

Claims

1. A polypeptide binding to mucin1, the polypeptide comprising a pair of a heavy chain variable (VH) region and a light chain variable (VL) region selected from the following VH and VL regions:

- a VH region comprising complementarity-determining region (CDR) 1, 2, and 3 represented by amino acid sequences of SEQ ID NO: 1, SEQ ID NO: 2, and SEQ ID NO: 3, respectively, and a VL region comprising CDR 1, 2, and 3 represented by amino acid sequences of SEQ ID NO: 4, SEQ ID NO: 5, and SEQ ID NO: 6, respectively;

- a VH region comprising CDR 1, 2, and 3 represented by amino acid sequences of SEQ ID NO: 11, SEQ ID NO: 12, and SEQ ID NO: 13, respectively, and a VL region comprising CDR 1, 2, and 3 represented by amino acid sequences of SEQ ID NO: 14, SEQ ID NO: 15, and SEQ ID NO: 16, respectively;

- a VH region comprising CDR 1, 2, and 3 represented by amino acid sequences of SEQ ID NO: 21, SEQ ID NO: 22, and SEQ ID NO: 23, respectively, and a VL region comprising CDR 1, 2, and 3 represented by amino acid sequences of SEQ ID NO: 24, SEQ ID NO: 25, and SEQ ID NO: 26, respectively;

- a VH region comprising CDR 1, 2, and 3 represented by amino acid sequences of SEQ ID NO: 31, SEQ ID NO: 32, and SEQ ID NO: 33, respectively, and a VL region comprising CDR 1, 2, and 3 represented by amino acid sequences of SEQ ID NO: 34, SEQ ID NO: 35, and SEQ ID NO: 36, respectively;

- a VH region comprising CDR 1, 2, and 3 represented by amino acid sequences of SEQ ID NO: 41, SEQ ID NO: 42, and SEQ ID NO: 43, respectively, and a VL region comprising

CDR 1, 2, and 3 represented by amino acid sequences of SEQ ID NO: 44, SEQ ID NO: 45, and SEQ ID NO: 46, respectively;

- a VH region comprising CDR 1, 2, and 3 represented by amino acid sequences of SEQ ID NO: 51, SEQ ID NO: 52, and SEQ ID NO: 53, respectively, and a VL region comprising CDR 1, 2, and 3 represented by amino acid sequences of SEQ ID NO: 54, SEQ ID NO: 55, and SEQ ID NO: 56, respectively;

- a VH region comprising CDR 1, 2, and 3 represented by amino acid sequences of SEQ ID NO: 61, SEQ ID NO: 62, and SEQ ID NO: 63, respectively, and a VL region comprising CDR 1, 2, and 3 represented by amino acid sequences of SEQ ID NO: 64, SEQ ID NO: 65, and SEQ ID NO: 66, respectively;

- a VH region comprising CDR 1, 2, and 3 represented by amino acid sequences of SEQ ID NO: 71, SEQ ID NO: 72, and SEQ ID NO: 73, respectively, and a VL region comprising CDR 1, 2, and 3 represented by amino acid sequences of SEQ ID NO: 74, SEQ ID NO: 75, and SEQ ID NO: 76, respectively;

- a VH region comprising CDR 1, 2, and 3 represented by amino acid sequences of SEQ ID NO: 81, SEQ ID NO: 82, and SEQ ID NO: 83, respectively, and a VL region comprising CDR 1, 2, and 3 represented by amino acid sequences of SEQ ID NO: 84, SEQ ID NO: 85, and SEQ ID NO: 86, respectively; and

- a VH region comprising CDR 1, 2, and 3 represented by amino acid sequences of SEQ ID NO: 91, SEQ ID NO: 92, and SEQ ID NO: 93, respectively, and a VL region comprising CDR 1, 2, and 3 represented by amino acid sequences of SEQ ID NO: 94, SEQ ID NO: 95, and SEQ ID NO: 96, respectively.

2. The polypeptide of claim 1, comprising a pair of a heavy chain variable (VH) region and a light chain variable (VL) region selected from the following VH and VL regions:

- a VH region comprising an amino acid sequence of SEQ ID NO: 7 and a VL region comprising an amino acid sequence of SEQ ID NO: 8;

- a VH region comprising an amino acid sequence of SEQ ID NO: 17 and a VL region comprising an amino acid sequence of SEQ ID NO: 18;

- a VH region comprising an amino acid sequence of SEQ ID NO: 27 and a VL region comprising an amino acid sequence of SEQ ID NO: 28;

- a VH region comprising an amino acid sequence of SEQ ID NO: 37 and a VL region comprising an amino acid sequence of SEQ ID NO: 38;

- a VH region comprising an amino acid sequence of SEQ ID NO: 47 and a VL region comprising an amino acid sequence of SEQ ID NO: 48;

- a VH region comprising an amino acid sequence of SEQ ID NO: 57 and a VL region comprising an amino acid sequence of SEQ ID NO: 58;

- a VH region comprising an amino acid sequence of SEQ ID NO: 67 and a VL region comprising an amino acid sequence of SEQ ID NO: 68;

- a VH region comprising an amino acid sequence of SEQ ID NO: 77 and a VL region comprising an amino acid sequence of SEQ ID NO: 78;

- a VH region comprising an amino acid sequence of SEQ ID NO: 87 and a VL region comprising an amino acid sequence of SEQ ID NO: 88; and

- a VH region comprising an amino acid sequence of SEQ ID NO: 97 and a VL region comprising an amino acid sequence of SEQ ID NO: 98.

3. The polypeptide of claim 1, wherein the polypeptide is an antibody or an antigen-binding fragment thereof.
4. The polypeptide of claim 1, wherein the polypeptide is a single chain variable fragment (scFv), a peptibody, a fragment antigen binding (Fab), a monoclonal antibody, a bispecific antibody, a minibody, a domain antibody, a synthetic antibody, a chimeric antibody, a humanized antibody, a human antibody, or an antibody fusion protein.
5. The polypeptide of claim 1, wherein the VH region and the VL region are linked to each other via a linker.
6. The polypeptide of claim 5, wherein an amino acid sequence of the linker is GGGGSGGGGSGGGAS.
7. The polypeptide of claim 1, wherein the polypeptide is a single chain variable fragment (scFv) and the scFv includes an amino acid sequence selected from the group consisting of SEQ ID NO: 9, SEQ ID NO: 19, SEQ ID NO: 29, SEQ ID NO: 39, SEQ ID NO: 49, SEQ ID NO: 59, SEQ ID NO: 69, SEQ ID NO: 79, SEQ ID NO: 89, and SEQ ID NO: 99.
8. An isolated polynucleotide encoding the mucin1-binding polypeptide of any one of claims 1 to 7.
9. A vector comprising the polynucleotide of claim 8.

10. A cell comprising the vector of claim 9.
11. A chimeric antigen receptor comprising the mucin1-binding polypeptide of any one of claims 1 to 7.
12. The chimeric antigen receptor of claim 11, comprising an extracellular domain comprising the mucin1-binding polypeptide; a transmembrane domain; and an intracellular signaling domain.
13. The chimeric antigen receptor of claim 12, wherein the extracellular domain further includes a spacer region between the mucin1-binding polypeptide and the transmembrane domain.
14. The chimeric antigen receptor of claim 13, wherein the spacer region includes a hinge region of CD8 α or CD28, or all or part of a constant region of an immunoglobulin (IgG).
15. The chimeric antigen receptor of claim 12, wherein the transmembrane domain is a transmembrane domain of CD28 or CD8.
16. The chimeric antigen receptor of claim 12, wherein the intracellular signaling domain is a CD3 zeta signaling domain.

17. The chimeric antigen receptor of claim 12, further comprising one or more co-stimulatory domains.
18. The chimeric antigen receptor of claim 17, wherein the co-stimulatory domain is placed between the transmembrane domain and the intracellular signaling domain.
19. The chimeric antigen receptor of claim 17, wherein the co-stimulatory domain is a signaling domain of CD28, OX-40, 4-1BB (CD137), CD27, or ICOS.
20. An isolated polynucleotide encoding the chimeric antigen receptor of claim 11.
21. A vector comprising the polynucleotide of claim 20.
22. An immune cell expressing a chimeric antigen receptor comprising the mucin1-binding polypeptide of any one of claims 1 to 7, or comprising a polynucleotide encoding the chimeric antigen receptor.
23. The immune cell of claim 22, wherein the immune cell is a T cell, a tumor infiltrating lymphocyte (TIL), a natural killer (NK) cell, a TCR-expressing cell, a dendritic cell, or an NK-T cell.
24. The immune cell of claim 22, wherein the immune cell is an autologous T cell or an allogenic T cell.

25. A composition for preventing or treating cancer, the composition comprising the mucin1-binding polypeptide of any one of claims 1 to 7;

an isolated polynucleotide encoding the mucin1-binding polypeptide;

a vector comprising the polynucleotide encoding the mucin1-binding polypeptide;

a cell comprising the polynucleotide encoding the mucin1-binding polypeptide;

a chimeric antigen receptor comprising the mucin1-binding polypeptide;

an isolated polynucleotide encoding the chimeric antigen receptor;

a vector comprising the polynucleotide encoding the chimeric antigen receptor; or

an immune cell comprising the polynucleotide encoding the chimeric antigen receptor,

or expressing the chimeric antigen receptor.