

WHAT IS CLAIMED IS:

1. A method for preparing a serum free cell culture medium, the method comprising adding a lipoprotein particle composition or a lipoprotein composition to a basal culture medium, wherein the lipoprotein particle composition or a lipoprotein composition is added in an amount to function as a serum replacement.
2. The method of claim 1, wherein the lipoprotein particle composition comprises one or more lipoprotein particle selected from the group consisting of:
 - (a) high density lipoprotein particles,
 - (b) low density lipoprotein particles, and
 - (c) very low density lipoprotein particles.
3. The method of claims 1 or 2, wherein the lipoprotein particle composition comprises lipoprotein particles obtained from human blood.
4. The method of any one of claims 1 through 2, wherein the lipoprotein particle composition comprises a synthetic lipoprotein particle.
5. The method of any one of claims 1, 2, or 4, wherein the lipoprotein particle composition comprises a synthetic high density lipoprotein particle.
6. The method of claim 4, wherein the synthetic lipoprotein particle comprises apolipoprotein AI or apolipoprotein AII.
7. The method of claim 5, wherein the synthetic lipoprotein particle comprises a portion of apolipoprotein AI or apolipoprotein AII.
8. The method of any one of claims 6 through 7, wherein the apolipoprotein AI or apolipoprotein AII is recombinantly produced.

9. The method of claim 8, wherein the recombinantly production the apolipoprotein AI or apolipoprotein AII is performed using a non-mammalian cell.

10. The method of claim 9, wherein the non-mammalian cell is an insect cell.

11. A serum free cell culture medium comprising one or more lipoprotein compound, wherein the serum free cell culture medium supports the expansion of mammalian cells and wherein the expansion of the mammalian cells is increased by 10% in the serum free cell culture medium comprising the one or more lipoprotein compound as compared to the same cell expanded in culture medium without the one or more lipoprotein compound but containing serum.

12. The serum free cell culture medium of claim 11, wherein at least one of the one or more lipoprotein compound is Apolipoprotein AI.

13. The serum free cell culture medium of claim 11, wherein at least one of the one or more lipoprotein compound is Apolipoprotein AII.

14. The serum free cell culture medium of any one of claims 11 through 13, wherein at least one of the one or more lipoprotein compound is a component of a lipoprotein particle.

15. The serum free cell culture medium of claim 14, wherein the lipoprotein particle is a high density lipoprotein.

16. The serum free cell culture medium of any one of claims 14 through 15, wherein the lipoprotein particle is obtained from a mammal.

17. The serum free cell culture medium of any one of claims 14 through 15, wherein the lipoprotein particle is non-naturally occurring.

18. The serum free cell culture medium of claim 17, wherein the non-naturally occurring lipoprotein particle contains either a non-naturally occurring protein, a naturally occurring apolipoprotein, or a portion of a naturally occurring apolipoprotein.

19. The serum free cell culture medium of any one of claims 11 through 18, wherein the increase in cell viability is in the range of from 10% to about 75%.

20. The serum free cell culture medium of claim 11, wherein the mammalian cells are hybridoma cells.

21. The serum free cell culture medium of claim 20, wherein the mammalian cells are human cells.

22. The serum free cell culture medium of claim 11, wherein the mammalian cells are immune cells.

23. The serum free cell culture medium of claim 22, wherein the immune cells are T cells.

24. The serum free cell culture medium of claim 23, wherein the T cells are one or more T cells selected from the group consisting of:

- (a) regulatory T cells,
- (b) CD4+ T cells,
- (c) CD8+ T cells,
- (d) T_H1 cells,
- (e) T_H2 cells,
- (f) T_H3 cells,
- (g) T_H17 cells,
- (h) T_H9 cells, and
- (i) T_{FH} cells.

25. The serum free cell culture medium of any one of claims 23 through 24, wherein the T cells are isolated from blood through ligation to a CD3 surface marker.

26. A method for expanding a mammalian cell, the method comprising incubating the mammalian cell in a serum free cell culture medium comprising one or more lipoprotein compound under conditions that allow for expansion of the mammalian cell.

27. The method of claim 26, wherein the lipoprotein compound comprises one or more lipoprotein particle.

28. The method of claim 27, wherein the lipoprotein particle compound comprises one or more lipoprotein particle selected from the group consisting of:

- (a) high density lipoprotein particles,
- (b) low density lipoprotein particles, and
- (c) very low density lipoprotein particles.

29. A method for electroporation of a mammalian cell population, the method comprising:

- (a) contacting the mammalian cell population with one or more lipoprotein compound for at least 12 hours in a serum free culture medium under conditions that allow for expansion of the mammalian cells, and
- (b) applying one or more electric pulse to the mammalian cell population to thereby electroporate cell membranes of members of the mammalian cell population, wherein the electroporation efficiency is at least 60% and wherein the viability of the cells in the mammalian cell population decreases by less than 10%.

30. The method of claim 29, wherein the electroporation efficiency is measured by expression of a detectable marker in members of the mammalian cell population.

31. The method of claim 30, wherein the detectable marker is a fluorescent protein.

32. A method for the maintenance of an activated T cell population, the method comprising:

- (a) generating the activated population of T cells,

(b) expanding the activated population of T cells generated in step (a) in the presence of a lipoprotein supplement,

(c) exposing the expanded activated population of T cells produced in step (b) to an electric field of sufficient strength to result in a decrease in the rate of cell expansion over the following seven day by at least 30%, and

(d) maintaining the activated population of T cells of step (c) under the same conditions as in step (b) for seven days,

wherein the viability of the activated population of T cells during steps (a) - (d) remains above 70%.

33. The method of claim 32, wherein one or more nucleic acid molecule is introduced in step (c) into individual T cells of the activated population of T cells.

34. The method of claim 33, wherein at least one of the one or more nucleic acid molecule encodes a chimeric antigen receptor.

35. The method of claim 34, wherein the chimeric antigen receptor is stably expressed in individual T cells of the activated population of T cells.

36. The method of claim 32, wherein the activated population of T cells is expanded for three days in step (b).

37. The method of claim 32, further comprising:

(e) washing of the activated population of T cells after step (d), and

(f) expanding the washed, activated population of T cells generated in step (e) in the absence of a lipoprotein supplement.

38. The method of claim 37, wherein, over a five day time period, the viability of the washed, activated population of T cells remains above 70% and the washed, activated population of T cells expand at least three fold.

39. The method of claim 32, wherein the activated population of T cells are shipped to a different location during step (d).

40. The method of claim 32, wherein the different location is greater than 100 miles away.

41. A method for storing mammalian cells, the method comprising the following steps in order:

(a) expanding the mammalian cells in a culture medium comprising one or more lipoprotein compound,

(b) exposing the mammalian cells to an electric field, and

(c) expanding the mammalian cells in a culture medium comprising one or more lipoprotein compound,

wherein the mammalian cells in step (c) expand at a rate that is at least 50% lower than in step (a), and

wherein the viability of the mammalian cells remains above 70% during steps (a) – (c).

42. The method of claim 41, wherein the mammalian cells are T cells.

43. The method of claim 41, wherein the mammalian cells are expanded for seven days in step (c).

44. The method of claim 43, wherein the cell viability of the mammalian cells in step (c) remains above 70% during the seven days of expansion.

45. The method of claim 41, wherein the mammalian cells in step (c) are washed and transferred to a culture medium comprising at least a 50% lower concentration of the one or more lipoprotein compound.

46. The method of claim 41, wherein a nucleic acid molecule is introduced into the mammalian cells in step (b).

47. The method of claim 46, wherein the nucleic acid molecule encodes a chimeric antigen receptor.

48. The method of claim 47, wherein the mammalian cells are T cells.