

WHAT IS CLAIMED:

1. A recombinant vector comprising a polycistronic expression cassette, wherein the polycistronic expression cassette comprises a transcriptional regulatory element operably linked to a polycistronic polynucleotide that comprises:
 - a. a first polynucleotide sequence that encodes a T cell receptor (TCR) alpha chain comprising an alpha chain variable ($V\alpha$) region and an alpha chain constant ($C\alpha$) region;
 - b. a second polynucleotide sequence that comprises a first 2A element;
 - c. a third polynucleotide sequence that encodes a TCR beta chain comprising a beta chain variable ($V\beta$) region and a beta chain constant ($C\beta$) region;
 - d. a fourth polynucleotide sequence that comprises a second 2A element; and
 - e. a fifth polynucleotide sequence that encodes a fusion protein that comprises IL-15, or a functional fragment or functional variant thereof, and IL-15R α , or a functional fragment or functional variant thereof.
2. The recombinant vector of claim 1, wherein either or both of the first 2A element and the second 2A element, independently, is a P2A element, a T2A element, an F2A element, or an E2A element.
3. The recombinant vector of claim 2, wherein the P2A element comprises (a) a polynucleotide sequence that encodes the amino acid sequence of SEQ ID NO: 18 or 20, or the amino acid sequence of SEQ ID NO: 18 or 20 comprising 1, 2, or 3 amino acid modifications; or (b) a polynucleotide sequence at least 75%, 80%, 85%, 90%, 95%, 96%, 97%, 98%, 99%, or 100% identical to the polynucleotide sequence of SEQ ID NO: 19 or 21.
4. The recombinant vector of claim 2, wherein the T2A element comprises (a) a polynucleotide sequence that encodes the amino acid sequence of SEQ ID NO: 22 or 24, or the amino acid sequence of SEQ ID NO: 22 or 24 comprising 1, 2, or 3 amino acid modifications; or a polynucleotide sequence at least 75%, 80%, 85%, 90%, 95%, 96%, 97%, 98%, 99%, or 100% identical to the polynucleotide sequence of SEQ ID NO: 23 or 25.

5. The recombinant vector of any one of claims 1-4, wherein either or both of the second polynucleotide sequence and the fourth polynucleotide sequence, independently, encode a furin recognition site, wherein optionally, the furin recognition site comprises (a) the amino acid sequence of SEQ ID NO: 2 or 4, or the amino acid sequence of SEQ ID NO: 2 or 4 comprising 1, 2, or 3 amino acid modifications; or (b) an amino acid encoded by the polynucleotide sequence of SEQ ID NO: 3 or 5 or the polynucleotide sequence of SEQ ID NO: 3 or 5 comprising 1, 2, or 3 nucleotide modifications.
6. The recombinant vector of any one of claims 1-5, wherein the second polynucleotide sequence comprises (a) a polynucleotide sequence that encodes the amino acid sequence of SEQ ID NO: 10, or the amino acid sequence of SEQ ID NO: 10 comprising 1, 2, or 3 amino acid modifications; or (b) a polynucleotide sequence at least 75%, 80%, 85%, 90%, 95%, 96%, 97%, 98%, 99%, or 100% identical to the polynucleotide sequence of SEQ ID NO: 11.
7. The recombinant vector of any one of claims 1-6, wherein the fourth polynucleotide sequence comprises (a) a polynucleotide sequence that encodes the amino acid sequence of SEQ ID NO: 12, or the amino acid sequence of SEQ ID NO: 12 comprising 1, 2, or 3 amino acid modifications; or (b) a polynucleotide sequence at least 75%, 80%, 85%, 90%, 95%, 96%, 97%, 98%, 99%, or 100% identical to the polynucleotide sequence of SEQ ID NO: 13.
8. The recombinant vector of any one of claims 1-7, wherein the IL-15, or functional fragment or functional variant thereof, comprises (a) an amino acid sequence at least 90%, 95%, 96%, 97%, 98%, 99%, or 100% identical to the amino acid sequence of SEQ ID NO: 76; or (b) an amino acid sequence encoded by a polynucleotide sequence at least 75%, 80%, 85%, 90%, 95%, 96%, 97%, 98%, 99%, or 100% identical to the polynucleotide sequence of SEQ ID NO: 77.
9. The recombinant vector of any one of claims 1-8, wherein the IL-15R α , or functional fragment or functional variant thereof, comprises (a) an amino acid sequence at least 90%, 95%, 96%, 97%, 98%, 99%, or 100% identical to the amino acid sequence of SEQ ID NO: 78; or (b) an amino acid sequence encoded by a polynucleotide sequence at least 75%, 80%, 85%, 90%, 95%, 96%, 97%, 98%, 99%, or 100% identical to the polynucleotide sequence of SEQ ID NO: 79.

10. The recombinant vector of any one of claims 1-9, wherein the C α region comprises (a) an amino acid sequence at least 90%, 95%, 96%, 97%, 98%, 99%, or 100% identical to the amino acid sequence of SEQ ID NO: 40-49; or (b) an amino acid sequence encoded by a polynucleotide sequence at least 75%, 80%, 85%, 90%, 95%, 96%, 97%, 98%, 99%, or 100% identical to the polynucleotide sequence of SEQ ID NO: 55, 57, or 58.
11. The recombinant vector of any one of claims 1-10, wherein the C β region comprises (a) an amino acid sequence at least 90%, 95%, 96%, 97%, 98%, 99%, or 100% identical to the amino acid sequence of SEQ ID NO: 50-54 or 60; or (b) an amino acid sequence encoded by a polynucleotide sequence at least 75%, 80%, 85%, 90%, 95%, 96%, 97%, 98%, 99%, or 100% identical to the polynucleotide sequence of SEQ ID NO: 56 or 59.
12. The recombinant vector of any one of claims 1-11, wherein the polycistronic polynucleotide comprises, in order from 5' to 3': (a) the first polynucleotide sequence, the second polynucleotide sequence, the third polynucleotide sequence, the fourth polynucleotide sequence, and the fifth polynucleotide sequence; (b) the first polynucleotide sequence, the fourth polynucleotide sequence, the third polynucleotide sequence, the second polynucleotide sequence, and the fifth polynucleotide sequence; (c) the first polynucleotide sequence, the second polynucleotide sequence, the fifth polynucleotide sequence, the fourth polynucleotide sequence, and the third polynucleotide sequence; (d) the first polynucleotide sequence, the fourth polynucleotide sequence, the fifth polynucleotide sequence, the second polynucleotide sequence, and the third polynucleotide sequence; (e) the third polynucleotide sequence, the second polynucleotide sequence, the first polynucleotide sequence, the fourth polynucleotide sequence, and the fifth polynucleotide sequence; (f) the third polynucleotide sequence, the fourth polynucleotide sequence, the first polynucleotide sequence, the second polynucleotide sequence, and the fifth polynucleotide sequence; (g) the third polynucleotide sequence, the second polynucleotide sequence, the fifth polynucleotide sequence, the fourth polynucleotide sequence, and the first polynucleotide sequence; (h) the third polynucleotide sequence, the fourth polynucleotide sequence, the fifth polynucleotide sequence, the second polynucleotide sequence, and the first polynucleotide sequence; (i) the fifth polynucleotide sequence, the second polynucleotide sequence, the first polynucleotide sequence, the fourth polynucleotide sequence, and the

- third polynucleotide sequence; (j) the fifth polynucleotide sequence, the fourth polynucleotide sequence, the first polynucleotide sequence, the second polynucleotide sequence, and the third polynucleotide sequence; (k) the fifth polynucleotide sequence, the second polynucleotide sequence, the third polynucleotide sequence, the fourth polynucleotide sequence, and the first polynucleotide sequence; or (l) the fifth polynucleotide sequence, the fourth polynucleotide sequence, the third polynucleotide sequence, the second polynucleotide sequence, and the first polynucleotide sequence.
13. The recombinant vector of any one of claims 1-12, wherein the polycistronic polynucleotide further comprises
 - (a) a sixth polynucleotide sequence that comprises a third 2A element; and
 - (b) a seventh polynucleotide sequence that comprises a marker protein.
 14. The recombinant vector of any one of claims 1-13, wherein the V α region comprises (a) complementarity determining region 1 α (CDR1 α), CDR2 α , and CDR3 α , comprising the amino acid sequences of SEQ ID NO: 1001 + 10n, 1002 + 10n, and 1003 + 10n, respectively, wherein n is an integer from 0 to 79; (b) the CDR1 α , CDR2 α , and CDR3 α from a V α region comprising the amino acid sequence of SEQ ID NO: 1004 + 10n, 1005 + 10n, 1006 + 10n, or 1007 + 10n, wherein n is an integer from 0 to 79; (c) an amino acid sequence at least 90%, 95%, 96%, 97%, 98%, 99%, or 100% identical to the amino acid sequence of SEQ ID NO: 1004 + 10n, 1005 + 10n, 1006 + 10n, or 1007 + 10n, wherein n is an integer from 0 to 79; or (d) an amino acid sequence at least 90%, 95%, 96%, 97%, 98%, 99%, or 100% identical to the amino acid sequence of SEQ ID NO: 1004 + 10n, wherein the V β region comprises an amino acid sequence at least 90%, 95%, 96%, 97%, 98%, 99%, or 100% identical to the amino acid sequence of SEQ ID NO: 2004 + 10n, and wherein n is an integer from 0 to 79; wherein the V α region comprises an amino acid sequence at least 90%, 95%, 96%, 97%, 98%, 99%, or 100% identical to the amino acid sequence of SEQ ID NO: 1005 + 10n, wherein the V β region comprises an amino acid sequence at least 90%, 95%, 96%, 97%, 98%, 99%, or 100% identical to the amino acid sequence of SEQ ID NO: 2005 + 10n, and wherein n is an integer from 0 to 79; wherein the V α region comprises an amino acid sequence at least 90%, 95%, 96%, 97%, 98%, 99%, or 100% identical to the amino acid sequence of SEQ ID NO: 1006 + 10n, wherein the V β region comprises an amino acid sequence at least

- 90%, 95%, 96%, 97%, 98%, 99%, or 100% identical to the amino acid sequence of SEQ ID NO: 2006 + 10n, and wherein n is an integer from 0 to 79; or wherein the V α region comprises an amino acid sequence at least 90%, 95%, 96%, 97%, 98%, 99%, or 100% identical to the amino acid sequence of SEQ ID NO: 1007 + 10n, wherein the V β region comprises an amino acid sequence at least 90%, 95%, 96%, 97%, 98%, 99%, or 100% identical to the amino acid sequence of SEQ ID NO: 2007 + 10n, and wherein n is an integer from 0 to 79.
15. The recombinant vector of any one of claims 1-14, wherein the V β region comprises (a) CDR1 β , CDR2 β , and CDR3 β , comprising the amino acid sequences of SEQ ID NO: 2001 + 10n, 2002 + 10n, and 2003 + 10n, respectively, wherein n is an integer from 0 to 79; (b) the CDR1 β , CDR2 β , and CDR3 β from a V β region comprising the amino acid sequence of SEQ ID NO: 2004 + 10n, 2005 + 10n, 2006 + 10n, or 2007 + 10n, wherein n is an integer from 0 to 79; or (c) an amino acid sequence at least 90%, 95%, 96%, 97%, 98%, 99%, or 100% identical to the amino acid sequence of SEQ ID NO: 2004 + 10n, 2005 + 10n, 2006 + 10n, or 2007 + 10n, wherein n is an integer from 0 to 79.
 16. The recombinant vector of any one of claims 1-15, wherein the TCR alpha chain comprises (a) an amino acid sequence at least 90%, 95%, 96%, 97%, 98%, 99%, or 100% identical to the amino acid sequence of SEQ ID NO: 1008 + 10n, wherein n is an integer from 0 to 79; (b) an amino acid sequence at least 90%, 95%, 96%, 97%, 98%, 99%, or 100% identical to the amino acid sequence of SEQ ID NO: 1009 + 10n, wherein n is an integer from 0 to 79; or (c) an amino acid sequence at least 90%, 95%, 96%, 97%, 98%, 99%, or 100% identical to the amino acid sequence of SEQ ID NO: 1010 + 10n, wherein n is an integer from 0 to 79.
 17. The recombinant vector of any one of claims 1-16, wherein the TCR beta chain comprises (a) an amino acid sequence at least 90%, 95%, 96%, 97%, 98%, 99%, or 100% identical to the amino acid sequence of SEQ ID NO: 2008 + 10n, wherein n is an integer from 0 to 79; (b) an amino acid sequence at least 90%, 95%, 96%, 97%, 98%, 99%, or 100% identical to the amino acid sequence of SEQ ID NO: 2009 + 10n, wherein n is an integer from 0 to 79; or (c) an amino acid sequence at least 90%, 95%, 96%, 97%, 98%, 99%, or 100% identical to the amino acid sequence of SEQ ID NO: 2010 + 10n, wherein n is an integer from 0 to 79.

18. A polynucleotide, wherein the polynucleotide encodes an amino acid sequence at least 90%, 95%, 96%, 97%, 98%, 99%, or 100% identical to an amino acid sequence selected from the group consisting of SEQ ID NOs: 161, 163, 164, 165, 167, 169, 170, and 171; or wherein the polynucleotide comprises a polynucleotide sequence at least 75%, 80%, 85%, 90%, 95%, 96%, 97%, 98%, 99%, or 100% identical to a polynucleotide sequence selected from the group consisting of SEQ ID NOs: 232, 235, 236, 238, 239, 241, 242, and 243.
19. A population of cells comprising a polycistronic expression cassette comprising
- a first cistron comprising a polynucleotide sequence that encodes a fusion protein that comprises IL-15, or a functional fragment or functional variant thereof, and IL-15R α , or a functional fragment or functional variant thereof;
 - a second cistron comprising a polynucleotide sequence that encodes a TCR beta chain comprising a V β region and a C β region; and
 - a third cistron comprising a polynucleotide sequence that encodes a TCR alpha chain comprising a V α region and a C α region,
- wherein the population of cells are T cells that comprise i) more than 5%, 10%, 15%, 20%, 25%, 30%, 35%, 40%, 45% or 50% CD45RA+CD45RO-CD62L+CD95+ cells, or ii) more than 5%, 10%, 15%, 20%, 25%, 30%, 35%, 40%, 45% or 50% CD45RA+CD45RO+CD62L+CD95+ cells.
20. Use of a population of cells comprising the recombinant vector of any one of claims 1-17, or a population of cells comprising the polynucleotide of claim 18, or the population of cells of claim 19 in the manufacture of a medicament for treating cancer or an autoimmune disease or disorder in a subject in need thereof.