We claim:

1. A method of producing natural killer (NK) cells comprising one or more heterologous nucleic acids, comprising:

culturing a population of isolated NK cells in the presence of 500 IU/ml interleukin-2 (IL-2) and irradiated feeder cells for at least two days to produce a population of activated NK cells;

transducing the population of activated NK cells with a viral vector comprising one or more heterologous nucleic acids to produce a population of transduced NK cells, wherein the transducing is performed in the presence of one or more inhibitors of toll-like receptor (TLR) or RIG-I-like receptor (RLR) and/or one or more inhibitors of TBK1/IKKε; and

culturing the population of transduced NK cells in the presence of 500 IU/ml IL-2 and irradiated feeder cells to produce an expanded population of transduced NK cells.

2. The method of claim 1, wherein:

the activated NK cells are transduced with the viral vector in the presence of irradiated feeder cells.

3. The method of claim 1 or claim 2, wherein the population of isolated NK cells is cultured in the presence of IL-2 and no other added cytokines.

4. The method of any one of claims 1 to 3, wherein the one or more inhibitors of TLR and/or RLR and/or one or more inhibitors of TBK1/IKKε is one or more of BX795, 2-aminopurine, BAY11-7082, Celastrol, CLI-095, H-89, Norharmane, IRAK1/4 inhibitor, MRT67307, AZ13102909, MPI-0485520, Amlexanox, Compound II, and SR8185.

5. The method of claim 4, wherein the one or more inhibitors of TLR and/or RLR and/or one or more inhibitors of TBK1/IKKε is BX795.

6. The method of any one of claims 1 to 5, wherein the viral vector comprising one or more heterologous nucleic acids is a lentivirus vector.

7. The method of claim 6, wherein the lentivirus vector comprises or consists of a nucleic acid sequence with at least 90% sequence identity to any one of SEQ ID NOs: 8-19.

8. The method of any one of claims 1 to 7, wherein the ratio of the irradiated feeder cells to the transduced NK cells is 10:1.

9. The method of any one of claims 1 to 8, wherein the irradiated feeder cells comprise an Epstein-Barr virus transformed lymphoblastoid cell line or K562 cells.

10. The method of any one of claims 1 to 9, wherein the heterologous nucleic acid encodes:

high affinity CD16 (CD16-V158), CXCR4, CCR7, CXCR3, CD34, double negative TGFβ type II receptor, VLA-4, LFA-1, CD19, or CD4;

a chimeric antigen receptor (CAR) that specifically binds to an antigen expressed on tumor cells, wherein the heterologous nucleic acid encodes a CAR that specifically binds to CD19, CD20, CD33, CD138, CS1, GD2, HER2, erbB2, CEA, EpCAM, NKG2D-L, or TRAIL-R1;

a nucleic acid molecule encoding a truncated CD34 protein lacking an intracellular domain; and/or

a short hairpin RNA (shRNA), small interfering RNA (siRNA), or an antisense nucleic acid.

11. The method of any one of claims 1 to 10, wherein the feeder cells are substantially separated from the activated NK cells or the expanded NK cells using CD19 immunodepletion and/or CD56 immunoselection.

12. A method of producing natural killer (NK) cells comprising one or more heterologous nucleic acids, comprising:

culturing a population of isolated NK cells in the presence of 500 IU/ml interleukin-2 (IL-2) and irradiated feeder cells for at least two days to produce a population of activated NK cells;

transducing the population of activated NK cells with a viral vector comprising one or more heterologous nucleic acids to produce a population of transduced NK cells in the presence of 0.75-3 μM BX795; and

culturing the population of transduced NK cells in the presence of 500 IU/ml IL-2 and irradiated feeder cells to produce an expanded population of transduced NK cells comprising the one or more heterologous nucleic acids.

13. The method of claim 12, wherein the population of isolated NK cells is cultured in the presence of IL-2 and no other added cytokines.