

table providing the SEQ ID NO for each VL and CDR sequence illustrated in FIG. 2C. FIG. 2E shows a sequence alignment of example anti-BCMA binding molecules comprising a VH domain. Complementarity determining regions (CDRs) and framework regions (FRs) are shown, as determined by Chothia numbering (FIG. 2E). SEQ ID NOS 253-260, CDR1 in order from top to bottom; SEQ ID NOS 261-268, CDR2 from top to bottom, SEQ ID NOS 269-276, CDR3 from top to bottom. FIG. 2F is a table providing the SEQ ID NO for each VH and CDR numbered by an alternative method. FIG. 2G shows a sequence alignment of example anti-BCMA binding molecules comprising a VL domain. CDRs and FRs are shown, as determined by Chothia numbering (FIG. 2G). SEQ ID NOS 37-44, CDR1 in order from top to bottom; SEQ ID NOS 45-52, CDR2 from top to bottom, SEQ ID NOS 277-284, CDR3 from top to bottom. FIG. 2H is a table providing the SEQ ID NO for each VL and CDR sequence numbered by an alternative method.

[0056] FIG. 3 depicts CAR expression in primary human T cells electroporated with mRNA encoding for various CARs. Data obtained from CAR having a complete hinge domain (“CHD”) is shown and data obtained from CAR having a truncated hinge domain (“THD”) is shown.

[0057] FIGs. 4A-4X show IFN γ , IL-2, and TNF α production by electroporated anti-FLT3 CAR T cells following 16 hours of co-culture with the indicated target cell lines. FIGs. 4A-4B, 4G-4H, 4M-4N, and 4S-4T show IFN γ production following co-culture with Namalwa, EoL-1, HL60, and MV4;11 target cells, respectively. FIGs. 4C-4D, 4I-4J, 4O-4P, and 4U-4V show IL-2 production following co-culture with Namalwa, EoL-1, HL60, and MV4;11 target cells, respectively. FIGs. 4E-4F, 4K-4L, 4Q-4R, and 4W-4X show TNF α production following co-culture with Namalwa, EoL-1, HL60, and MV4;11 target cells, respectively.

[0058] FIGs. 5A-5H show cytolytic activity of electroporated anti-FLT3 CAR T cells against Namalwa (FIGs. 5A-5B), EoL1 (FIGs. 5C-5D), HL60 (FIGs. 5E-5F), and MV4;11 (FIGs. 5G-5H) target cell lines following 16 hours of co-culture.

[0059] FIGs. 6A-6B depict CAR expression in lentivirus transduced primary human T cells from two healthy donors.

[0060] FIGs. 7A-7F show IFN γ (FIGs. 7A-7B), TNF α (FIGs. 7C-7D), and IL-2 (FIGs. 7E-7F) production by lentivirus transduced CAR T cells from two healthy donors following 16 hours of co-culture with the indicated target cell lines.

[0069] FIGs 16A-16F shows IFN γ , TNF α , and IL-2 production by lentivirus transduced CAR T cells from two healthy donors following 16 hours of co-cultured with EoL-1 (Black), NCI-H929 (light grey), or MM1S (grey) target cell lines. FIGs. 16A and 16B show the IFN γ (pg/ml; y-axis) production in lentivirus transduced CAR T cells from a first donor (FIG. 6A) and a second donor (FIG. 16B). FIGs. 16C and 16D show the TNF α (pg/ml; y-axis) production in lentivirus transduced CAR T cells from a first donor (FIG. 16C) and a second donor (FIG. 16D). FIGs. 16E and 16F show the IL-2 production (pg/ml; y-axis) in lentivirus transduced CAR T cells from a first donor (FIG. 16E) and a second donor (FIG. 16F).

[0070] FIGs. 17A-17F show the average cytolytic activity (as a percentage of viable target cells remaining; y-axis) over time from two healthy donors expressing the indicated CARs co-cultured with EoL1 (FIGs. 17A and 17B), NCI-H929 (FIGs. 17C and 17D), or MM1S (FIGs. 17E and 17F) target cells for 16 hours, 40 hours, 64 hours, 88 hours, or 112 hours. FIGs. 17A and 17B show the average cytolytic activity of transduced CAR T cells from a first donor (FIG. 17A) and a second donor (FIG. 17B) co-cultured with EoL1 target cells for 16 hours, 40 hours, 64 hours, 88 hours, or 112 hours. FIGs. 17C and 17D show the average cytolytic activity of transduced CAR T cells from a first donor (FIG. 17C) and a second donor (FIG. 17D) co-cultured with NCI-H929 target cells for 16 hours, 40 hours, 64 hours, 88 hours, or 112 hours. FIGs. 17E and 17F show the average cytolytic activity of transduced CAR T cells from a first donor (FIG. 17E) and a second donor (FIG. 17F) co-cultured with MM1S target cells for 16 hours, 40 hours, 64 hours, 88 hours, or 112 hours.

[0071] FIGs. 18A and 18B show proliferation of CFSE-labeled lentivirus transduced CAR T cells from a first healthy donor (FIG. 18A) and a second healthy donor (FIG. 18B) following 6 days of co-culture with CD3-CD28 beads (top row), EoL-1 (second row), NCI-H929 (third row), or MM1S (bottom row) target cell lines.

[0072] FIG 19A and FIG. 19B are graphs showing thermostability of chimeric antigen receptors (CARs) of the present invention. FIG. 19A: In a phosphate-buffered saline (PBS) solution, a CAR comprising an extracellular domain with a truncated hinge domain (“THD”) has a higher melting temperature relative to a CAR comprising an extracellular domain with a complete hinge domain (“CHD”). FIG. 19B: In the presence of 50 mM NaCl, a CAR comprising an extracellular domain with a THD has a higher melting temperature relative to a CAR comprising an extracellular domain with a CHD. FIG. 20 is a schematic representation of the pGAR vector.

TACTCATACTCTTCCTTTTTCAATATTATTGAAGCATTTATCAGGGTTATTGTCTC
ATGAGCGGATACATATTTGAATGTATTTAGAAAAATAAACAAATAGGGGTTCCG
CGCACATTTCCCCGAAAAGTGCCAC (SEQ ID NO: 252)

[0222] The pGAR vector map is set forth in FIG. 20. Suitable additional exemplary
5 vectors include e.g., pBABE-puro, pBABE-neo largeTcDNA, pBABE-hygro-hTERT,
pMKO.1 GFP, MSCV-IRES-GFP, pMSCV PIG (Puro IRES GFP empty plasmid), pMSCV-
loxp-dsRed-loxp-eGFP-Puro-WPRE, MSCV IRES Luciferase, pMIG, MDH1-PGK-GFP_2.0,
TtRMPVIR, pMSCV-IRES-mCherry FP, pRetroX GFP T2A Cre, pRXTN, pLncEXP, and
pLXIN-Luc.

10 **[0223]** In other aspects, provided herein are cells comprising a polynucleotide or a
vector of the present invention. In some embodiments, the present invention is directed to cells,
e.g., in vitro cells, comprising a polynucleotide encoding a CAR or a TCR comprising a TCD
described herein. In other embodiments, the present invention is directed to cells, e.g., in vitro
15 cells, comprising a polypeptide encoded by a CAR or a TCR comprising a TCD described
herein.

[0224] Any cell may be used as a host cell for the polynucleotides, the vectors, or the
polypeptides of the present invention. In some embodiments, the cell can be a prokaryotic cell,
fungal cell, yeast cell, or higher eukaryotic cells such as a mammalian cell. Suitable prokaryotic
cells include, without limitation, eubacteria, such as Gram-negative or Gram-positive
20 organisms, for example, *Enterobactehaceae* such as *Escherichia*, e.g., *E. coli*; *Enterobacter*;
Erwinia; *Klebsiella*; *Proteus*; *Salmonella*, e.g., *Salmonella typhimurium*; *Serratia*, e.g.,