WHAT IS CLAIMED IS:

1. A method of producing natural killer cells, comprising:

isolating peripheral blood mononuclear cells (PBMCs) from a blood sample;

isolating at least one of CD56+ cells and/or CD3-/CD56+ cells from the PBMCs; and

co-culturing the at least one of CD56+ cells and/or CD3-/CD56+ cells with a combination of feeder cells in the presence of a cytokine.

2. The method of Claim 1, wherein isolating at least one of CD56+ cells and/or CD3-/CD56+ cells from the PBMCs is conducted by using at least one of CD56 microbeads and CD3 microbeads.

3. The method of Claim 1 or 2, wherein the cytokine is selected from a group consisting of IL-2, IL-21, IL-15, Flt3-L, SCF, IL-7, IL-18, IL-4, type I interferons, GM-CSF, IGF 1, and combinations thereof.

4. The method of any one of Claims 1-3, wherein the cytokine is added at a concentration of 50-1000 IU/mL.

5. The method of any one of Claims 1-4, wherein the combination of feeder cells comprises irradiated Jurkat cells and irradiated Epstein-Barr virus transformed lymphocyte continuous line (EBV-LCL) cells.

6. The method of Claim 5, wherein the ratio of the irradiated Jurkat cells and the irradiated EBV-LCL cells is about 1:0.1-5 or 0.1-5:1.

7. The method of Claim 5 or 6, wherein each of the irradiated Jurkat cells and the irradiated EBV-LCL cells are obtained by irradiation of 50-500Gy.

8. The method of any one of Claims 1-7, wherein the co-culturing comprises co-culturing for 1-50 days.

9. The method of any one of Claims 1-8, further comprising:

co-culturing the at least one of CD56+ cells and/or CD3-/CD56+ cells with a combination of feeder cells, in the presence of a first cytokine for a first period; and

subsequently co-culturing the at least one of CD56+ cells and/or CD3-/CD56+ cells with the combination of feeder cells, in the presence of a second cytokine for a second period.

10. The method of Claim 9, wherein the second cytokine is added once or more during Day 0-6 of the second period.

11. The method of Claim 10, wherein the second cytokine and the combination of feeder cells are added once or more during Day 0-6 of the second period.

12. The method of Claim 10 or 11, wherein the second cytokine is added once or more during the first six days of every fourteen-day cycle during the second period.

13. The method of any one of Claims 9-12, wherein the first cytokine is IL-2.

14. The method of any one of Claims 9-13, wherein the second cytokine is IL-21.

15. The method of any one of Claims 9-14, wherein the second cytokine is added at a concentration of 10-100 ng/mL.

16. The method of any one of Claims 1-15, wherein the at least one of CD56+ cells and/or CD3-/CD56+ cells and the combination of feeder cells is co-cultured with a ratio of about 1:1-100 of CD56+ cells and/or CD3-/CD56+ cells to feeder cells.

17. A composition made by the method of any one of Claims 1-16.

18. A composition for treating cancer in a patient in need thereof, comprising:

an effective amount of CD56+ natural killer cells derived from peripheral blood, wherein the effective amount is in a range of about 1×10^6 to 5×10^8 cells per kg of the patient's body weight, and wherein the CD56+ natural killer cells are at least about 90% pure;

IL-2 having a concentration of 50-50,000 IU/mL; and

a pharmaceutically acceptable carrier.

19. The composition of Claim 18, wherein the cytokine is selected from a group consisting of IL-2, IL-21, IL-15, Flt3-L, SCF, IL-7, IL-18, IL-4, type I interferons, GM-CSF, IGF 1, and combinations thereof.

20. The composition of Claim 18 or 19, wherein the cytokine is IL-2.

21. The composition of any one of Claims 18-20, wherein the cytokine has a concentration of 50-50000 IU/mL.

22. The composition of any one of Claims 18-21, wherein the cancer is selected from a group consisting of: blood cancer, stomach cancer, pancreatic cancer,

cholangiocarcinoma, colon cancer, breast cancer, liver cancer, ovarian cancer, lung cancer, kidney cancer, prostate cancer and neuroblastoma.

23. The composition of any one of Claims 18-22, wherein the composition comprises less than about 1% T cells.

What is claimed is:

1. A method of expanding natural killer cells in culture, comprising:

isolating peripheral blood mononuclear cells (PBMCs) from a blood sample;

isolating at least one of CD56+ cells and/or CD3-/CD56+ cells from the PBMCs; and

co-culturing the at least one of CD56+ cells and/or CD3-/CD56+ cells with a combination of feeder cells in the presence of at least two cytokines;

wherein the combination of feeder cells comprises irradiated Jurkat cells and irradiated Epstein-Barr virus transformed lymphocyte continuous line (EBV-LCL) cells,

wherein the at least two cytokines comprise IL-2 and IL-21.

2. The method of claim 1, wherein isolating at least one of CD56+ cells and/or CD3-/CD56+ cells from the PBMCs is conducted by using at least one of CD56 microbeads and CD3 microbeads.

3. The method of claim 1, wherein the at least two cytokines further comprise one or more cytokines selected from a group consisting of IL-15, Flt3-L, SCF, IL-7, IL-18, IL-4, type I interferons, GM-CSF, IGF 1, and combinations thereof.

4. The method of claim 1, wherein IL-2 is added at a concentration of 50-1000 IU/mL.

5. The method of claim 1, wherein IL-21 is added at a concentration of 10-100 ng/mL.

6. The method of claim 1, wherein the ratio of the irradiated Jurkat cells and the irradiated EBV-LCL cells is about 1:0.1-5 or 0.1-5:1.

7. The method of claim 1, wherein the co-culturing comprises co-culturing for 1-50 days.

8. The method of claim 1, further comprising:

co-culturing the at least one of CD56+ cells and/or CD3-/CD56+ cells with the combination of feeder cells, in the presence of IL-2 for a first period; and

co-culturing the at least one of CD56+ cells and/or CD3-/CD56+ cells with the combination of feeder cells, in the presence of IL-21 for a second period.

9. The method of claim 8, wherein IL-21 is added more than once during Day 0-6 of the second period.

10. The method of claim 8, wherein IL-21 and the combination of feeder cells are added more than once during Day 0-6 of the second period.

11. The method of claim 8, wherein IL-21 is added more than once during the first six days of every fourteen-day cycle during the second period.

12. The method of claim 1, wherein the at least one of CD56+ cells and/or CD3-/CD56+ cells and the combination of feeder cells is co-cultured with a ratio of about 1:1-100 of CD56+ cells and/or CD3-/CD56+ cells to feeder cells.

13. A composition made by the method of claim 1.

14. A method of expanding natural killer cells in culture, comprising:

isolating peripheral blood mononuclear cells (PBMCs) from a blood sample;

isolating at least one of CD56+ cells and/or CD3-/CD56+ cells from the PBMCs; and

co-culturing the at least one of CD56+ cells and/or CD3-/CD56+ cells with a combination of feeder cells in the presence of at least two cytokines;

wherein the combination of feeder cells comprises irradiated Jurkat cells and irradiated Epstein-Barr virus transformed lymphocyte continuous line (EBV-LCL) cells,

wherein the at least two cytokines comprise IL-2 and IL-21, and

wherein both the feeder cells and the cytokines are supplemented at intervals throughout the expansion in culture.

15. The method of claim 14, wherein isolating at least one of CD56+ cells and/or CD3-/CD56+ cells from the PBMCs is conducted by using at least one of CD56

microbeads and CD3 microbeads.

16. The method of claim 14, wherein IL-21 is added at a concentration of 10-100 ng/mL.

17. The method of claim 14, wherein IL-21 is added once or more during each of the following periods: Day 0-6; Day 14-20; and Day 28-34.

18. The method of claim 14, wherein the co-culturing comprises co-culturing for 1-50 days.