CLAIMS

What is claimed is:

1. A method of mobilizing a population of hematopoietic stem cells from the bone marrow of a mammalian donor into peripheral blood, the method comprising administering to the donor (i) a CXCR2 agonist selected from the group consisting of Gro-β, Gro-β T, and variants thereof at a dose of from about 50 μg/kg to about 300 mg/kg and (ii) a CXCR4 antagonist.

2. The method of claim 1, wherein the CXCR2 agonist is Gro-β T.

3. The method of claim 1 or 2, wherein the CXCR2 agonist is administered to the donor at a dose of from about 100 μg/kg to about 250 μg/kg.

4. The method of claim 3, wherein the CXCR2 agonist is administered to the donor at a dose of from about 125 μg/kg to about 225 μg/kg.

5. The method of claim 4, wherein the CXCR2 agonist is administered to the donor at a dose of about 150 μg/kg.

6. The method of any one of claims 1-5, wherein the CXCR2 agonist is administered intravenously to the donor.

7. The method of any one of claims 1-6, wherein the CXCR4 antagonist is administered subcutaneously to the donor.

8. The method of any one of claims 1-7, wherein the CXCR4 antagonist is plerixafor or a pharmaceutically acceptable salt thereof.

9. The method of claim 8, wherein the plerixafor or pharmaceutically acceptable salt thereof is administered to the donor at a dose of from about 50 μg/kg to about 500 μg/kg.

10. The method of claim 9, wherein the plerixafor or pharmaceutically acceptable salt thereof is administered to the donor at a dose of from about 200 μg/kg to about 300 μg/kg.

11. The method of claim 10, wherein the plerixafor or pharmaceutically acceptable salt thereof is administered to the donor at a dose of about 240 μg/kg.

12. A method of mobilizing a population of hematopoietic stem cells from the bone marrow of a mammalian donor into peripheral blood, the method comprising administering to the donor a CXCR2 agonist and a CXCR4 antagonist in amounts sufficient to produce a population of cells having a ratio of CD34+ cells to leukocytes of from about 0.0008 to about 0.0021 in a sample of peripheral blood of the donor following administration of the CXCR2 agonist and CXCR4 antagonist.

13. The method of claim 12, wherein the ratio of CD34+ stem cells to leukocytes in the sample is from about 0.0010 to about 0.0018.

14. A method of mobilizing a population of hematopoietic stem cells from the bone marrow of a mammalian donor into peripheral blood, the method comprising administering to the donor a CXCR2 agonist and a CXCR4 antagonist in amounts sufficient to enrich the peripheral blood of the donor with CD34+ cells relative to leukocytes by a ratio of from about 3.4:1 to about 6.9:1 as assessed by comparing a sample of peripheral blood of the donor following administration of the CXCR2 agonist and CXCR4 antagonist to a sample of peripheral blood of the donor prior to administration of the CXCR2 agonist and CXCR4 antagonist.

15. The method of claim 14, wherein the peripheral blood of the donor is enriched with CD34+ cells relative to leukocytes by a ratio of from about 4.0:1 to about 6.0:1.

16. A method of mobilizing a population of hematopoietic stem cells from the bone marrow of a mammalian donor into peripheral blood, the method comprising administering to the donor a CXCR2 agonist and a CXCR4 antagonist in amounts sufficient to produce a population of cells having a ratio of CD34+ cells to neutrophils of from about 0.0018 to about 0.0058 in a sample of peripheral blood of the donor following administration of the CXCR2 agonist and CXCR4 antagonist.

17. The method of claim 16, wherein the ratio of CD34+ cells to neutrophils in the sample is from about 0.0026 to about 0.0046.

18. A method of mobilizing a population of hematopoietic stem cells from the bone marrow of a mammalian donor into peripheral blood, the method comprising administering to the donor a CXCR2 agonist and a CXCR4 antagonist in amounts sufficient to enrich the peripheral blood of the donor with CD34+ cells relative to neutrophils by a ratio of from

about 2.1:1 to about 8.1:1 as assessed by comparing a sample of peripheral blood of the donor following administration of the CXCR2 agonist and CXCR4 antagonist to a sample of peripheral blood of the donor prior to administration of the CXCR2 agonist and CXCR4 antagonist.

19. The method of claim 18, wherein the peripheral blood of the donor is enriched with CD34+ cells relative to neutrophils by a ratio of from about 5.4:1 to about 7.4:1.

20. A method of mobilizing a population of hematopoietic stem cells from the bone marrow of a mammalian donor into peripheral blood, the method comprising administering to the donor a CXCR2 agonist and a CXCR4 antagonist in amounts sufficient to produce a population of cells having a ratio of CD34+ cells to lymphocytes of from about 0.0021 to about 0.0094 in a sample of peripheral blood of the donor following administration of the CXCR2 agonist and CXCR4 antagonist.

21. The method of claim 20, wherein the ratio of CD34+ cells to lymphocytes in the sample is from about 0.0025 to about 0.0035.

22. A method of mobilizing a population of hematopoietic stem cells from the bone marrow of a mammalian donor into peripheral blood, the method comprising administering to the donor a CXCR2 agonist and a CXCR4 antagonist in amounts sufficient to enrich the peripheral blood of the donor with CD34+ cells relative to lymphocytes by a ratio of from about 4.8:1 to about 8.4 as assessed by comparing a sample of peripheral blood of the donor following administration of the CXCR2 agonist and CXCR4 antagonist to a sample of peripheral blood of the donor prior to administration of the CXCR2 agonist and CXCR4 antagonist.

23. The method of claim 22, wherein the peripheral blood of the donor is enriched with CD34+ cells relative to lymphocytes by a ratio of from about 5.0:1 to about 6.5:1.

24. A method of mobilizing a population of hematopoietic stem cells from the bone marrow of a mammalian donor into peripheral blood, the method comprising administering to the donor a CXCR2 agonist and a CXCR4 antagonist in amounts sufficient to produce a population of cells having a ratio of CD34+ cells to monocytes of from about 0.0071 to about 0.0174 in a sample of peripheral blood of the donor following administration of the CXCR2 agonist.

25. The method of claim 24, wherein the ratio of CD34+ cells to monocytes in the sample is from about 0.0100 to about 0.0140.

26. A method of mobilizing a population of hematopoietic stem cells from the bone marrow of a mammalian donor into peripheral blood, the method comprising administering to the donor a CXCR2 agonist and a CXCR4 antagonist in amounts sufficient to enrich the peripheral blood of the donor with CD34+ cells relative to monocytes by a ratio of from about 1.1:1 to about 2.3:1 as assessed by comparing a sample of peripheral blood of the donor following administration of the CXCR2 agonist and CXCR4 antagonist to a sample of peripheral blood of the donor prior to administration of the CXCR2 agonist and CXCR4 antagonist.

27. The method of claim 26, wherein the peripheral blood of the donor is enriched with CD34+ cells relative to monocytes by a ratio of from about 1.3:1 to about 1.9:1.

28. A method of mobilizing a population of hematopoietic stem cells from the bone marrow of a mammalian donor into peripheral blood, the method comprising administering to the donor a CXCR2 agonist and a CXCR4 antagonist in amounts sufficient to produce a population of cells having a frequency of CD34+ cells of from about 0.051% to about 0.140% in a sample of peripheral blood of the donor following administration of the CXCR2 agonist and CXCR4 antagonist.

29. The method of claim 28, wherein the frequency of CD34+ cells in the sample is from about 0.080% to about 0.120%.

30. A method of mobilizing a population of hematopoietic stem cells from the bone marrow of a mammalian donor into peripheral blood, the method comprising administering to the donor a CXCR2 agonist and a CXCR4 antagonist in amounts sufficient to induce an increase in the frequency of CD34+ cells in the peripheral blood of the donor by from about 3.4-fold to about 7.1-fold as assessed by comparing a sample of peripheral blood of the donor following administration of the CXCR2 agonist and CXCR4 antagonist to a sample of peripheral blood of the donor prior to administration of the CXCR2 agonist and CXCR4 antagonist.

31. The method of claim 30, wherein the frequency of CD34+ cells in the peripheral blood of the donor is increased by from about 4.0-fold to about 6.0-fold following administration of the CXCR2 agonist and CXCR4 antagonist.

32. A method of mobilizing a population of hematopoietic stem cells from the bone marrow of a mammalian donor into peripheral blood, the method comprising administering to the donor a CXCR2 agonist and a CXCR4 antagonist in amounts sufficient to produce a population of cells having a ratio of CD34+ CD90+ CD45RA- cells to leukocytes of from about 0.0003 to about 0.0016 in a sample of peripheral blood of the donor following administration of the CXCR2 agonist and CXCR4 antagonist.

33. The method of claim 32, wherein the ratio of CD34+ CD90+ CD45RA- cells to leukocytes in the sample is from about 0.0006 to about 0.0012.

34. A method of mobilizing a population of hematopoietic stem cells from the bone marrow of a mammalian donor into peripheral blood, the method comprising administering to the donor a CXCR2 agonist and a CXCR4 antagonist in amounts sufficient to enrich the peripheral blood of the donor with CD34+ CD90+ CD45RA- cells relative to leukocytes by a ratio of from about 5.5:1 to about 26.9:1 as assessed by comparing a sample of peripheral blood of the donor following administration of the CXCR2 agonist and CXCR4 antagonist to a sample of peripheral blood of the donor prior to administration of the CXCR2 agonist and CXCR4 antagonist.

35. The method of claim 34, wherein the peripheral blood of the donor is enriched with CD34+ CD90+ CD45RA- cells relative to leukocytes by a ratio of from about 5.5:1 to about 6.5:1.

36. A method of mobilizing a population of hematopoietic stem cells from the bone marrow of a mammalian donor into peripheral blood, the method comprising administering to the donor a CXCR2 agonist and a CXCR4 antagonist in amounts sufficient to produce a population of cells having a ratio of CD34+ CD90+ CD45RA- cells to neutrophils of from about 0.0007 to about 0.0043 in a sample of peripheral blood of the donor following administration of the CXCR2 agonist and CXCR4 antagonist.

37. The method of claim 36, wherein the ratio of CD34+ CD90+ CD45RA- cells to neutrophils in the sample is from about 0.0014 to about 0.0034.

38. A method of mobilizing a population of hematopoietic stem cells from the bone marrow of a mammalian donor into peripheral blood, the method comprising administering to the donor a CXCR2 agonist and a CXCR4 antagonist in amounts sufficient to enrich the peripheral blood of the donor with CD34+ CD90+ CD45RA- cells relative to neutrophils by a ratio of from about 3.5:1 to about 22.0:1 as assessed by comparing a sample of peripheral blood of the donor following administration of the CXCR2 agonist and CXCR4 antagonist to a sample of peripheral blood of the donor prior to administration of the CXCR2 agonist and CXCR4 antagonist.

39. The method of claim 38, wherein the peripheral blood of the donor is enriched with CD34+ CD90+ CD45RA- cells relative to neutrophils by a ratio of from about 7.0:1 to about 9.0:1.

40. A method of mobilizing a population of hematopoietic stem cells from the bone marrow of a mammalian donor into peripheral blood, the method comprising administering to the donor a CXCR2 agonist and a CXCR4 antagonist in amounts sufficient to produce a population of cells having a ratio of CD34+ CD90+ CD45RA- cells to lymphocytes of from about 0.0008 to about 0.0069 in a sample of peripheral blood of the donor following administration of the CXCR2 agonist and CXCR4 antagonist.

41. The method of claim 40, wherein the ratio of CD34+ CD90+ CD45RA- cells to lymphocytes in the sample is from about 0.0011 to about 0.0031.

42. A method of mobilizing a population of hematopoietic stem cells from the bone marrow of a mammalian donor into peripheral blood, the method comprising administering to the donor a CXCR2 agonist and a CXCR4 antagonist in amounts sufficient to enrich the peripheral blood of the donor with CD34+ CD90+ CD45RA- cells relative to lymphocytes by a ratio of from about 5.6:1 to about 37.0:1 as assessed by comparing a sample of peripheral blood of the donor following administration of the CXCR2 agonist and CXCR4 antagonist to a sample of peripheral blood of the donor prior to administration of the CXCR2 agonist and CXCR4 antagonist.

43. The method of claim 42, wherein the peripheral blood of the donor is enriched with CD34+ CD90+ CD45RA- cells relative to lymphocytes by a ratio of from about 8.0:1 to about 10.0:1.

44. A method of mobilizing a population of hematopoietic stem cells from the bone marrow of a mammalian donor into peripheral blood, the method comprising administering to the donor a CXCR2 agonist and a CXCR4 antagonist in amounts sufficient to produce a population of cells having a ratio of CD34+ CD90+ CD45RA- cells to monocytes of from about 0.0028 to about 0.0130 in a sample of peripheral blood of the donor following administration of the CXCR2 agonist.

45. The method of claim 44, wherein the ratio of CD34+ CD90+ CD45RA- cells to monocytes in the sample is from about 0.0063 to about 0.0083.

46. A method of mobilizing a population of hematopoietic stem cells from the bone marrow of a mammalian donor into peripheral blood, the method comprising administering to the donor a CXCR2 agonist and a CXCR4 antagonist in amounts sufficient to enrich the peripheral blood of the donor with CD34+ CD90+ CD45RA- cells relative to monocytes by a ratio of from about 1.5:1 to about 8.5:1 as assessed by comparing a sample of peripheral blood of the donor following administration of the CXCR2 agonist and CXCR4 antagonist to a sample of peripheral blood of the donor prior to administration of the CXCR2 agonist and CXCR4 antagonist.

47. The method of claim 46, wherein the peripheral blood of the donor is enriched with CD34+ CD90+ CD45RA- cells relative to monocytes by a ratio of from about 1.3:1 to about 2.5:1.

48. A method of mobilizing a population of hematopoietic stem cells from the bone marrow of a mammalian donor into peripheral blood, the method comprising administering to the donor a CXCR2 agonist and a CXCR4 antagonist in amounts sufficient to produce a population of cells having a ratio of CD34+ CD90+ CD45RA- cells to CD34+ cells of from about 0.393 to about 0.745 in a sample of peripheral blood of the donor following administration of the CXCR2 agonist and CXCR4 antagonist.

49. The method of claim 48, wherein the ratio of CD34+ CD90+ CD45RA- cells to CD34+ cells in the sample is from about 0.625 to about 0.725.

50. A method of mobilizing a population of hematopoietic stem cells from the bone marrow of a mammalian donor into peripheral blood, the method comprising administering to the donor a CXCR2 agonist and a CXCR4 antagonist in amounts sufficient to enrich the

peripheral blood of the donor with CD34+ CD90+ CD45RA- cells relative to CD34+ cells by a ratio of from about 1.1:1 to about 4.8:1 as assessed by comparing a sample of peripheral blood of the donor following administration of the CXCR2 agonist and CXCR4 antagonist to a sample of peripheral blood of the donor prior to administration of the CXCR2 agonist and CXCR4 antagonist.

51. The method of claim 50, wherein the peripheral blood of the donor is enriched with CD34+ CD90+ CD45RA- cells relative to CD34+ cells by a ratio of from about 1.1:1 to about 1.5:1.

52. A method of mobilizing a population of hematopoietic stem cells from the bone marrow of a mammalian donor into peripheral blood, the method comprising administering to the donor a CXCR2 agonist and a CXCR4 antagonist in amounts sufficient to produce a population of cells having a frequency of CD34+ CD90+ CD45RA- cells of from about 0.020% to about 0.110% in a sample of peripheral blood of the donor following administration of the CXCR2 agonist and CXCR4 antagonist.

53. The method of claim 52, wherein the frequency of CD34+ CD90+ CD45RA- cells in the sample is from about 0.046% to about 0.086%.

54. A method of mobilizing a population of hematopoietic stem cells from the bone marrow of a mammalian donor into peripheral blood, the method comprising administering to the donor a CXCR2 agonist and a CXCR4 antagonist in amounts sufficient to induce an increase in the frequency of CD34+ CD90+ CD45RA- cells in the peripheral blood of the donor by from about 5.1-fold to about 25.7-fold as assessed by comparing a sample of peripheral blood of the donor following administration of the CXCR2 agonist and CXCR4 antagonist to a sample of peripheral blood of the donor prior to administration of the CXCR2 agonist and CXCR4 antagonist.

55. The method of claim 54, wherein the frequency of CD34+ CD90+ CD45RA- cells in the peripheral blood of the donor is increased by from about 5.1-fold to about 7.1-fold following administration of the CXCR2 agonist and CXCR4 antagonist.

56. A method of mobilizing a population of hematopoietic stem cells from the bone marrow of a mammalian donor into peripheral blood, the method comprising:

a. administering to the donor mobilizing amounts of a CXCR2 agonist and a CXCR4 antagonist;
b. acquiring an input value for each of one or more parameters listed in **TABLE 2** characterizing a sample of peripheral blood of the donor; and
c. releasing the sample for *ex vivo* expansion of the hematopoietic stem cells or for use in the treatment of one or more stem cell disorders in a mammalian patient if the input value for each of the one or more parameters meets the corresponding reference criterion for each of the one or more parameters.

57. The method of claim 56, wherein the one or more reference parameters are a set of parameters listed in any one of **TABLES 3-6**.

58. The method of claim 56 or 57, further comprising expanding the hematopoietic stem cells *ex vivo* if the sample is released for *ex vivo* expansion.

59. The method of any one of claims 56-58, further comprising infusing the hematopoietic stem cells, or progeny thereof, into a mammalian patient suffering from one or more stem cell disorders if the sample is released for use in the treatment thereof.

60. The method of any one of claims 12-59, wherein the sample is isolated from the donor at from about 3 hours to about 5 hours following administration of the CXCR2 agonist and CXCR4 antagonist.

61. The method of claim 60, wherein the sample is isolated from the donor at about 4 hours following administration of the CXCR2 agonist and CXCR4 antagonist.

62. The method of any one of claims 12-61, wherein the CXCR2 agonist is Gro-β T or a variant thereof.

63. The method of claim 62, wherein the CXCR2 agonist is a peptide having at least 85% sequence identity to the amino acid sequence of SEQ ID NO: 2.

64. The method of claim 63, wherein the amino acid sequence of the CXCR2 agonist differs from that of SEQ ID NO: 2 only by way of one or more conservative amino acid substitutions.

65. The method of claim 63, wherein the CXCR2 agonist is Gro-β T.

66. The method of any one of claims 12-61, wherein the CXCR2 agonist is Gro-β or a variant thereof.

67. The method of claim 66, wherein the CXCR2 agonist is a peptide having at least 85% sequence identity to the amino acid sequence of SEQ ID NO: 1.

68. The method of claim 67, wherein the amino acid sequence of the CXCR2 agonist differs from that of SEQ ID NO: 1 only by way of one or more conservative amino acid substitutions.

69. The method of claim 67, wherein the CXCR2 agonist is Gro-β.

70. The method of any one of claims 12-69, wherein the CXCR2 agonist is administered to the donor at a dose of from about 50 μg/kg to about 1 mg/kg.

71. The method of claim 70, wherein the CXCR2 agonist is administered to the donor at a dose of from about 50 μg/kg to about 300 μg/kg.

72. The method of claim 71, wherein the CXCR2 agonist is administered to the donor at a dose of from about 100 μg/kg to about 250 μg/kg.

73. The method of claim 72, wherein the CXCR2 agonist is administered to the donor at a dose of about 150 μg/kg.

74. The method of any one of claims 1-73, wherein the CXCR2 agonist is administered intravenously to the donor.

75. The method of any one of claims 12-74, wherein the CXCR2 agonist and the CXCR4 antagonist are administered to the donor concurrently.

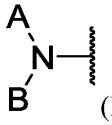
76. The method of any one of claims 12-75, wherein the CXCR4 antagonist is a compound represented by formula (**I**)

Z – linker – Z' (**I**)

or a pharmaceutically acceptable salt thereof, wherein Z is:

(i) a cyclic polyamine containing from 9 to 32 ring members, wherein from 2 to 8 of the ring members are nitrogen atoms separated from one another by 2 or more carbon atoms; or

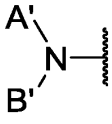
(ii) an amine represented by formula (**IA**)


(IA)

wherein A comprises a monocyclic or bicyclic fused ring system comprising at least one nitrogen atom and B is H or a substituent of from 1 to 20 atoms; and wherein Z' is:

(i) a cyclic polyamine containing from 9 to 32 ring members, wherein from 2 to 8 of the ring members are nitrogen atoms separated from one another by 2 or more carbon atoms;

(ii) an amine represented by formula (**IB**)


(IB)

wherein A' comprises a monocyclic or bicyclic fused ring system comprising at least one nitrogen atom and B' is H or a substituent of from 1 to 20 atoms; or

(iii) a substituent represented by formula (**IC**)

$$-N(R)-(CR_2)_n-X \quad (\mathbf{IC})$$

wherein each R is independently H or C_1-C_6 alkyl, n is 1 or 2, and X is an aryl or heteroaryl group or a mercaptan;

wherein the linker is a bond, optionally substituted C_1-C_6 alkylene, optionally substituted C_1-C_6 heteroalkylene, optionally substituted C_2-C_6 alkenylene, optionally substituted C_2-C_6 heteroalkenylene, optionally substituted C_2-C_6 alkynylene, optionally substituted C_2-C_6 heteroalkynylene, optionally substituted cycloalkylene, optionally substituted heterocycloalkylene, optionally substituted arylene, or optionally substituted heteroarylene.

77. The method of claim 76, wherein Z and Z' are each independently a cyclic polyamine containing from 9 to 32 ring members, of which from 2 to 8 are nitrogen atoms separated from one another by 2 or more carbon atoms.

78. The method of claim 76 or 77, wherein Z and Z' are identical substituents.

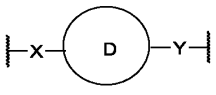
79. The method of any one of claims 76-78, wherein Z is a cyclic polyamine comprising from 10 to 24 ring members.

80. The method of claim 79, wherein Z is a cyclic polyamine comprising 14 ring members.

81. The method of any one of claims 76-80, wherein Z comprises 4 nitrogen atoms.

82. The method of any one of claims 76-81, wherein Z is 1,4,8,11-tetraazocyclotetradecane.

83. The method of any one of claims 76-82, wherein the linker is represented by formula (**ID**)

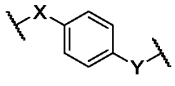


(ID)

wherein ring D is an optionally substituted aryl group, an optionally substituted heteroaryl group, an optionally substituted cycloalkyl group, or an optionally substituted heterocycloalkyl group; and

X and Y are each independently optionally substituted C_1-C_6 alkylene, optionally substituted C_1-C_6 heteroalkylene, optionally substituted C_2-C_6 alkenylene, optionally substituted C_2-C_6 heteroalkenylene, optionally substituted C_2-C_6 alkynylene, or optionally substituted C_2-C_6 heteroalkynylene.

84. The method of claim 83, wherein the linker is represented by formula (**IE**)



(IE).

wherein ring D is an optionally substituted aryl group, an optionally substituted heteroaryl group, an optionally substituted cycloalkyl group, or an optionally substituted heterocycloalkyl group; and

X and Y are each independently optionally substituted C_1-C_6 alkylene, optionally substituted C_1-C_6 heteroalkylene, optionally substituted C_2-C_6 alkenylene, optionally substituted C_2-C_6 heteroalkenylene, optionally substituted C_2-C_6 alkynylene, or optionally substituted C_2-C_6 heteroalkynylene.

85. The method of claim 83 or 84, wherein X and Y are each independently optionally substituted C_1-C_6 alkylene.

86. The method of any one of claim 83-85, wherein X and Y are identical substituents.

87. The method of claim 86, wherein X and Y are each methylene groups.

88. The method of any one of claims 76-87, wherein the CXCR4 antagonist is plerixafor or a pharmaceutically acceptable salt thereof.

89. The method of claim 88, wherein the plerixafor or pharmaceutically acceptable salt thereof is administered subcutaneously to the donor.

90. The method of claim 88 or 89, wherein the plerixafor or pharmaceutically acceptable salt thereof is administered to the donor at a dose of from about 50 μg/kg to about 500 μg/kg.

91. The method of claim 90, wherein the plerixafor or pharmaceutically acceptable salt thereof is administered to the donor at a dose of from about 200 μg/kg to about 300 μg/kg.

92. The method of claim 91, wherein the plerixafor or pharmaceutically acceptable salt thereof is administered to the donor at a dose of about 240 μg/kg.

93. A pharmaceutical composition comprising a population of hematopoietic stem cells or progeny thereof isolated from a mammalian donor, wherein the ratio of CD34+ cells to leukocytes in the population is from about 0.0008 to about 0.0021.

94. The pharmaceutical composition of claim 93, wherein the ratio of CD34+ cells to leukocytes in the population is from about 0.0010 to about 0.0018.

95. A pharmaceutical composition comprising a population of hematopoietic stem cells or progeny thereof isolated from a mammalian donor, wherein the ratio of CD34+ cells to neutrophils in the population is from about 0.0018 to about 0.0058.

96. The pharmaceutical composition of claim 95, wherein the ratio of CD34+ cells to neutrophils in the population is from about 0.0026 to about 0.0046.

97. A pharmaceutical composition comprising a population of hematopoietic stem cells or progeny thereof isolated from a mammalian donor, wherein the ratio of CD34+ cells to lymphocytes in the population is from about 0.0021 to about 0.0094.

98. The pharmaceutical composition of claim 97, wherein the ratio of CD34+ cells to lymphocytes in the population is from about 0.0025 to about 0.0035.

99. A pharmaceutical composition comprising a population of hematopoietic stem cells or progeny thereof isolated from a mammalian donor, wherein the ratio of CD34+ cells to monocytes in the population is from about 0.0071 to about 0.0174.

100. The pharmaceutical composition of claim 99, wherein the ratio of CD34+ cells to monocytes in the population is from about 0.0100 to about 0.0140.

101. A pharmaceutical composition comprising a population of hematopoietic stem cells or progeny thereof isolated from a mammalian donor, wherein the frequency of CD34+ cells in the population is from about 0.051% to about 0.140%.

102. The pharmaceutical composition of claim 101, wherein the frequency of CD34+ cells in the population is from about 0.080% to about 0.120%.

103. A pharmaceutical composition comprising a population of hematopoietic stem cells or progeny thereof isolated from a mammalian donor, wherein the ratio of CD34+ cells to leukocytes in the population is from about 0.0003 to about 0.0016.

104. The pharmaceutical composition of claim 103, wherein the ratio of CD34+ CD90+ CD45RA- cells to leukocytes in the population is from about 0.0006 to about 0.0012.

105. A pharmaceutical composition comprising a population of hematopoietic stem cells or progeny thereof isolated from a mammalian donor, wherein the ratio of CD34+ CD90+ CD45RA- cells to neutrophils in the population is from about 0.0007 to about 0.0043.

106. The pharmaceutical composition of claim 105, wherein the ratio of CD34+ CD90+ CD45RA- cells to neutrophils in the population is from about 0.0014 to about 0.0034.

107. A pharmaceutical composition comprising a population of hematopoietic stem cells or progeny thereof isolated from a mammalian donor, wherein the ratio of CD34+ CD90+ CD45RA- cells to lymphocytes in the population is from about 0.0008 to about 0.0069.

108. The pharmaceutical composition of claim 107, wherein the ratio of CD34+ CD90+ CD45RA- cells to lymphocytes in the population is from about 0.0011 to about 0.0031.

109. A pharmaceutical composition comprising a population of hematopoietic stem cells or progeny thereof isolated from a mammalian donor, wherein the ratio of CD34+ CD90+ CD45RA- cells to monocytes in the population is from about 0.0028 to about 0.0130.

110. The pharmaceutical composition of claim 109, wherein the ratio of CD34+ CD90+ CD45RA- cells to monocytes in the population is from about 0.0063 to about 0.0083.

111. A pharmaceutical composition comprising a population of hematopoietic stem cells or progeny thereof isolated from a mammalian donor, wherein the ratio of CD34+ CD90+ CD45RA- cells to CD34+ cells in the population is from about 0.393 to about 0.745.

112. The pharmaceutical composition of claim 111, wherein the ratio of CD34+ CD90+ CD45RA- cells to CD34+ cells in the population is from about 0.625 to about 0.725.

113. A pharmaceutical composition comprising a population of hematopoietic stem cells or progeny thereof isolated from a mammalian donor, wherein the frequency of CD34+ CD90+ CD45RA- cells in the population is from about 0.020% to about 0.110%.

114. The pharmaceutical composition of claim 113, wherein the frequency of CD34+ CD90+ CD45RA- cells in the population is from about 0.046% to about 0.086%.

115. A method of treating a stem cell disorder in a mammalian patient, the method comprising:

a. mobilizing a population of hematopoietic stem cells in a mammalian donor in accordance with the method of any one of claims 1-92; and
b. infusing a therapeutically effective amount of the hematopoietic stem cells, or progeny thereof, into the patient.

116. A method of treating a stem cell disorder in a mammalian patient, the method comprising infusing into the patient a therapeutically effective amount of the hematopoietic stem cells mobilized by the method of any one of claims 1-92, or progeny thereof.

117. A method of treating a stem cell disorder in a mammalian patient, the method comprising administering to the patient the pharmaceutical composition of any one of claims 93-114.

118. The method of any one of claims 115-117, wherein the stem cell disorder is a hemoglobinopathy disorder.

119. The method of claim 118, wherein the hemoglobinopathy disorder is selected from the group consisting of sickle cell anemia, thalassemia, Fanconi anemia, aplastic anemia, and Wiskott-Aldrich syndrome.

120. The method of any one of claims 115-117, wherein the stem cell disorder is a myelodysplastic disorder.

121. The method of any one of claims 115-117, wherein the stem cell disorder is an immunodeficiency disorder.

122. The method of claim 121, wherein the immunodeficiency disorder is a congenital immunodeficiency.

123. The method of claim 121, wherein the immunodeficiency disorder is an acquired immunodeficiency.

124. The method of claim 123, wherein the acquired immunodeficiency is human immunodeficiency virus or acquired immune deficiency syndrome.

125. The method of any one of claims 115-117, wherein the stem cell disorder is a metabolic disorder.

126. The method of claim 125, wherein the metabolic disorder is selected from the group consisting of glycogen storage diseases, mucopolysaccharidoses, Gaucher's Disease, Hurlers Disease, sphingolipidoses, and metachromatic leukodystrophy.

127. The method of any one of claims 115-117, wherein the stem cell disorder is cancer.

128. The method of claim 127, wherein the cancer is selected from the group consisting of leukemia, lymphoma, multiple myeloma, and neuroblastoma.

129. The method of claim 123, wherein the cancer is a hematological cancer.

130. The method of claim 127, wherein the cancer is acute myeloid leukemia, acute lymphoid leukemia, chronic myeloid leukemia, chronic lymphoid leukemia, multiple myeloma, diffuse large B-cell lymphoma, or non-Hodgkin’s lymphoma.

131. The method of any one of claims 115-117, wherein the stem cell disorder is a disorder selected from the group consisting of adenosine deaminase deficiency and severe combined immunodeficiency, hyper immunoglobulin M syndrome, Chediak-Higashi disease, hereditary lymphohistiocytosis, osteopetrosis, osteogenesis imperfecta, storage diseases, thalassemia major, systemic sclerosis, systemic lupus erythematosus, multiple sclerosis, and juvenile rheumatoid arthritis.

132. The method of any one of claims 115-117, wherein the stem cell disorder is an autoimmune disorder.

133. The method of claim 132, wherein the autoimmune disorder is selected from the group consisting of multiple sclerosis, human systemic lupus, rheumatoid arthritis, inflammatory bowel disease, treating psoriasis, Type 1 diabetes mellitus, acute disseminated encephalomyelitis, Addison's disease, alopecia universalis, ankylosing spondylitis, antiphospholipid antibody syndrome, aplastic anemia, autoimmune hemolytic anemia, autoimmune hepatitis, autoimmune inner ear disease, autoimmune lymphoproliferative syndrome, autoimmune oophoritis, Balo disease, Behcet's disease, bullous pemphigoid, cardiomyopathy, Chagas' disease, chronic fatigue immune dysfunction syndrome, chronic inflammatory demyelinating polyneuropathy, Crohn's disease, cicatricial pemphigoid, coeliac sprue-dermatitis herpetiformis, cold agglutinin disease, CREST syndrome, Degos disease, discoid lupus, dysautonomia, endometriosis, essential mixed cryoglobulinemia, fibromyalgia-fibromyositis, Goodpasture' s syndrome, Grave's disease, Guillain-Barre syndrome, Hashimoto' s thyroiditis, Hidradenitis suppurativa, idiopathic and/or acute thrombocytopenic purpura, idiopathic pulmonary fibrosis, IgA neuropathy, interstitial cystitis, juvenile arthritis, Kawasaki's disease, lichen planus, Lyme disease, Meniere disease, mixed connective tissue disease, myasthenia gravis, neuromyotonia, opsoclonus myoclonus syndrome, optic neuritis, Ord's thyroiditis, pemphigus vulgaris, pernicious anemia, polychondritis, polymyositis and dermatomyositis, primary biliary cirrhosis, polyarteritis nodosa, polyglandular syndromes, polymyalgia rheumatica, primary agammaglobulinemia, Raynaud phenomenon, Reiter' s syndrome, rheumatic fever, sarcoidosis, scleroderma, Sjögren's syndrome, stiff person syndrome, Takayasu's arteritis, temporal arteritis, ulcerative colitis, uveitis, vasculitis, vitiligo, vulvodynia, and Wegener's granulomatosis.

134. The method of any one of claims 115-133, wherein the hematopoietic stem cells are autologous with respect to the patient.

135. The method of any one of claims 115-133, wherein the hematopoietic stem cells are allogeneic with respect to the patient.

136. The method of claim 135, wherein the hematopoietic stem cells are HLA-matched with respect to the patient.

137. The method of any one of claims 115-136, wherein the hematopoietic stem cells have been genetically modified to disrupt an endogenous gene.

138. The method of claim 137, wherein the endogenous gene encodes a major histocompatibility complex protein.

139. The method of any one of claims 115-138, wherein the hematopoietic stem cells, or progeny thereof, maintain hematopoietic stem cell functional potential after two or more days following infusion of the hematopoietic stem cells, or progeny thereof, into the patient.

140. The method of any one of claims 115-139, wherein the hematopoietic stem cells, or progeny thereof, localize to hematopoietic tissue and/or reestablish hematopoiesis following infusion of the hematopoietic stem cells, or progeny thereof, into the patient.

141. The method of any one of claims 115-140, wherein upon infusion into the patient, the hematopoietic stem cells, or progeny thereof, give rise to recovery of a population of cells selected from the group consisting of megakaryocytes, thrombocytes, platelets, erythrocytes, mast cells, myeoblasts, basophils, neutrophils, eosinophils, microglia, granulocytes, monocytes, osteoclasts, antigen-presenting cells.

142. The method of any one of claims 1-92, wherein the mammalian donor is a human donor.

143. The pharmaceutical composition of any one of claims 93-114, wherein the mammalian donor is a human donor.

144. The method of any one of claims 115-141, wherein the mammalian donor is a human donor and the mammalian patient is a human patient.

145. The method of any one of the above claims, further comprising isolating the hematopoietic stem cells or progeny thereof by drawing peripheral blood from the donor.

146. The method of any one of the above claims, further comprising using apheresis to collect the hematopoietic stem cells or progeny thereof from the donor.

147. The method of any one of the above claims, wherein the Gro-β, Gro-β T, and variants thereof have a purity of at least about 95% relative to the deamidated versions of these peptides.

148. An enriched preparation of human blood cells comprising a population of hematopoietic stem cells or progeny thereof, wherein the ratio of CD34+ cells to leukocytes in the preparation is from about 0.0008 to about 0.0021.

149. A enriched preparation of human blood cells comprising a population of hematopoietic stem cells or progeny thereof, wherein the ratio of CD34+ CD90+ CD45RA- cells to neutrophils in the population is from about 0.0007 to about 0.0043.

150. A human blood cell preparation comprising hematopoietic stem cells or progeny thereof prepared using the method of any one of claims 1-92.

151. A method of mobilizing $CD34^{dim}$ cells from the bone marrow of a human donor into peripheral blood, the method comprising administering to the donor (i) a CXCR2 agonist selected from the group consisting of Gro-β, Gro-β T, and variants thereof at a dose of from about 50 μg/kg to about 1,000 μg/kg and (ii) a CXCR4 antagonist.

152. A method of performing an allogeneic hematopoietic stem cell transplant in a patient in need thereof, the method comprising infusing into the patient a therapeutically effective amount of allogeneic hematopoietic stem cells, wherein the hematopoietic stem cells were mobilized from bone marrow of a human donor into peripheral blood of the human donor by a method comprising administering to the donor (i) a CXCR2 agonist selected from the group consisting of Gro-β, Gro-β T, and variants thereof at a dose of from about 50 μg/kg to about 1,000 μg/kg and (ii) a CXCR4 antagonist.

153. A method of preventing, reducing the risk of developing, or reducing the severity of a post-transplant infection in a patient in need thereof, the method comprising infusing into the patient a therapeutically effective amount of hematopoietic stem cells, wherein the hematopoietic stem cells were mobilized from bone marrow of a human donor into peripheral blood of the human donor by a method comprising administering to the human donor (i) a

CXCR2 agonist selected from the group consisting of Gro-β, Gro-β T, and variants thereof at a dose of from about 50 μg/kg to about 1,000 μg/kg and (ii) a CXCR4 antagonist.

154. A method of preventing, reducing the risk of developing, or reducing the severity of graft versus host disease (GVHD) in a patient in need thereof, the method comprising infusing into the patient a therapeutically effective amount of hematopoietic stem cells, wherein the hematopoietic stem cells were mobilized from bone marrow of a human donor into peripheral blood of the human donor by a method comprising administering to the human donor (i) a CXCR2 agonist selected from the group consisting of Gro-β, Gro-β T, and variants thereof at a dose of from about 50 μg/kg to about 1,000 μg/kg and (ii) a CXCR4 antagonist.

155. The method of any one of claims 151-154, wherein the $CD34^{dim}$ cells are present in the peripheral blood in a amount that is at least two- to ten-fold higher than if the hematopoietic stem cells were mobilized using the CXCR4 antagonist alone.

156. The method of any one of claims 151-155, wherein the $CD34^{dim}$ cells are capable of suppressing alloreactive T lymphocyte proliferation when administered to a recipient.

157. The method of any one of claims 151-156, wherein the CXCR2 agonist is Gro-β T.

158. The method of any one of claims 151-157, wherein the CXCR2 agonist is administered to the donor at a dose of from about 100 μg/kg to about 250 μg/kg.

159. The method of claim 158, wherein the CXCR2 agonist is administered to the donor at a dose of from about 125 μg/kg to about 225 μg/kg.

160. The method of claim 159, wherein the CXCR2 agonist is administered to the donor at a dose of about 150 μg/kg.

161. The method of any one of claims 151-160, wherein the CXCR2 agonist is administered intravenously to the donor.

162. The method of any one of claims 151-161, wherein the CXCR4 antagonist is administered subcutaneously to the donor.

163. The method of any one of claims 151-162, wherein the CXCR4 antagonist is plerixafor or a pharmaceutically acceptable salt thereof.

164. The method of claim 163, wherein the plerixafor or pharmaceutically acceptable salt thereof is administered to the donor at a dose of from about 50 µg/kg to about 500 µg/kg.

165. The method of claim 164, wherein the plerixafor or pharmaceutically acceptable salt thereof is administered to the donor at a dose of from about 200 µg/kg to about 300 µg/kg.

166. The method of claim 165, wherein the plerixafor or pharmaceutically acceptable salt thereof is administered to the donor at a dose of about 240 µg/kg.

167. The population of $CD34^{dim}$ cells derived from the method of any one of claims 151-165.