What is claimed is:

1. Use of a population of cyclophosphamide-resistant modified bone marrow cells and at least one non-myeloablative dose of cyclophosphamide in the manufacture of a medicament for the treatment of HIV, wherein the population of cyclophosphamide-resistant modified bone marrow cells comprises a heterologous gene encoding aldehyde dehydrogenase 1 (ALDH1); and wherein the non-myeloablative dose of cyclophosphamide is from 0.16 mg/kg/day to less than 2.5 mg/kg/day~~A method for performing a bone marrow transplant in a patient, the method comprising: administering to the patient a population of cyclophosphamide-resistant modified cells and at least one non-myeloablative dose of a chemotherapeutic~~.

~~2. The method of claim 1, wherein the population of cyclophosphamide resistance modified cells comprises a heterologous gene encoding aldehyde dehydrogenase 1 (ALDH1).~~

2~~3~~. The ~~method~~ use of claim 1, wherein the population of cyclophosphamide resistan~~t~~~~ce~~ modified bone marrow cells express ALDH1.

3~~4~~. The ~~method~~ use of claim 1 or claim 2, wherein the cyclophosphamide resistance of cyclophosphamide-resistant modified cells is conferred by expression of aldehyde dehydrogenase 1 (ALDH-1).

4~~5~~. The ~~method~~ use of any one of claims 1 to 3, wherein greater than 50% of the patient's bone marrow is replaced with the cyclophosphamide-resistant modified bone marrow cells or cells derived therefrom within 6 months.

~~6. The method of claim 1, wherein the patient has HIV.~~

5~~7~~. The ~~method~~ use of any one of claims 1 to 5, wherein the cyclophosphamide resistance of the modified bone marrow cells is transient.

6~~8~~. The ~~method~~ use of any one of claims 1 to 5, wherein the bone marrow cells are stem cells or immune cells.

7~~9~~. The ~~method~~ use of claim 6~~8~~, wherein the stem cell are fetal stem cells, cord blood derived stem cells, hematopoietic stem cells (HSCs), pluripotent stem cells (PSCs), induced PSCs (iPSCs), embryonic stem cells (ESCs) or cells derived therefrom, such as CD34+ cells, CD90+ cells, CD45+ cells, CD17+ cells, CD45RA- cells, CD38-cells, or any combination thereof.

8~~10~~. The ~~method~~ use of claim 6~~8~~, wherein the immune cells are T cells.

9~~11~~. The ~~method~~ use of any one of claims 1 to 8, wherein the modified bone marrow cells are autologous to the patient, allogeneic to the patient, or a combination thereof.

10~~2~~. The ~~method~~ use of any one of claims 1 to 9, wherein the cyclophosphamide-resistant modified bone marrow cells are produced by ~~further comprising~~ contacting unmodified bone marrow cells with an expression vector encoding for the expression of ALDH1 ~~to produce the cyclophosphamide resistant modified cells~~.

11~~3~~. The ~~method~~ use of claim 10~~2~~, wherein the expression vector is a viral vector or a non-viral vector.

12~~4~~. The ~~method~~ use of claim 11~~3~~, wherein the viral vector is a lentiviral or adenoviral vector.

13~~5~~. The ~~method~~ use of claim 12, wherein the expression vector is a retrovirus, a transposon, an episomal expression vector, modified RNA, a plasmid, or any combination thereof.

14~~6~~. The ~~method~~ use of claim 1, wherein the at least one non-myeloablative dose ~~of the chemotherapeutic agent~~cyclophosphamide is administered after administration of the modified bone marrow cells.

17. The method of claim 1, wherein the at least one non-myeloablative dose of the chemotherapeutic agent is a non-myeloablative dose of cyclophosphamide.

18. The method of claim 17, wherein the non-myeloablative dose of cyclophosphamide is from about 0.16 mg/kg/day to less than 2.5 mg/kg/day.

159. The method use of any one of claims 1 to 147, wherein the non-myeloablative dose of cyclophosphamide is from about 0.41 mg/kg/day to about 1.63 mg/kg/day.

2016. The method use of any one of claims 1 to 157, wherein the non-myeloablative dose of cyclophosphamide is from about 0.81 mg/kg/day to about 1.46 mg/kg/day.

1721. The method use of any one of claims 1 to 167, wherein the non-myeloablative dose of cyclophosphamide is about 1.3 mg/kg/day.

2182. The method use of any one of claims 1 to 17, wherein the patient is not administered a dose of 100 mg/m^2/day of cyclophosphamide for 1–14 consecutive days is not administered.

2193. The method use of any one of claims 1 to 17, wherein the patient is not administered a dose of 5–7 g/m^2 of cyclophosphamide over 12–24 hours is not administered.

204. The method use of any one of claims 1 to 17, wherein the non-myeloablative dose of cyclophosphamidechemotherapeutic agent is administered every day for at least 1 week, at least 2 weeks, at least 3 weeks, at least 1 month, at least 2 months, at least 3 months, at least 4 months, at least 5 months, or at least 6 months.

215. The method use of claim 1, further comprising not administeringwherein the non-myeloablative dose of cyclophosphamide is not administered the chemotherapeutic agent for a period of time between the administering of the cyclophosphamide-resistant modified bone

marrow cells and the at least one non-myeloablative dose of ~~the chemotherapeutic agent~~cyclophosphamide.

2~~2~~6. The ~~method~~ use of claim 2~~1~~5, wherein the period of time is selected from the group consisting of about 3 days, about 7 days, about 10 days, and about 14 days.

2~~3~~7. The ~~method~~ use of any one of claims 1 to 22, wherein greater than about 60%, about 70%, about 80%, about 90%, about 95%, or 100% of the patient's bone marrow is replaced with the modified bone marrow cells.

2~~4~~8. The ~~method~~ use of any one of claims 1 to 23, wherein ~~the~~ a patient administered the medicament is not myeloablated and/or immunocompromised as a result of the administration of the at least one non-myeloablative dose of ~~the chemotherapeutic agent~~cyclophosphamide.

2~~5~~9. The ~~method~~ use of any one of claims 1 to 24, wherein ~~the~~ a patient administered the medicament does not experience clinically relevant anemia, neutropenia, thrombocytopenia, pancytopenia, low platelet, low white blood cells, or any combination thereof or related symptoms.

~~30~~26. The ~~method~~ use of any one of claims 1 to 25, wherein the medicament is for administration to a patient who has previously received a preconditioning step ~~is performed prior to administration of the cells~~.

27~~31~~. The ~~method~~ use of claim ~~30~~26, wherein the preconditioning step is a non-myeloablative chemotherapy preconditioning step.

28~~32~~. The ~~method~~ use of any one of claims 1 to 27, wherein the modified bone marrow cells are resistant to HIV infection.

29~~32~~3. The ~~method~~ use of claim ~~32~~28, wherein the modified bone marrow cells heterologously express a mutation of at least one HIV co-receptor resistant to HIV infection, a mutation or

plurality of mutations of at least one HIV co-receptor, at least one HIV fusion inhibitor, a molecule that reduces the expression of a HIV co-receptor, or any combination thereof.

304. The ~~method~~ use of claim ~~32~~28, wherein the modified cells heterologously express shCCR5, shCXCR4, a C-peptide fusion inhibitor or any combination thereof.

315. The ~~method~~ use of any one of claims 1 to 30~~32~~, wherein the modified bone marrow cells do not express a HIV co-receptor.

326. The ~~method~~ use of any one of claims 1 to 31~~32~~, wherein the modified bone marrow cells do not express CCR5, CXCR4, or express CCR5-Δ32 or a combination thereof.

337. A bone marrow cell comprising a heterologous nucleotide molecule that encodes for the expression of ALDH1 and one of: i) a heterologous nucleotide molecule encoding for at least one HIV co-receptor mutant, a mutation or plurality of mutations of at least one HIV co-receptor, at least one HIV fusion inhibitor, a molecule that reduces the expression of a HIV co-receptor, or any combination thereof; and/or ii) an endogenous HIV co-receptor mutation or deletion, wherein the cell includes an heterologous nucleic acid sequence of SEQ ID NO: 4.

348. The cell of claim 337, wherein the cell comprises a heterologous nucleotide sequence that:

i. encodes for a molecule reduces expression of the CCR5;

ii. encodes for a reduces expression of the CXCR4;

iii. encodes for the expression of a C-peptide fusion inhibitor;

iv. comprises a sequence of : 1, 3, 6, 7, 8, 9, 12, 13, 14, 16, 18, or any combination thereof;

v. encodes for a sequence of SEQ ID NO: 10, 11, 6, 7, 13, 15, 17, 19, or any combination thereof;

or any combination thereof~~;~~.

35~~9~~. The cell of claim 33 or claim 34~~7~~, wherein the cell expresses shCCR5, shCXCR4, and/or a C-peptide fusion inhibitor, such as C44.

36~~40~~. The cell of any one of claims 33 to 34~~7~~, wherein the cell is modified to express the heterologous nucleotide sequences with a non-viral gene transfer system.

~~41~~37. The cell of claim 36~~40~~, wherein the non-viral gene transfer system is a transposon gene transfer system.

~~42~~38. The cell of claim 37, wherein the transposon gene transfer system is a Sleeping Beauty gene transfer system or a PiggyBac transposon gene transfer system.

~~43. The cell of claim, 37, wherein the cell includes an heterologous nucleic acid sequence of SEQ ID NO: 4.~~

~~44~~39. A composition comprising one or more cells of any one of claims 33 to 38~~7~~.

~~45. A nucleic acid molecule encoding for ALDH1 and one of: i) a heterologous nucleotide molecule encoding for at least one HIV co-receptor mutant, a mutation or plurality of mutations of at least one HIV co-receptor, at least one HIV fusion inhibitor, a molecule that reduces the expression of a HIV co-receptor, or any combination thereof.~~

~~46. The nucleic acid molecule of claim 45, wherein the heterologous nucleotide sequence encodes a molecule that:~~

~~i. reduces expression of the CCR5;~~

~~ii. reduces expression of the CXCR4;~~

~~iii. encodes for the expression of a C-peptide fusion inhibitor;~~

~~or any combination thereof.~~

47. The nucleic acid molecule of claim 45, wherein the nucleic acid molecule encodes for the expression shCCR5, shCXCR4, and/or a C-peptide fusion inhibitor.

48. The nucleic acid molecule of claim 45, wherein the molecule comprises a sequence of : 1, 3, 6, 7, 8, 9, 12, 13, 14, 16, 18, or any combination thereof.

49. The nucleic acid molecule of claim 45, wherein the molecule comprises a nucleic acid molecule that encodes for a sequence of SEQ ID NO: 10, 11, 6, 7, 13, 15, 17, 19, or any combination thereof.

50. A vector comprising the nucleic acid molecules of claim 45.

51. The vector of claim 50, wherein the vector is a vector that can be used to produce a lentivirus.

52. The vector of claim 50, wherein the vector is a lentiviral vector.

53. The vector of claim 50, wherein the vector comprises a sequence of SEQ ID NO: 1, 3, 6, 7, 8, 9, 12, 13, 14, 16, 18, or any combination thereof.

54. The vector of claim 50, wherein the vector comprises a nucleic acid molecule that encodes for a sequence of SEQ ID NO: 10, 11, 6, 7, 13, 15, 17, 19, or any combination thereof.

55. A method of treating HIV in a subject, the method comprising administering to the subject a population of cells heterologously expressing ALDH1 and one of: i) a heterologous nucleotide molecule encoding for at least one HIV co-receptor mutant, a mutation or plurality of mutations of at least one HIV co-receptor, at least one HIV fusion inhibitor, a molecule that reduces the expression of a HIV co-receptor, or any combination thereof;

and at least one non-myeloablative dose of a chemotherapeutic agent.

56. The method of claim 55, wherein the cells express shCCR5, shCXCR4, and/or a C-peptide fusion inhibitor.

57. The method of claim 55, wherein the cell comprises a nucleic acid molecule comprising a sequence of 1, 3, 6, 7, 8, 9, 12, 13, 14, 16, 18, or any combination thereof.

58. The method of claim 55, wherein the cell comprises a nucleic acid molecule that encodes for a sequence of SEQ ID NO: 10, 11, 6, 7, 13, 15, 17, 19, or any combination thereof.

5940. Use of a population of bone marrow cellsA method of expressing a molecule of interest in a subject, the method comprising administering to the subject a cell that heterologously expresses ALDH1 and the a molecule of interest; and administering a non-myeloablative dose of cyclophosphamide, wherein the non-myeloablative dose of cyclophosphamide is from about 0.16 mg/kg/day to less than 2.5 mg/kg/day, in the manufacture of a medicament for treating a condition requiring a bone marrow transplant, wherein the medicament is for administration to a subject undergoing the bone marrow transplant..

4160. The method use of claim 5940, wherein the bone marrow cell is CD34+ and/or CD4+, or as otherwise as provided herein.

6142. The method use of claim 5940 or claim 41, wherein the molecule of interest is one that reduces expression of the CCR5; reduces expression of the CXCR4; encodes for the expression of a C-peptide fusion inhibitor; or any combination thereof.

6243. The method use of claim 6142, wherein the molecule of interest that reduces expression of the CCR5 is shCCR5.

6344. The method use of claim 6243, wherein the molecule of interest comprises a nucleic acid molecule comprising or encoding for SEQ ID NO: 6 and/or SEQ ID NO: 7.

~~64~~45. The ~~method~~ use of claim ~~61~~42, wherein the C-peptide fusion inhibitor comprises a sequence of SEQ ID NO: 11, 15, 19, or any combination thereof.