CLAIMS

1. Use of a population of cyclophosphamide-resistant modified bone marrow cells in the manufacture of a first medicament, and use of at least one non-myeloablative dose of cyclophosphamide in the manufacture of a second medicament, wherein the first and second medicaments are to be used in combination therapy for performing a bone marrow transplant in a patient infected with 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.

2. The use of claim 1, wherein the population of cyclophosphamide resistant modified bone marrow cells express ALDH1.

3. The use of claim 1 or claim 2, wherein the cyclophosphamide resistance of the cyclophosphamide-resistant modified bone marrow cells is conferred by expression of aldehyde dehydrogenase 1 (ALDH1).

4. The 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.

5. The use of any one of claims 1 to 4, wherein the cyclophosphamide resistance of the modified bone marrow cells is transient.

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

7. The use of claim 6, 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. The use of claim 6, wherein the immune cells are T cells.

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

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

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

13. The use of claim 10, wherein the expression vector is a retrovirus, a transposon, an episomal expression vector, modified RNA, a plasmid, or any combination thereof.

14. The use of claim 1, wherein the at least one non-myeloablative dose of cyclophosphamide is to be administered after administration of the modified bone marrow cells.

15. The use of any one of claims 1 to 14, wherein the non-myeloablative dose of cyclophosphamide is from 0.41 mg/kg/day to 1.63 mg/kg/day.

16. The use of any one of claims 1 to 15, wherein the non-myeloablative dose of cyclophosphamide is from 0.81 mg/kg/day to 1.46 mg/kg/day.

17. The use of any one of claims 1 to 16, wherein the non-myeloablative dose of cyclophosphamide is 1.3 mg/kg/day.

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

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

20. The use of any one of claims 1 to 17, wherein the non-myeloablative dose of cyclophosphamide is to be 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.

21. The use of claim 1, wherein the non-myeloablative dose of cyclophosphamide is not to be administered 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 cyclophosphamide.

22. The use of claim 21, wherein the period of time is selected from the group consisting of 3 days, 7 days, 10 days, and 14 days.

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

24. The use of any one of claims 1 to 23, wherein a patient to be administered the medicament is not myeloablated and/or immunocompromised as a result of the administration of the at least one non-myeloablative dose of cyclophosphamide.

25. The use of any one of claims 1 to 24, wherein a patient to be 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.

26. The 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.

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

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

29. The use of claim 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.

30. The use of claim 28, wherein the modified bone marrow cells heterologously express shCCR5, shCXCR4, a C-peptide fusion inhibitor or any combination thereof.

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

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

33. Use of a population of bone marrow stem cells that heterologously express ALDH1 and a molecule of interest for the manufacture of a first medicament; and use of a non-myeloablative dose of cyclophosphamide for the manufacture of a second medicament, wherein the first and second medicaments are to be used in combination therapy for treating a condition requiring a bone marrow transplant, wherein the treatment further comprises expressing the molecule of interest in a subject,

wherein the molecule of interest is one that reduces expression of CCR5; reduces expression of CXCR4; encodes for the expression of a C-peptide fusion inhibitor; or any combination thereof;

wherein the medicament is suitable for administration to the subject undergoing the bone marrow transplant, and

wherein the non-myeloablative dose of cyclophosphamide is from 0.16 mg/kg/day to less than 2.5 mg/kg/day.

34. The use of claim 33, wherein the bone marrow stem cell is CD34+ and/or CD4+.

35. The use of claim 33, wherein the molecule of interest that reduces expression of the CCR5 is shCCR5.

36. The use of claim 35, wherein the molecule of interest comprises a nucleic acid molecule comprising or encoding for SEQ ID NO: 6 and/or SEQ ID NO: 7.

37. The use of claim 33, wherein the C-peptide fusion inhibitor comprises a sequence of SEQ ID NO: 11, 15, 19, or any combination thereof.