

CLAIMS

1. An antibody that specifically binds to Mucin-1 (MUC-1), the antibody comprising:
 - a variable heavy chain (VH) chain comprising:
 - a heavy chain CDR1 comprising the amino acid sequence of SEQ ID NO: 17;
 - a heavy chain CDR2 comprising the amino acid sequence of SEQ ID NO: 18; and
 - a heavy chain CDR3 comprising the amino acid sequence of SEQ ID NO: 9; and
 - a variable light chain (VL) chain comprising:
 - a light chain CDR1 comprising the amino acid sequence of SEQ ID NO: 10 or SEQ ID NO: 13;
 - a light chain CDR2 comprising the amino acid sequence of SEQ ID NO: 11 or 14;
 - and
 - a light chain CDR3 comprising the amino acid sequence of SEQ ID NO: 12, SEQ ID NO: 15, or SEQ ID NO: 16.
2. The antibody of claim 1, wherein the VH chain comprises an amino acid sequence having at least 80% identity to the amino acid sequence set forth in SEQ ID NO:1.
3. The antibody of claim 2, wherein the VL chain comprises an amino acid sequence having at least 80% identity to the amino acid sequence set forth in SEQ ID NO:2, 3, or 4.
4. The antibody of any one of claims 1-3, comprising:
 - a heavy chain CDR1 (HCDR1) comprising the amino acid sequence DHTMH (SEQ ID NO:17);
 - a heavy chain CDR2 (HCDR2) comprising the amino acid sequence YFYPRDDSTNYNEKFKG (SEQ ID NO:18);
 - a heavy chain CDR3 (HCDR3) comprising the amino acid sequence GLRYALDY (SEQ ID NO:9);
 - a light chain CDR1 (LCDR1) comprising the amino acid sequence RASSSVSSSYLY (SEQ ID NO:10);

a light chain CDR2 (LCDR2) comprising the amino acid sequence GTSNLAS (SEQ ID NO:11); and

a light chain CDR3 (LCDR3) comprising the amino acid sequence HQYAWSPPT (SEQ ID NO:12), as per Kabat definition.

5. The antibody of any one of claims 1-3, comprising:

a heavy chain CDR1 (HCDR1) comprising the amino acid sequence DHTMH (SEQ ID NO:17);

a heavy chain CDR2 (HCDR2) comprising the amino acid sequence YFYPRDDSTNYNEKFKG (SEQ ID NO:18);

a heavy chain CDR3 (HCDR3) comprising the amino acid sequence GLRYALDY (SEQ ID NO:9);

a light chain CDR1 (LCDR1) comprising the amino acid sequence RASSSVGSSNLY (SEQ ID NO:13);

a light chain CDR2 (LCDR2) comprising the amino acid sequence RSTKLAS (SEQ ID NO:14); and

a light chain CDR3 (LCDR3) comprising the amino acid sequence HQYRWSPTT (SEQ ID NO:15), as per Kabat definition.

6. The antibody of any one of claims 1-3, comprising:

a heavy chain CDR1 (HCDR1) comprising the amino acid sequence DHTMH (SEQ ID NO:17);

a heavy chain CDR2 (HCDR2) comprising the amino acid sequence YFYPRDDSTNYNEKFKG (SEQ ID NO:18);

a heavy chain CDR3 (HCDR3) comprising the amino acid sequence GLRYALDY (SEQ ID NO:9);

a light chain CDR1 (LCDR1) comprising the amino acid sequence RASSSVSSSYLY (SEQ ID NO:10);

a light chain CDR2 (LCDR2) comprising the amino acid sequence GTSNLAS (SEQ ID NO:11); and

a light chain CDR3 (LCDR3) comprising the amino acid sequence
HQYSWSPPT (SEQ ID NO:16), as per Kabat definition.

7. The antibody of any one of claims 1-3, wherein the antibody is a humanized antibody or a chimeric antibody.
8. The antibody of any one of claims 1-3, wherein the antibody is selected from the group consisting of: an IgG, Fv, single chain antibody, scFv, Fab, F(ab')₂, or Fab'.
9. The antibody of any one of claims 1-3, wherein the antibody is an antibody fragment that binds to MUC-1.
10. The antibody of any one of claims 1-3, wherein the antibody is an IgG, an IgG1, a Fab, a single chain antibody, an scFv, or a bispecific antibody.
11. The antibody of any one of claims 1-3, wherein the antibody is detectably labeled.
12. The antibody of any one of claims 1-3, wherein the antibody comprises a covalently linked non-peptide synthetic polymer.
13. The antibody of claim 12, wherein the synthetic polymer is poly(ethylene glycol) polymer.
14. The antibody of any one of claims 1-3, wherein the antibody comprises a covalently linked lipid or fatty acid moiety.
15. The antibody of any one of claims 1-3, wherein the antibody comprises a covalently linked polysaccharide or carbohydrate moiety.
16. The antibody of any one of claims 1-3, wherein the antibody is linked to a contrast agent.

17. The antibody of any one of claims 1-3, wherein the antibody is immobilized on a solid support.
18. The antibody of any one of claims 1-3, wherein the antibody comprises a covalently linkage to a cytotoxin.
19. The antibody of any one of claims 1-3, wherein the antibody comprises a constant region amino acid sequence comprising an amino acid sequence of a sulfatase motif.
20. The antibody of any one of claims 1-3, wherein the antibody comprises a constant region amino acid sequence comprising an amino acid sequence of a sulfatase motif, and wherein the sulfatase motif is modified to comprise a 2-formylglycine (fGly) moiety.
21. The antibody of claim 20, wherein the antibody is covalently linked to a heterologous moiety via the fGly moiety.
22. The antibody of claim 21, wherein the heterologous moiety is selected from a drug, a toxin, a detectable label, a water-soluble polymer, and a synthetic peptide.
23. A pharmaceutical composition comprising:
a) the antibody of any one of claims 1-10; and
b) a pharmaceutically acceptable carrier.
24. The pharmaceutical composition of claim 23, further comprising a T cell activator.
25. The pharmaceutical composition of claim 24, wherein the T cell activator is selected from the group consisting of: an immune checkpoint inhibitor, a cytokine, and an antagonist of an inhibitory immune receptor.
26. The pharmaceutical composition of any one of claims 23-25, wherein the antibody is encapsulated in a liposome.
27. The antibody of any one of claims 1-10 for use in therapy.

28. Use of the antibody of any one of claims 1-10 in the preparation of a medicament for treating cancer in a subject, wherein the cancer cells express MUC-1 on their surface.

29. An antibody comprising a heavy chain and a light chain,
wherein the heavy chain comprises:

a heavy chain CDR1 as set forth in SEQ ID NO: 17, a heavy chain CDR2 as set forth in SEQ ID NO: 18, and a heavy chain CDR3 as set forth in SEQ ID NO: 9;

wherein the light chain comprises:

a light chain CDR1 as set forth in SEQ ID NO: 10, a light chain CDR2 as set forth in SEQ ID NO: 11, and a light chain CDR3 as set forth in SEQ ID NO: 12; or

a light chain CDR1 as set forth in SEQ ID NO: 13, a light chain CDR2 as set forth in SEQ ID NO: 14, and a light chain CDR3 as set forth in SEQ ID NO: 15; or

a light chain CDR1 as set forth in SEQ ID NO: 10, a light chain CDR2 as set forth in SEQ ID NO: 11, and a light chain CDR3 as set forth in SEQ ID NO: 16.

30. The antibody of claim 29, wherein the heavy chain comprises the amino acid sequence as set forth in SEQ ID NO: 1, and wherein the light chain comprises the amino acid sequence as set forth in SEQ ID NO: 2, SEQ ID NO: 3, or SEQ ID NO: 4.

31. An antibody or fragment thereof that specifically binds to Mucin-1 (MUC-1),
wherein the antibody or fragment thereof comprises:

a heavy chain complementarity determining region (HCDR) 1, HCDR2, and HCDR3 as set forth in a variable heavy (VH) chain comprising the amino acid sequence of SEQ ID NO: 1; and

a light chain complementarity determining region (LCDR) 1, LCDR2, and LCDR3 as set forth in a variable light (VL) chain comprising the amino acid sequence of any one of SEQ ID NOs: 2, 3, or 4.