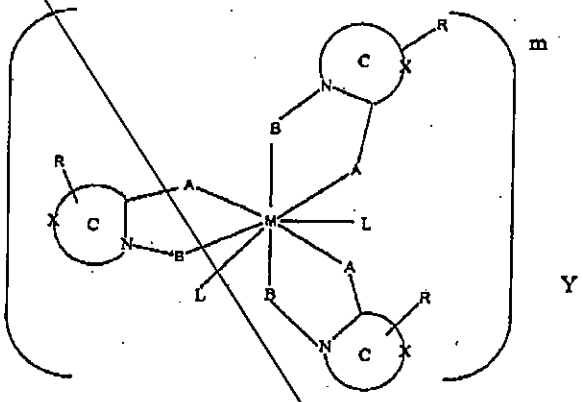
CLAIMS

What is claimed is:

1. A method of killing a cell comprising administering to the cell a compound of formula (I)

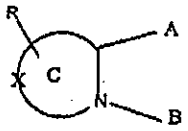


(I)

wherein

M is a lanthanide element;

C is a ring system of the formula:



the ring system comprising 5 to 8 main chain atoms, wherein the ring system can be fused to at least one 5- to 8-membered ring, wherein one or more of the atoms in the ring system can be substituted by a group X, wherein X is selected from the group consisting

of S, O, N, NH, NHR^4, SO or SO_2, and wherein one or more of the atoms in the ring system can carry a substituent R;

R is independently selected from the group consisting of hydrogen, hydroxyl, alkyl, alkylene, alkenyl, alkynyl, acyl, cycloalkyl, cycloalkenyl, substituted or unsubstituted aryl, substituted or unsubstituted heteroaryl, substituted or unsubstituted heteroalicyclyl, halogen, carbonyl, thiocarbonyl, O-carbamyl, O-thiocarbomyl, O-carboxy, isocyanato, thiocyanato, silyl, amino, mono- and di-substituted amino groups, perhaloalkyl, sulfonyl, sulfonamide, thio, $-CF_3$, -CO, -CN, -COOH, $-CONH_2$, -SH, -Se, $-SO_2$, -N=N, -N=O, and OCF_3;

A and B are electron donating units coordinated to M;

L is a complexing moiety;

m is +1, +2, +3 or +4; and

Y is an anion, or a combination of anions that balances m.

2. The method according to claim 1, wherein the cell killing is caspase- independent.

3. The method according to claim 1 or 2, wherein the cell is comprised in a mammal.

4. The method according to any one of claims 1 to 3, wherein the cell is cultured.

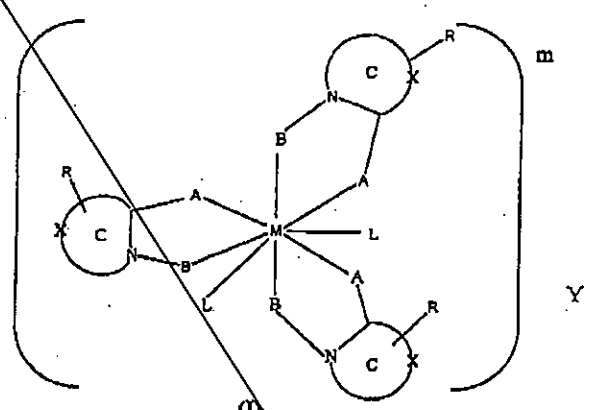
5. The method according to claim 4, wherein the cell is obtained from a mammal.

6. The method according to any one of claims 1 to 5, wherein the cell is a tumor cell.

7. The method according to claim 6, wherein the tumor cell is derived from a cancer selected from a group consisting of breast cancer, lung cancer, brain cancer,

neuroblastoma, colon cancer, rectal cancer, bladder cancer, liver tumor, a pancreatic tumor, ovarian cancer, prostate cancer and melanoma.

8. A method of treating a mammal having cancer comprising administering to the mammal a compound of formula (I)



(I)

wherein

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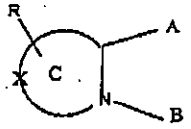

the ring system comprising 5 to 8 main chain atoms, wherein the ring system can be fused to at least one 5- to 8-membered ring, wherein one or more of the atoms in the ring system can be substituted by a group X, wherein X is selected from the group consisting of S, O, N, NH, NHR^4, SO or SO_2, and wherein one or more of the atoms in the ring system can carry a substituent R;

R is independently selected from the group consisting of hydrogen, hydroxyl, alkyl, alkylene, alkenyl, alkynyl, acyl, cycloalkyl, cycloalkenyl, substituted or unsubstituted aryl, substituted or unsubstituted heteroaryl, substituted or unsubstituted heteroalicyclyl, halogen, carbonyl, thiocarbonyl, O-carbamyl, O-thiocarbomyl, O-carboxy, isocyanato, thiocyanato, silyl, amino, mono- and di-substituted amino groups, perhaloalkyl, sulfonyl, sulfonamide, thio, $-CF_3$, -CO, -CN, -COOH, $-CONH_2$, -SH, -Se, $-SO_2$, -N=N, -N=O, and OCF_3;

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Y is an anion, or a combination of anions that balances m.

9. The method according to claim 8, wherein the cancer is selected from a group consisting of breast cancer, lung cancer, brain cancer, neuroblastoma, colon cancer, rectal cancer, bladder cancer, liver tumor, a pancreatic tumor, ovarian cancer, prostate cancer and melanoma.

10. A method of treating a mammal having diabetes comprising administering to the mammal a compound of formula (I)

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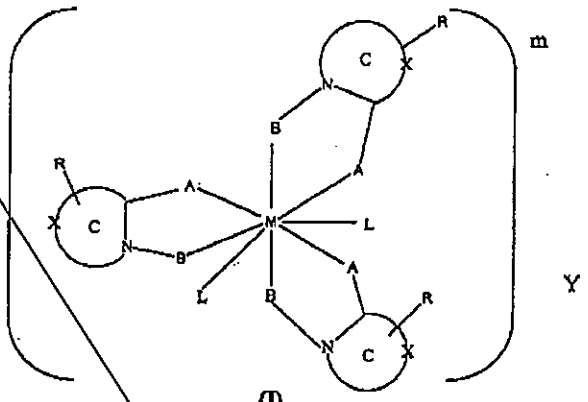

(I)

wherein

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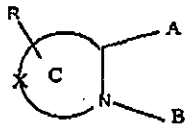
C is a ring system of the formula:



the ring system comprising 5 to 8 main chain atoms, wherein the ring system can be fused to at least one 5- to 8-membered ring, wherein one or more of the atoms in the ring system can be substituted by a group X, wherein X is selected from the group consisting of S, O, N, NH, NHR^4, SO or SO_2, and wherein one or more of the atoms in the ring system can carry a substituent R;

R is independently selected from the group consisting of hydrogen, hydroxyl, alkyl, alkylene, alkenyl, alkynyl, acyl, cycloalkyl, cycloalkenyl, substituted or unsubstituted aryl, substituted or unsubstituted heteroaryl, substituted or unsubstituted heteroalicyclyl, halogen, carbonyl, thiocarbonyl, O-carbamyl, O-thiocarbomyl, O-carboxy, isocyanato,

thiocyanato, silyl, amino, mono- and di-substituted amino groups, perhaloalkyl, sulfonyl, sulfonamide, thio, $-CF_3$, -CO, -CN, -COOH, $-CONH_2$, -SH, -Se, $-SO_2$, -N=N, -N=O, and OCF_3;

A and B are electron donating units coordinated to M;

L is a complexing moiety;

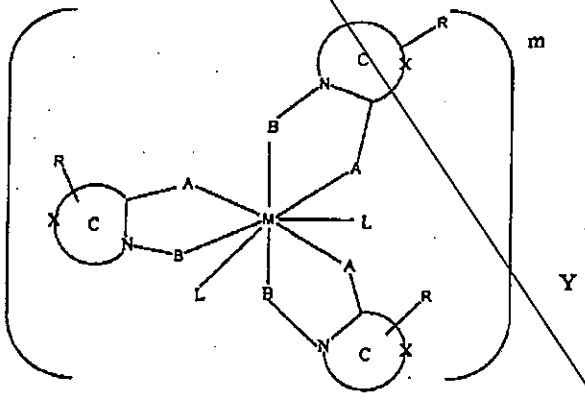
m is +1, +2, +3 or +4; and

Y is an anion, or a combination of anions that balances m.

11. The method according to any one of claims 3, 5 or 8 to 10, wherein the mammal is selected from the group consisting of a rat, a cow, a goat, a sheep, a pig, a dog, a mouflon, a guinea pig, a hamster, a chimpanzee, a rhesus monkey and a human.

12. A pharmaceutical composition, comprising:

(a) a compound of formula (I)



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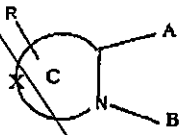

the ring system comprising 5 to 8 main chain atoms, wherein the ring system can be fused to at least one 5- to 8-membered ring, wherein one or more of the atoms in the ring system can be substituted by a group X, wherein X is selected from the group consisting of S, O, N, NH, NHR^4, SO or SO_2, and wherein one or more of the atoms in the ring system can carry a substituent R;

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A and B are electron donating units coordinated to M;

L is a complexing moiety;

m is +1, +2, +3 or +4; and

Y is an anion, or a combination of anions that balances m;

and

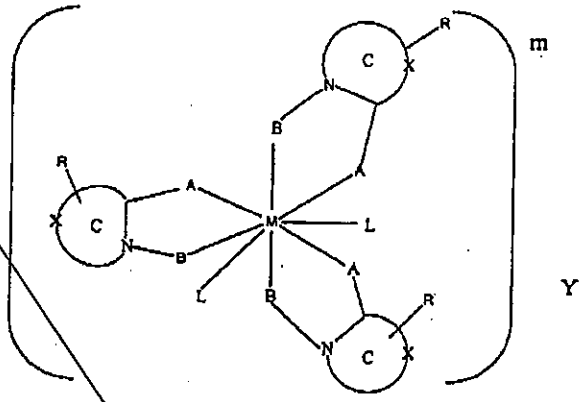
(b) a carrier or diluent.

13. The pharmaceutical composition according to claim 12, wherein the compound is praseodymium(2-mercaptopyridine N-oxide)(dimethyl sulfoxide).

14. The pharmaceutical composition according to claim 12 to 13, further comprising at least one of a nucleic acid alkylator, a nucleoside analogue, an anthracycline, an antibiotic, an aromatase inhibitor, a folate antagonist, an estrogen receptor modulator, an inorganic aresenate, a microtubule inhibitor, a nitrosourea, an osteoclast inhibitor, a platinum containing compound, a retinoid, a topoisomerase 1 inhibitor, a topoisomerase 2 inhibitor, a thymidylate synthase inhibitor, an aromatase inhibitor, a cyclo-oxygenase inhibitor, an isoflavone, a tyrosine kinase inhibitor, a growth factor, a bisphosphonate, and a monoclonal antibody.

15. A method of treating a mammal having cancer or diabetes mellitus comprising administering to the mammal the pharmaceutical composition according to any one of claims 12 to 14.

16. A method of modulating the expression of a PPAR-γ target protein in a cell, the method comprising contacting the cell with a compound of formula (I)



(I)

wherein

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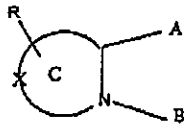
C is a ring system of the formula:



the ring system comprising 5 to 8 main chain atoms, wherein the ring system can be fused to at least one 5- to 8-membered ring, wherein one or more of the atoms in the ring system can be substituted by a group X, wherein X is selected from the group consisting of S, O, N, NH, NHR^4, SO or SO_2, and wherein one or more of the atoms in the ring system can carry a substituent R;

R is independently selected from the group consisting of hydrogen, hydroxyl, alkyl, alkylene, alkenyl, alkynyl, acyl, cycloalkyl, cycloalkenyl, substituted or unsubstituted aryl, substituted or unsubstituted heteroaryl, substituted or unsubstituted heteroalicyclyl, halogen, carbonyl, thiocarbonyl, O-carbamyl, O-thiocarbomyl, O-carboxy, isocyanato, thiocyanato, silyl, amino, mono- and di-substituted amino groups, perhaloalkyl, sulfonyl,

sulfonamide, thio, $-CF_3$, -CO, -CN, -COOH, $-CONH_2$, -SH, -Se, $-SO_2$, -N=N, -N=O, and OCF_3;

A and B are electron donating units coordinated to M;

L is a complexing moiety;

m is +1, +2, +3 or +4; and

Y is an anion, or a combination of anions that balances m.

17. The method according to claim 16, wherein the modulating comprises increasing or decreasing the expression of the PPAR-γ target protein.

18. The method according to claim 16 or 17, wherein the PPAR-γ target protein is selected from the group consisting of phosphotase and tensin homologue (PTEN), manganese superoxide dismutase (MnSOD) and Ras homolog gene family, member B (RhoB).

19. The method according to claim 18, wherein the amount of PTEN and RhoB are increased.

20. The method according to claim 18, wherein the amount of MnSOD is decreased.

21. The method according to any one of claims 16 to 20, wherein the method is carried out *in vitro* or *in vivo*.

22. The method according to any one of claims 16 to 21, wherein the cell is a tumor cell.

23. The method according to claim 22, wherein the tumor cell is derived from a cancer selected from the group consisting of breast cancer, lung cancer, brain cancer, neuroblastoma, colon cancer, rectal cancer, bladder cancer, liver tumor, a pancreatic tumor, ovarian cancer, prostate cancer and melanoma.

24. A method of identifying a candidate compound capable of preventing, inhibiting, arresting or reversing tumourigenesis in a cell and/or inducing apoptosis in a tumour cell, the method comprising introducing the compound into a cell capable of expressing a PPAR-γ target protein, and determining the expression of the PPAR-γ target protein, wherein an altered/modulated expression of the PPAR-γ target protein is an indication that the compound is capable of preventing, inhibiting, arresting or reversing tumourigenesis in a cell and/or inducing apoptosis in a tumor cell.

25. The method according to claim 24, further comprising comparing the obtained results with those of a control measurement.

26. The methods according to claim 25, wherein the control measurement comprises the use of a compound that does not alter/modulate the expression of the PPAR-γ target protein.

27. The method according to any one of claims 24 to 26, wherein PPAR-γ target protein is selected from the group consisting of PTEN, MnSOD and RhoB.

28. The method according to claim 27, wherein the amount of PTEN and RhoB are increased.

29. The method according to claim 27, wherein the amount of RhoB is decreased.

30. A method of identifying a candidate compound capable of activating a PPAR-γ receptor protein in a cell, the method comprising introducing the compound into a cell expressing PTEN, MnSOD and RhoB, and determining the expression of PTEN, MnSOD

and RhoB, wherein an increased expression of PTEN and RhoB and a decreased expression of RhoB is an indication that the compound is capable of activating the PPAR-γ receptor protein.

31. The pharmaceutical composition according to any one of claims 12 to 14 for use in treating diabetes mellitus.

CLAIMS

What is claimed is:

1. A pharmaceutical composition comprising
    (a) praseodymium(2-mercaptopyridine N-oxide)(dimethyl sulfoxide);
    (b) a carrier or diluent; and
    (c) an estrogen receptor modulator.