered ring containing C, O, S or N, optionally substituted with one or more R⁴), CN or CF₃.

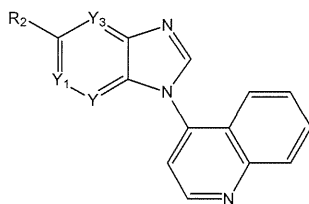
37. The ~~method compound~~ of claim 28, wherein the compound is of the following formula:



wherein Y₁ and Y₃ are independently N or CR₁; R₁-R₄ are independently selected from hydrogen, halogen, C₁₋₁₀ alkyl, C₃₋₁₀ cycloalkyl, OC₁₋₁₀ alkyl (which may contain a C₃₋₈ membered ring containing C, O, S or N, optionally substituted with one or more R⁴), CN or CF₃.

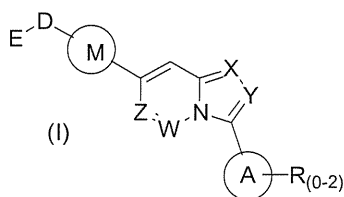
38. The ~~method compound~~ of claim 28, wherein the compound is of the following formula:





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 .

39. ~~A method of~~ A compound for use as a medicament for treating acute megakaryoblastic leukemia, comprising administering to a subject in need thereof at least one compound in a dosage and amount effective to propagate a cell, 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;

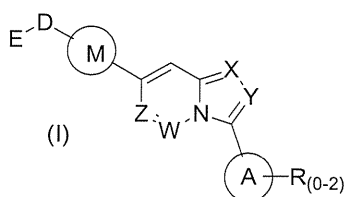
D is selected from a bond, O, CR_1R_2 or NH or NR_1 or NR_1R_2 or $S(O)_{0-2}R_1R_2$;

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.

40. ~~A method for~~ A compound 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; ~~comprising administering to a subject in need thereof at least one compound in a dosage and amount effective to propagate a cell,~~ 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, CF₃, halogen, CN, alkyl, aryl, heteroaryl, NR₁R₂, COR₁R₂, CR₁R₂, S(O)₀₋₂NR₁R₂; or S(O)₀₋₂R₁R₂;

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

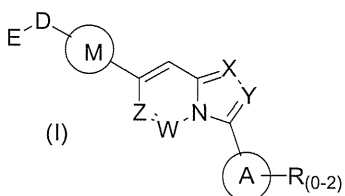
D is selected from a bond, O, CR₁R₂ or NH or NR₁ or NR₁R₂ or S(O)₀₋₂R₁R₂;

E is selected from H, CF₃, halogen, CN, alkyl, aryl, heteroaryl, C₃-C₁₂ cycloalkyl or C₃-C₁₂ cycloheteroalkyl or -(CH₂)_x-C₃-C₁₂ cycloalkyl or -(CH₂)_x-C₃-C₁₂ cycloheteroalkyl;

R₁ is selected from H, alkyl, aryl, heteraryl, or COR₁; and

R₂ is selected from H, alkyl, aryl, heteraryl, COR₁, and further, R₁ and R₂ can form a C₃-C₁₂ cycloalkyl or C₃-C₁₂ cycloheteroalkyl containing O, N or S; or a pharmaceutically acceptable salt thereof, or a pharmaceutically acceptable derivative thereof.

41. ~~A method for~~ 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, ~~comprising administering to a subject in need thereof at least one compound in a dosage and amount effective to propagate a cell,~~ 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, CF₃, halogen, CN, alkyl, aryl, heteroaryl, NR₁R₂, COR₁R₂, CR₁R₂, S(O)₀₋₂NR₁R₂; or S(O)₀₋₂R₁R₂;

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

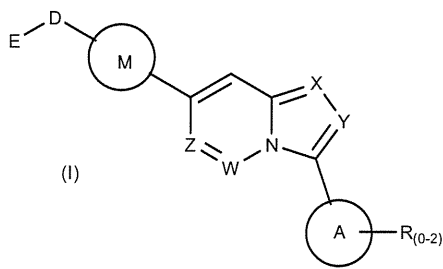
D is selected from a bond, O, CR₁R₂ or NH or NR₁ or NR₁R₂ or S(O)₀₋₂R₁R₂;

E is selected from H, CF₃, halogen, CN, alkyl, aryl, heteroaryl, C₃-C₁₂ cycloalkyl or C₃-C₁₂ cycloheteroalkyl or -(CH₂)_x-C₃-C₁₂ cycloalkyl or -(CH₂)_x-C₃-C₁₂ cycloheteroalkyl;

R₁ is selected from H, alkyl, aryl, heteraryl, or COR₁; and

R₂ is selected from H, alkyl, aryl, heteraryl, COR₁, and further, R₁ and R₂ can form a C₃-C₁₂ cycloalkyl or C₃-C₁₂ cycloheteroalkyl containing O, N or S; or a pharmaceutically acceptable salt thereof, or a pharmaceutically acceptable derivative thereof.

42. A method for modulating the BMP signaling pathway comprising *in vitro* administration to at least one cell an amount effective to modulate BMP signaling, the compound having a structure represented by the 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, CF₃, halogen, CN, alkyl, aryl, heteroaryl, NR₁R₂, COR₁R₂, CR₁R₂, S(O)₀₋₂NR₁R₂; or S(O)₀₋₂R₁R₂;

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

D is selected from a bond, O, CR₁R₂ or NH or NR₁ or NR₁R₂ or S(O)₀₋₂R₁R₂;

E is selected from H, CF₃, halogen, CN, alkyl, aryl, heteroaryl, C₃-C₁₂ cycloalkyl or C₃-C₁₂ cycloheteroalkyl or -(CH₂)_x-C₃-C₁₂ cycloalkyl or -(CH₂)_x-C₃-C₁₂ cycloheteroalkyl;

R₁ is selected from H, alkyl, aryl, heteraryl, or COR₁; and

R₂ is selected from H, alkyl, aryl, heteraryl, COR₁, and further, R₁ and R₂ can form a C₃-C₁₂ cycloalkyl or C₃-C₁₂ cycloheteroalkyl containing O, N or S; or a pharmaceutically acceptable salt thereof, or a pharmaceutically acceptable derivative thereof.

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

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

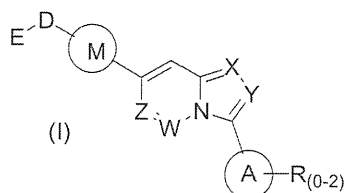
45. The method of claim 44, wherein modulating the BMP signaling pathway regulates the differentiation and regeneration of precursor and stem cell populations.

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

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

the BMP signaling pathway, methods of making same, pharmaceutical compositions comprising same, and methods of treating disorders associated with BMP signaling.

Disclosed is 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):



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, CF₃, halogen, CN, alkyl, aryl, heteroaryl, NR₁R₂, COR₁R₂, CR₁R₂, S(O)₀₋₂NR₁R₂; or S(O)₀₋₂R₁R₂;

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

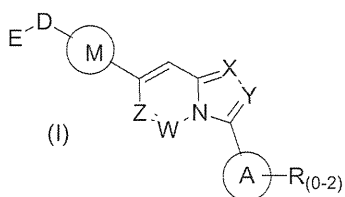
D is selected from a bond, O, CR₁R₂ or NH or NR₁ or NR₁R₂ or S(O)₀₋₂R₁R₂;

E is selected from H, CF₃, halogen, CN, alkyl, aryl, heteroaryl, C₃-C₁₂ cycloalkyl or C₃-C₁₂ cycloheteroalkyl or -(CH₂)_x-C₃-C₁₂ cycloalkyl or -(CH₂)_x-C₃-C₁₂ cycloheteroalkyl;

R₁ is selected from H, alkyl, aryl, heteraryl, COR₁; and

R₂ is selected from H, alkyl, aryl, heteraryl, COR₁, and further, R₁ and R₂ can form a C₃-C₁₂ cycloalkyl or C₃-C₁₂ cycloheteroalkyl containing O, N or S; or a pharmaceutically acceptable salt thereof, or a pharmaceutically acceptable derivative thereof.

Also disclosed is a compound for use as a medicament in modulating the BMP signaling pathway 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, CF₃, halogen, CN, alkyl, aryl, heteroaryl, NR₁R₂, COR₁R₂, CR₁R₂, S(O)₀₋₂NR₁R₂; S(O)₀₋₂R₁R₂;

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

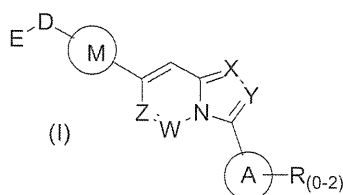
D is selected from a bond, O, CR₁R₂ or NH or NR₁ or NR₁R₂ or S(O)₀₋₂R₁R₂;

E is selected from H, CF₃, halogen, CN, alkyl, aryl, heteroaryl, C₃-C₁₂ cycloalkyl or C₃-C₁₂ cycloheteroalkyl or -(CH₂)_x-C₃-C₁₂ cycloalkyl or -(CH₂)_x-C₃-C₁₂ cycloheteroalkyl;

R₁ is selected from H, alkyl, aryl, heteraryl, COR₁; and

R₂ is selected from H, alkyl, aryl, heteraryl, COR₁, and further, R₁ and R₂ can form a C₃-C₁₂ cycloalkyl or C₃-C₁₂ cycloheteroalkyl containing O, N or S; or a pharmaceutically acceptable salt thereof, or a pharmaceutically acceptable derivative thereof.

Also disclosed is a compound for use in the treatment of anemia, including iron deficiency, and anemia of chronic disease, 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, CF₃, halogen, CN, alkyl, aryl, heteroaryl, NR₁R₂, COR₁R₂, CR₁R₂, S(O)₀₋₂NR₁R₂; or S(O)₀₋₂R₁R₂;

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

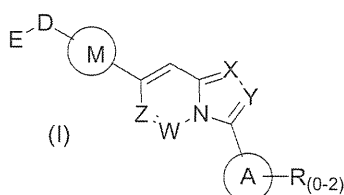
D is selected from a bond, O, CR₁R₂ or NH or NR₁ or NR₁R₂ or S(O)₀₋₂R₁R₂;

E is selected from H, CF₃, halogen, CN, alkyl, aryl, heteroaryl, C₃-C₁₂ cycloalkyl or C₃-C₁₂ cycloheteroalkyl or -(CH₂)_x-C₃-C₁₂ cycloalkyl or -(CH₂)_x-C₃-C₁₂ cycloheteroalkyl;

R₁ is selected from H, alkyl, aryl, heteraryl, COR₁; and

R₂ is selected from H, alkyl, aryl, heteraryl, COR₁, and further, R₁ and R₂ can form a C₃-C₁₂ cycloalkyl or C₃-C₁₂ cycloheteroalkyl containing O, N or S; or a pharmaceutically acceptable salt thereof, or a pharmaceutically acceptable derivative thereof.

Also disclosed is a compound for use in the treatment of fibrodysplasia ossificans progressiva (FOP), 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, CF₃, halogen, CN, alkyl, aryl, heteroaryl, NR₁R₂, COR₁R₂, CR₁R₂, S(O)₀₋₂NR₁R₂; or S(O)₀₋₂R₁R₂;

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

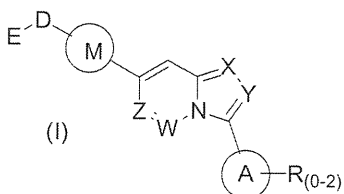
D is selected from a bond, O, CR₁R₂ or NH or NR₁ or NR₁R₂ or S(O)₀₋₂R₁R₂;

E is selected from H, CF₃, halogen, CN, alkyl, aryl, heteroaryl, C₃-C₁₂ cycloalkyl or C₃-C₁₂ cycloheteroalkyl or -(CH₂)_x-C₃-C₁₂ cycloalkyl or -(CH₂)_x-C₃-C₁₂ cycloheteroalkyl;

R₁ is selected from H, alkyl, aryl, heteraryl, COR₁; and

R₂ is selected from H, alkyl, aryl, heteraryl, COR₁, and further, R₁ and R₂ can form a C₃-C₁₂ cycloalkyl or C₃-C₁₂ cycloheteroalkyl containing O, N or S; or a pharmaceutically acceptable salt thereof, or a pharmaceutically acceptable derivative thereof.

Also disclosed is a compound for use as a medicament in inhibiting the oncogenesis, 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):



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, CF₃, halogen, CN, alkyl, aryl, heteroaryl, NR₁R₂, COR₁R₂, CR₁R₂, S(O)₀₋₂NR₁R₂; or S(O)₀₋₂R₁R₂;

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

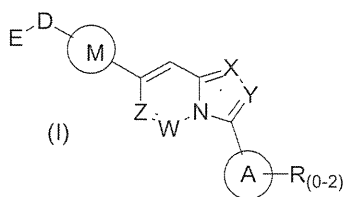
D is selected from a bond, O, CR₁R₂ or NH or NR₁ or NR₁R₂ or S(O)₀₋₂R₁R₂;

E is selected from H, CF₃, halogen, CN, alkyl, aryl, heteroaryl, C₃-C₁₂ cycloalkyl or C₃-C₁₂ cycloheteroalkyl or -(CH₂)_x-C₃-C₁₂ cycloalkyl or -(CH₂)_x-C₃-C₁₂ cycloheteroalkyl;

R₁ is selected from H, alkyl, aryl, heteraryl, COR₁; and

R₂ is selected from H, alkyl, aryl, heteraryl, COR₁, and further, R₁ and R₂ can form a C₃-C₁₂ cycloalkyl or C₃-C₁₂ cycloheteroalkyl containing O, N or S; or a pharmaceutically acceptable salt thereof, or a pharmaceutically acceptable derivative thereof.

Also disclosed is 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):



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, CF₃, halogen, CN, alkyl, aryl, heteroaryl, NR₁R₂, COR₁R₂, CR₁R₂, S(O)₀₋₂NR₁R₂; or S(O)₀₋₂R₁R₂;

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

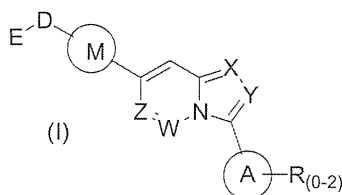
D is selected from a bond, O, CR₁R₂ or NH or NR₁ or NR₁R₂ or S(O)₀₋₂R₁R₂;

E is selected from H, CF₃, halogen, CN, alkyl, aryl, heteroaryl, C₃-C₁₂ cycloalkyl or C₃-C₁₂ cycloheteroalkyl or -(CH₂)_x-C₃-C₁₂ cycloalkyl or -(CH₂)_x-C₃-C₁₂ cycloheteroalkyl;

R₁ is selected from H, alkyl, aryl, heteraryl, COR₁; and

R₂ is selected from H, alkyl, aryl, heteraryl, COR₁, and further, R₁ and R₂ can form a C₃-C₁₂ cycloalkyl or C₃-C₁₂ cycloheteroalkyl containing O, N or S; or a pharmaceutically acceptable salt thereof, or a pharmaceutically acceptable derivative thereof.

Also disclosed is a compound for use as a medicament for treating pathologic bone function the compound having a structure represented by the 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, CF₃, halogen, CN, alkyl, aryl, heteroaryl, NR₁R₂, COR₁R₂, CR₁R₂, S(O)₀₋₂, NR₁R₂; or S(O)₀₋₂R₁R₂;

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

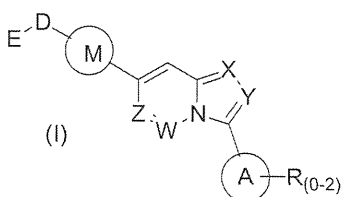
D is selected from a bond, O, CR₁R₂ or NH or NR₁ or NR₁R₂ or S(O)₀₋₂R₁R₂;

E is selected from H, CF₃, halogen, CN, alkyl, aryl, heteroaryl, C₃-C₁₂ cycloalkyl or C₃-C₁₂ cycloheteroalkyl or -(CH₂)_x-C₃-C₁₂ cycloalkyl or -(CH₂)_x-C₃-C₁₂ cycloheteroalkyl;

R₁ is selected from H, alkyl, aryl, heteraryl, COR₁; and

R₂ is selected from H, alkyl, aryl, heteraryl, COR₁, and further, R₁ and R₂ can form a C₃-C₁₂ cycloalkyl or C₃-C₁₂ cycloheteroalkyl containing O, N or S; or a pharmaceutically acceptable salt thereof, or a pharmaceutically acceptable derivative thereof.

Also disclosed is 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, CF₃, halogen, CN, alkyl, aryl, heteroaryl, NR₁R₂, COR₁R₂, CR₁R₂, S(O)₀₋₂NR₁R₂; or S(O)₀₋₂R₁R₂;

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

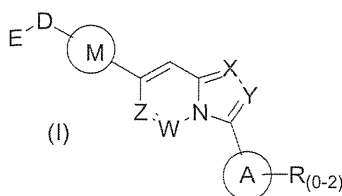
D is selected from a bond, O, CR₁R₂ or NH or NR₁ or NR₁R₂ or S(O)₀₋₂R₁R₂;

E is selected from H, CF₃, halogen, CN, alkyl, aryl, heteroaryl, C₃-C₁₂ cycloalkyl or C₃-C₁₂ cycloheteroalkyl or -(CH₂)_x-C₃-C₁₂ cycloalkyl or -(CH₂)_x-C₃-C₁₂ cycloheteroalkyl;

R₁ is selected from H, alkyl, aryl, heteraryl, COR₁; and

R₂ is selected from H, alkyl, aryl, heteraryl, COR₁, and further, R₁ and R₂ can form a C₃-C₁₂ cycloalkyl or C₃-C₁₂ cycloheteroalkyl containing O, N or S; or a pharmaceutically acceptable salt thereof, or a pharmaceutically acceptable derivative thereof.

Also disclosed are compounds 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, CF₃, halogen, CN, alkyl, aryl, heteroaryl, NR₁R₂, COR₁R₂, CR₁R₂, S(O)₀₋₂NR₁R₂; or S(O)₀₋₂R₁R₂;

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

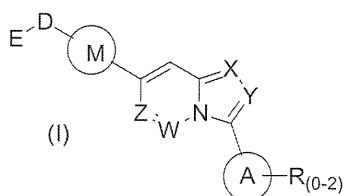
D is selected from a bond, O, CR₁R₂ or NH or NR₁ or NR₁R₂ or S(O)₀₋₂R₁R₂;

E is selected from H, CF₃, halogen, CN, alkyl, aryl, heteroaryl, C₃-C₁₂ cycloalkyl or C₃-C₁₂ cycloheteroalkyl or -(CH₂)_x-C₃-C₁₂ cycloalkyl or -(CH₂)_x-C₃-C₁₂ cycloheteroalkyl;

R₁ is selected from H, alkyl, aryl, heteraryl, COR₁; and

R₂ is selected from H, alkyl, aryl, heteraryl, COR₁, and further, R₁ and R₂ can form a C₃-C₁₂ cycloalkyl or C₃-C₁₂ cycloheteroalkyl containing O, N or S; or a pharmaceutically acceptable salt thereof, or a pharmaceutically acceptable derivative thereof.

Also disclosed is 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):



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, CF₃, halogen, CN, alkyl, aryl, heteroaryl, NR₁R₂, COR₁R₂, CR₁R₂, S(O)₀₋₂NR₁R₂; or S(O)₀₋₂R₁R₂;

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

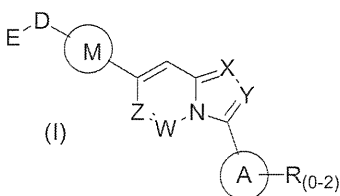
D is selected from a bond, O, CR₁R₂ or NH or NR₁ or NR₁R₂ or S(O)₀₋₂R₁R₂;

E is selected from H, CF₃, halogen, CN, alkyl, aryl, heteroaryl, C₃-C₁₂ cycloalkyl or C₃-C₁₂ cycloheteroalkyl or -(CH₂)_x-C₃-C₁₂ cycloalkyl or -(CH₂)_x-C₃-C₁₂ cycloheteroalkyl;

R₁ is selected from H, alkyl, aryl, heteraryl, COR₁; and

R₂ is selected from H, alkyl, aryl, heteraryl, COR₁, and further, R₁ and R₂ can form a C₃-C₁₂ cycloalkyl or C₃-C₁₂ cycloheteroalkyl containing O, N or S; or a pharmaceutically acceptable salt thereof, or a pharmaceutically acceptable derivative thereof.

Also disclosed is 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):



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, CF₃, halogen, CN, alkyl, aryl, heteroaryl, NR₁R₂, COR₁R₂, CR₁R₂, S(O)₀₋₂NR₁R₂; or S(O)₀₋₂R₁R₂;

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

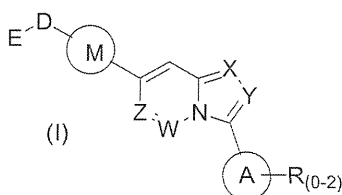
D is selected from a bond, O, CR₁R₂ or NH or NR₁ or NR₁R₂ or S(O)₀₋₂R₁R₂;

E is selected from H, CF₃, halogen, CN, alkyl, aryl, heteroaryl, C₃-C₁₂ cycloalkyl or C₃-C₁₂ cycloheteroalkyl or -(CH₂)_x-C₃-C₁₂ cycloalkyl or -(CH₂)_x-C₃-C₁₂ cycloheteroalkyl;

R₁ is selected from H, alkyl, aryl, heteraryl, COR₁; and

R₂ is selected from H, alkyl, aryl, heteraryl, COR₁, and further, R₁ and R₂ can form a C₃-C₁₂ cycloalkyl or C₃-C₁₂ cycloheteroalkyl containing O, N or S; or a pharmaceutically acceptable salt thereof, or a pharmaceutically acceptable derivative thereof.

Also disclosed is 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):



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, CF₃, halogen, CN, alkyl, aryl, heteroaryl, NR₁R₂, COR₁R₂, CR₁R₂, S(O)₀₋₂NR₁R₂; or S(O)₀₋₂R₁R₂;

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

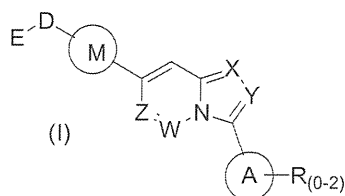
D is selected from a bond, O, CR₁R₂ or NH or NR₁ or NR₁R₂ or S(O)₀₋₂R₁R₂;

E is selected from H, CF₃, halogen, CN, alkyl, aryl, heteroaryl, C₃-C₁₂ cycloalkyl or C₃-C₁₂ cycloheteroalkyl or -(CH₂)_x-C₃-C₁₂ cycloalkyl or -(CH₂)_x-C₃-C₁₂ cycloheteroalkyl;

R₁ is selected from H, alkyl, aryl, heteraryl, COR₁; and

R₂ is selected from H, alkyl, aryl, heteraryl, COR₁, and further, R₁ and R₂ can form a C₃-C₁₂ cycloalkyl or C₃-C₁₂ cycloheteroalkyl containing O, N or S; or a pharmaceutically acceptable salt thereof, or a pharmaceutically acceptable derivative thereof.

Also disclosed is 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):



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, CF₃, halogen, CN, alkyl, aryl, heteroaryl, NR₁R₂, COR₁R₂, CR₁R₂, S(O)₀₋₂NR₁R₂; or S(O)₀₋₂R₁R₂;

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

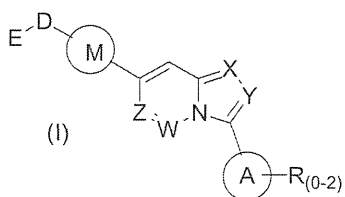
D is selected from a bond, O, CR₁R₂ or NH or NR₁ or NR₁R₂ or S(O)₀₋₂R₁R₂;

E is selected from H, CF₃, halogen, CN, alkyl, aryl, heteroaryl, C₃-C₁₂ cycloalkyl or C₃-C₁₂ cycloheteroalkyl or -(CH₂)_x-C₃-C₁₂ cycloalkyl or -(CH₂)_x-C₃-C₁₂ cycloheteroalkyl;

R₁ is selected from H, alkyl, aryl, heteraryl, COR₁; and

R₂ is selected from H, alkyl, aryl, heteraryl, COR₁, and further, R₁ and R₂ can form a C₃-C₁₂ cycloalkyl or C₃-C₁₂ cycloheteroalkyl containing O, N or S; or a pharmaceutically acceptable salt thereof, or a pharmaceutically acceptable derivative thereof.

Also disclosed is a compound for use as a medicament for treating acute megakaryoblastic leukemia, 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, CF₃, halogen, CN, alkyl, aryl, heteroaryl, NR₁R₂, COR₁R₂, CR₁R₂, S(O)₀₋₂NR₁R₂; or S(O)₀₋₂R₁R₂;

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

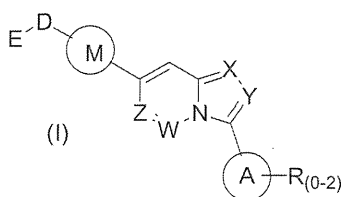
D is selected from a bond, O, CR₁R₂ or NH or NR₁ or NR₁R₂ or S(O)₀₋₂R₁R₂;

E is selected from H, CF₃, halogen, CN, alkyl, aryl, heteroaryl, C₃-C₁₂ cycloalkyl or C₃-C₁₂ cycloheteroalkyl or -(CH₂)_x-C₃-C₁₂ cycloalkyl or -(CH₂)_x-C₃-C₁₂ cycloheteroalkyl;

R₁ is selected from H, alkyl, aryl, heteraryl, COR₁; and

R₂ is selected from H, alkyl, aryl, heteraryl, COR₁, and further, R₁ and R₂ can form a C₃-C₁₂ cycloalkyl or C₃-C₁₂ cycloheteroalkyl containing O, N or S; or a pharmaceutically acceptable salt thereof, or a pharmaceutically acceptable derivative thereof.

Also disclosed is a compound for use as a medicament 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):



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, CF₃, halogen, CN, alkyl, aryl, heteroaryl, NR₁R₂, COR₁R₂, CR₁R₂, S(O)₀₋₂NR₁R₂; or S(O)₀₋₂R₁R₂;

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

D is selected from a bond, O, CR₁R₂ or NH or NR₁ or NR₁R₂ or S(O)₀₋₂R₁R₂;

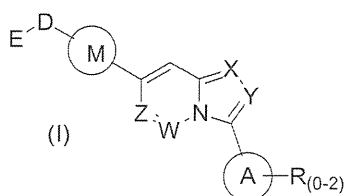
E is selected from H, CF₃, halogen, CN, alkyl, aryl, heteroaryl, C₃-C₁₂ cycloalkyl or C₃-C₁₂ cycloheteroalkyl or -(CH₂)_x-C₃-C₁₂ cycloalkyl or -(CH₂)_x-C₃-C₁₂ cycloheteroalkyl;

R₁ is selected from H, alkyl, aryl, heteraryl, COR₁; and

R₂ is selected from H, alkyl, aryl, heteraryl, COR₁, and further, R₁ and R₂ can form a C₃-C₁₂ cycloalkyl or C₃-C₁₂ cycloheteroalkyl containing O, N or S; or a pharmaceutically acceptable salt thereof, or a pharmaceutically acceptable derivative thereof.

Also disclosed is a compound for use as a medicament 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):



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, CF₃, halogen, CN, alkyl, aryl, heteroaryl, NR₁R₂, COR₁R₂, CR₁R₂, S(O)₀₋₂NR₁R₂; or S(O)₀₋₂R₁R₂;

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

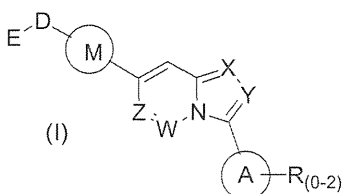
D is selected from a bond, O, CR₁R₂ or NH or NR₁ or NR₁R₂ or S(O)₀₋₂R₁R₂;

E is selected from H, CF₃, halogen, CN, alkyl, aryl, heteroaryl, C₃-C₁₂ cycloalkyl or C₃-C₁₂ cycloheteroalkyl or -(CH₂)_x-C₃-C₁₂ cycloalkyl or -(CH₂)_x-C₃-C₁₂ cycloheteroalkyl;

R₁ is selected from H, alkyl, aryl, heteraryl, COR₁; and

R₂ is selected from H, alkyl, aryl, heteraryl, COR₁, and further, R₁ and R₂ can form a C₃-C₁₂ cycloalkyl or C₃-C₁₂ cycloheteroalkyl containing O, N or S; or a pharmaceutically acceptable salt thereof, or a pharmaceutically acceptable derivative thereof.

Also disclosed is 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, CF₃, halogen, CN, alkyl, aryl, heteroaryl, NR₁R₂, COR₁R₂, CR₁R₂, S(O)₀₋₂NR₁R₂; or S(O)₀₋₂R₁R₂;

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

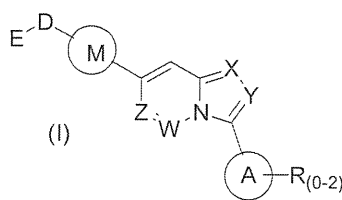
D is selected from a bond, O, CR₁R₂ or NH or NR₁ or NR₁R₂ or S(O)₀₋₂R₁R₂;

E is selected from H, CF₃, halogen, CN, alkyl, aryl, heteroaryl, C₃-C₁₂ cycloalkyl or C₃-C₁₂ cycloheteroalkyl or -(CH₂)_x-C₃-C₁₂ cycloalkyl or -(CH₂)_x-C₃-C₁₂ cycloheteroalkyl;

R₁ is selected from H, alkyl, aryl, heteraryl, COR₁; and

R₂ is selected from H, alkyl, aryl, heteraryl, COR₁, and further, R₁ and R₂ can form a C₃-C₁₂ cycloalkyl or C₃-C₁₂ cycloheteroalkyl containing O, N or S; or a pharmaceutically acceptable salt thereof, or a pharmaceutically acceptable derivative thereof.

Also disclosed are also disclosed are compounds and compositions that comprises the compounds disclosed herein. The compounds disclosed herein include those having a structure represented by the 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, CF₃, halogen, CN, alkyl, aryl, heteroaryl, NR₁R₂, COR₁R₂, CR₁R₂, S(O)₀₋₂NR₁R₂; S(O)₀₋₂R₁R₂;

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

D is selected from a bond, O, CR₁R₂ or NH or NR₁ or NR₁R₂ or S(O)₀₋₂R₁R₂;

E is selected from H, CF₃, halogen, CN, alkyl, aryl, heteroaryl, C₃-C₁₂ cycloalkyl or C₃-C₁₂ cycloheteroalkyl or -(CH₂)_x-C₃-C₁₂ cycloalkyl or -(CH₂)_x-C₃-C₁₂ cycloheteroalkyl;

R₁ is selected from H, alkyl, aryl, heteraryl, COR₁; and

R₂ is selected from H, alkyl, aryl, heteraryl, COR₁, and further, R₁ and R₂ can form a C₃-C₁₂ cycloalkyl or C₃-C₁₂ cycloheteroalkyl containing O, N or S; or a pharmaceutically acceptable salt thereof, or a pharmaceutically acceptable derivative thereof.

Other embodiments of the present invention include a compound for use as a medicament for treating at least one of myocardial ischemic injury, retinopathy of prematurity, diabetic retinopathy, and wet macular degeneration, aortic valve calcification

(both native and prosthetic), vascular calcification, diabetic nephropathy and renal fibrosis, hereditary spastic paraplegias, dystrophic phenotype in Duchenne Muscular Dystrophy, inflammatory bowel disease, childhood leukemias, cancer metastasis by targeting lymphatics and primary tumor growth; and methods of promoting liver regeneration and healing following acute injury, including hepatotoxin exposure such as Tylenol overdose.

Additional advantages of the invention will be set forth in part in the description which follows, and in part will be obvious from the description, or can be learned by practice of the invention. The advantages of the invention will be realized and attained by means of the elements and combinations particularly pointed out in the appended claims. It is to be understood that both the foregoing general description and the following detailed description are exemplary and explanatory only and are not restrictive of the invention, as claimed.

DESCRIPTION

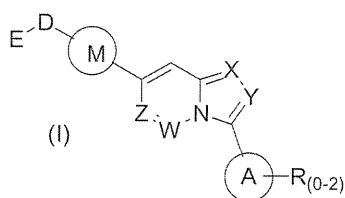
The present invention can be understood more readily by reference to the following detailed description of the invention and the Examples included therein.

Before the present compounds, compositions, articles, systems, devices, and/or methods are disclosed and described, it is to be understood that they are not limited to specific synthetic methods unless otherwise specified, or to particular reagents unless otherwise specified, as such may, of course, vary. It is also to be understood that the terminology used herein is for the purpose of describing particular aspects only and is not intended to be limiting. Although any methods and materials similar or equivalent to those described herein can be used in the practice or testing of the present invention, example methods and materials are now described.

All publications mentioned herein are incorporated herein by reference to disclose and describe the methods and/or materials in connection with which the publications are cited. The publications discussed herein are provided solely for their disclosure prior to the filing date of the present application. Nothing herein is to be construed as an admission that the present invention is not entitled to antedate such publication by virtue of prior invention. Further, the dates of publication provided herein can be different from the actual publication dates, which need to be independently confirmed.

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):



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, CF₃, halogen, CN, alkyl, aryl, heteroaryl, NR₁R₂, COR₁R₂, CR₁R₂, S(O)₀₋₂NR₁R₂; or S(O)₀₋₂R₁R₂;

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

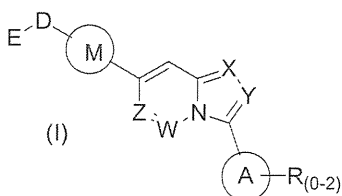
D is selected from a bond, O, CR₁R₂ or NH or NR₁ or NR₁R₂ or S(O)₀₋₂R₁R₂;

E is selected from H, CF₃, halogen, CN, alkyl, aryl, heteroaryl, C₃-C₁₂ cycloalkyl or C₃-C₁₂ cycloheteroalkyl or -(CH₂)_x-C₃-C₁₂ cycloalkyl or -(CH₂)_x-C₃-C₁₂ cycloheteroalkyl;

R₁ is selected from H, alkyl, aryl, heteraryl, or COR₁; and

R₂ is selected from H, alkyl, aryl, heteraryl, COR₁, and further, R₁ and R₂ can form a C₃-C₁₂ cycloalkyl or C₃-C₁₂ 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):



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, CF₃, halogen, CN, alkyl, aryl, heteroaryl, NR₁R₂, COR₁R₂, CR₁R₂, S(O)₀₋₂NR₁R₂; or S(O)₀₋₂R₁R₂;

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

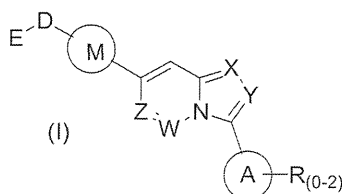
D is selected from a bond, O, CR₁R₂ or NH or NR₁ or NR₁R₂ or S(O)₀₋₂R₁R₂;

E is selected from H, CF₃, halogen, CN, alkyl, aryl, heteroaryl, C₃-C₁₂ cycloalkyl or C₃-C₁₂ cycloheteroalkyl or -(CH₂)_x-C₃-C₁₂ cycloalkyl or -(CH₂)_x-C₃-C₁₂ cycloheteroalkyl;

R₁ is selected from H, alkyl, aryl, heteraryl, or COR₁; and

R₂ is selected from H, alkyl, aryl, heteraryl, COR₁, and further, R₁ and R₂ can form a C₃-C₁₂ cycloalkyl or C₃-C₁₂ 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):



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, CF₃, halogen, CN, alkyl, aryl, heteroaryl, NR₁R₂, COR₁R₂, CR₁R₂, S(O)₀₋₂NR₁R₂; or S(O)₀₋₂R₁R₂;

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

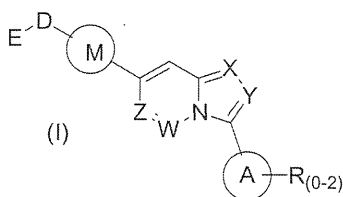
D is selected from a bond, O, CR₁R₂ or NH or NR₁ or NR₁R₂ or S(O)₀₋₂R₁R₂;

E is selected from H, CF₃, halogen, CN, alkyl, aryl, heteroaryl, C₃-C₁₂ cycloalkyl or C₃-C₁₂ cycloheteroalkyl or -(CH₂)_x-C₃-C₁₂ cycloalkyl or -(CH₂)_x-C₃-C₁₂ cycloheteroalkyl;

R₁ is selected from H, alkyl, aryl, heteraryl, or COR₁; and

R₂ is selected from H, alkyl, aryl, heteraryl, COR₁, and further, R₁ and R₂ can form a C₃-C₁₂ cycloalkyl or C₃-C₁₂ 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):



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, CF₃, halogen, CN, alkyl, aryl, heteroaryl, NR₁R₂, COR₁R₂, CR₁R₂, S(O)₀₋₂NR₁R₂; or S(O)₀₋₂R₁R₂;

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

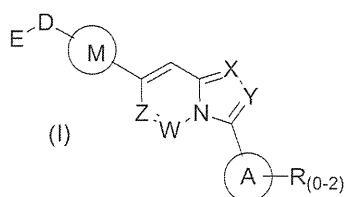
D is selected from a bond, O, CR₁R₂ or NH or NR₁ or NR₁R₂ or S(O)₀₋₂R₁R₂;

E is selected from H, CF₃, halogen, CN, alkyl, aryl, heteroaryl, C₃-C₁₂ cycloalkyl or C₃-C₁₂ cycloheteroalkyl or -(CH₂)_x-C₃-C₁₂ cycloalkyl or -(CH₂)_x-C₃-C₁₂ cycloheteroalkyl;

R₁ is selected from H, alkyl, aryl, heteraryl, or COR₁; and

R₂ is selected from H, alkyl, aryl, heteraryl, COR₁, and further, R₁ and R₂ can form a C₃-C₁₂ cycloalkyl or C₃-C₁₂ 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):



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, CF₃, halogen, CN, alkyl, aryl, heteroaryl, NR₁R₂, COR₁R₂, CR₁R₂, S(O)₀₋₂NR₁R₂; or S(O)₀₋₂R₁R₂;

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

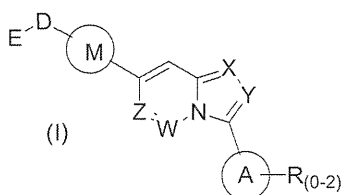
D is selected from a bond, O, CR₁R₂ or NH or NR₁ or NR₁R₂ or S(O)₀₋₂R₁R₂;

E is selected from H, CF₃, halogen, CN, alkyl, aryl, heteroaryl, C₃-C₁₂ cycloalkyl or C₃-C₁₂ cycloheteroalkyl or -(CH₂)_x-C₃-C₁₂ cycloalkyl or -(CH₂)_x-C₃-C₁₂ cycloheteroalkyl;

R₁ is selected from H, alkyl, aryl, heteraryl, or COR₁; and

R₂ is selected from H, alkyl, aryl, heteraryl, COR₁, and further, R₁ and R₂ can form a C₃-C₁₂ cycloalkyl or C₃-C₁₂ 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):



wherein:

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

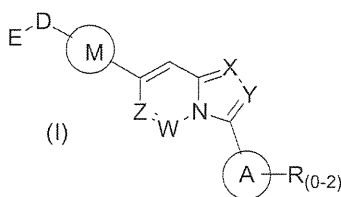
A is substituted or unsubstituted and selected from cycloalkyl, heterocycloalkyl, aryl or heteroaryl;

R is selected from H, CF₃, halogen, CN, alkyl, aryl, heteroaryl, NR₁R₂, COR₁R₂, CR₁R₂, S(O)₀₋₂NR₁R₂; or S(O)₀₋₂R₁R₂;

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

D is selected from a bond, O, CR₁R₂ or NH or NR₁ or NR₁R₂ or S(O)₀₋₂R₁R₂;

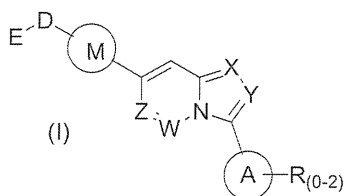
7. A compound for use as a medicament for treating pathologic bone function, the compound having a structure represented by the following formula (I):



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

R₂ is selected from H, alkyl, aryl, heteraryl, COR₁, and further, R₁ and R₂ can form a C₃-C₁₂ cycloalkyl or C₃-C₁₂ 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, CF₃, halogen, CN, alkyl, aryl, heteroaryl, NR₁R₂, COR₁R₂, CR₁R₂, S(O)₀₋₂NR₁R₂; or S(O)₀₋₂R₁R₂;

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

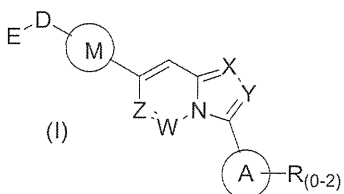
D is selected from a bond, O, CR₁R₂ or NH or NR₁ or NR₁R₂ or S(O)₀₋₂R₁R₂;

E is selected from H, CF₃, halogen, CN, alkyl, aryl, heteroaryl, C₃-C₁₂ cycloalkyl or C₃-C₁₂ cycloheteroalkyl or -(CH₂)_x-C₃-C₁₂ cycloalkyl or -(CH₂)_x-C₃-C₁₂ cycloheteroalkyl;

R₁ is selected from H, alkyl, aryl, heteraryl, or COR₁; and

R₂ is selected from H, alkyl, aryl, heteraryl, COR₁, and further, R₁ and R₂ can form a C₃-C₁₂ cycloalkyl or C₃-C₁₂ 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;

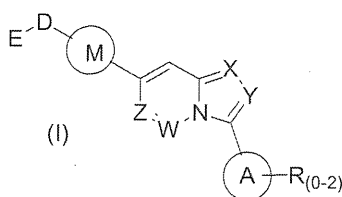
R is selected from H, CF₃, halogen, CN, alkyl, aryl, heteroaryl, NR₁R₂, COR₁R₂, CR₁R₂, S(O)₀₋₂NR₁R₂; or S(O)₀₋₂R₁R₂;

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

D is selected from a bond, O, CR₁R₂ or NH or NR₁ or NR₁R₂ or S(O)₀₋₂R₁R₂;

E is selected from H, CF₃, halogen, CN, alkyl, aryl, heteroaryl, C₃-C₁₂ cycloalkyl or C₃-C₁₂ cycloheteroalkyl or -(CH₂)_x-C₃-C₁₂ cycloalkyl or -(CH₂)_x-C₃-C₁₂ cycloheteroalkyl;
R₁ is selected from H, alkyl, aryl, heteraryl, or COR₁; and
R₂ is selected from H, alkyl, aryl, heteraryl, COR₁, and further, R₁ and R₂ can form a C₃-C₁₂ cycloalkyl or C₃-C₁₂ 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):



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, CF₃, halogen, CN, alkyl, aryl, heteroaryl, NR₁R₂, COR₁R₂, CR₁R₂, S(O)₀₋₂NR₁R₂; or S(O)₀₋₂R₁R₂;

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

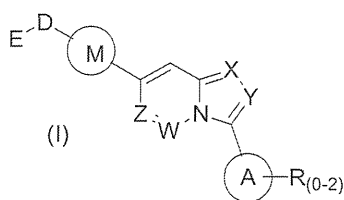
D is selected from a bond, O, CR₁R₂ or NH or NR₁ or NR₁R₂ or S(O)₀₋₂R₁R₂;

E is selected from H, CF₃, halogen, CN, alkyl, aryl, heteroaryl, C₃-C₁₂ cycloalkyl or C₃-C₁₂ cycloheteroalkyl or -(CH₂)_x-C₃-C₁₂ cycloalkyl or -(CH₂)_x-C₃-C₁₂ cycloheteroalkyl;

R₁ is selected from H, alkyl, aryl, heteraryl, or COR₁; and

R₂ is selected from H, alkyl, aryl, heteraryl, COR₁, and further, R₁ and R₂ can form a C₃-C₁₂ cycloalkyl or C₃-C₁₂ 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):



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, CF₃, halogen, CN, alkyl, aryl, heteroaryl, NR₁R₂, COR₁R₂, CR₁R₂, S(O)₀₋₂NR₁R₂; or S(O)₀₋₂R₁R₂;

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

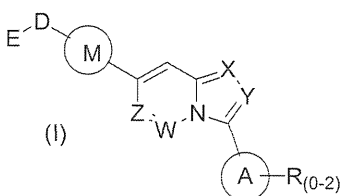
D is selected from a bond, O, CR₁R₂ or NH or NR₁ or NR₁R₂ or S(O)₀₋₂R₁R₂;

E is selected from H, CF₃, halogen, CN, alkyl, aryl, heteroaryl, C₃-C₁₂ cycloalkyl or C₃-C₁₂ cycloheteroalkyl or -(CH₂)_x-C₃-C₁₂ cycloalkyl or -(CH₂)_x-C₃-C₁₂ cycloheteroalkyl;

R₁ is selected from H, alkyl, aryl, heteraryl, or COR₁; and

R₂ is selected from H, alkyl, aryl, heteraryl, COR₁, and further, R₁ and R₂ can form a C₃-C₁₂ cycloalkyl or C₃-C₁₂ 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):



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, CF₃, halogen, CN, alkyl, aryl, heteroaryl, NR₁R₂, COR₁R₂, CR₁R₂, S(O)₀₋₂NR₁R₂; or S(O)₀₋₂R₁R₂;

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

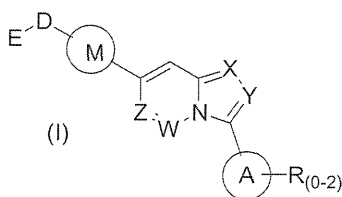
D is selected from a bond, O, CR₁R₂ or NH or NR₁ or NR₁R₂ or S(O)₀₋₂R₁R₂;

E is selected from H, CF₃, halogen, CN, alkyl, aryl, heteroaryl, C₃-C₁₂ cycloalkyl or C₃-C₁₂ cycloheteroalkyl or -(CH₂)_x-C₃-C₁₂ cycloalkyl or -(CH₂)_x-C₃-C₁₂ cycloheteroalkyl;

R₁ is selected from H, alkyl, aryl, heteraryl, or COR₁; and

R₂ is selected from H, alkyl, aryl, heteraryl, COR₁, and further, R₁ and R₂ can form a C₃-C₁₂ cycloalkyl or C₃-C₁₂ 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):



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, CF₃, halogen, CN, alkyl, aryl, heteroaryl, NR₁R₂, COR₁R₂, CR₁R₂, S(O)₀₋₂NR₁R₂; or S(O)₀₋₂R₁R₂;

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

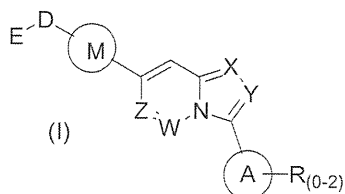
D is selected from a bond, O, CR₁R₂ or NH or NR₁ or NR₁R₂ or S(O)₀₋₂R₁R₂;

E is selected from H, CF₃, halogen, CN, alkyl, aryl, heteroaryl, C₃-C₁₂ cycloalkyl or C₃-C₁₂ cycloheteroalkyl or -(CH₂)_x-C₃-C₁₂ cycloalkyl or -(CH₂)_x-C₃-C₁₂ cycloheteroalkyl;

R₁ is selected from H, alkyl, aryl, heteraryl, or COR₁; and

R₂ is selected from H, alkyl, aryl, heteraryl, COR₁, and further, R₁ and R₂ can form a C₃-C₁₂ cycloalkyl or C₃-C₁₂ 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, CF₃, halogen, CN, alkyl, aryl, heteroaryl, NR₁R₂, COR₁R₂, CR₁R₂, S(O)₀₋₂NR₁R₂; or S(O)₀₋₂R₁R₂;

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

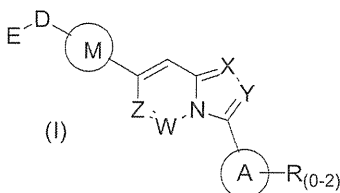
D is selected from a bond, O, CR₁R₂ or NH or NR₁ or NR₁R₂ or S(O)₀₋₂R₁R₂;

E is selected from H, CF₃, halogen, CN, alkyl, aryl, heteroaryl, C₃-C₁₂ cycloalkyl or C₃-C₁₂ cycloheteroalkyl or -(CH₂)_x-C₃-C₁₂ cycloalkyl or -(CH₂)_x-C₃-C₁₂ cycloheteroalkyl;

R₁ is selected from H, alkyl, aryl, heteraryl, or COR₁; and

R₂ is selected from H, alkyl, aryl, heteraryl, COR₁, and further, R₁ and R₂ can form a C₃-C₁₂ cycloalkyl or C₃-C₁₂ cycloheteroalkyl containing O, N or S; or a pharmaceutically acceptable salt thereof, or a pharmaceutically acceptable derivative thereof.

15. A 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;

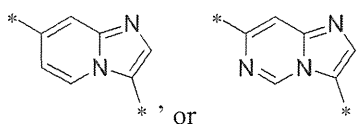
R is selected from H, CF₃, halogen, CN, alkyl, aryl, heteroaryl, NR₁R₂, COR₁R₂, CR₁R₂, S(O)₀₋₂NR₁R₂; or S(O)₀₋₂R₁R₂;

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

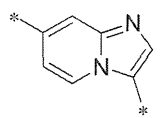
D is selected from a bond, O, CR₁R₂ or NH or NR₁ or NR₁R₂ or S(O)₀₋₂R₁R₂;

E is selected from H, CF₃, halogen, CN, alkyl, aryl, heteroaryl, C₃-C₁₂ cycloalkyl or C₃-C₁₂ cycloheteroalkyl or -(CH₂)_x-C₃-C₁₂ cycloalkyl or -(CH₂)_x-C₃-C₁₂ cycloheteroalkyl;
R₁ is selected from H, alkyl, aryl, heteraryl, or COR₁; and
R₂ is selected from H, alkyl, aryl, heteraryl, COR₁, and further, R₁ and R₂ can form a C₃-C₁₂ cycloalkyl or C₃-C₁₂ cycloheteroalkyl containing O, N or S; or a pharmaceutically acceptable salt thereof, or a pharmaceutically acceptable derivative thereof.

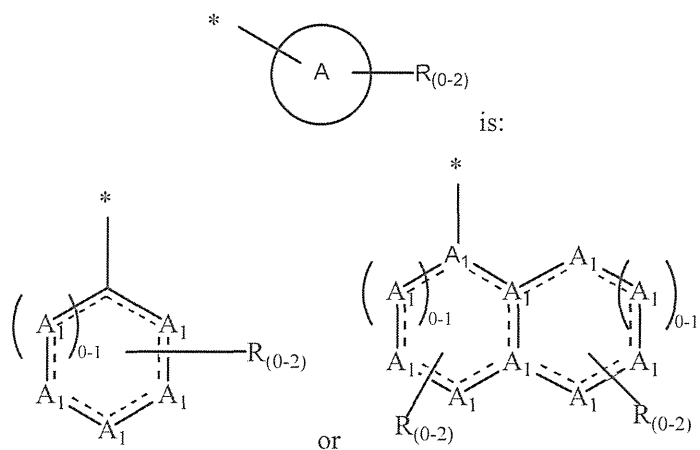
16. A compound of claim 15, wherein W, X, Y and Z together help form:



17. A compound of claim 15, wherein W, X, Y and Z together help form:



18. A compound of claim 15, wherein



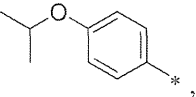
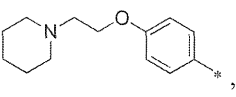
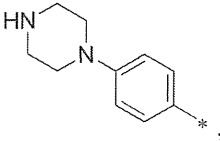
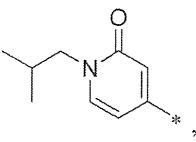
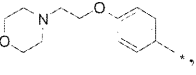
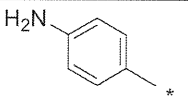
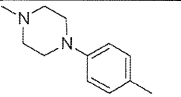
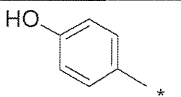
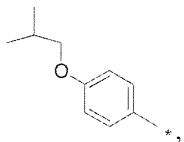
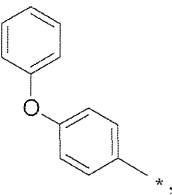
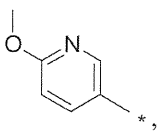
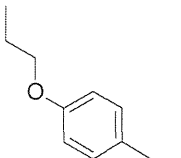
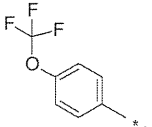
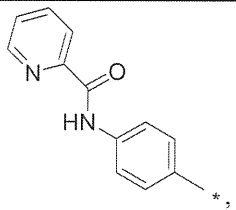
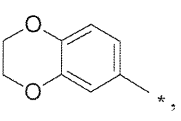
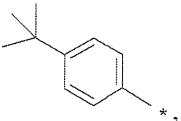
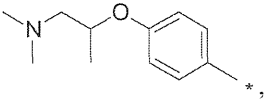
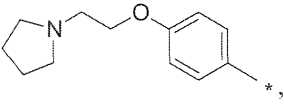
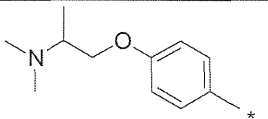
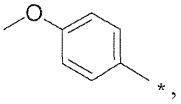
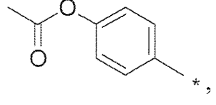
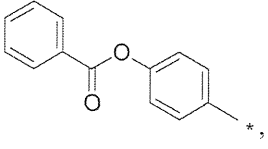
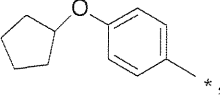
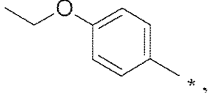
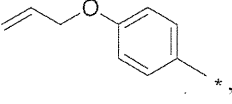
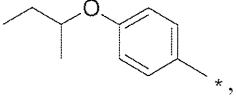
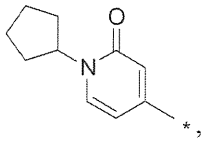
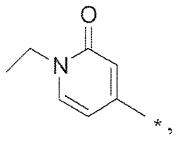
wherein A₁ is independently O, CR₁R₂ or NH or NR₁ or NR₁R₂, or can join with another A₁ to form C₃-C₁₂ cycloalkyl or C₃-C₁₂ cycloalkenyl or aryl or heteroaryl or C₃-C₁₂ heterocycloalkyl or C₃-C₁₂ heterocycloalkenyl or 3-8 membered ring comprising C, O, S, and/or N.

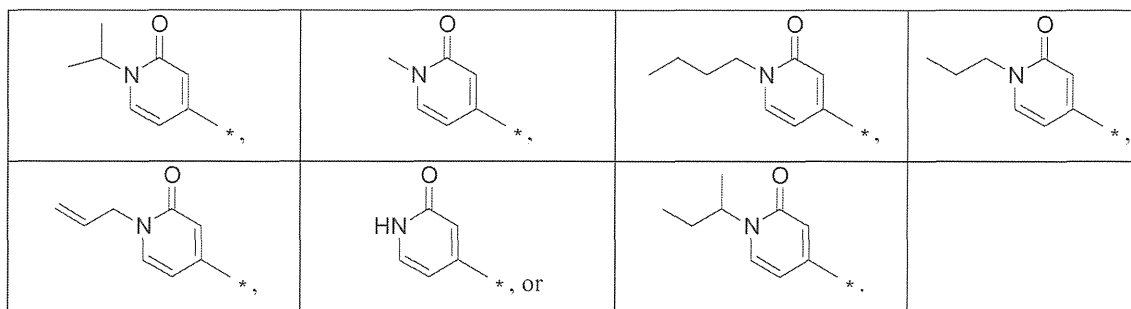
19. A compound of claim 15, wherein M is optionally substituted with one or more R, and is selected from C₃-C₁₂ cycloalkyl or C₃-C₁₂ cycloalkenyl or aryl or heteroaryl or C₃-C₁₂

heterocycloalkyl or C₃-C₁₂ heterocycloalkenyl or 3-8 membered ring comprising C, O, S, and/or N.

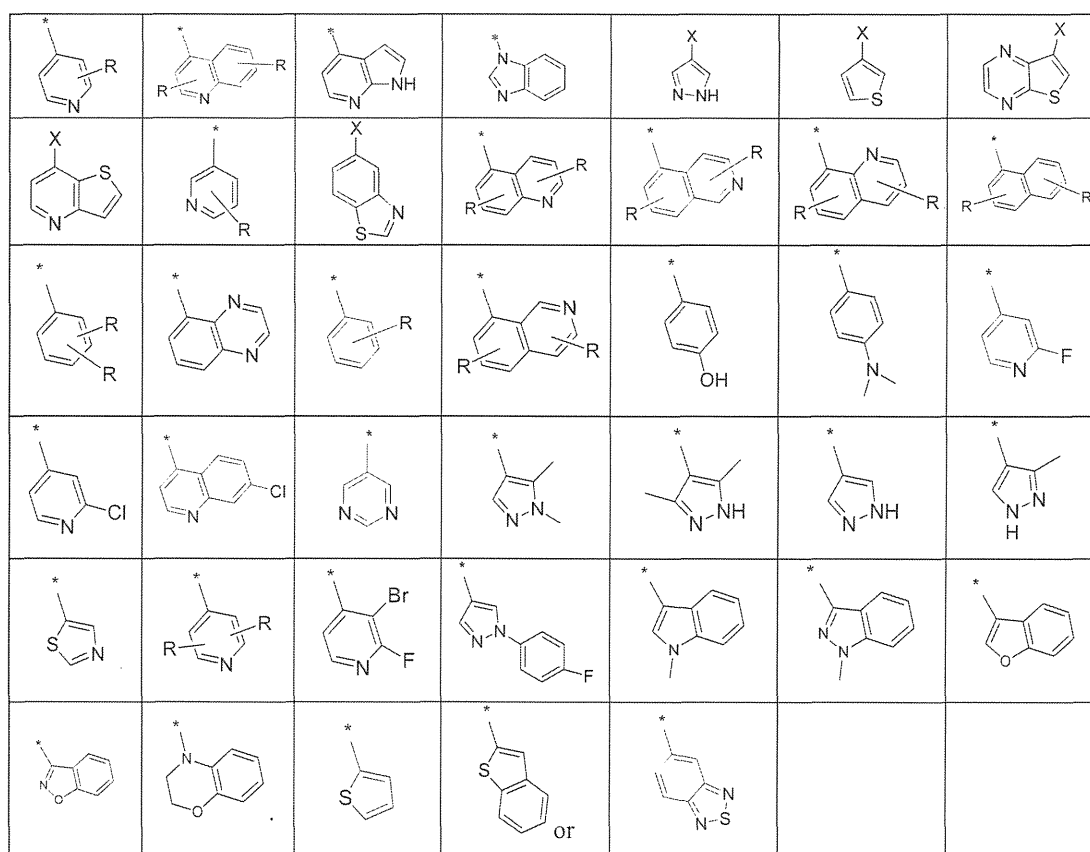
20. A compound of claim 19, wherein M is optionally substituted phenyl or pyridine.

21. A compound of claim 15, wherein M, D, and E together form:

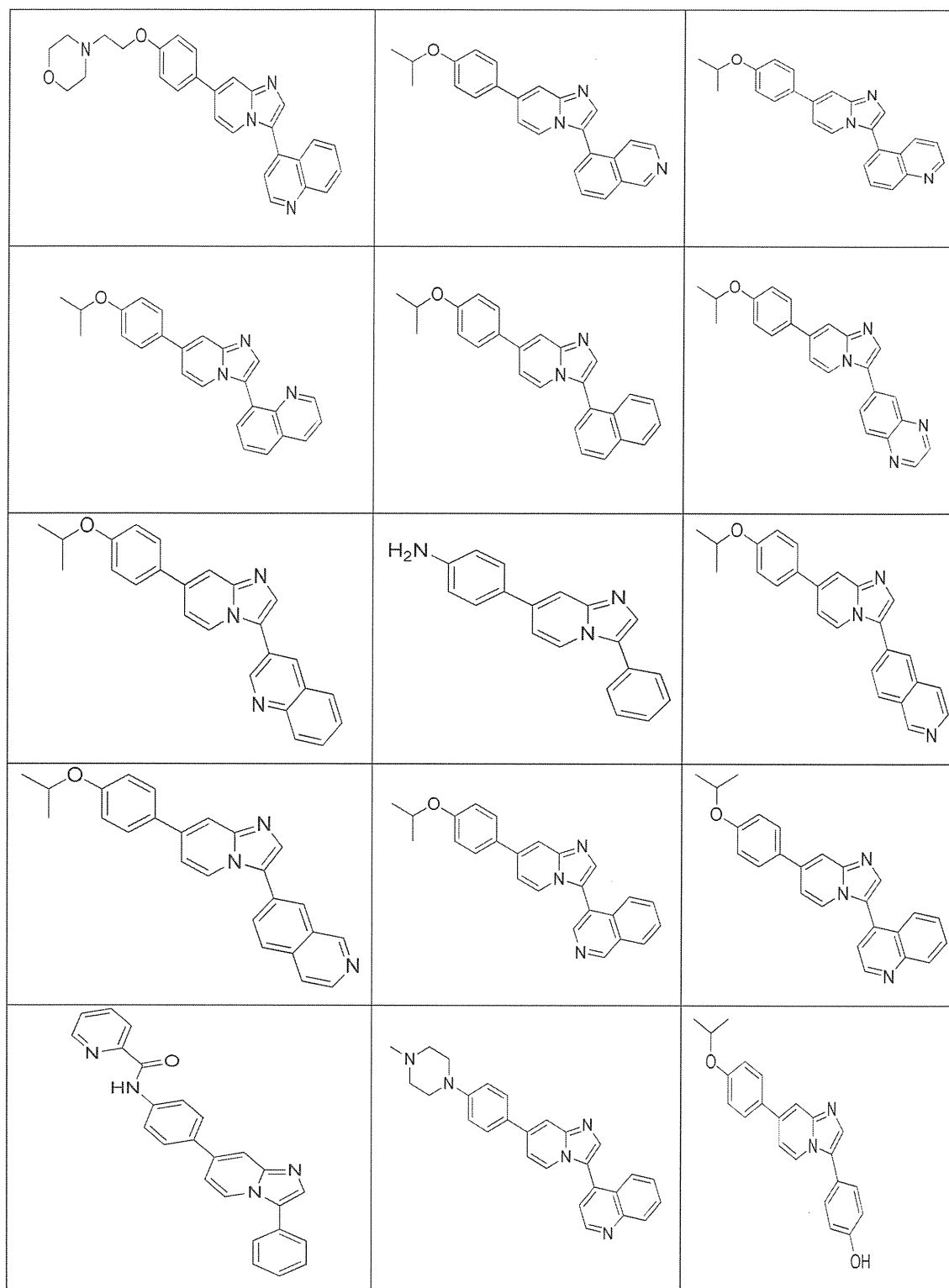
			
			
			
			
			
			
			

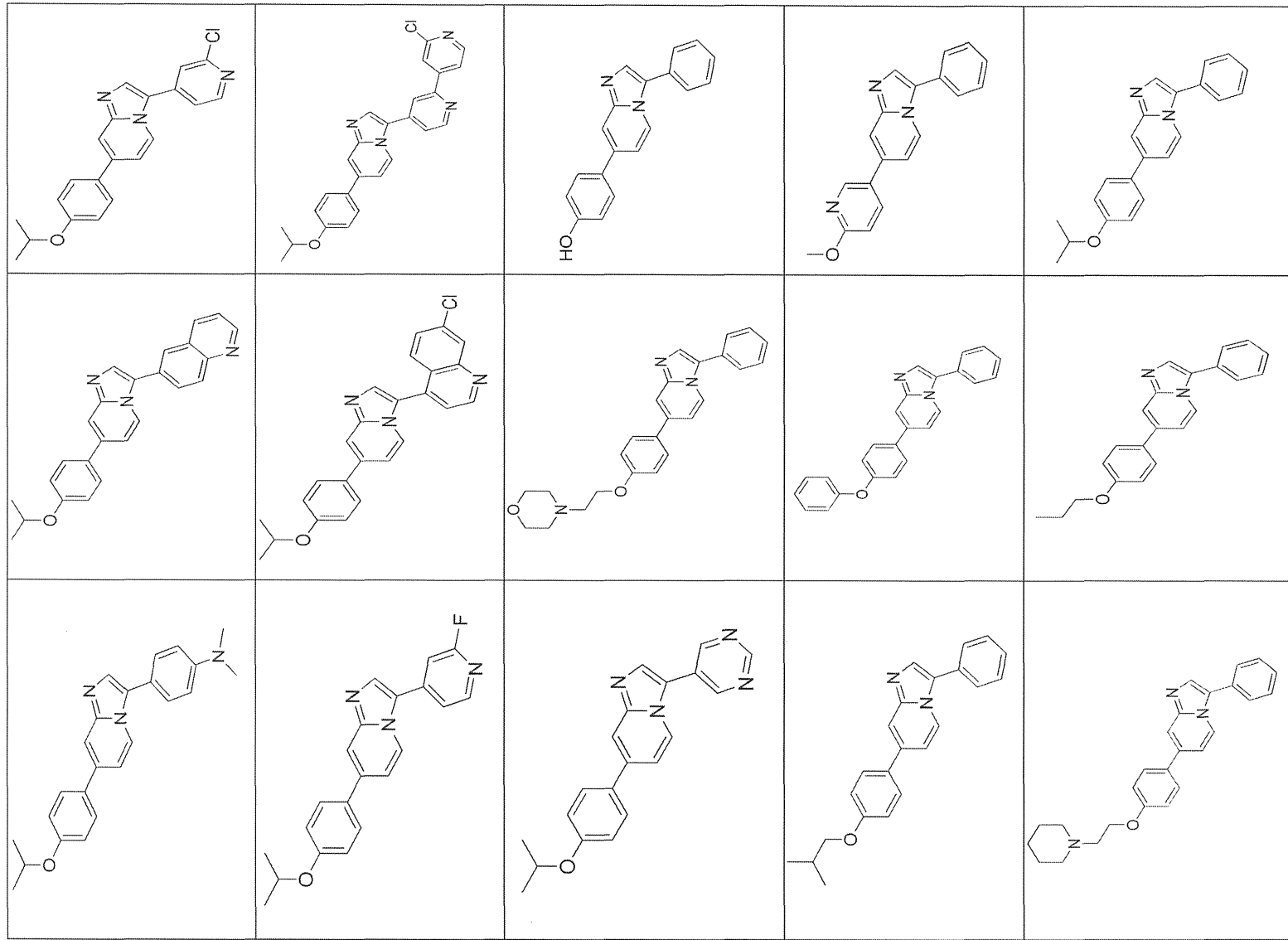


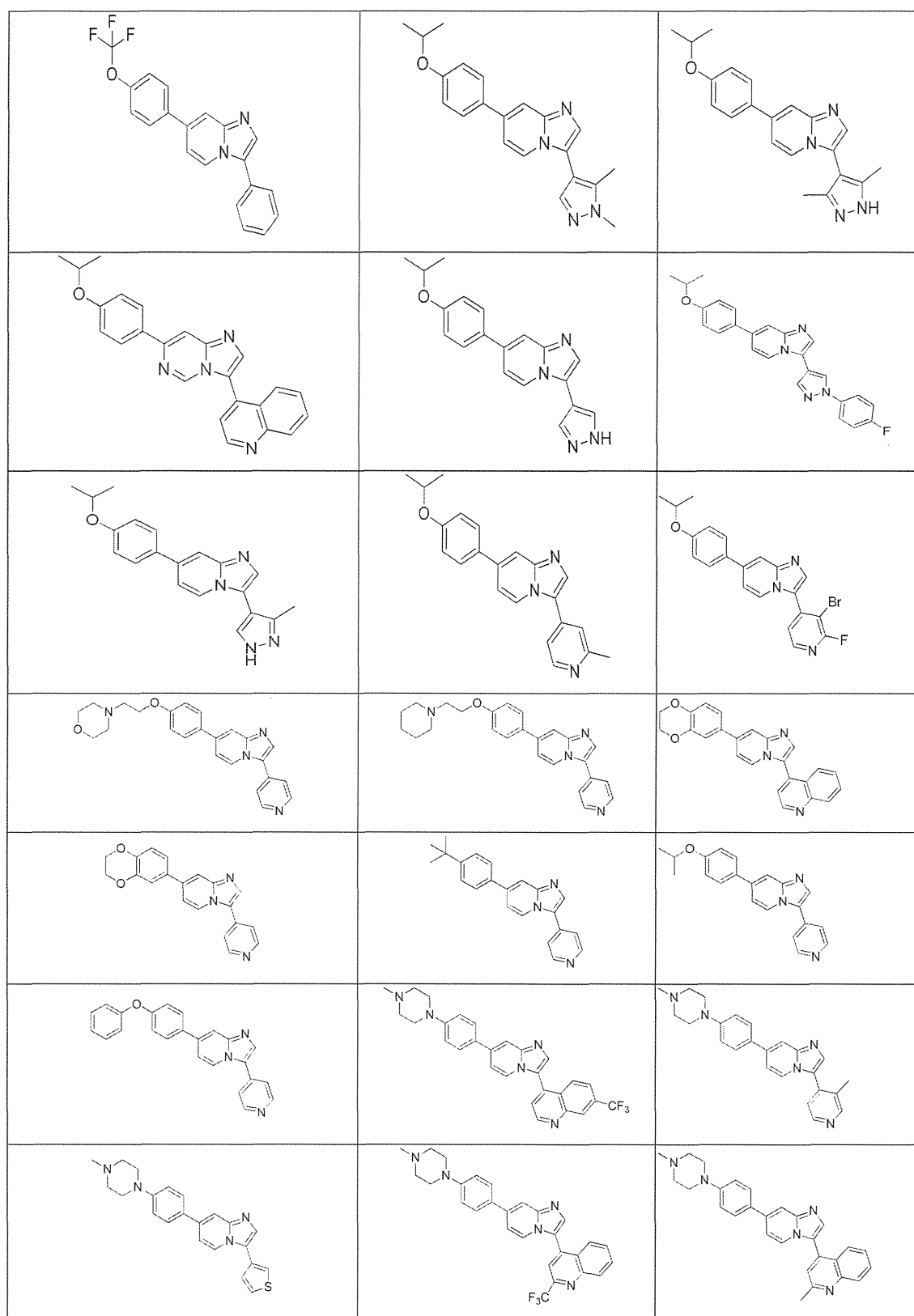
22. A compound of claim 15, wherein A is chosen from the following:

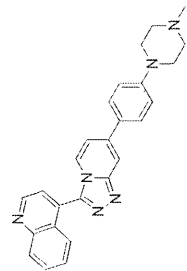
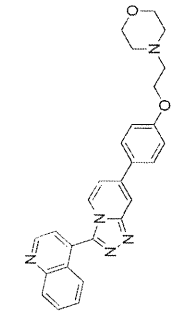
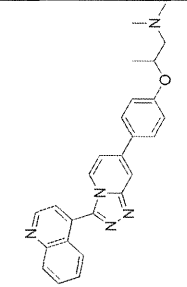
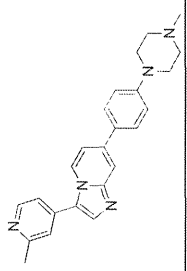
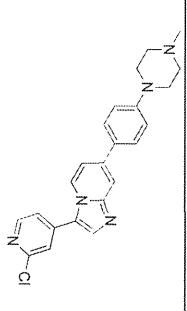
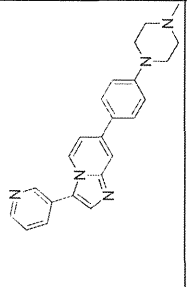
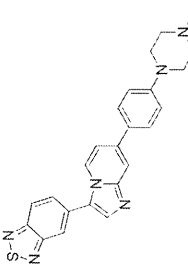
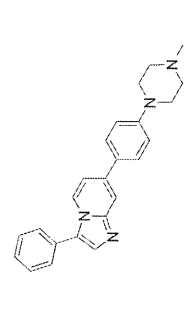
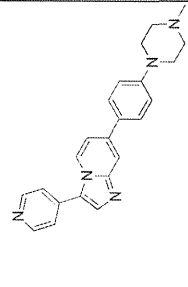
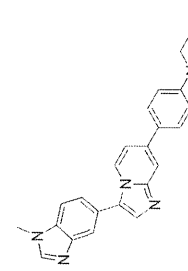
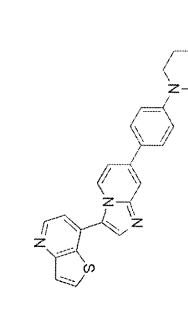
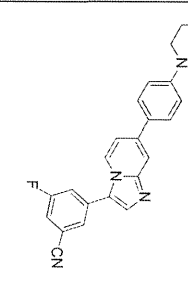
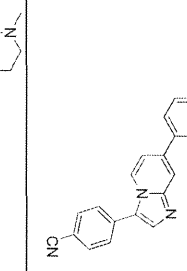
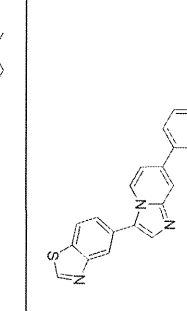
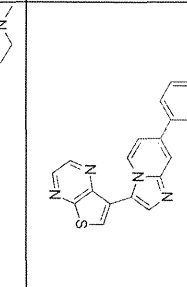
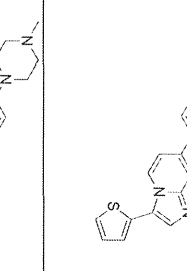
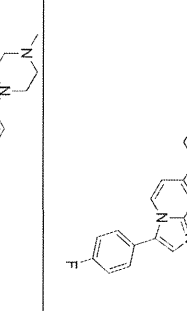
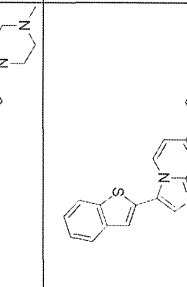
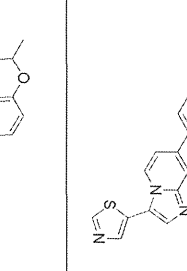
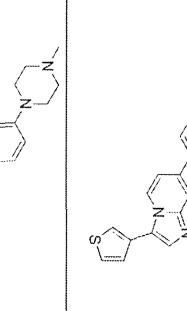
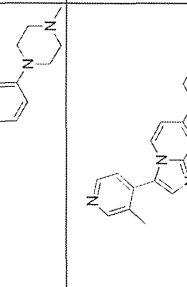


23. A compound of claim 15, wherein the compound is of the following formula:

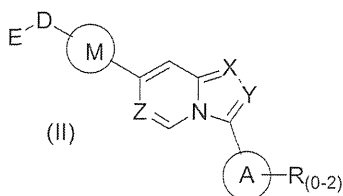






24. A compound having a structure represented by the following formula (II):



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, CF₃, halogen, CN, alkyl, aryl, heteroaryl, NR₁R₂, COR₁R₂, CR₁R₂, S(O)₀₋₂NR₁R₂; or S(O)₀₋₂R₁R₂;

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

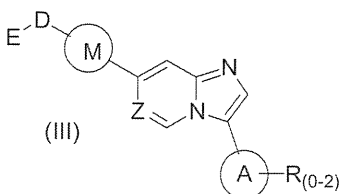
D is selected from a bond, O, CR₁R₂ or NH or NR₁ or NR₁R₂ or S(O)₀₋₂R₁R₂;

E is selected from H, CF₃, halogen, CN, alkyl, aryl, heteroaryl, C₃-C₁₂ cycloalkyl or C₃-C₁₂ cycloheteroalkyl or -(CH₂)_x-C₃-C₁₂ cycloalkyl or -(CH₂)_x-C₃-C₁₂ cycloheteroalkyl;

R₁ is selected from H, alkyl, aryl, heteraryl, or COR₁; and

R₂ is selected from H, alkyl, aryl, heteraryl, COR₁, and further, R₁ and R₂ can form a C₃-C₁₂ cycloalkyl or C₃-C₁₂ 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):



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, CF₃, halogen, CN, alkyl, aryl, heteroaryl, NR₁R₂, COR₁R₂, CR₁R₂, S(O)₀₋₂NR₁R₂; or S(O)₀₋₂R₁R₂;

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

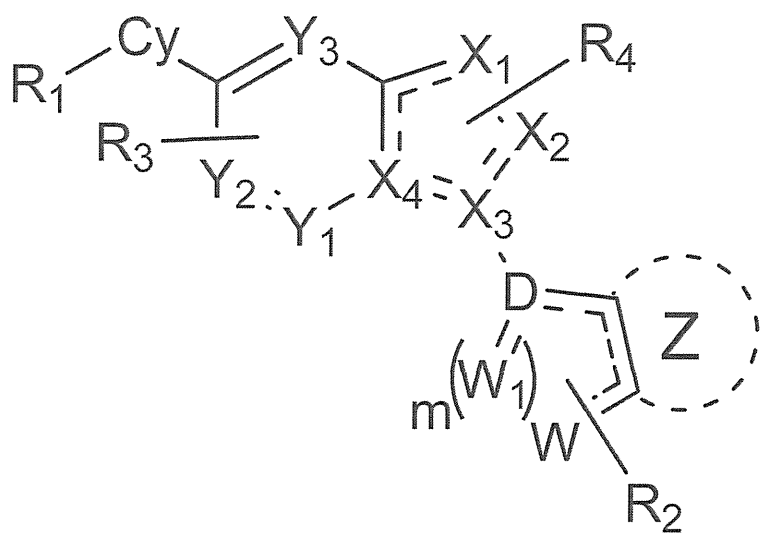
D is selected from a bond, O, CR₁R₂ or NH or NR₁ or NR₁R₂ or S(O)₀₋₂R₁R₂;

E is selected from H, CF₃, halogen, CN, alkyl, aryl, heteroaryl, C₃-C₁₂ cycloalkyl or C₃-C₁₂ cycloheteroalkyl or -(CH₂)_x-C₃-C₁₂ cycloalkyl or -(CH₂)_x-C₃-C₁₂ cycloheteroalkyl;

R₁ is selected from H, alkyl, aryl, heteraryl, or COR₁; and

R₂ is selected from H, alkyl, aryl, heteraryl, COR₁, and further, R₁ and R₂ can form a C₃-C₁₂ cycloalkyl or C₃-C₁₂ cycloheteroalkyl containing O, N or S; or a pharmaceutically acceptable salt thereof, or a pharmaceutically acceptable derivative thereof.

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



wherein:

X₁ is N, O, or CR₁;

X₂, and X₄ are independently N or CR₁;

X₃ is C or N;

Y₁, Y₂, and Y₃ are independently N or CR₁;

D is C or N;

W is N or O;

W₁ is N, O or C;

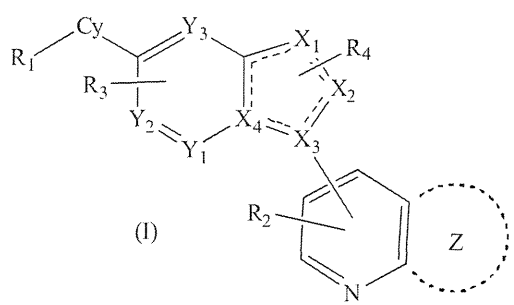
Cy is optionally substituted with one or more R₁, and is selected from C₃-C₁₂ cycloalkyl or C₃-C₁₂ cycloalkenyl or aryl or heteroaryl or C₃-C₁₂ heterocycloalkyl or C₃-C₁₂ heterocycloalkenyl or 3-8 membered ring comprising C, O, S, and/or N.

R₁-R₄ are independently selected from hydrogen, halogen, C₁₋₁₀ alkyl, C₃₋₁₀ cycloalkyl, OC₁₋₁₀ alkyl (which may contain a C₃₋₈ 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. 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;

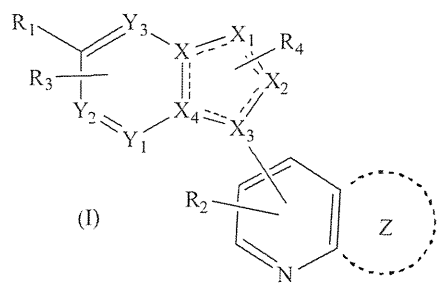
Y_1 , Y_2 , and Y_3 are independently N or CR_1 ;

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

X is N, O, or CR_1 ;

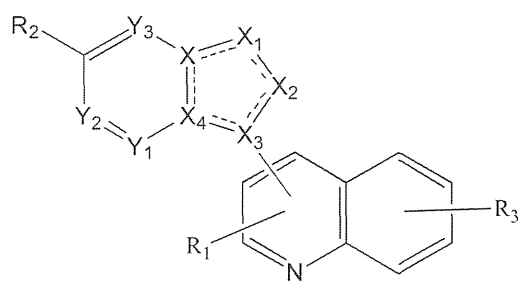
X_3 is C or N;

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

R_1 - R_4 are 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.

29. The compound of claim 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 ;

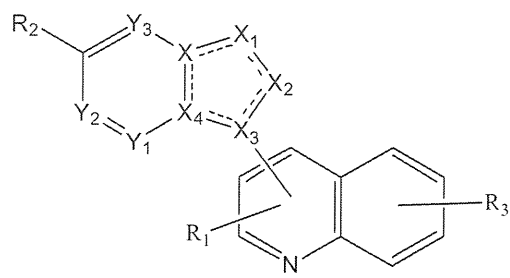
X is N, O, or CR_1 ;

X_3 is C or N;

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

R₁-R₄ are independently selected from hydrogen, halogen, C₁₋₁₀ alkyl, C₃₋₁₀ cycloalkyl, OC₁₋₁₀ alkyl (which may contain a C₃₋₈ membered ring containing C, O, S or N, optionally substituted with one or more R⁴), CN or CF₃;

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



wherein

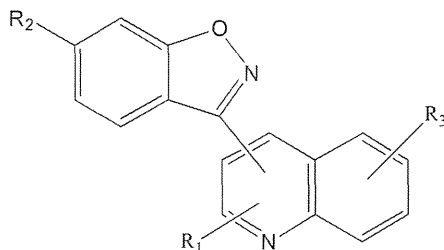
- (i) X₁ is O, X₂ is N, and X, X₃, X₄, Y₁, Y₂, and Y₃ are independently C or CR₁;
- (ii) X₁ is O, X₂ is N, Y₁ is N, and X, X₃, X₄, Y₂, and Y₃ are independently C or CR₁;
- (iii) X₁ is N, X₄ is N, and X₂, X₃, X₄, Y₁, Y₂, and Y₃ are independently C or CR₁;
- (iv) X₁ is N, X₂ is N, Y₁ is N, and X, X₃, X₄, Y₂, and Y₃ are independently C or CR₁;
- (v) X₁ is N, X₂ is N, Y₂ is N, and X, X₃, X₄, Y₂, and Y₃ are independently C or CR₁;

or

- (vi) X₁ is N, X₃ is N, and X₂, X₃, X₄, Y₁, Y₂, and Y₃ are independently C or CR₁;
- Y₁, Y₂, and Y₃ are independently N or CR₁;

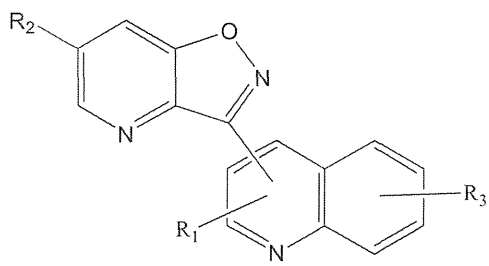
R₁-R₄ are independently selected from hydrogen, halogen, C₁₋₁₀ alkyl, C₃₋₁₀ cycloalkyl, OC₁₋₁₀ alkyl (which may contain a C₃₋₈ membered ring containing C, O, S or N, optionally substituted with one or more R⁴), CN or CF₃.

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



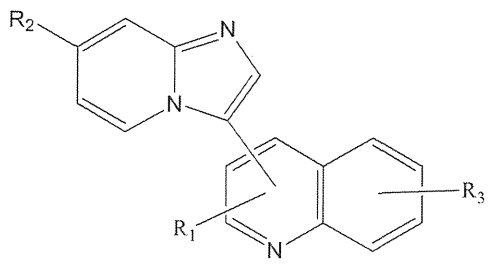
wherein R₁-R₄ are independently selected from hydrogen, halogen, C₁₋₁₀ alkyl, C₃₋₁₀ cycloalkyl, OC₁₋₁₀ alkyl (which may contain a C₃₋₈ membered ring containing C, O, S or N, optionally substituted with one or more R⁴), CN or CF₃.

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



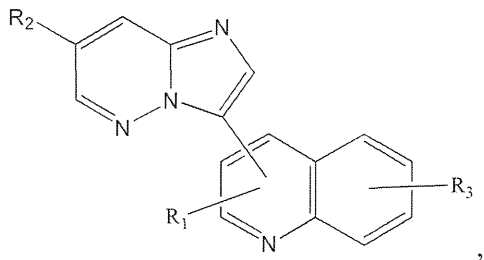
wherein R₁-R₄ are independently selected from hydrogen, halogen, C₁₋₁₀ alkyl, C₃₋₁₀ cycloalkyl, OC₁₋₁₀ alkyl (which may contain a C₃₋₈ membered ring containing C, O, S or N, optionally substituted with one or more R⁴), CN or CF₃.

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



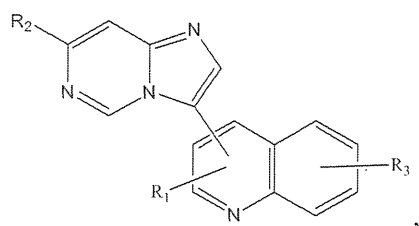
wherein R₁-R₄ are independently selected from hydrogen, halogen, C₁₋₁₀ alkyl, C₃₋₁₀ cycloalkyl, OC₁₋₁₀ alkyl (which may contain a C₃₋₈ membered ring containing C, O, S or N, optionally substituted with one or more R⁴), CN or CF₃.

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



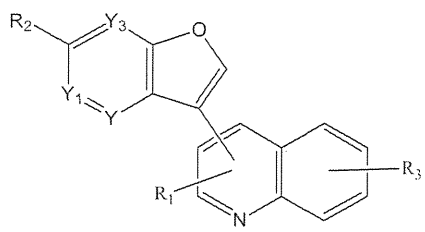
wherein R₁-R₄ are independently selected from hydrogen, halogen, C₁₋₁₀ alkyl, C₃₋₁₀ cycloalkyl, OC₁₋₁₀ alkyl (which may contain a C₃₋₈ membered ring containing C, O, S or N, optionally substituted with one or more R⁴), CN or CF₃.

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



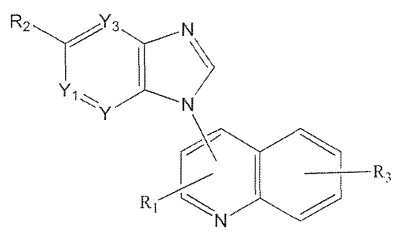
wherein R₁-R₄ are independently selected from hydrogen, halogen, C₁₋₁₀ alkyl, C₃₋₁₀ cycloalkyl, OC₁₋₁₀ alkyl (which may contain a C₃₋₈ membered ring containing C, O, S or N, optionally substituted with one or more R⁴), CN or CF₃.

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



wherein Y₁ and Y₃ are independently N or CR₁; R₁-R₄ are independently selected from hydrogen, halogen, C₁₋₁₀ alkyl, C₃₋₁₀ cycloalkyl, OC₁₋₁₀ alkyl (which may contain a C₃₋₈ membered ring containing C, O, S or N, optionally substituted with one or more R⁴), CN or CF₃.

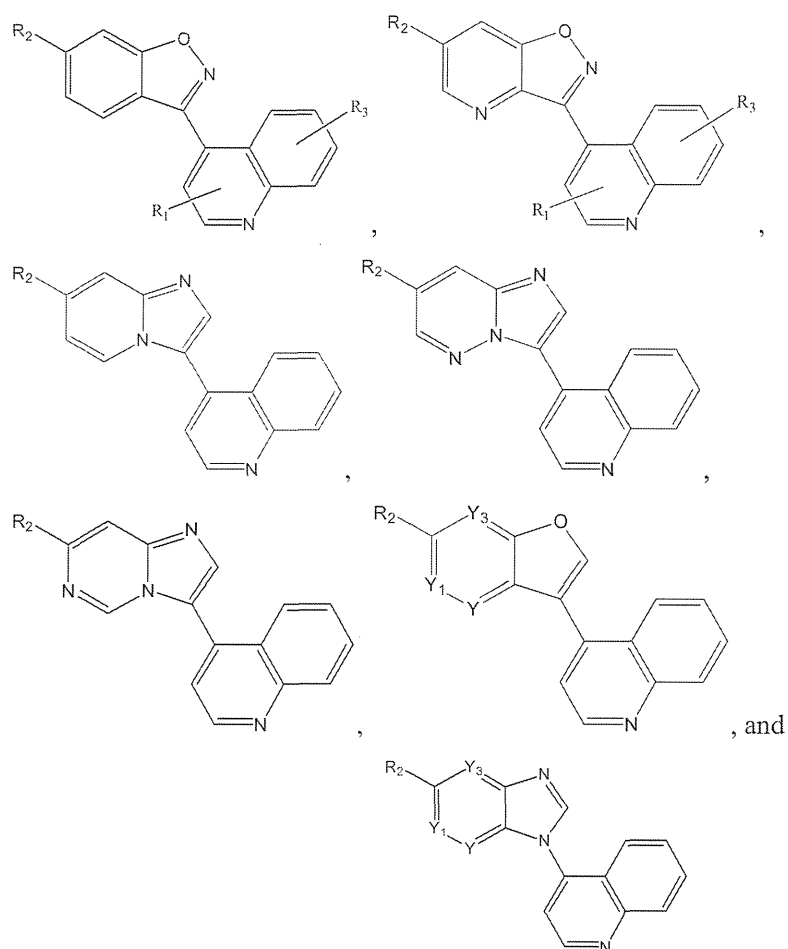
37. The compound of claim 28, wherein the compound is of the following formula:



wherein Y₁ and Y₃ are independently N or CR₁; R₁-R₄ are independently selected from hydrogen, halogen, C₁₋₁₀ alkyl, C₃₋₁₀ cycloalkyl, OC₁₋₁₀ alkyl (which may contain a C₃₋₈

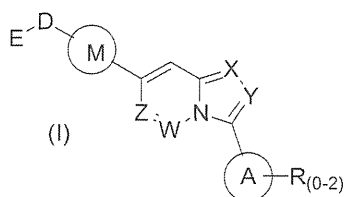
membered ring containing C, O, S or N, optionally substituted with one or more R⁴), CN or CF₃.

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



wherein Y₁ and Y₃ are independently N or CR₁; R₁-R₄ are independently selected from hydrogen, halogen, C₁₋₁₀ alkyl, C₃₋₁₀ cycloalkyl, OC₁₋₁₀ alkyl (which may contain a C₃₋₈ membered ring containing C, O, S or N, optionally substituted with one or more R⁴), CN or CF₃.

39. A compound for use as a medicament for treating acute megakaryoblastic leukemia, 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, CF₃, halogen, CN, alkyl, aryl, heteroaryl, NR₁R₂, COR₁R₂, CR₁R₂, S(O)₀₋₂NR₁R₂; or S(O)₀₋₂R₁R₂;

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

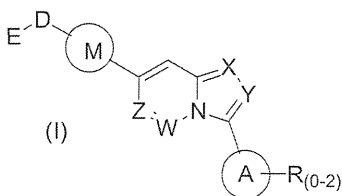
D is selected from a bond, O, CR₁R₂ or NH or NR₁ or NR₁R₂ or S(O)₀₋₂R₁R₂;

E is selected from H, CF₃, halogen, CN, alkyl, aryl, heteroaryl, C₃-C₁₂ cycloalkyl or C₃-C₁₂ cycloheteroalkyl or -(CH₂)_x-C₃-C₁₂ cycloalkyl or -(CH₂)_x-C₃-C₁₂ cycloheteroalkyl;

R₁ is selected from H, alkyl, aryl, heteraryl, or COR₁; and

R₂ is selected from H, alkyl, aryl, heteraryl, COR₁, and further, R₁ and R₂ can form a C₃-C₁₂ cycloalkyl or C₃-C₁₂ cycloheteroalkyl containing O, N or S; or a pharmaceutically acceptable salt thereof, or a pharmaceutically acceptable derivative thereof.

40. A compound 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):



wherein:

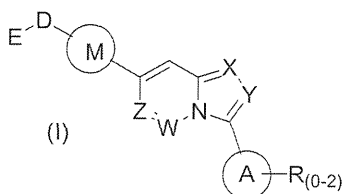
W, X, Y, and Z are independently N or CH;

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

R is selected from H, CF₃, halogen, CN, alkyl, aryl, heteroaryl, NR₁R₂, COR₁R₂, CR₁R₂, S(O)₀₋₂NR₁R₂; or S(O)₀₋₂R₁R₂;

M is substituted or unsubstituted and is selected from aryl or heteroaryl;
D is selected from a bond, O, CR₁R₂ or NH or NR₁ or NR₁R₂ or S(O)₀₋₂R₁R₂;
E is selected from H, CF₃, halogen, CN, alkyl, aryl, heteroaryl, C₃-C₁₂ cycloalkyl or C₃-C₁₂ cycloheteroalkyl or -(CH₂)_x-C₃-C₁₂ cycloalkyl or -(CH₂)_x-C₃-C₁₂ cycloheteroalkyl;
R₁ is selected from H, alkyl, aryl, heteraryl, or COR₁; and
R₂ is selected from H, alkyl, aryl, heteraryl, COR₁, and further, R₁ and R₂ can form a C₃-C₁₂ cycloalkyl or C₃-C₁₂ 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):



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, CF₃, halogen, CN, alkyl, aryl, heteroaryl, NR₁R₂, COR₁R₂, CR₁R₂, S(O)₀₋₂NR₁R₂; or S(O)₀₋₂R₁R₂;

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

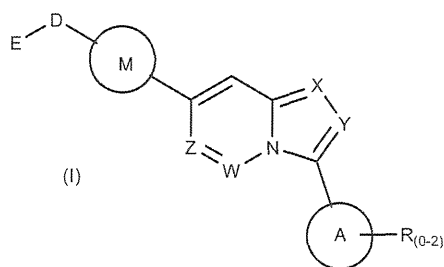
D is selected from a bond, O, CR₁R₂ or NH or NR₁ or NR₁R₂ or S(O)₀₋₂R₁R₂;

E is selected from H, CF₃, halogen, CN, alkyl, aryl, heteroaryl, C₃-C₁₂ cycloalkyl or C₃-C₁₂ cycloheteroalkyl or -(CH₂)_x-C₃-C₁₂ cycloalkyl or -(CH₂)_x-C₃-C₁₂ cycloheteroalkyl;

R₁ is selected from H, alkyl, aryl, heteraryl, or COR₁; and

R₂ is selected from H, alkyl, aryl, heteraryl, COR₁, and further, R₁ and R₂ can form a C₃-C₁₂ cycloalkyl or C₃-C₁₂ cycloheteroalkyl containing O, N or S; or a pharmaceutically acceptable salt thereof, or a pharmaceutically acceptable derivative thereof.

42. A method for modulating the BMP signaling pathway comprising *in vitro* administration to at least one cell an amount effective to modulate BMP signaling, the compound having a structure represented by the 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, CF₃, halogen, CN, alkyl, aryl, heteroaryl, NR₁R₂, COR₁R₂, CR₁R₂, S(O)₀₋₂NR₁R₂; or S(O)₀₋₂R₁R₂;

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

D is selected from a bond, O, CR₁R₂ or NH or NR₁ or NR₁R₂ or S(O)₀₋₂R₁R₂;

E is selected from H, CF₃, halogen, CN, alkyl, aryl, heteroaryl, C₃-C₁₂ cycloalkyl or C₃-C₁₂ cycloheteroalkyl or -(CH₂)_x-C₃-C₁₂ cycloalkyl or -(CH₂)_x-C₃-C₁₂ cycloheteroalkyl;

R₁ is selected from H, alkyl, aryl, heteraryl, or COR₁; and

R₂ is selected from H, alkyl, aryl, heteraryl, COR₁, and further, R₁ and R₂ can form a C₃-C₁₂ cycloalkyl or C₃-C₁₂ cycloheteroalkyl containing O, N or S; or a pharmaceutically acceptable salt thereof, or a pharmaceutically acceptable derivative thereof.

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

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

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

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

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