

**WHAT IS CLAIMED IS:**

1. A chimeric antigen receptor (CAR) bridging protein comprising (1) an antigen-binding domain and (2) a CAR-binding domain, that comprises at least a portion of an HIV-1 gp120 protein.
- 5 2. The CAR bridging protein of claim 1, wherein the CAR-binding domain is chemically conjugated to the antigen-binding domain.
3. The CAR bridging protein of claim 1, wherein the antigen-binding domain is chemically conjugated to the CAR-binding domain.
4. The CAR bridging protein of claim 1, wherein the antigen-binding domain and the  
10 CAR-binding domain are comprised in a fusion protein.
5. The CAR bridging protein of claim 4, further comprising an antibody Fc domain.
6. The CAR bridging protein of claim 5, wherein the Fc domain is positioned between the CAR-binding domain and the antigen-binding domain.
7. The CAR bridging protein of claim 5, wherein the CAR-binding domain is positioned  
15 between the antigen-binding domain and the Fc domain.
8. The CAR bridging protein of claim 5, wherein the Fc domain comprises a human Fc domain sequence.
9. The CAR bridging protein of claim 8, wherein the Fc domain comprises a human heavy chain Fc domain sequence.
- 20 10. The CAR bridging protein of claim 8, wherein the Fc domain comprises CH2 and CH3 regions of a human heavy chain Fc domain sequence.
11. The CAR bridging protein of claim 8, wherein the Fc domain comprises substitutions relative to the wild-type human heavy chain Fc domain sequence which prevent binding to FcγR receptors.
- 25 12. The CAR bridging protein of claim 8, wherein the Fc domain comprises a sequence that is at least 85%, at least 90%, at least 95%, or 100% identical to the sequence provided by SEQ ID NO: 4.

13. The CAR bridging protein of claim 1, further comprising a linker sequence between the antigen binding domain and the CAR-binding domain.
14. The CAR bridging protein of claim 1, wherein the CAR-binding domain comprises the sequence provided in SEQ ID NO: 6.
- 5 15. The CAR bridging protein of any one of claims 1-14, wherein the antigen-binding domain binds to a tumor antigen or a viral antigen.
16. The CAR bridging protein of any one of claims 1-15, wherein the antigen-binding domain comprises a peptide that interacts with an antigen of interest.
17. The CAR bridging protein of any one of claims 1-16, wherein the antigen-binding  
10 domain comprises an antigen-binding portion of an antibody that recognizes the antigen of interest.
18. The CAR bridging protein of any one of claims 1-17, wherein the antigen-binding domain comprises at least a portion of a ligand that interacts with the antigen of interest.
- 15 19. The CAR bridging protein of any one of claims 1-18, wherein the antigen-binding domain is capable of binding to CD19, CD20, or CD22.
20. The CAR bridging protein of any one of claims 1-18, wherein the antigen-binding domain is capable of binding to a coronavirus spike protein.
21. The CAR bridging protein of claim 20, wherein the coronavirus spike protein is a  
20 SARS-CoV-1 or SARS-CoV-2 spike protein.
22. The CAR bridging protein of any one of claims 1-21, wherein the antigen-binding domain comprises at least a portion of an ACE2 extracellular domain.
23. The CAR bridging protein of claim 22, wherein the portion of an ACE2 extracellular domain is the ACE2t domain.
- 25 24. The CAR bridging protein of claim 23, wherein the ACE2t domain comprises a sequence that is at least 85%, at least 90%, at least 95%, or 100% identical to the sequence of SEQ ID NO: 2.

25. The CAR bridging protein of any one of claims 1-24, further comprising at least one linker sequence between the CAR-binding domain, Fc domain, and/or antigen-binding domain.
26. The CAR bridging protein of claim 25, wherein the CAR bridging protein comprises a linker sequence between each of the CAR-binding domain, Fc domain, and/or antigen-binding domains.
27. The CAR bridging protein of claim 25 or 26, wherein the linker sequence comprises the sequence of GGGS.
28. The CAR bridging protein of any one of claims 25-27, wherein the linker sequence comprises a sequence provided by SEQ ID NO: 6.
29. The CAR bridging protein of any one of claims 1-28, wherein the CAR bridging protein forms a homodimer.
30. A chimeric antigen receptor (CAR) bridging protein comprising a CAR-binding domain and an antigen-binding domain.
31. The CAR bridging protein of claim 30, wherein the CAR-binding domain is chemically conjugated to the antigen-binding domain.
32. The CAR bridging protein of claim 30, wherein the antigen-binding domain is chemically conjugated to the CAR-binding domain.
33. The CAR bridging protein of claim 1, wherein the antigen-binding domain and the CAR-binding domain are comprised in a fusion protein.
34. The CAR bridging protein of claim 30, further comprising an antibody Fc domain.
35. The CAR bridging protein of claim 34, wherein the Fc domain is positioned between the CAR-binding domain and the antigen-binding domain.
36. The CAR bridging protein of claim 34, wherein the CAR-binding domain is positioned between the antigen-binding domain and the Fc domain.
37. The CAR bridging protein of any one of claims 30-36, wherein the CAR-binding domain comprises a peptide that interacts with the extracellular portion of a CAR.

38. The CAR bridging protein of any one of claims 30-37, wherein the CAR-binding domain comprises the antigen-binding portion of an antibody that recognizes the extracellular portion of a CAR.
39. The CAR bridging protein of any one of claims 30-37, wherein the CAR-binding domain comprises at least a portion of a ligand that interacts with the extracellular portion of a CAR.
40. The CAR bridging protein of any one of claims 30-37, wherein the CAR-binding domain binds to a portion of the CAR that is specific for the target of the CAR.
41. The CAR bridging protein of claim 40, wherein the CAR comprises scFv and wherein the CAR-binding domain binds to a variable region of the scFv.
42. The CAR bridging protein of any one of claims 30-37, wherein the CAR-binding domain comprises an antibody or an antigen binding fragment thereof.
43. The CAR bridging protein of claim 42, wherein the CAR-binding domain comprises scFv.
44. The CAR bridging protein of any one of claims 30-37, wherein the CAR-binding domain comprises at least a portion of an HIV-1 gp120 protein.
45. The CAR bridging protein of claim 44, wherein the CAR-binding domain comprises the sequence provided in SEQ ID NO: 6.
46. The CAR bridging protein of any one of claims 30-37, wherein the CAR is a CD19 specific CAR and the CAR binding domain binds to the CD19-specific CAR.
47. The CAR bridging protein of claim 46, wherein the CAR binding domain comprises an antibody or an antigen binding fragment thereof.
48. The CAR bridging protein of claim 47, wherein the CAR binding domain comprises a scFv.
49. The CAR bridging protein of claim 46, wherein the CAR-binding domain comprises at least a portion of a CD19 protein.

50. The CAR bridging protein of any one of claims 34-49, wherein the Fc domain comprises a human Fc domain sequence.
51. The CAR bridging protein of any one of claims 34-50, wherein the Fc domain comprises a human heavy chain Fc domain sequence.
- 5 52. The CAR bridging protein of any one of claims 34-51, wherein the Fc domain comprises CH2 and CH3 regions of a human heavy chain Fc domain sequence.
53. The CAR bridging protein of any one of claims 34-52, wherein the Fc domain comprises substitutions relative to the wild-type human heavy chain Fc domain sequence which prevent binding to FcγR receptors.
- 10 54. The CAR bridging protein of any one of claims 34-53, wherein the Fc domain comprises a sequence that is at least 85%, at least 90%, at least 95%, or 100% identical to the sequence provided by SEQ ID NO: 4.
55. The CAR bridging protein of claim 30, wherein the antigen-binding domain binds to a tumor antigen or a viral antigen.
- 15 56. The CAR bridging protein of any one of claims 30-55, wherein the antigen-binding domain comprises a peptide that interacts with an antigen of interest.
57. The CAR bridging protein of any one of claims 30-56, wherein the antigen-binding domain comprises an antigen-binding portion of an antibody that recognizes the antigen of interest.
- 20 58. The CAR bridging protein of any one of claims 30-57, wherein the antigen-binding domain comprises at least a portion of a ligand that interacts with the antigen of interest.
59. The CAR bridging protein of any one of claims 30-58, wherein the antigen-binding domain binds to CD19, CD20, or CD22.
- 25 60. The CAR bridging protein of any one of claims 30-58, wherein the antigen-binding domain is capable of binding to a coronavirus spike protein.

61. The CAR bridging protein of claim 60, wherein the coronavirus spike protein is a SARS-CoV-1 or SARS-CoV-2 spike protein.
62. The CAR bridging protein of any one of claims 30-61, wherein the antigen-binding domain comprises at least a portion of an ACE2 extracellular domain.
- 5 63. The CAR bridging protein of claim 62, wherein the portion of an ACE2 extracellular domain is the ACE2t domain.
64. The CAR bridging protein of claim 63, wherein the ACE2t domain comprises a sequence that is at least 85%, at least 90%, at least 95%, or 100% identical to the sequence of SEQ ID NO: 2.
- 10 65. The CAR bridging protein of any one of claims 34-64, further comprising at least one linker sequence between the CAR-binding domain, Fc domain, and/or antigen-binding domain.
66. The CAR bridging protein of any one of claims 34-65, wherein the CAR bridging protein comprises a linker sequence between the CAR-binding domain and the  
15 antigen-binding domain, and optionally, the Fc domain.
67. The CAR bridging protein of claim 65 or 66, wherein the linker sequence comprises the sequence of GGS.
68. The CAR bridging protein of any one of claims 65-67, wherein the linker sequence comprises a sequence provided by SEQ ID NO: 6.
- 20 69. The CAR bridging protein of any one of claims 30-68, wherein the CAR bridging protein forms a homodimer.
70. A nucleic acid molecule encoding a CAR bridging protein in accordance with any one of claims 1-69.
71. The nucleic acid molecule of claim 70, wherein the sequence encoding the CAR  
25 bridging protein is operatively linked to an expression control sequence.
72. The nucleic acid molecule of claim 70, further defined as an expression vector.

73. The nucleic acid molecule of claim 72, wherein the expression vector is an episomal vector.
74. The nucleic acid molecule of claim 72, wherein the expression vector is a viral vector.
75. The nucleic acid molecule of claim 74, wherein the viral vector is an adenovirus,  
5 adeno-associated virus, retrovirus or lentivirus vector.
76. A pharmaceutical composition comprising a CAR bridging protein in accordance with any one of claims 1-69 in a pharmaceutically acceptable carrier.
77. The pharmaceutical composition of claim 76, further comprising a population of  
10 immune effector cells comprising a CAR polypeptide that the CAR-binding domain of the CAR bridging protein binds.
78. A method of treating a subject in need thereof, the method comprising administering to the subject an effective amount of a CAR bridging protein in accordance with any one of claims 1-69.
79. The method of claim 78, wherein the subject has previously been administered a  
15 population of immune effector cells comprising a CAR polypeptide that the CAR-binding domain of the CAR bridging protein binds.
80. The method of claim 78, further comprising administering to the subject an effective amount of a population of immune effector cells comprising a CAR polypeptide that the CAR-binding domain of the CAR bridging protein binds.
- 20 81. The method of claim 80, wherein the cells are allogeneic to the subject.
82. The method of claim 80, wherein the cells are autologous to the subject.
83. The method of claim 80, wherein the cells are HLA matched to the subject.
84. The method of any one of claims 78-83, wherein the subject has a coronavirus infection.
- 25 85. The method of any one of claims 78-84, wherein the subject has a SAR-CoV infection.

86. The method of any one of claims 78-84, wherein the subject has a SAR-CoV-2 infection.
87. The method of any one of claims 78-84, wherein the subject has COVID-19.
- 5 88. The method of claim 86 or 87, wherein the CAR bridging protein comprises (i) an antigen-binding domain that is at least 85%, at least 90%, at least 95%, or 100% identical to the sequence of SEQ ID NO: 2; and (ii) a CAR-binding domain that is comprises the sequence provided in SEQ ID NO: 6, and wherein the CAR polypeptide comprises a CD4 domain as its antigen-binding domain.
89. The method of any one of claims 78-83, wherein the subject has a cancer.
- 10 90. The method of claim 89, wherein the CAR bridging protein comprises an antigen-binding domain that is capable of binding to CD19, CD20, or CD22.
91. The method of claim 78, wherein the CAR-binding domain of the CAR bridging protein comprises at least a portion of a CD19 protein.