CLAIMS

1. Use of a synthetic nanostructure comprising:

a nanostructure core, a shell comprising a lipid surrounding and attached to the nanostructure core, wherein the shell comprises a phospholipid, in the manufacture of a medicament for the treatment of cancer in a subject;

wherein the subject has cancer cells and wherein the medicament is to be administered in an effective amount to induce ferroptosis in the cancer cells, after first having identified that the subject has a ferroptosis sensitive malignancy

2. Use of a synthetic nanostructure comprising:

a nanostructure core, a shell comprising a lipid surrounding and attached to the nanostructure core, wherein the shell comprises a phospholipid, in the manufacture of a medicament to reduce in a population of cells, the number of cancer cells;

wherein the synthetic nanostructure is in an effective amount to induce ferroptosis in the cancer cells.

3. The use of claim 1 or claim 2, wherein the nanostructure core is gold.

4. The use of any one of claims 1-3, wherein the synthetic nanostructure further comprises an apolipoprotein.

5. The use of any one of claims 1-4, wherein apolipoprotein is apolipoprotein A-I, apolipoprotein A-II, or apolipoprotein E.

6. The use of any one of claims 1-5, wherein the synthetic nanostructure further comprises a cholesterol.

7. The use of any one of claims 1-6, wherein the phospholipid shell comprises a lipid monolayer.

8. The use of any one of claims 1-6, wherein the phospholipid shell comprises a lipid bilayer.

9. The use of claim 8, wherein at least a portion of the lipid bilayer is covalently bound to the nanostructure core.

10. The use of any one of claims 1-9, wherein the nanostructure core has a largest cross-sectional dimension of less than or equal to about 500 nanometers (nm).

11. The use of any one of claims 1-10, wherein the nanostructure core has a largest cross-sectional dimension of less than or equal to about 250 nanometers (nm).

12. The use of any one of claims 1-11, wherein the nanostructure core has a largest cross-sectional dimension of less than or equal to about 100 nanometers (nm).

13. The use of any one of claims 1-12, wherein the nanostructure core has a largest cross-sectional dimension of less than or equal to about 75 nanometers (nm).

14. The use of any one of claims 1-13, wherein the nanostructure core has a largest cross-sectional dimension of less than or equal to about 50 nanometers (nm).

15. The use of any one of claims 1-14, wherein the nanostructure core has a largest cross-sectional dimension of less than or equal to about 30 nanometers (nm).

16. The use of any one of claims 1-15, wherein the nanostructure core has a largest cross-sectional dimension of less than or equal to about 15 nanometers (nm).

17. The use of any one of claims 1-16, wherein the nanostructure core has a largest cross-sectional dimension of less than or equal to about 10 nanometers (nm).

18. The use of any one of claims 1-17, wherein the nanostructure core has a largest cross-sectional dimension of less than or equal to about 5 nanometers (nm).

19. The use of any one of claims 1-18, wherein the nanostructure core has a largest cross-sectional dimension of less than or equal to about 3 nanometers (nm).

20. The use of any one of claims 1-19, wherein the nanostructure core has an aspect ratio of greater than about 1:1.

21. The use of any one of claims 1-20, wherein the nanostructure core has an aspect ratio of greater than 3:1.

22. The use of any one of claims 1-21, wherein the nanostructure core has an aspect ratio of greater than 5:1.

23. The use of any one of claims 1-22, wherein the phospholipid comprise 1,2-dipalmitoyl-sn-glycero-3-phosphocholine (DPPC), 1,2-dioleoyl-sn-glycero-3-phosphocholine (DOPC), 1,2-dipalmitoyl-sn-glycero-3-phosphoethanolamine (16:0 PE), 1,2-distearoyl-sn-glycero-3-phosphoethanolamine (18:0 PE), sphingomyelin, 1,2-dioleoyl-3-trimethylammonium-propane (DOTAP), or a combination thereof.

24. The use of any one of claims 1-23, wherein the subject has been diagnosed with cancer.

25. The use of any one of claims 1-24, wherein the subject has been diagnosed with a ferroptosis sensitive malignancy or cholesterol auxotrophic malignancy.

26. The use of any one of claims 1-25, wherein the cancer is selected from: B-cell lymphoma, renal cell carcinoma, T-cell lymphoma, gastric cancer, ovarian carcinoma, and endometrial adenocarcinoma.

27. The use of any one of claims 1-26, wherein the cancer is selected from: sarcoma, lymphoma, gastric cancer, anaplastic large cell lymphoma, clear cell renal cell carcinoma (ccRCC), ovarian cancer, platinum resistant ovarian cancer, and clear cell ovarian cancerB-cell lymphoma and T-cell lymphoma.

28. The use of any one of claims 1-27, wherein the medicament is to be administered to the subject or contacted to the cells more than once.

29. The use of claim 28, wherein the medicament is to be administered to the subject or contacted to the cells at least once per month.

30. The use of claim 28 or claim 29, wherein the medicament is to be administered to the subject or contacted to the cells at least once per week.

31. The use of any one of claims 28-30, wherein the medicament is to be administered to the subject or contacted to the cells at least once per day.

32. The use of any one of claims 28-31, wherein the medicament is to be administered to the subject or contacted to the cells twice per day.

33. The use of any one of claims 1-32, wherein the subject is a mammal.

34. The use of any one of claims 1-33, wherein the subject is human.

35. The use of any one of claims 1-33, wherein a ferroptosis inducer compound is also to be administered to the subject.

36. The use of any one of claims 1-33, further comprising determining if the cancer is sensitive to ferroptosis.

37. Use of a synthetic nanostructure comprising:

a nanostructure core, a shell comprising a lipid surrounding and attached to the nanostructure core, wherein the shell comprises a phospholipid in the manufacture of a medicament for the treatment of a subject having a ferroptosis sensitive disorder; wherein the subject is identified as having a ferroptosis sensitive disorder; and

the medicament is to be administered to the subject; in an effective amount to induce ferroptosis in diseased cells of the subject.

38. A composition comprising synthetic nanostructure comprising:

a nanostructure core, a shell comprising a lipid surrounding and attached to the nanostructure core, wherein the shell comprises a phospholipid and a ferroptosis inducer compound.

39. Use of a nanostructure core, a shell comprising a lipid surrounding and attached to the nanostructure core, wherein the shell comprises a phospholipid in the manufacture of a medicament able to induce ferroptosis in a cell, wherein the medicament in an effective amount is to be brought into contact with the cell to induce ferroptosis in the cell.

40. A nanostructure core, a shell comprising a lipid surrounding and attached to the nanostructure core, wherein the shell comprises a phospholipid for use as a medicament.