WHAT IS CLAIMED IS:

1. A humanized antibody or antigen binding fragment thereof that specifically binds a human folate receptor 1, wherein the antibody comprises:

(a) a heavy chain CDR1 comprising GYFMN (SEQ ID NO:1); a heavy chain CDR2 comprising RIHPYDGDTFYNQXaa$_1$FXaa$_2$Xaa$_3$ (SEQ ID NO:56); and a heavy chain CDR3 comprising YDGSRAMDY (SEQ ID NO:3); and

(b) a light chain CDR1 comprising KASQSVSFAGTSLMH (SEQ ID NO:7); a light chain CDR2 comprising RASNLEA (SEQ ID NO:8); and a light chain CDR3 comprising QQSREYPYT (SEQ ID NO:9);

wherein Xaa$_1$ is selected from K, Q, H, and R; Xaa$_2$ is selected from Q, H, N, and R; and Xaa$_3$ is selected from G, E, T, S, A, and V.

2. The humanized antibody or antigen binding fragment thereof of claim 1 which binds a human folate receptor 1 with substantially the same affinity as the antibody chimeric Mov19.

3. The humanized antibody or antigen binding fragment thereof of claim 2, wherein the binding affinity is measured by flow cytometry, Biacore, or radioimmunoassay.

4. The humanized antibody or antigen binding fragment thereof of any of claims 1-3, wherein the heavy chain CDR2 sequence comprises RIHPYDGDTFYNQKFQG (SEQ ID NO:2)

5. A humanized antibody or antigen binding fragment thereof that specifically binds a human folate receptor 1, wherein the antibody comprises:

(a) a heavy chain CDR1 comprising GYFMN (SEQ ID NO:1), or a variant thereof comprising 1, 2, 3, or 4 conservative amino acid substitutions; a heavy chain CDR2 comprising RIHPYDGDTFYNQKFQG (SEQ ID NO:2), or a variant thereof comprising 1, 2, 3, or 4 amino conservative acid substitutions; and a heavy chain CDR3 comprising YDGSRAMDY (SEQ ID NO:3), or a variant thereof comprising 1, 2, 3, or 4 conservative amino acid substitutions; and/or

(b) a light chain CDR1 comprising KASQSVSFAGTSLMH (SEQ ID NO:7), or a variant thereof comprising 1, 2, 3, or 4 conservative amino acid substitutions; a light chain CDR2 comprising RASNLEA (SEQ ID NO:8), or a variant thereof comprising 1, 2, 3, or 4 conservative amino acid substitutions; and a light chain CDR3 comprising QQSREYPYT (SEQ ID NO:9), or a variant thereof comprising 1, 2, 3, or 4 conservative amino acid substitutions.

6. A humanized antibody or antigen binding fragment thereof that specifically binds the human folate receptor 1 comprising the heavy chain of SEQ ID NO:6.

7. A humanized antibody or antigen binding fragment thereof encoded by the plasmid DNA deposited with the ATCC on April 7, 2010 and having ATCC deposit nos. PTA-10772, PTA-10773, or 10774.

8. A humanized antibody or antigen binding fragment thereof that competes with the antibody of any of claims 1-7 for specific binding to a human folate receptor 1.

9. A humanized antibody or antigen binding fragment thereof comprising a heavy chain variable domain at least about 90% identical to SEQ ID NO:4, and a light chain variable domain at least about 90% identical to SEQ ID NO:10 or SEQ ID NO:11.

10. The humanized antibody or antigen binding fragment thereof of claim 9, wherein said heavy chain variable domain is at least about 95% identical to SEQ ID NO:4, and said light chain variable domain is at least about 95% identical to SEQ ID NO:10 or SEQ ID NO:11.

11. The humanized antibody or antigen binding fragment thereof of claim 10, wherein said heavy chain variable domain is at least about 99% identical to SEQ ID NO:4, and said light chain variable domain is at least about 99% identical to SEQ ID NO:10 or SEQ ID NO:11.

12. The humanized antibody or antigen binding fragment thereof of claim 11, wherein said heavy chain variable domain is identical SEQ ID NO:4, and said light chain variable domain is identical to SEQ ID NO:10 or SEQ ID NO:11.

13. The humanized antibody or antigen binding fragment thereof of any one of claims 1-12, wherein said antibody is expressed at least ten-fold higher than chMov19 in eukaryotic cells.

14. The humanized antibody of claim 13, wherein said eukaryotic cells are HEK-293T cells.

15. A polypeptide that specifically binds a human folate receptor 1, wherein said polypeptide comprises:

(a) a polypeptide having at least about 90% sequence identity to SEQ ID NO:4; and/or

(b) a polypeptide having at least about 90% sequence identity to SEQ ID NO:10 or SEQ ID NO:11.

16. The polypeptide of claim 15, wherein said polypeptide comprises:

(a) a polypeptide having at least about 95% sequence identity to SEQ ID NO:4; and/or

(b) a polypeptide having at least about 95% sequence identity to SEQ ID NO:10 or SEQ ID NO:11.

17. The polypeptide of claim 16, wherein said polypeptide comprises:

(a) a polypeptide having at least about 99% sequence identity to SEQ ID NO:4; and/or

(b) a polypeptide having at least about 99% sequence identity to SEQ ID NO:10 or SEQ ID NO:11.

18. The polypeptide of claim 17, wherein said polypeptide comprises:

(a) the polypeptide of SEQ ID NO:4; and/or

(b) the polypeptide of SEQ ID NO:10 or SEQ ID NO:11.

19. The polypeptide of claim 18, wherein said polypeptide comprises:

(a) the polypeptide of SEQ ID NO:4; and

(b) the polypeptide of SEQ ID NO:10 or SEQ ID NO:11.

20. An antibody or antigen binding fragment thereof that specifically binds a human folate receptor 1, wherein the antibody comprises:

(a) a heavy chain CDR1 comprising SSYGMS (SEQ ID NO:30); a heavy chain CDR2 comprising TISSGGSYTY (SEQ ID NO:31); and/or a heavy chain CDR3 comprising DGEGGLYAMDY (SEQ ID NO:32); and/or

(b) a light chain CDR1 comprising KASDHINNWLA (SEQ ID NO:27); a light chain CDR2 comprising GATSLET (SEQ ID NO:28); and a light chain CDR3 comprising QQYWSTPFT (SEQ ID NO:29).

21. An antibody or antigen binding fragment thereof that specifically binds a human folate receptor 1, wherein the antibody comprises:

(a) a heavy chain CDR1 comprising TNYWMQ (SEQ ID NO:60); a heavy chain CDR2 comprising AIYPGNGDSR (SEQ ID NO:61); and/or a heavy chain CDR3 comprising RDGNYAAY (SEQ ID NO:62); and/or

(b) a light chain CDR1 comprising RASENIYSNLA (SEQ ID NO:57); a light chain CDR2 comprising AATNLAD (SEQ ID NO:58); and a light chain CDR3 comprising QHFWASPYT (SEQ ID NO:59).

22. An antibody or antigen binding fragment thereof that specifically binds a human folate receptor 1, wherein the antibody comprises:

(a) a heavy chain CDR1 comprising TNYWMY (SEQ ID NO:66); a heavy chain CDR2 comprising AIYPGNSDTT (SEQ ID NO:67); and/or a heavy chain CDR3 comprising RHDYGAMDY (SEQ ID NO:68); and/or

(b) a light chain CDR1 comprising RASENIYTNLA (SEQ ID NO:63); a light chain CDR2 comprising TASNLAD (SEQ ID NO:64); and a light chain CDR3 comprising QHFWVSPYT (SEQ ID NO:65).

23. An antibody or antigen binding fragment thereof that specifically binds a human folate receptor 1, wherein the antibody comprises:

(a) a heavy chain CDR1 comprising SSFGMH (SEQ ID NO:72); a heavy chain CDR2 comprising YISSGSSTIS (SEQ ID NO:73); and/or a heavy chain CDR3 comprising EAYGSSMEY (SEQ ID NO:74); and/or

(b) a light chain CDR1 comprising RASQNINNNLH (SEQ ID NO:69); a light chain CDR2 comprising YVSQSVS (SEQ ID NO:70); and a light chain CDR3 comprising QQSNSWPHYT (SEQ ID NO:71).

24. An antibody or antigen binding fragment thereof that specifically binds a human folate receptor 1, wherein the antibody comprises:

(a) a heavy chain CDR1 comprising TSYTMH (SEQ ID NO:78); a heavy chain CDR2 comprising YINPISGYTN (SEQ ID NO:79); and/or a heavy chain CDR3 comprising GGAYGRKPMDY (SEQ ID NO:80); and/or

(b) a light chain CDR1 comprising KASQNVGPNVA (SEQ ID NO:75); a light chain CDR2 comprising SASYRYS (SEQ ID NO:76); and a light chain CDR3 comprising QQYNSYPYT (SEQ ID NO:77).

25. A polypeptide that specifically binds a human folate receptor 1, wherein said polypeptide comprises:

(a) a polypeptide having at least about 90% sequence identity to SEQ ID NO:97; and/or

(b) a polypeptide having at least about 90% sequence identity to SEQ ID NO:96.

26. The polypeptide of claim 25, wherein said polypeptide comprises:

(a) a polypeptide having at least about 95% sequence identity to SEQ ID NO:97; and/or

(b) a polypeptide having at least about 95% sequence identity to SEQ ID NO:96.

27. The polypeptide of claim 26, wherein said polypeptide comprises:

(a) a polypeptide having at least about 99% sequence identity to SEQ ID NO:97; and/or

(b) a polypeptide having at least about 99% sequence identity to SEQ ID NO:96.

28. The polypeptide of claim 27, wherein said polypeptide comprises:

(a) the polypeptide of SEQ ID NO:97; and/or

(b) the polypeptide of SEQ ID NO:96.

29. The polypeptide of claim 28, wherein said polypeptide comprises the polypeptide of SEQ ID NO:97 and the polypeptide of SEQ ID NO:96.

30. A polypeptide that specifically binds a human folate receptor 1, wherein said polypeptide comprises:

(a) a polypeptide having at least about 90% sequence identity to SEQ ID NO:99; and/or

(b) a polypeptide having at least about 90% sequence identity to SEQ ID NO:98.

31. The polypeptide of claim 30, wherein said polypeptide comprises:

(a) a polypeptide having at least about 95% sequence identity to SEQ ID NO:99; and/or

(b) a polypeptide having at least about 95% sequence identity to SEQ ID NO:98.

32. The polypeptide of claim 31, wherein said polypeptide comprises:

(a) a polypeptide having at least about 99% sequence identity to SEQ ID NO:99; and/or

(b) a polypeptide having at least about 99% sequence identity to SEQ ID NO:98.

33. The polypeptide of claim 32, wherein said polypeptide comprises:

(a) the polypeptide of SEQ ID NO:99; and/or

(b) the polypeptide of SEQ ID NO:98.

34. The polypeptide of claim 33, wherein said polypeptide comprises the polypeptide of SEQ ID NO:99 and the polypeptide of SEQ ID NO:98.

35. A polypeptide that specifically binds a human folate receptor 1, wherein said polypeptide comprises:

(a) a polypeptide having at least about 90% sequence identity to SEQ ID NO:101; and/or

(b) a polypeptide having at least about 90% sequence identity to SEQ ID NO:100.

36. The polypeptide of claim 35, wherein said polypeptide comprises:

(a) a polypeptide having at least about 95% sequence identity to SEQ ID NO:101; and/or

(b) a polypeptide having at least about 95% sequence identity to SEQ ID NO:100.

37. The polypeptide of claim 36, wherein said polypeptide comprises:

(a) a polypeptide having at least about 99% sequence identity to SEQ ID NO:101; and/or

(b) a polypeptide having at least about 99% sequence identity to SEQ ID NO:100.

38. The polypeptide of claim 37, wherein said polypeptide comprises (a) the polypeptide of SEQ ID NO:101; and/or (b) the polypeptide of SEQ ID NO:100.

39. The polypeptide of claim 38, wherein said polypeptide comprises the polypeptide of SEQ ID NO:101 and the polypeptide of SEQ ID NO:100.

40. A polypeptide that specifically binds a human folate receptor 1, wherein said polypeptide comprises:

(a) a polypeptide having at least about 90% sequence identity to SEQ ID NO:103; and/or

(b) a polypeptide having at least about 90% sequence identity to SEQ ID NO:102.

41. The polypeptide of claim 40, wherein said polypeptide comprises:

(a) a polypeptide having at least about 95% sequence identity to SEQ ID NO:103; and/or

(b) a polypeptide having at least about 95% sequence identity to SEQ ID NO:102.

42. The polypeptide of claim 41, wherein said polypeptide comprises:

(a) a polypeptide having at least about 99% sequence identity to SEQ ID NO:103; and/or

(b) a polypeptide having at least about 99% sequence identity to SEQ ID NO:102.

43. The polypeptide of claim 42, wherein said polypeptide comprises: (a) the polypeptide of SEQ ID NO:103; and/or (b) the polypeptide of SEQ ID NO:102.

44. The polypeptide of claim 43, wherein said polypeptide comprises the polypeptide of SEQ ID NO:103 and the polypeptide of SEQ ID NO:102.

45. A polypeptide that specifically binds a human folate receptor 1, wherein said polypeptide comprises:

(a) a polypeptide having at least about 90% sequence identity to SEQ ID NO:113; and/or

(b) a polypeptide having at least about 90% sequence identity to SEQ ID NO:112.

46. The polypeptide of claim 45, wherein said polypeptide comprises:

(a) a polypeptide having at least about 95% sequence identity to SEQ ID NO:113; and/or

(b) a polypeptide having at least about 95% sequence identity to SEQ ID NO:112.

47. The polypeptide of claim 46, wherein said polypeptide comprises:

(a) a polypeptide having at least about 99% sequence identity to SEQ ID NO:113; and/or

(b) a polypeptide having at least about 99% sequence identity to SEQ ID NO:112.

48. The polypeptide of claim 47, wherein said polypeptide comprises: (a) the polypeptide of SEQ ID NO:113; and/or (b) the polypeptide of SEQ ID NO:112.

49. The polypeptide of claim 48, wherein said polypeptide comprises the polypeptide of SEQ ID NO:113 and the polypeptide of SEQ ID NO:112.

50. A polypeptide that specifically binds a human folate receptor 1, wherein said polypeptide comprises:

(a) a polypeptide having at least about 90% sequence identity to SEQ ID NO:115; and/or

(b) a polypeptide having at least about 90% sequence identity to SEQ ID NO:114.

51. The polypeptide of claim 50, wherein said polypeptide comprises:

(a) a polypeptide having at least about 95% sequence identity to SEQ ID NO:115; and/or

(b) a polypeptide having at least about 95% sequence identity to SEQ ID NO:114.

52. The polypeptide of claim 51, wherein said polypeptide comprises:

(a) a polypeptide having at least about 99% sequence identity to SEQ ID NO:115; and/or

(b) a polypeptide having at least about 99% sequence identity to SEQ ID NO:114.

53. The polypeptide of claim 52, wherein said polypeptide comprises: (a) the polypeptide of SEQ ID NO:115; and/or (b) the polypeptide of SEQ ID NO:114.

54. The polypeptide of claim 53, wherein said polypeptide comprises the polypeptide of SEQ ID NO:115 and the polypeptide of SEQ ID NO:114.

55. A polypeptide that specifically binds a human folate receptor 1, wherein said polypeptide comprises:

(a) a polypeptide having at least about 90% sequence identity to SEQ ID NO:117; and/or

(b) a polypeptide having at least about 90% sequence identity to SEQ ID NO:116.

56. The polypeptide of claim 55, wherein said polypeptide comprises:

(a) a polypeptide having at least about 95% sequence identity to SEQ ID NO:117; and/or

(b) a polypeptide having at least about 95% sequence identity to SEQ ID NO:116.

57. The polypeptide of claim 56, wherein said polypeptide comprises:

(a) a polypeptide having at least about 99% sequence identity to SEQ ID NO:117; and/or

(b) a polypeptide having at least about 99% sequence identity to SEQ ID NO:116.

58. The polypeptide of claim 57, wherein said polypeptide comprises: (a) the polypeptide of SEQ ID NO:117; and/or (b) the polypeptide of SEQ ID NO:116.

59. The polypeptide of claim 58, wherein said polypeptide comprises the polypeptide of SEQ ID NO:117 and the polypeptide of SEQ ID NO:116.

60. A polypeptide that specifically binds a human folate receptor 1, wherein said polypeptide comprises:

(a) a polypeptide having at least about 90% sequence identity to SEQ ID NO:119; and/or

(b) a polypeptide having at least about 90% sequence identity to SEQ ID NO:118.

61. The polypeptide of claim 60, wherein said polypeptide comprises:

(a) a polypeptide having at least about 95% sequence identity to SEQ ID NO:119; and/or

(b) a polypeptide having at least about 95% sequence identity to SEQ ID NO:118.

62. The polypeptide of claim 61, wherein said polypeptide comprises:

(a) a polypeptide having at least about 99% sequence identity to SEQ ID NO:119; and/or

(b) a polypeptide having at least about 99% sequence identity to SEQ ID NO:118.

63. The polypeptide of claim 62, wherein said polypeptide comprises: (a) the polypeptide of SEQ ID NO:119; and/or (b) the polypeptide of SEQ ID NO:118.

64. The polypeptide of claim 63, wherein said polypeptide comprises the polypeptide of SEQ ID NO:119 and the polypeptide of SEQ ID NO:118.

65. The polypeptide of any one of claims 25-65 which is an antibody.

66. The antibody of any one of claims 1-24 which is a full length antibody.

67. The antibody of any one of claims 1-24 which is an antigen binding fragment.

68. The antibody of claim 67, wherein said antibody or antigen binding fragment comprises a Fab, a Fab', a F(ab')2, a Fd, a single chain Fv or scFv, a disulfide linked Fv, a V NAR domain, a IgNar, an intrabody, an IgG-CH2, a minibody, a F(ab')3, a tetrabody, a triabody, a diabody, a single-domain antibody, DVD-Ig, Fcab, mAb2, a (scFv)2, or a scFv-Fc.

69. The antibody or polypeptide of any one of claim 1-68, which binds to a human folate receptor 1 with a Kd of about 1.0 to about 10 nM.

70. The antibody or polypeptide of any one of claims 1-69, which binds to a human folate receptor 1 with a Kd of about 1.0 nM or better.

71. The antibody of claims 69 or 70, wherein the binding affinity is measured by flow cytometry, Biacore, or radioimmunoassay.

72. A method of making the antibody of any one of claims 1-24 comprising (a) culturing a cell expressing said antibody; and (b) isolating the antibody from said cultured cell.

73. The method of claim 72, wherein said cell is a eukaryotic cell.

74. An immunoconjugate having the formula (A) - (L) - (C), wherein:

(A) is an antibody or antigen binding fragment or polypeptide of any one of claims 1-71;

(L) is a linker; and

(C) is a cytotoxic agent.

wherein said linker (L) links (A) to (C).

75. The immunoconjugate of claim 74, wherein said linker is selected from the group consisting of a cleavable linker, a non-cleavable linker, a hydrophilic linker, and a dicarboxylic acid based linker.

76. The immunoconjugate of claim 75, wherein said linker is selected from the group consisting: *N*-succinimidyl 4-(2-pyridyldithio)pentanoate (SPP) or *N*-succinimidyl 4-(2-pyridyldithio)-2-sulfopentanoate (sulfo-SPP); *N*-succinimidyl 4-(2-pyridyldithio)butanoate (SPDB) or *N*-succinimidyl 4-(2-pyridyldithio)-2-sulfobutanoate (sulfo-SPDB); *N*-succinimidyl 4-(maleimidomethyl) cyclohexanecarboxylate (SMCC); *N*-sulfosuccinimidyl 4-(maleimidomethyl) cyclohexanecarboxylate (sulfoSMCC); *N*-succinimidyl-4-(iodoacetyl)-aminobenzoate (SIAB); and *N*-succinimidyl-[(N-maleimidopropionamido)-tetraethyleneglycol] ester (NHS-PEG4-maleimide).

77. The immunoconjugate of claim 75, wherein said linker is *N*-succinimidyl-[(N-maleimidopropionamido)-tetraethyleneglycol] ester (NHS-PEG4-maleimide).

78. The immunoconjugate of claim 75, wherein said linker is *N*-succinimidyl 4-(2-pyridyldithio)butanoate (SPDB) or *N*-succinimidyl 4-(2-pyridyldithio)-2-sulfobutanoate (sulfo-SPDB).

79. The immunoconjugate of any one of claims 74-78, wherein said cytotoxic agent is selected from the group consisting of a maytansinoid, maytansinoid analog, benzodiazepine, taxoid, CC-1065, CC-1065 analog, duocarmycin, duocarmycin analog, calicheamicin, dolastatin, dolastatin analog, auristatin, tomaymycin derivative, and leptomycin derivative or a prodrug of the agent.

80. The immunoconjugate of claim 79, wherein said cytotoxic agent is a maytansinoid.

81. The immunoconjugate of claim 80, wherein said cytotoxic agent is N(2')-deacetyl-N(2')-(3-mercapto-1-oxopropyl)-maytansine or N(2')-deacetyl-N2-(4-mercapto-4-methyl-1-oxopentyl)-maytansine.

82. An immunoconjugate comprising:

(A) a humanized antibody comprising the heavy chain variable domain of SEQ ID NO:97, 99, 101, or 103, and the light chain variable domain of SEQ ID NO:96, 98, 100, or 102;

(L) *N*-succinimidyl 4-(maleimidomethyl) cyclohexanecarboxylate (SMCC); and

(C) N(2')-deacetyl-N(2')-(3-mercapto-1-oxopropyl)-maytansine;

wherein (L) links (A) to (C)

83. An immunoconjugate comprising:

(A) a humanized antibody comprising the heavy chain variable domain of SEQ ID NO:4, and the light chain variable domain of SEQ ID NO:10 or SEQ ID NO:11;

(L) *N*-succinimidyl-[(N-maleimidopropionamido)-tetraethyleneglycol] ester (NHS-PEG4-maleimide); and

(C) N(2')-deacetyl-N2-(4-mercapto-4-methyl-1-oxopentyl)-maytansine;

wherein (L) links (A) to (C).

84. An immunoconjugate comprising:

(A) a humanized antibody comprising the heavy chain variable domain of SEQ ID NO:4, and the light chain variable domain of SEQ ID NO:10 or SEQ ID NO:11;

(L) *N*-succinimidyl 4-(2-pyridyldithio)butanoate (SPDB); and

(C) N(2')-deacetyl-N2-(4-mercapto-4-methyl-1-oxopentyl)-maytansine;

wherein (L) links (A) to (C).

85. An immunoconjugate comprising:

(A) a humanized antibody comprising the heavy chain variable domain of SEQ ID NO:4, and the light chain variable domain of SEQ ID NO:10 or SEQ ID NO:11;

(L) *N*-succinimidyl 4-(2-pyridyldithio)-2-sulfobutanoate (sulfo-SPDB) and

(C) N(2')-deacetyl-N2-(4-mercapto-4-methyl-1-oxopentyl)-maytansine;

wherein (L) links (A) to (C).

86. An immunoconjugate comprising:

(A) a humanized antibody comprising the heavy chain variable domain of SEQ ID NO:4, and the light chain variable domain of SEQ ID NO:10 or SEQ ID NO:11;

(L) *N*-succinimidyl 4-(2-pyridyldithio)-2-sulfopentanoate (sulfo-SPP); and

(C) N(2')-deacetyl-N(2')-(3-mercapto-1-oxopropyl)-maytansine;

wherein (L) links (A) to (C).

87. An immunoconjugate comprising:

(A) a humanized antibody comprising the heavy chain variable domain of SEQ ID NO:4, and the light chain variable domain of SEQ ID NO:10 or SEQ ID NO:11;

(L) *N*-succinimidyl 4-(2-pyridyldithio)pentanoate (SPP); and

(C) N(2')-deacetyl-N(2')-(3-mercapto-1-oxopropyl)-maytansine;

wherein (L) links (A) to (C).

88. The immunoconjugate of any one of claims 74-87, further comprising a second (C).

89. The immunoconjugate of claim 88, further comprising a third (C).

90. The immunoconjugate of claim 89, further comprising a fourth (C).

91. The immunoconjugate of any one of claims 74-90 comprising 2-6 (C).

92. The immunoconjugate of any one of claims 74-90 comprising 3-4 (C).

93. A pharmaceutical composition comprising the antibody, antigen binding fragment, polypeptide, or immunoconjugate of any one of claims 1-71 and 74-92 and a pharmaceutically acceptable carrier.

94. A pharmaceutical composition comprising the immunoconjugate of any one of claims 74-92, wherein the immunoconjugates have an average of about 3 to about 4 (C) per (A).

95. The pharmaceutical composition of claim 47, wherein the immunoconjugates have an average of about 3.5 ± 0.5 (C) per (A).

96. The pharmaceutical composition of any one of claims 93-95, further comprising a second anti-cancer agent.

97. A diagnostic reagent comprising the antibody, antigen binding fragment, polypeptide, or immunoconjugate of any one of claims 1-71 and 74-92 which is labeled.

98. The diagnostic reagent of claim 97, wherein said label is selected from the group consisting of a radiolabel, a fluorophore, a chromophore, an imaging agent and a metal ion.

99. A kit comprising the antibody, antigen binding fragment, polypeptide, or immunoconjugate of any one of claims 1-71 and 74-92.

100. A method of inhibiting tumor growth in a subject, comprising administering a therapeutically effective amount of the antibody, antigen binding fragment, polypeptide, immunoconjugate, or pharmaceutical composition of any one of claims 1-71 and 71-95 to the subject.

101. A method of inhibiting tumor growth in a subject comprising administering a therapeutically effective amount of an immunoconjugate having the formula (A) - (L) - (C), wherein:

(A) is an antibody or antigen binding fragment thereof that specifically binds a human folate receptor 1;

(L) is a linker; and

(C) is a cytotoxin selected from the group consisting of a maytansinoid and a maytansinoid analog; wherein (L) links (A) to (C) and

wherein the immunoconjugate reduces mean tumor volume at least two-fold in a KB xenograft model.

102. The method of claim 101, wherein said antibody or antigen binding fragment thereof comprises:

(a) a heavy chain CDR1 comprising GYFMN (SEQ ID NO:1); a heavy chain CDR2 comprising RIHPYDGDTFYNQXaa$_1$FXaa$_2$Xaa$_3$ (SEQ ID NO:56); and a heavy chain CDR3 comprising YDGSRAMDY (SEQ ID NO:3); and

(b) a light chain CDR1 comprising KASQSVSFAGTSLMH (SEQ ID NO:7); a light chain CDR2 comprising RASNLEA (SEQ ID NO:8); and a light chain CDR3 comprising QQSREYPYT (SEQ ID NO:9);

wherein Xaa$_1$ is selected from K, Q, H, and R; Xaa$_2$ is selected from Q, H, N, and R; and Xaa$_3$ is selected from G, E, T, S, A, and V.

103. The method of claim 102, wherein said heavy chain CDR2 comprises RIHPYDGDTFYNQKFQG (SEQ ID NO:2).

104. The method of claims 101, wherein said antibody or antigen binding fragment thereof is encoded by the plasmid DNA deposited with the ATCC on April 7, 2010 and having ATCC deposit nos. PTA-10772, PTA-10773, or 10774.

105. The method of claim 101, wherein said immunoconjugate comprises:

(A) a humanized antibody comprising the heavy chain variable domain of SEQ ID NO:4, and the light chain variable domain of SEQ ID NO:10 or SEQ ID NO:11;

(L) *N*-succinimidyl-[(N-maleimidopropionamido)-tetraethyleneglycol] ester (NHS-PEG4-maleimide); and

(C) N(2')-deacetyl-N2-(4-mercapto-4-methyl-1-oxopentyl)-maytansine.

106. The method of claim 101, wherein said immunoconjugate comprises:

(A) a humanized antibody comprising the heavy chain variable domain of SEQ ID NO:4, and the light chain variable domain of SEQ ID NO:10 or SEQ ID NO:11;

(L) *N*-succinimidyl 4-(2-pyridyldithio)butanoate (SPDB); and

(C) N(2')-deacetyl-N2-(4-mercapto-4-methyl-1-oxopentyl)-maytansine;

wherein (L) links (A) to (C).

107. The method of claim 101, wherein said immunoconjugate comprises:

(A) a humanized antibody comprising the heavy chain variable domain of SEQ ID NO:4, and the light chain variable domain of SEQ ID NO:10 or SEQ ID NO:11;

(L) *N*-succinimidyl 4-(2-pyridyldithio)-2-sulfobutanoate (sulfo-SPDB); and

(C) N(2')-deacetyl-N2-(4-mercapto-4-methyl-1-oxopentyl)-maytansine;

wherein (L) links (A) to (C).

108. The method of claim 101, wherein said immunoconjugate comprises:

(A) a humanized antibody comprising the heavy chain variable domain of SEQ ID NO:4, and the light chain variable domain of SEQ ID NO:10 or SEQ ID NO:11;

(L) *N*-succinimidyl 4-(2-pyridyldithio)-2-sulfopentanoate (sulfo-SPP); and

(C) N(2')-deacetyl-N(2')-(3-mercapto-1-oxopropyl)-maytansine;

wherein (L) links (A) to (C).

109. The method of claim 101, wherein said immunoconjugate comprises:

(A) a humanized antibody comprising the heavy chain variable domain of SEQ ID NO:4, and the light chain variable domain of SEQ ID NO:10 or SEQ ID NO:11;

(L) N-succinimidyl 4-(2-pyridyldithio)pentanoate (SPP); and

(C) N(2')-deacetyl-N(2')-(3-mercapto-1-oxopropyl)-maytansine;

wherein (L) links (A) to (C).

110. The method of claim 101, wherein said antibody is the huFR-1-21 antibody deposited with ATCC on April 7, 2010 and having ATCC deposit nos. PTA-10775 and PTA-10776.

111. The method of claim 101, wherein said antibody is the huFR1-21 antibody wherein said antibody comprises:

(a) a heavy chain CDR1 comprising SSYGMS (SEQ ID NO:30); a heavy chain CDR2 comprising TISSGGSYTY (SEQ ID NO:31); and a heavy chain CDR3 comprising DGEGGLYAMDY (SEQ ID NO:32); and

(b) a light chain CDR1 comprising KASDHINNWLA (SEQ ID NO:27); a light chain CDR2 comprising GATSLET (SEQ ID NO:28); and a light chain CDR3 comprising QQYWSTPFT (SEQ ID NO:29).

112. The method of claim 101, wherein said antibody is the huFR1-48 antibody wherein said antibody comprises:

(a) a heavy chain CDR1 comprising TNYWMQ (SEQ ID NO:60); a heavy chain CDR2 comprising AIYPGNGDSR (SEQ ID NO:61); and a heavy chain CDR3 comprising RDGNYAAY (SEQ ID NO:62); and

(b) a light chain CDR1 comprising RASENIYSNLA (SEQ ID NO:57); a light chain CDR2 comprising AATNLAD (SEQ ID NO:58); and a light chain CDR3 comprising QHFWASPYT (SEQ ID NO:59).

113. The method of claim 101, wherein said antibody is the huFR1-49 antibody wherein said antibody comprises:

(a) a heavy chain CDR1 comprising TNYWMY (SEQ ID NO:66); a heavy chain CDR2 comprising AIYPGNSDTT (SEQ ID NO:67); and a heavy chain CDR3 comprising RHDYGAMDY (SEQ ID NO:68); and

(b) a light chain CDR1 comprising RASENIYTNLA (SEQ ID NO:63); a light chain CDR2 comprising TASNLAD (SEQ ID NO:64); and a light chain CDR3 comprising QHFWVSPYT (SEQ ID NO:65).

114. The method of claim 101, wherein said antibody is the huFR1-57 antibody wherein said antibody comprises:

(a) a heavy chain CDR1 comprising SSFGMH (SEQ ID NO:72); a heavy chain CDR2 comprising YISSGSSTIS (SEQ ID NO:73); and a heavy chain CDR3 comprising EAYGSSMEY (SEQ ID NO:74); and

(b) a light chain CDR1 comprising RASQNINNNLH (SEQ ID NO:69); a light chain CDR2 comprising YVSQSVS (SEQ ID NO:70); and a light chain CDR3 comprising QQSNSWPHYT (SEQ ID NO:71).

115. The method of claim 101, wherein said antibody is the huFR1-65 antibody wherein said antibody comprises:

(a) a heavy chain CDR1 comprising TSYTMH (SEQ ID NO:78); a heavy chain CDR2 comprising YINPISGYTN (SEQ ID NO:79); and a heavy chain CDR3 comprising GGAYGRKPMDY (SEQ ID NO:80); and

(b) a light chain CDR1 comprising KASQNVGTNVA (SEQ ID NO:75); a light chain CDR2 comprising SASYRYS (SEQ ID NO:76); and a light chain CDR3 comprising QQYNSYPYT (SEQ ID NO:77).

116. The method of any one of claims 100-115, wherein the tumor is a tumor selected from the group consisting of ovarian tumor, brain tumor, breast tumor, uterine tumor, endometrial tumor, pancreatic tumor, renal tumor, and lung tumor.

117. The method of claim 116, wherein the tumor is an ovarian tumor.

118. The method of claim 116, wherein the tumor is a lung tumor.

119. The method of any one of claims 100-118, wherein tumor growth is inhibited to treat cancer.

120. The method of claim 119, further comprising administering a second anti-cancer agent to the subject.

121. The method of claim 120, wherein said second anti-cancer agent is a chemotherapeutic agent.

122. An isolated cell producing the antibody, antigen binding fragment, or polypeptide of any one of claims 1-71.

123. An isolated polynucleotide comprising a sequence at least 90% identical to a sequence selected from the group consisting of SEQ ID NOs: 5, 14, 15, 37, 38, 43, 44, 47, 48, and 120-127.

124. The isolated polynucleotide of claim 123, wherein said sequence is at least 95% identical a sequence selected from the group consisting of SEQ ID NOs: 5, 14, 15, 37, 38, 43, 44, 47, 48, and 120-127.

125. The isolated polynucleotide of claim 124, wherein said sequence is at least 99% identical to a sequence selected from the group consisting of SEQ ID NOs: 5, 14, 15, 37, 38, 43, 44, 47, 48, and 120-127.

126. A vector comprising the polynucleotide of any one of claims 123-125.

127. A host cell comprising the vector of claim 126.

CLAIMS

1. A humanized antibody or an antigen binding fragment thereof that specifically binds to a human folate receptor 1, the humanized antibody or an antigen binding fragment thereof comprising,

the antibody including:

(a) a heavy chain CDR1 including GYFMN (SEQ ID no. 1); a heavy chain CDR2 including RIHPYDGDTFYNQKFQG (SEQ ID no. 2); and a heavy chain CDR3 including YDGSRAMDY (SEQ ID no. 3); and

(b) a light chain CDR1 including KASQSVSFAGTSLMH (SEQ ID no. 7), a light chain CDR2 including RASNLEA (SEQ ID no. 8); and a light chain CDR3 including QQSREYPYT (SEQ ID no. 9).

2. The humanized antibody or an antigen binding fragment thereof according to claim 1 comprising a heavy chain variable domain of SEQ ID no. 4 and a light chain variable domain of SEQ ID no. 10 or 11.

3. The humanized antibody or an antigen binding fragment thereof according to claim 1 comprising a heavy chain of SEQ ID no. 6 and a light chain of SEQ ID no. 12 or 13.

4. The humanized antibody or an antigen binding fragment thereof according to claim 1 comprising a heavy chain encoded by plasmid DNA having an ATCC deposit No. PTA-10772 deposited to ATCC on April 7, 2010, and a light chain encoded by plasmid DNA having an ATCC deposit No. PTA-10773 or PTA-10774 deposited to ATCC on April 7, 2010.

5. The humanized antibody or an antigen binding fragment thereof according to any one of claims 1 through 4 that is a full length antibody.

6. The humanized antibody or an antigen binding fragment thereof according to any one of claims 1 or 2 that is an antigen binding fragment.

7. The humanized antibody or an antigen binding fragment thereof according to claim 6 wherein the humanized antibody or the antigen binding fragment thereof include Fab, Fab', $F(ab')_2$, single chain Fv, that is, scFv, disulfide linked Fv, intrabody, IgG-CH2, minibody, $F(ab')_3$, tetrabody, triabody, diabody, DVD-Ig, mAb^2, $(scFv)_2$, or scFv-Fc.

8. The humanized antibody or an antigen binding fragment thereof according to any one of claims 1 through 7 which binds to a human folate receptor 1 with a Kd of 1.0 to 10 nM.

9. The humanized antibody or an antigen binding fragment thereof according to any one of claims 1 through 7 which binds to a human folate receptor 1 with a Kd of 0.06 to 1.0 nM.

10. A method for creating a humanized antibody comprising

(a) cultivating cells where the humanized antibody according to any one of claims 1 through 9 is manifest; and

(b) isolating the humanized antibody from the cultivated cell.

11. An immunoconjugate having a formula (A) – (L) – (C), wherein:

(A) is a humanized antibody or an antigen binding fragment thereof;

(L) is a linker; and,

(C) is a cytotoxic agent; and

wherein the linker (L) links (A) to (C),

wherein the humanized antibody or an antigen binding fragment thereof (A) comprises a heavy chain CDR1 including GYFMN (SEQ ID no. 1); a heavy chain CDR2 including RIHPYDGDTFYNQKFQG (SEQ ID no. 2); and a heavy chain CDR3 including YDGSRAMDY (SEQ ID no. 3); and a light chain CDR1 including KASQSVSFAGTSLMH (SEQ ID no. 7), a light chain CDR2 including RASNLEA (SEQ ID no. 8); and a light chain CDR3 including QQSREYPYT (SEQ ID no. 9).

12. The immunoconjugate according to claim 11 wherein the linker is selected from a group consisting of a cleavable linker, a non-cleavable linker, a hydrophilic linker, or a dicarboxylic acid-based linker.

13. The immunoconjugate according to claim 12 wherein the linker is selected from a group consisting of N-succinimidyl 4-(2-pyridyldithio)pentanoate (SPP) or N-succinimidyl 4-(2-pyridyldithio)-2-sulfopentanoate (sulfo-SPP); N-succinimidyl 4-(2-pyridyldithio)butanoate (SPDB) or N-succinimidyl 4-(2-pyridyldithio)-2-sulfobutanoate (sulfo-SPDB); N-succinimidyl 4-(maleimidomethyl) cyclohexanecarboxylate (SMCC); N-sulfosuccinimidyl 4-(maleimidomethyl) cyclohexanecarboxylate (sulfoSMCC); N-succinimidyl 4-(iodoacetyl)-aminobenzoate (SIAB); and N-succinimidyl-[(N-maleimidopropionamido)-tetraethyleneglycol] ester (NHS-PEG4-maleimide).

14. The immunoconjugate according to claim 13 wherein the linker is N-succinimidyl 4-(2-pyridyldithio)butanoate (SPDB) or N-succinimidyl 4-(2-pyridyldithio)-2-sulfobutanoate (sulfo-SPDB).

15. The immunoconjugate according to any one of claims 11 through 14 wherein the cytotoxic agent is maytansinoid, maytansinoid analog, benzodiazepine, taxoid, CC-1065, CC-1065 analog,

duocarmycin, duocarmycin analog, calicheamicin, dolastatin, dolastatin analog, auristatin, tomaymycin derivative, and leptomycin derivative or a prodrug of the agent.

16. The immunoconjugate according to claim 15 wherein the cytotoxic agent is maytansinoid.

17. The immunoconjugate according to claim 16 wherein the cytotoxic agent is (2')-deacetyl-N(2')-(3-mercapto-1-oxopropyl)-maytansine or N(2')-deacetyl-N(2')-(4-mercapto-4-methyl-oxopropyl)-maytansine.

18. An immunoconjugate comprising:

(A) a humanized antibody comprising a heavy chain variable domain of SEQ ID no. 4 and a heavy chain variable domain of SEQ ID no. 10 or SEQ ID no.11;

(L) N-succinimidyl-[(N-maleimidopropionamido)-tetraethyleneglycol] ester (NHS-PEG4-maleimide); N-succinimidyl 4-(2-pyridyldithio)butanoate (SPDB); or N-succinimidyl 4-(2-pyridiyldithio)-2-sulfobutanoate (sulfo-SPDB); and

(B) N(2')-deacetyl-N(2')-(4-mercapto-4-methyl-1-oxopentyl)-maytansine;

wherein (L) links (A) to (C).

19. An immunoconjugate comprising:

(A) a humanized antibody including a heavy chain variable domain of SEQ ID no. 4 and a light chain variable domain of SEQ ID no. 10 or SEQ ID no. 11;

(L) N-succinimidyl 4-(2-pyridyldithio)-2-sulfobutanoate (sulfo-SPDB); and

(C) N(2')-deacetyl-N(2')-(4-mercapto-4-methyl-1-oxopentyl)-maytansine; and

wherein (L) links (A) to (C).

20. The immunoconjugate according to any one of claims 11 through 19 wherein the humanized antibody includes a heavy chain variable domain of SEQ ID no. 4, and a light chain variable domain of SEQ ID no. 11.

21. The immunoconjugate according to any one of claims 11 through 20 wherein (A) comprises an antibody or antigen binding fragment that competes with chMOV19 for specific binding to human folate receptor 1.

22. The immunoconjugate according to any one of claims 11 through 21 wherein the humanized antibody or an antigen binding fragment binds to a human folate receptor 1 at a KD of 10 nM or below.

23. The immunoconjugate according to any one of claims 11 through 22 further comprising 2

through 6 (C).

24. A pharmaceutical composition comprising the humanized antibody or an antigen binding fragment thereof according to any one of claims 1 through 9, or the immunoconjugate according to any one of claims 11 through 23 and a pharmaceutically acceptable carrier.

25. The pharmaceutical composition according to claim 24 wherein the immunoconjugate has an average of 3 to 4 (C) per (A).

26. A diagnostic reagent comprising the humanized antibody or an antigen binding fragment according to any one of claims 1 through 9.

27. The diagnostic reagent according to claim 26 further comprising a label.

28. The diagnostic reagent according to claim 27 wherein the label is selected from a group consisting of radiolabeling, fluorophore, chromophore, imaging agent, and metal ion.

29. A kit comprising the humanized antibody or an antigen binding fragment thereof according to any one of claims 1 through 9, or an immunoconjugate according to any one of claims 11 through 23.

30. The pharmaceutical composition of claim 24 or 25 for use in inhibiting tumor growth.

31. Use of the humanized antibody or antigen bonding fragment thereof according to any one of claims 1 through 9, the immunoconjugate according to any one of claims 11 through 23, or the pharmaceutical composition of claim 24 or 25 in the manufacture of a pharmaceutical for inhibiting tumor growth.

32. The pharmaceutical composition of claim 24 or 25 for use in treatment of cancer.

33. Use of the humanized antibody or an antigen bonding fragment thereof according to any one of claims 1 through 9, the immunoconjugate according to any one of claims 11 through 23, or a pharmaceutical composition of claim 24 or 25 in the manufacture of a pharmaceutical for cancer treatment.

34. The pharmaceutical composition according to claim 30 or 32 wherein the tumor or cancer is selected from a group consisting of an ovarian tumor or cancer, a brain tumor or cancer, a breast tumor or cancer, a cervical tumor or cancer, a pancreatic tumor or cancer, a renal tumor or cancer, and a lung tumor or cancer.

35. The pharmaceutical composition according to claim 34 wherein the tumor is an ovarian tumor or a lung tumor.

36. The pharmaceutical composition according to claim 32 wherein tumor growth is inhibited in the treatment of cancer.

37. The use according to claim 31 or 33 wherein the tumor or cancer is selected from a group derived of an ovarian tumor or cancer, a brain tumor or cancer, a breast tumor or cancer, a cervical tumor or cancer, a pancreatic tumor or cancer, a renal tumor or cancer, and a lung tumor or cancer.

38. The use according to claim 37 wherein the tumor is an ovarian tumor or a lung tumor.

39. The use according to claim 33 wherein tumor growth is inhibited in the treatment of cancer.

40. An isolated cell wherein a humanized antibody or an antigen binding fragment according to any one of claims 1 through 9 is produced.