

6. The antibody or fragment thereof of claim 5, which is humanized and wherein the heavy chain variable region comprises one or more back mutations selected from the group consisting of 12V, 20L, 24T, 38K, 48I, 68A, 70L, 72V and 91S, according to Kabat numbering, and combinations thereof.
7. The antibody or fragment thereof of claim 5, which is humanized and wherein the light chain variable region comprises one or more back mutations selected from the group consisting of 13T, 73F, 78V and 104L, according to Kabat numbering, and combinations thereof.
8. The antibody or fragment thereof of claim 5, comprising a heavy chain variable region comprising an amino acid sequence selected from the group consisting of SEQ ID NO: 1, and 35-38, or a peptide having at least 90% sequence identity to an amino acid sequence selected from the group consisting of SEQ ID NO: 1, and 35-38.
9. The antibody or fragment thereof of claim 5, comprising a light chain variable region comprising an amino acid sequence selected from the group consisting of SEQ ID NO: 2, and 39-42, or a peptide having at least 90% sequence identity to an amino acid sequence selected from the group consisting of SEQ ID NO: 2, and 39-42.
10. The antibody or fragment thereof of claim 1, wherein the HCDR1, HCDR2, HCDR3, LCDR1, LCDR2, and LCDR3 are HCDR1: DYYMY (SEQ ID NO: 43), HCDR2: SITKGGGSTYYPDTLKG (SEQ ID NO: 44), HCDR3: QSSYDFVMDY (SEQ ID NO: 45), LCDR1: KASQDVDTAVA (SEQ ID NO: 46), LCDR2: WASARHT (SEQ ID NO: 47), and LCDR3: QQYSNYPLT (SEQ ID NO: 48).
11. The antibody or fragment thereof of claim 10, which is humanized and wherein the heavy chain variable region comprises one or more back mutations selected from the group consisting of 3K, 44R, and 82R, according to Kabat numbering, and combinations thereof.
12. The antibody or fragment thereof of claim 10, which is humanized and wherein the light chain variable region comprises one or more back mutations selected from the group consisting of 3V, 42Q, 43S, and 87F, according to Kabat numbering, and combinations thereof.
13. The antibody or fragment thereof of claim 10, comprising a heavy chain variable region comprising an amino acid sequence selected from the group consisting of SEQ ID NO: 27, and 49-52, or a peptide having at least 90% sequence identity to an amino acid sequence selected from the group consisting of SEQ ID NO: 27, and 49-52.

14. The antibody or fragment thereof of claim 10, comprising a light chain variable region comprising an amino acid sequence selected from the group consisting of SEQ ID NO: 28, and 53-56, or a peptide having at least 90% sequence identity to an amino acid sequence selected from the group consisting of SEQ ID NO: 28, and 53-56.

15. The antibody or fragment thereof of claim 1, wherein the HCDR1, HCDR2, HCDR3, LCDR1, LCDR2, and LCDR3 are HCDR1: SDYAWN (SEQ ID NO: 57), HCDR2: YISYSGNTRYNPSLKS (SEQ ID NO: 58), HCDR3: KYYGSWFPY (SEQ ID NO: 59), LCDR1: KASQDVFTAVA (SEQ ID NO: 60), LCDR2: SASRYT (SEQ ID NO: 61), and LCDR3: QQHYSTPWT (SEQ ID NO: 62).

16. The antibody or fragment thereof of claim 15, which is humanized and wherein the heavy chain variable region comprises one or more back mutations selected from the group consisting of 49M, 68I, 72R, 83F and 97S, according to Kabat numbering, and combinations thereof.

17. The antibody or fragment thereof of claim 15, which is humanized and wherein the light chain variable region comprises one or more back mutations selected from the group consisting of 13T, 73F and 78V, according to Kabat numbering, and combinations thereof.

18. The antibody or fragment thereof of claim 15, comprising a heavy chain variable region comprising an amino acid sequence selected from the group consisting of SEQ ID NO: 3, and 63-66, or a peptide having at least 90% sequence identity to an amino acid sequence selected from the group consisting of SEQ ID NO: 3, and 63-66.

19. The antibody or fragment thereof of claim 15, comprising a light chain variable region comprising an amino acid sequence selected from the group consisting of SEQ ID NO: 4, and 67-70, or a peptide having at least 90% sequence identity to an amino acid sequence selected from the group consisting of SEQ ID NO: 4, and 67-70.

20. An antibody or fragment thereof having specificity to a human T cell immunoreceptor with Ig and ITIM domains (TIGIT) protein, wherein the antibody or fragment thereof comprises a heavy chain variable region comprising heavy chain complementarity determining regions HCDR1, HCDR2, and HCDR3, and a light chain variable region comprising light chain complementarity determining regions LCDR1, LCDR2, and LCDR3, wherein

the HCDR1, HCDR2, and HCDR3 have the amino acid sequences of the HCDR1, HCDR2, and HCDR3 of a heavy chain variable region selected from the group consisting of SEQ ID NO:3 and 71-75, respectively, and

the LCDR1, LCDR2, and LCDR3 have the amino acid sequences of the LCDR1, LCDR2, and LCDR3 of a light chain variable region selected from the group consisting of SEQ ID NO: 4 and 76-80, respectively.

21. The antibody or fragment thereof of any one of claims 1-20, which is bispecific.
22. The antibody or fragment thereof of claim 21, wherein the bispecificity comprises a second specificity to an immune checkpoint protein or a tumor antigen.
23. The antibody or fragment thereof of claim 21, wherein the bispecificity comprises a second specificity to a protein target selected from the group consisting of PD-L1, PD-1, CTLA-4, LAG3, CD28, CD122, 4-1BB, TIM3, OX-40, OX40L, CD40, CD40L, LIGHT, ICOS, ICOSL, GITR, GITRL, TIGIT, CD27, VISTA, B7H3, B7H4, HEVM, BTLA, KIR, CD47, CD73, EGFR, Her2, CD33, CD133, CEA and VEGF.
24. The antibody or fragment thereof of claim 21, wherein the bispecificity comprises a second specificity to PD-L1.
25. A composition comprising the antibody or fragment thereof of any one of claims 1-24 and a pharmaceutically acceptable carrier.
26. An isolated cell comprising one or more polynucleotide encoding the antibody or fragment thereof of any one of claims 1-24.
27. A method of detecting expression of TIGIT in a sample, comprising contacting the sample with the antibody or fragment thereof of any one of claims 1-24 under conditions for the antibody or fragment thereof to bind to the TIGIT, and detecting the binding which indicates expression of TIGIT in the sample.
28. A method of identifying a patient suitable for treatment with an anti-TIGIT therapy, comprising isolated a cell from the cancer patient and detecting the presence of a TIGIT protein with the antibody or fragment thereof of any one of claims 1-24.
29. Use of an antibody or fragment thereof of any one of claims 1-24 in the manufacture of a medicament for treating cancer in a patient in need thereof.

30. Use of an antibody or fragment thereof of any one of claims 1-24 in the manufacture of a medicament for treating or inhibiting infection in a patient in need thereof.

31. Use of a T cell in the preparation of a medicament for treating cancer in a patient in need thereof, wherein the T cell has been treated, in vitro, with the antibody or fragment thereof of any one of claims 1-24.