CLAIMS

What is Claimed:

A chimeric antigen receptor comprising an antigen binding molecule that specifically binds to CLL-1,

wherein the antigen binding molecule comprises a heavy chain variable region (VH) and light chain variable region (VL) pair that is selected from the group consisting of:

(a) a VH region comprising complementarity determining regions ("CDRs") 1, 2, and 3 with amino acid sequences SEQ ID NO: 17, SEQ ID NO: 18, and SEQ ID NO: 19, respectively, and a VL region comprising CDRs 1, 2, and 3 with amino acid sequences SEQ ID NO: 22, SEQ ID NO: 23, and SEQ ID NO: 24, respectively; and

(b) a VH region comprising CDRs 1, 2, and 3 with amino acid sequences SEQ ID NO: 51, SEQ ID NO: 52, and SEQ ID NO: 53, respectively, and a VL region comprising CDRs 1, 2, and 3 with amino acid sequences SEQ ID NO: 56, SEQ ID NO: 57, and SEQ ID NO: 58, respectively.

2. The chimeric antigen receptor of claim 1 comprising at least one of:

(a) a VH region comprising the amino acid sequence of SEQ ID NO: 16 and a VL region comprising the amino acid sequence of SEQ ID NO: 21; or

(b) a VH region comprising the amino acid sequence of SEQ ID NO: 50 and a VL region comprising the amino acid sequence of SEQ ID NO: 55;

wherein the VH and VL region is linked by at least one linker.

3. The chimeric antigen receptor according to claim 2, wherein the linker comprises at least one of SEQ ID NO: 130 and SEQ ID NO: 132.

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4. The chimeric antigen receptor according to any one of claims 1 to 3, further comprising at least one costimulatory domain.

5. The chimeric antigen receptor according to any one of claims 1 to 4, further comprising at least one activating domain.

6. The chimeric antigen receptor according to claim 4 or 5, wherein the costimulatory domain is a signaling region (or other suitable portion) of CD28, OX-40, 4-1BB/CD137, CD2, CD7, CD27, CD30, CD40, programmed death-1 (PD-1), inducible T cell costimulator

(ICOS), lymphocyte function-associated antigen-1 (LFA-1), CDl la/CD18, CD3 gamma, CD3 delta, CD3 epsilon, CD247, CD276 (B7-H3), LIGHT, (TNFSF14), NKG2C, Ig alpha (CD79a), DAP-10, Fc gamma receptor, MHC class I molecule, TNF receptor proteins, an Immunoglobulin protein, cytokine receptor, integrins, Signaling Lymphocytic Activation Molecules (SLAM proteins), activating NK cell receptors, BTLA, a Toll ligand receptor, ICAM-1, CDS, ICAM-1, GITR, BAFFR, HVEM (LIGHTR), KIRDS2, SLAMF7, NKp80 (KLRF1), NKp44, NKp30, NKp46, CD19, CD4, CD8alpha, CD8beta, IL-2R beta, IL-2R gamma, IL-7R alpha, ITGA4, VLA1, CD49a, IA4, CD49D, ITGA6, VLA-6, CD49f, ITGAD, CDl ld, ITGAE, CD103, ITGAL, ITGAM, CDl lb, ITGAX, CDl lc, ITGBl, CD29, ITGB2, CD18, LFA-1, ITGB7, NKG2D, TNFR2, TRANCE/RANKL, DNAM1 (CD226), SLAMF4 (CD244, 2B4), CD84, CD96 (Tactile), CEACAM1, CRT AM, Ly9 (CD229), CD160 (BY55), PSGL1, CD100 (SEMA4D), CD69, SLAMF6 (NTB-A, Lyl08), SLAM (SLAMF1, CD150, IPO-3), BLAME (SLAMF8), SELPLG (CD162), LTBR, LAT, GADS, SLP-76, PAG/Cbp, CD19a, a ligand that specifically binds with CD83, or any combination thereof.

7. The chimeric antigen receptor according to claim 6, wherein the costimulatory domain comprises CD28.

8. The chimeric antigen receptor according to claim 6, wherein the CD28 costimulatory domain comprises a sequence selected from the group consisting of SEQ ID NO: 2, SEQ ID NO: 4, SEQ ID NO: 6, and SEQ ID NO: 8.

9. The chimeric antigen receptor according to claim 6, wherein the CD8 costimulatory domain comprises SEQ ID NO: 14.

10. The chimeric antigen receptor according to any one of claims 5 to 9, wherein the CD3 comprises CD3 zeta.

11. The chimeric antigen receptor according to claim 10, wherein the CD3 zeta comprises SEQ ID NO: 10.

12. The chimeric antigen receptor according to any one of claims 1 to 11, further comprising SEQ ID NO: 2 and SEQ ID NO: 10.

13. An isolated polynucleotide encoding the chimeric antigen receptor of any one of claims 1 to 12.

14. The isolated polynucleotide of claim 13 comprising at least one of: SEQ ID NO: 27; SEQ ID NO: 31; SEQ ID NO: 35; SEQ ID NO: 39; SEQ ID NO: 43; SEQ ID NO: 47; SEQ ID NO: 61; SEQ ID NO: 65; and SEQ ID NO: 69.

15. A vector comprising the polynucleotide of claim 14, which is a retroviral vector, a DNA vector, a plasmid, a RNA vector, an adenoviral vector, an adenovirus associated vector, a lentiviral vector, or any combination thereof.

16. An immune cell comprising the vector of claim 14, wherein the immune cell is a T cell, tumor infiltrating lymphocyte (TIL), NK cell, TCR-expressing cell, dendritic cell, or NK-T cell.

17. The immune cell according to claim 16, wherein the cell is an autologous T cell.

18. The immune cell according to claim 16, wherein the cell is an allogeneic T cell.

19. Use of the cells according to any one of claims 16-18 in the manufacture of a medicament for treating a disease or disease in a subject in need thereof, wherein the disease or disorder is leukemia, lymphoma, or myeloma.

20. The use according to claim 19, wherein the disease or disorder is at least one of acute myeloid leukemia (AML), chronic myelogenous leukemia (CML), chronic myelomonocytic leukemia (CMML), juvenile myelomonocytic leukemia, atypical chronic myeloid leukemia, acute promyelocytic leukemia (APL), acute monoblastic leukemia, acute erythroid leukemia, acute megakaryoblastic leukemia, myelodysplastic syndrome (MDS), myeloproliferative disorder, myeloid neoplasm, myeloid sarcoma), Blastic Plasmacytoid Dendritic Cell Neoplasm (BPDCN), and inflammatory disease or autoimmune disease.