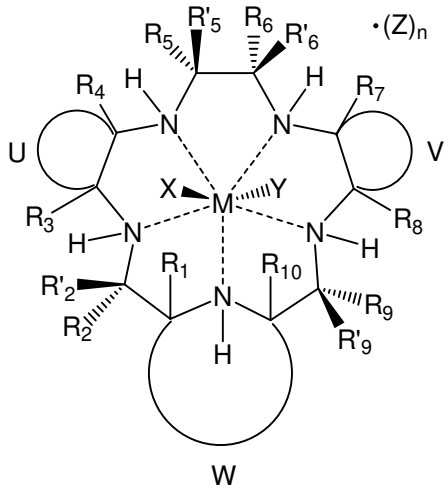
WHAT IS CLAIMED IS:

1. A method of reducing the risk of carcinogenesis associated with excessive radiation exposure in a mammalian subject, the method comprising:

administering to the mammalian subject a therapeutically effective amount of a pentaaza macrocyclic ring complex corresponding to the Formula (I) below:



(I)

wherein

M is Mn^{2+} or Mn^{3+};

R_1, R_2, R'_2, R_3, R_4, R_5, R'_5, R_6, R'_6, R_7, R_8, R_9, R'_9, and R_{10} are independently hydrogen, hydrocarbyl, substituted hydrocarbyl, heterocyclyl, an amino acid side chain moiety, or a moiety selected from the group consisting of $-OR_{11}$, $-NR_{11}R_{12}$, $-COR_{11}$, $-CO_2R_{11}$, $-CONR_{11}R_{12}$, $-SR_{11}$, $-SOR_{11}$, $-SO_2R_{11}$, $-SO_2NR_{11}R_{12}$, $-N(OR_{11})(R_{12})$, $-P(O)(OR_{11})(OR_{12})$, $-P(O)(OR_{11})(R_{12})$, and $-OP(O)(OR_{11})(OR_{12})$, wherein R_{11} and R_{12} are independently hydrogen or alkyl;

U, together with the adjacent carbon atoms of the macrocycle, forms a fused substituted or unsubstituted, saturated, partially saturated or unsaturated, cycle or heterocycle having 3 to 20 ring carbon atoms;

V, together with the adjacent carbon atoms of the macrocycle, forms a fused substituted or unsubstituted, saturated, partially saturated or unsaturated, cycle or heterocycle having 3 to 20 ring carbon atoms;

W, together with the nitrogen of the macrocycle and the carbon atoms of the macrocycle to which it is attached, forms an aromatic or alicyclic, substituted or unsubstituted, saturated, partially saturated or unsaturated nitrogen-containing fused heterocycle having 2 to 20 ring carbon atoms, provided that when W is a fused aromatic heterocycle the hydrogen attached to the nitrogen which is both part of the heterocycle and the macrocycle and R_1 and R_{10} attached to the carbon atoms which are both part of the heterocycle and the macrocycle are absent;

X and Y represent suitable ligands which are derived from any monodentate or polydentate coordinating ligand or ligand system or the corresponding anion thereof;

Z is a counterion;

n is an integer from 0 to 3; and

the dashed lines represent coordinating bonds between the nitrogen atoms of the macrocycle and the transition metal, manganese.

2. The method according to ~~any preceding~~ claim 1, wherein the mammalian subject is at increased risk of carcinogenesis, or will be at increased risk of carcinogenesis due to a therapeutic radiation exposure.

3. The method according to claim 1, wherein the mammalian subject has been exposed to radiation as a part of a course of radiation therapy provided to treat cancer.

4. The method according to claim 1, wherein the mammalian subject will be exposed to radiation as a part of a course of radiation therapy provided to treat cancer.

5. The method according to claim 1, wherein the mammalian subject is at increased risk of carcinogenesis, or will be at increased risk of carcinogenesis due to a non-therapeutic radiation exposure.

6. The method according to claim 1, wherein the mammalian subject has been exposed to radiation during travel beyond the upper atmosphere of the Earth.

7. The method according to claim 1, wherein the mammalian subject will be exposed to radiation during travel beyond the upper atmosphere of the Earth.

8. The method according to claim 1, wherein the mammalian subject is at increased risk of carcinogenesis, or will be at increased risk of carcinogenesis, due to exposure to gamma radiation.

9. The method according to claim 1, wherein the mammalian subject is at increased risk of carcinogenesis, or will be at increased risk of carcinogenesis, due to exposure to cosmic ray radiation.

10. The method of claim 1, wherein the administration of the pentaaza macrocyclic ring complex reduces the risk of ovarian tumors.

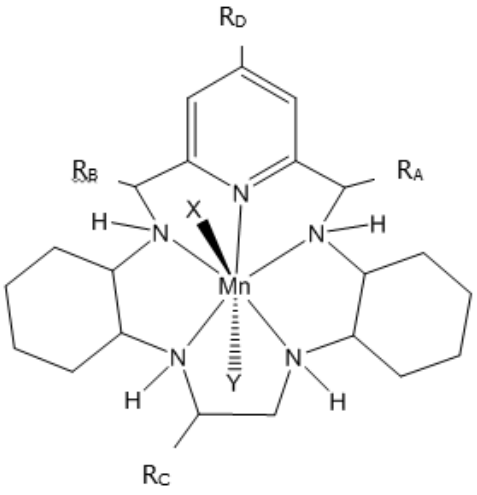
11. The method of claim 1, wherein the mammalian subject is a human subject.

12. The method according to claim 1, wherein R_1, R_2, R'_2, R_3, R_4, R_5, R'_5, R_6, R'_6, R_7, R_8, R_9, R'_9, and R_{10} are each hydrogen.

13. The method according to claim 1, wherein W is an unsubstituted pyridine moiety.

14. The method according to claim 1, wherein U and V are transcyclohexanyl fused rings.

15. The method according to claim 1, wherein the pentaaza macrocyclic ring complex is represented by Formula (II)



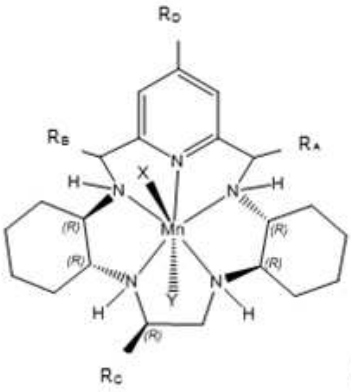
(II)

wherein

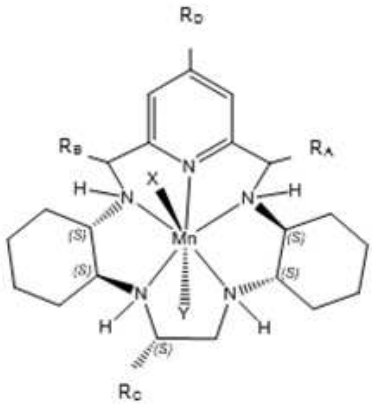
X and Y represent suitable ligands which are derived from any monodentate or polydentate coordinating ligand or ligand system or the corresponding anion thereof; and

R_A, R_B, R_C, and R_D are independently hydrogen, hydrocarbyl, substituted hydrocarbyl, heterocyclyl, an amino acid side chain moiety, or a moiety selected from the group consisting of $-OR_{11}$, $-NR_{11}R_{12}$, $-COR_{11}$, $-CO_2R_{11}$, $-CONR_{11}R_{12}$, $-SR_{11}$, $-SOR_{11}$, $-SO_2R_{11}$, $-SO_2NR_{11}R_{12}$, $-N(OR_{11})(R_{12})$, $-P(O)(OR_{11})(OR_{12})$, $-P(O)(OR_{11})(R_{12})$, and $-OP(O)(OR_{11})(OR_{12})$, wherein R_{11} and R_{12} are independently hydrogen or alkyl.

16. The method according to claim 1, wherein the pentaaza macrocyclic ring complex is represented by Formula (III) or Formula (IV):



(III)



(IV)

wherein

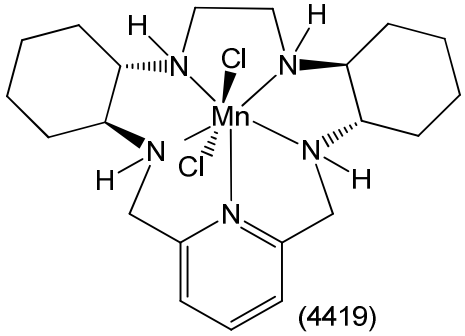
X and Y represent suitable ligands which are derived from any monodentate or polydentate coordinating ligand or ligand system or the corresponding anion thereof; and

R_A, R_B, R_C, and R_D are independently hydrogen, hydrocarbyl, substituted hydrocarbyl, heterocyclyl, an amino acid side chain moiety, or a moiety selected from the group consisting of $-OR_{11}$, $-NR_{11}R_{12}$, $-COR_{11}$, $-CO_2R_{11}$, $-CONR_{11}R_{12}$, $-SR_{11}$, $-SOR_{11}$, $-SO_2R_{11}$, $-SO_2NR_{11}R_{12}$, $-N(OR_{11})(R_{12})$, $-P(O)(OR_{11})(OR_{12})$, $-P(O)(OR_{11})(R_{12})$, and $-OP(O)(OR_{11})(OR_{12})$, wherein R_{11} and R_{12} are independently hydrogen or alkyl.

17. The method according to claim 1, wherein X and Y are independently selected from the group consisting of fluoro, chloro, bromo, and iodo anions.

18. The method according to claim 1, wherein X and Y are independently selected from the group consisting of alkyl carboxylates, aryl carboxylates and arylalkyl carboxylates.

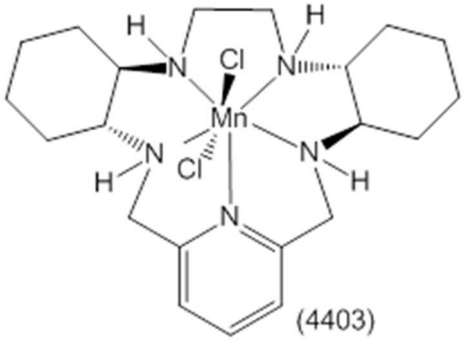
19. The method according to claim 1, wherein the pentaaza macrocyclic ring complex is a compound represented by the formula:



(4419)

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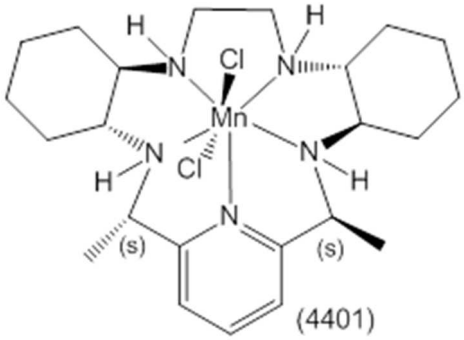
20. The method according to claim 1, wherein the pentaaza macrocyclic ring complex is a compound represented by the formula:



(4403)

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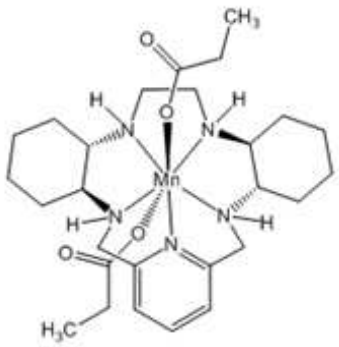
21. The method according to claim 1, wherein the pentaaza macrocyclic ring complex is a compound represented by the formula:



(4401)

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22. The method according to claim 1, wherein the pentaaza macrocyclic ring complex is represented by the formula:



GC4711

23. The method according to claim 1, wherein the pentaaza macrocyclic ring complex is administered to the subject in a dose in a range of from 0.2 mg/kg to 40 mg/kg.

24. The method according to claim 1, wherein the pentaaza macrocyclic ring complex is administered via at least one of parenteral route and oral route.

25. A kit for reducing carcinogenesis of a mammalian subject, the kit comprising:

the pentaaza macrocyclic ring complex corresponding to Formula (I); and

instructions for administering a therapeutically effective amount of the pentaaza macrocyclic ring complex in accordance with a method according to claim 1.

26. The method according to claim 1, wherein the mammalian subject is at increased risk of carcinogenesis, or will be at increased risk of carcinogenesis due occupational exposure to radiation.

27. The method according to claim 26, wherein the occupational exposure is in a lab or hospital.

28. The method according to claim 1, wherein the mammalian subject is at increased risk of carcinogenesis, or will be at increased risk of carcinogenesis due to accidental exposure to radiation.

29. The method according to claim 28, wherein the accidental exposure is due to a nuclear accident or terrorist incident.

30. The method according to claim 28, wherein the mammalian subject is a first responder.

31. The method according to claim 1, wherein mammalian subject has or will be receiving radionuclide therapy.

32. The method according to claim 1, wherein the mammalian subject is a pediatric patient that has or will be receiving therapeutic radiation therapy for the treatment of cancer.

33. The method according to claim 1, wherein the mammalian subject has an increased likelihood of secondary tumor development due to therapeutic radiation therapy provided to treat cancer.