WHAT IS CLAIMED IS:

1. An antibody-like binding protein that specifically binds the tumor-associated MUC1 sialoglycotype CA6, characterized in that the antibody-like binding protein comprises two polypeptides having structures represented by the formulas [I] and [II] below:

$$V_{L1}\text{-}L_1\text{-}V_{L2}\text{-}C_L \qquad [I]$$

$$V_{H1}\text{-}L_2\text{-}V_{H2}\text{-}C_{H1} \qquad [II]$$

wherein:

V_{L1} is an immunoglobulin light chain variable domain derived from the DS6 antibody;

V_{L2} is an immunoglobulin light chain variable domain derived from the DS6 antibody;

V_{HI} is an immunoglobulin heavy chain variable domain derived from the DS6 antibody;

V_{H2} is an immunoglobulin heavy chain variable domain derived from the DS6 antibody;

C_L is an immunoglobulin light chain constant domain, such as a human IGKC immunoglobulin light chain constant domain;

C_{H1} is an immunoglobulin C_{H1} heavy chain constant domain, such as a human immunoglobulin C_{H1} heavy chain constant domain;

L_1 and L_2 are amino acid linkers; and

wherein the polypeptides of formula I and the polypeptides of formula II form a bivalent monospecific tandem immunoglobulin antibody-like binding protein, wherein the polypeptide of formula [I] comprises a sequence at least 80% identical to SEQ ID NO: 1 and the polypeptide of formula [II] comprises a sequence at least 80% identical to SEQ ID NO: 7.

2. The antibody-like binding protein according to claim 1, wherein V_{L1} and V_{L2} are defined by sequence SEQ ID NO: 2; and V_{H1} and V_{H2} are defined by sequence SEQ ID NO: 8.

3. The antibody-like binding protein according to claim 1 or claim 2, wherein L_1 is GGGGS or GGGGSGGGGS (SEQ ID NO: 3).

4. The antibody- like binding protein according to anyone of claims 1 to 3, wherein L_2 is GGGGS or GGGGSGGGGS (SEQ ID NO: 3).

5. The antibody-like binding protein according to any one of claims 1 to 4, wherein the polypeptide of formula [I] comprises the amino acid sequence SEQ ID NO: 1.

6. The antibody- like binding protein according to any one of claims 1 to 5, wherein the polypeptide of formula [II] comprises the amino acid sequence SEQ ID NO: 7.

7. The antibody- like binding protein according to any one of claims 1 to 6, further comprising at least one radiolabel, imaging agent, therapeutic agent, or diagnostic agent.

8. The antibody- like binding protein according to claim 7, wherein the radiolabel, imaging agent, therapeutic agent, or diagnostic agent is ^{110}In, ^{111}In, ^{177}Lu, ^{18}F, ^{52}Fe, ^{62}Cu, ^{64}Cu, ^{67}Cu, ^{67}Ga, ^{68}Ga, ^{86}Y, ^{90}Y, ^{89}Zr, ^{94}Tc, ^{99m}Tc, ^{120}I, ^{123}I, ^{124}I, ^{125}I, ^{131}I, $^{154\text{-}158}$Gd, ^{32}P, ^{11}C, ^{13}N, ^{15}O, ^{186}Re, ^{188}Re, ^{51}Mn, ^{52m}Mn, ^{55}Co, ^{72}As, ^{75}Br, ^{76}Br, ^{82m}Rb, or ^{83}Sr.

9. The antibody-like binding protein according to claims 7 or 8, wherein the radiolabel, imaging agent, therapeutic agent, or diagnostic agent comprises one or more agents for an imaging platform selected from the group consisting of magnetic resonance imaging (MRI); positron emission tomography (PET); single photon emission tomography (SPECT); optical imaging; computed tomography (CT); ultrasound; X-ray; and photoacoustic imaging.

10. An isolated nucleic acid molecule encoding the polypeptides of formula [I] and [II] of the antibody-like binding protein as defined in any one of claims 1 to 6.

11. The isolated nucleic acid molecule of claim 10, wherein the nucleic acid molecule comprises the nucleotide sequence of SEQ ID NO: 5 or SEQ ID NO: 10.

12. An expression vector comprising the nucleic acid molecule as defined in claim 10 or 11.

13. An isolated host cell comprising the nucleic acid molecule as defined in claim 10 or 11, or the expression vector as defined in claim 12.

14. A method for making an antibody-like binding protein that specifically binds the tumor-associated MUC1 sialoglycotype CA6, comprising expressing in a cell one or more nucleic acid molecules encoding polypeptides having structures represented by the formulas [I] and [II] below:

$$V_{L1}\text{-}L_1\text{-}V_{L2}\text{-}C_L \qquad [I]$$

$$V_{H1}\text{-}L_2\text{-}V_{H2}\text{-}C_{H1} \qquad [II]$$

wherein:

V_{L1} is an immunoglobulin light chain variable domain derived from the DS6 antibody;

V_{L2} is an immunoglobulin light chain variable domain derived from the DS6 antibody;

V_{H1} is an immunoglobulin heavy chain variable domain derived from the DS6 antibody;

V_{H2} is an immunoglobulin heavy chain variable domain derived from the DS6 antibody;

C_L is an immunoglobulin light chain constant domain, such as a human IGKC immunoglobulin light chain constant domain;

C_{H1} is an immunoglobulin C_{HI} heavy chain constant domain, such as a human immunoglobulin C_{HI} heavy chain constant domain;

L_1 and L_2 are amino acid linkers; and

wherein the polypeptides of formula I and the polypeptides of formula II form a bivalent monospecific tandem immunoglobulin antibody-like binding protein; and

wherein the polypeptide of formula [I] comprises a sequence at least 80% identical to SEQ ID NO: 1 and the polypeptide of formula [II] comprises a sequence at least 80% identical to SEQ ID NO: 7

15. The method according to claim 14, wherein V_{L1} and V_{L2} are defined by sequence SEQ ID NO: 2; and V_{H1} and V_{H2} are defined by sequence SEQ ID NO: 8.