CLAIMS

What is claimed is:

1. A method for treating at least one of tumor recurrence, metastasis, drug resistance, and radiotherapy resistance, the method comprising administering a pharmaceutically effective amount of at least one TPP-derivative compound and at least one therapeutic agent having an anti-mitochondrial effect.

2. The method of claim 1, wherein the TPP-derivative compound comprises 2-butene-1,4-bis-TPP.

3. The method of claim 1, where in the TPP-derivative compound comprises at least one of: a derivative of 2-butene-1,4-bis-TPP; 2-chlorobenzyl-TPP; a derivative of 2-chlorobenzyl-TPP; 3-methylbenzyl-TPP; a derivative of 3-methylbenzyl-TPP; 2,4-dichlorobenzyl-TPP; a derivative of 2,4-dichlorobenzyl-TPP; 1-naphthylmethyl-TPP; a derivative of 1-naphthylmethyl-TPP; p-xylylenebis-TPP; and a derivative of p-xylylenebis-TPP.

4. The method of claim 1, wherein the at least one therapeutic agent having an anti-mitochondrial effect comprises at least one of an antibiotic, a chemotherapeutic, a nutraceutical, a mitochondrial biogenesis inhibitor, a mitoriboscin, a mitoketoscin, a mitoribocycline, a mitoribomycin, a mitoribosporin, a mitoribofloxin, an oxidative metabolism inhibitor, and a glycolytic metabolism inhibitor.

5. A method for preventing at least one of tumor recurrence, metastasis, drug resistance, and radiotherapy resistance, the method comprising administering a pharmaceutically effective amount of at least one TPP-derivative compound and at least one therapeutic agent having an anti-mitochondrial effect.

6. The method of claim 5, wherein the TPP-derivative compound comprises at least one of: 2-butene-1,4-bis-TPP; a derivative of 2-butene-1,4-bis-TPP; 2-chlorobenzyl-TPP; a derivative of 2-chlorobenzyl-TPP; 3-methylbenzyl-TPP; a derivative of 3-methylbenzyl-TPP; 2,4-dichlorobenzyl-TPP; a derivative of 2,4-dichlorobenzyl-TPP; 1-naphthylmethyl-TPP; a derivative of 1-naphthylmethyl-TPP; p-xylylenebis-TPP; and a derivative of p-xylylenebis-TPP.

7. The method of claim 5, wherein the at least one therapeutic agent having an anti-mitochondrial effect comprises at least one of an antibiotic, a chemotherapeutic, a nutraceutical, a mitochondrial biogenesis inhibitor, a mitoriboscin, a mitoketoscin, a mitoribocycline, a mitoribomycin, a mitoribosporin, a mitoribofloxin, an oxidative metabolism inhibitor, and a glycolytic metabolism inhibitor.

8. A method for treating cancer, the method comprising administering a pharmaceutically effective amount of at least one TPP-derivative compound and at least one therapeutic agent having an anti-mitochondrial effect.

9. The method of claim 8, wherein the at least one TPP-derivative compound comprises at least one of 2-butene-1,4-bis-TPP; a derivative of 2-butene-1,4-bis-TPP; 2-chlorobenzyl-TPP; a derivative of 2-chlorobenzyl-TPP; 3-methylbenzyl-TPP; a derivative of 3-methylbenzyl-TPP; 2,4-dichlorobenzyl-TPP; a derivative of 2,4-dichlorobenzyl-TPP; 1-naphthylmethyl-TPP; a derivative of 1-naphthylmethyl-TPP; p-xylylenebis-TPP; and a derivative of p-xylylenebis-TPP.

10. The method of claim 8, wherein the at least one TPP-derivative compound comprises 2-butene-1,4-bis-TPP.

11. The method of claim 8, wherein the at least one TPP-derivative compound selectively targets at least one of bulk cancer cells, CSCs, and energetic cancer stem cells.

12. The method of claim 11, wherein the at least one TPP-derivative compound selectively targets normal senescent cells.

13. The method of claim 8, wherein the at least one TPP-derivative compound is non-toxic to normal healthy cells.

14. The method of claim 8, wherein the at least one therapeutic agent having an anti-mitochondrial effect comprises at least one of an antibiotic, a mitochondrial biogenesis inhibitor, a mitoriboscin, a mitoketoscin, a mitoribocycline, a mitoribomycin, a mitoribosporin, a mitoribofloxin, an oxidative metabolism inhibitor, and a glycolytic metabolism inhibitor.

15. The method of claim 14, wherein the glycolytic metabolism inhibitor comprises at least one of a glycolysis inhibitor, an OXPHOS inhibitor, and an autophagy inhibitor.

16. A composition comprising, as its active ingredient, at least one TPP-derivative compound and at least one therapeutic agent having an anti-mitochondrial effect.

17. The composition of claim 16, wherein the at least one TPP-derivative compound comprises at least one of: 2-butene-1,4-bis-TPP; a derivative of 2-butene-1,4-bis-TPP; 2-chlorobenzyl-TPP; a derivative of 2-chlorobenzyl-TPP; 3-methylbenzyl-TPP; a derivative of 3-methylbenzyl-TPP; 2,4-dichlorobenzyl-TPP; a derivative of 2,4-dichlorobenzyl-TPP; 1-naphthylmethyl-TPP; a derivative of 1-naphthylmethyl-TPP; p-xylylenebis-TPP; and a derivative of p-xylylenebis-TPP.

18. The composition of claim 16, wherein the at least one TPP-derivative compound is 2-butene-1,4-bis-TPP.

19. The composition of claim 16, wherein the active ingredient eradicates at least one of bulk cancer cells, cancer stem cells, energetic cancer stem cells, and normal senescent cells.

20. The composition of claim 16, wherein the TPP-derivative compound is non-toxic towards normal healthy cells.

21. The composition of claim 16, wherein the composition possesses at least one of radiosensitizing activity, photosensitizing activity, and activity to sensitive cancer cells to at least one of chemotherapeutic agents, natural substances, and caloric restriction.

22. A method for targeting a therapeutic agent to a cancer stem cell mitochondria, the method comprising chemically modifying the therapeutic agent with at least one TPP-derivative compound.

23. The method of claim 22, wherein the therapeutic agent has an anti-mitochondrial effect.

24. The method of claim 22, wherein the at least one TPP-derivative compound comprises at least one of: 2-butene-1,4-bis-TPP; a derivative of 2-butene-1,4-bis-TPP; 2-chlorobenzyl-TPP; a derivative of 2-chlorobenzyl-TPP; 3-methylbenzyl-TPP; a derivative of 3-methylbenzyl-TPP; 2,4-dichlorobenzyl-TPP; a derivative of 2,4-dichlorobenzyl-TPP; 1-naphthylmethyl-TPP; a derivative of 1-naphthylmethyl-TPP; p-xylylenebis-TPP; and a derivative of p-xylylenebis-TPP.

25. The method of claim 22, wherein the chemically modified therapeutic agent comprises at least one of enhanced anti-viral activity, enhanced anti-bacterial activity, and enhanced anti-microbial activity.

25. A pharmaceutical composition comprising 2-butene-1,4-bis-TPP and at least one therapeutic agent having an anti-mitochondrial effect.