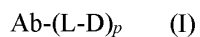


CLAIMS

1. An isolated antibody or antigen-binding fragment, wherein the antibody or antigen-binding fragment is capable of binding to mesothelin and comprises three heavy chain complementarity determining regions comprising amino acid sequences of SEQ ID NO: 1 (HCDR1), SEQ ID NO: 2 (HCDR2), and SEQ ID NO: 3 (HCDR3); and three light chain complementarity determining regions comprising amino acid sequences of SEQ ID NO: 4 (LCDR1), SEQ ID NO: 5 (LCDR2), and SEQ ID NO: 6 (LCDR3), as defined by the Kabat numbering system; or three heavy chain complementarity determining regions comprising amino acid sequences of SEQ ID NO: 7 (HCDR1), SEQ ID NO: 8 (HCDR2), and SEQ ID NO: 9 (HCDR3); and three light chain complementarity determining regions comprising amino acid sequences of SEQ ID NO: 10 (LCDR1), SEQ ID NO: 11 (LCDR2), and SEQ ID NO: 12 (LCDR3), as defined by the IMGT numbering system.
2. An isolated antibody or antigen-binding fragment, wherein the antibody or antigen-binding fragment is capable of binding to mesothelin and comprises three heavy chain complementarity determining regions from a heavy chain variable region comprising an amino acid sequence of SEQ ID NO: 13, and three light chain complementarity determining regions from a light chain variable region comprising an amino acid sequence of SEQ ID NO: 14.
3. The antibody or antigen-binding fragment of claim 1 or claim 2, wherein the antibody or antigen-binding fragment comprises human heavy and light chain variable region frameworks, or human heavy and light chain variable region frameworks with one or more back mutations.
4. The antibody or antigen-binding fragment of any one of claims 1 to 3, wherein the antibody or antigen-binding fragment comprises a heavy chain variable region that is at least 90% identical to an amino acid sequence of SEQ ID NO: 13, and a light chain variable region that is at least 90% identical to an amino acid sequence of SEQ ID NO: 14.
5. The antibody or antigen-binding fragment of any one of claims 1 to 4, wherein the antibody or antigen-binding fragment comprises a heavy chain variable region comprising an amino acid sequence of SEQ ID NO: 13, and a light chain variable region comprising an amino acid sequence of SEQ ID NO: 14.

6. The antibody or antigen-binding fragment of any one of claims 1 to 5, wherein the antibody or antigen-binding fragment comprises a human IgG1 heavy chain constant region, and a human Ig kappa light chain constant region.
7. The antibody or antigen-binding fragment of any one of claims 1 to 6, wherein the antibody or antigen-binding fragment comprises a heavy chain constant region comprising an amino acid sequence of SEQ ID NO: 15.
8. The antibody or antigen-binding fragment of any one of claims 1 to 7, wherein the antibody or antigen-binding fragment comprises a light chain constant region comprising an amino acid sequence of SEQ ID NO: 16.
9. The antibody or antigen-binding fragment of any one of claims 1 to 8, wherein the antibody or antigen-binding fragment comprises a heavy chain constant region comprising an amino acid sequence of SEQ ID NO: 15, and a light chain constant region comprising an amino acid sequence of SEQ ID NO: 16.
10. The antibody or antigen-binding fragment of any one of claims 1 to 9, wherein the antibody or antigen-binding fragment comprises a heavy chain comprising an amino acid sequence of SEQ ID NO: 17, and a light chain comprising an amino acid sequence of SEQ ID NO: 18.
11. The antibody or antigen-binding fragment of any one of claims 1 to 10, wherein the antibody or antigen-binding fragment is conjugated to a therapeutic agent.
12. The antibody or antigen-binding fragment of claim 11, wherein the therapeutic agent is eribulin.
13. An antibody-drug conjugate of Formula (I):



wherein

Ab is an antibody or antigen-binding fragment, wherein the antibody or antigen-binding fragment is capable of binding to mesothelin and comprises three heavy chain complementarity

determining regions comprising amino acid sequences of SEQ ID NO: 1 (HCDR1), SEQ ID NO: 2 (HCDR2), and SEQ ID NO: 3 (HCDR3); and three light chain complementarity determining regions comprising amino acid sequences of SEQ ID NO: 4 (LCDR1), SEQ ID NO: 5 (LCDR2), and SEQ ID NO: 6 (LCDR3), as defined by the Kabat numbering system; or three heavy chain complementarity determining regions comprising amino acid sequences of SEQ ID NO: 7 (HCDR1), SEQ ID NO: 8 (HCDR2), and SEQ ID NO: 9 (HCDR3); and three light chain complementarity determining regions comprising amino acid sequences of SEQ ID NO: 10 (LCDR1), SEQ ID NO: 11 (LCDR2), and SEQ ID NO: 12 (LCDR3), as defined by the IMGT numbering system;

D is eribulin;

L is a cleavable linker that covalently attaches Ab to D; and

p is an integer from 1 to 8.

14. The antibody-drug conjugate of claim 13, wherein p is an integer from 1 to 6.
15. The antibody-drug conjugate of claim 13 or claim 14, wherein p is 6.
16. The antibody-drug conjugate of claim 13 or claim 14, wherein p is 2.
17. The antibody-drug conjugate of any one of claims 13 to 16, wherein the cleavable linker comprises a cleavable moiety that is positioned such that no part of the linker or the antibody or antigen-binding fragment remains bound to eribulin upon cleavage.
18. The antibody-drug conjugate of any one of claims 13 to 17, wherein the cleavable linker comprises a cleavable peptide moiety.
19. The antibody-drug conjugate of claim 18, wherein the cleavable peptide moiety is cleavable by an enzyme.
20. The antibody-drug conjugate of claim 18 or claim 19, wherein the cleavable peptide moiety is cleavable by cathepsin.
21. The antibody-drug conjugate of any one of claims 18 to 20, wherein the cleavable peptide moiety is cleavable by cathepsin B.

22. The antibody-drug conjugate of any one of claims 13 to 21, wherein the cleavable peptide moiety or cleavable linker comprises an amino acid unit.
23. The antibody-drug conjugate of claim 22, wherein the amino acid unit comprises valine-citrulline (Val-Cit).
24. The antibody-drug conjugate of any one of claims 13 to 23, wherein the cleavable linker comprises at least one spacer unit.
25. The antibody-drug conjugate of any one of claims 13 to 24, wherein the spacer unit or cleavable linker comprises a polyethylene glycol (PEG) moiety.
26. The antibody-drug conjugate of claim 25, wherein the PEG moiety comprises $-(\text{PEG})_m-$ and m is an integer from 1 to 10.
27. The antibody-drug conjugate of claim 26, wherein m is 2.
28. The antibody-drug conjugate of any one of claims 24 to 27, wherein the spacer unit attaches to the antibody or antigen-binding fragment via a maleimide (Mal) moiety ("Mal-spacer unit").
29. The antibody-drug conjugate of claim 28, wherein the Mal-spacer unit is joined to the antibody or antigen-binding fragment via a cysteine residue on the antibody or antigen-binding fragment.
30. The antibody-drug conjugate of claim 29, wherein the cysteine residue is a cysteine residue at amino acid position 80 of a light chain variable region on an antibody or an antigen-binding fragment according to the Kabat numbering system ("LCcys80").
31. The antibody-drug conjugate of claim 30, wherein p is 2.
32. The antibody-drug conjugate of claim 31, wherein each -L-D moiety is attached to a LCcys80 on the antibody or antigen-binding fragment.
33. The antibody-drug conjugate of any one of claims 28 to 32, wherein the cleavable linker comprises the Mal-spacer unit and a cleavable peptide moiety.

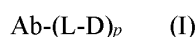
34. The antibody-drug conjugate of claim 33, wherein the cleavable peptide moiety comprises Val-Cit.
35. The antibody-drug conjugate of any one of claims 28 to 34, wherein the Mal-spacer unit attaches the antibody or antigen-binding fragment to the cleavable moiety in the linker.
36. The antibody-drug conjugate of claim 35, wherein the cleavable moiety in the linker comprises a cleavable peptide moiety.
37. The antibody-drug conjugate of claim 36, wherein the cleavable peptide moiety comprises Val-Cit.
38. The antibody-drug conjugate of any one of claims 35 to 37, wherein the cleavable linker comprises Mal-(PEG)₂-Val-Cit.
39. The antibody-drug conjugate of any one of claims 24 to 38, wherein the cleavable moiety in the linker is directly joined to eribulin, or wherein a spacer unit attaches the cleavable moiety in the linker to eribulin.
40. The antibody-drug conjugate of claim 39, wherein cleavage of the conjugate releases eribulin from the antibody or antigen-binding fragment and linker.
41. The antibody-drug conjugate of claim 39 or claim 40, wherein the spacer unit attaching the cleavable moiety in the linker to eribulin is self-immolative.
42. The antibody-drug conjugate of any one of claims 39 to 41, wherein the spacer unit attaching the cleavable moiety in the linker to eribulin comprises a *p*-aminobenzyloxycarbonyl (pAB).
43. The antibody-drug conjugate of claim 42, wherein the pAB attaches the cleavable moiety in the linker to eribulin.
44. The antibody-drug conjugate of claim 42 or claim 43, wherein the pAB covalently attaches to eribulin via a C-35 amine.
45. The antibody-drug conjugate of any one of claims 39 to 44, wherein the cleavable moiety in the linker comprises a cleavable peptide moiety.

46. The antibody-drug conjugate of claim 45, wherein the cleavable peptide moiety comprises Val-Cit.
47. The antibody-drug conjugate of claim 45 or claim 46, wherein the cleavable linker comprises Val-Cit-pAB.
48. The antibody-drug conjugate of any one of claims 13 to 47, wherein the antibody or antigen-binding fragment comprises human heavy and light chain variable region frameworks, or human heavy and light chain variable region frameworks with one or more back mutations.
49. The antibody-drug conjugate of any one of claims 13 to 48, wherein the antibody or antigen-binding fragment comprises a heavy chain variable region that is at least 90% identical to an amino acid sequence of SEQ ID NO: 13, and a light chain variable region that is at least 90% identical to an amino acid sequence of SEQ ID NO: 14.
50. The antibody-drug conjugate of any one of claims 13 to 49, wherein the antibody or antigen-binding fragment comprises a heavy chain variable region comprising an amino acid sequence of SEQ ID NO: 13, and a light chain variable region comprising an amino acid sequence of SEQ ID NO: 14.
51. The antibody-drug conjugate of any one of claims 13 to 50, wherein the antibody or antigen-binding fragment comprises a human IgG1 heavy chain constant region.
52. The antibody-drug conjugate of any one of claims 13 to 51, wherein the antibody or antigen-binding fragment comprises a heavy chain constant region comprising an amino acid sequence of SEQ ID NO: 15.
53. The antibody-drug conjugate of any one of claims 13 to 52, wherein the antibody or antigen-binding fragment comprises a human Ig kappa light chain constant region.
54. The antibody-drug conjugate of any one of claims 13 to 53, wherein the antibody or antigen-binding fragment comprises a light chain constant region comprising an amino acid sequence of SEQ ID NO: 16.
55. The antibody-drug conjugate of any one of claims 13 to 54, wherein the antibody or antigen-binding fragment comprises a heavy chain constant region comprising an amino acid

sequence of SEQ ID NO: 15, and a light chain constant region comprising an amino acid sequence of SEQ ID NO: 16.

56. The antibody-drug conjugate of any one of claims 13 to 55, wherein the antibody or antigen-binding fragment comprises a heavy chain comprising an amino acid sequence of SEQ ID NO: 17, and a light chain comprising an amino acid sequence of SEQ ID NO: 18.

57. An antibody-drug conjugate of Formula (I):



wherein

Ab is an antibody or antigen-binding fragment, wherein the antibody or antigen-binding fragment is capable of binding to mesothelin and comprises three heavy chain complementarity determining regions comprising amino acid sequences of SEQ ID NO: 1 (HCDR1), SEQ ID NO: 2 (HCDR2), and SEQ ID NO: 3 (HCDR3); and three light chain complementarity determining regions comprising amino acid sequences of SEQ ID NO: 4 (LCDR1), SEQ ID NO: 5 (LCDR2), and SEQ ID NO: 6 (LCDR3), as defined by the Kabat numbering system; or three heavy chain complementarity determining regions comprising amino acid sequences of SEQ ID NO: 7 (HCDR1), SEQ ID NO: 8 (HCDR2), and SEQ ID NO: 9 (HCDR3); and three light chain complementarity determining regions comprising amino acid sequences of SEQ ID NO: 10 (LCDR1), SEQ ID NO: 11 (LCDR2), and SEQ ID NO: 12 (LCDR3), as defined by the IMGT numbering system;

D is eribulin;

L is a cleavable linker comprising Mal-(PEG)₂-Val-Cit-pAB; and

p is an integer from 1 to 8.

58. The antibody-drug conjugate of claim 57, wherein the antibody or antigen-binding fragment comprises human heavy and light chain variable region frameworks, or human heavy and light chain variable region frameworks with one or more back mutations.

59. The antibody-drug conjugate of claim 57 or claim 58, wherein the antibody or antigen-binding fragment comprises a heavy chain variable region that is at least 90% identical to an amino acid sequence of SEQ ID NO: 13, and a light chain variable region that is at least 90% identical to an amino acid sequence of SEQ ID NO: 14.

60. The antibody-drug conjugate of any one of claims 57 to 59, wherein the antibody or antigen-binding fragment comprises a heavy chain variable region comprising an amino acid sequence of SEQ ID NO: 13, and a light chain variable region comprising an amino acid sequence of SEQ ID NO: 14.
61. The antibody-drug conjugate of any one of claims 57 to 60, wherein the antibody or antigen-binding fragment comprises a human IgG1 heavy chain constant region, and a human Ig kappa light chain constant region.
62. The antibody-drug conjugate of any one of claims 57 to 61, wherein the antibody or antigen-binding fragment comprises a heavy chain constant region comprising an amino acid sequence of SEQ ID NO: 15, and a light chain constant region comprising an amino acid sequence of SEQ ID NO: 16.
63. The antibody-drug conjugate of any one of claims 57 to 62, wherein the antibody or antigen-binding fragment comprises a heavy chain comprising an amino acid sequence of SEQ ID NO: 17, and a light chain comprising an amino acid sequence of SEQ ID NO: 18.
64. An antibody-drug conjugate of Formula (I):
- $$\text{Ab-(L-D)}_p \quad (\text{I})$$
- wherein
- Ab is an antibody or antigen-binding fragment, wherein the antibody or antigen-binding fragment is capable of binding to mesothelin and comprises a heavy chain variable region comprising an amino acid sequence of SEQ ID NO: 13, and a light chain variable region comprising an amino acid sequence of SEQ ID NO: 14;
- D is eribulin;
- L is a cleavable linker comprising Mal-(PEG)₂-Val-Cit-pAB; and
- p* is an integer from 1 to 8.
65. The antibody-drug conjugate of claim 64, wherein the antibody or antigen-binding fragment comprises a human IgG1 heavy chain constant region, and a human Ig kappa light chain constant region.

66. The antibody-drug conjugate of claim 64 or claim 65, wherein the antibody or antigen-binding fragment comprises a heavy chain constant region comprising an amino acid sequence of SEQ ID NO: 15, and a light chain constant region comprising an amino acid sequence of SEQ ID NO: 16.
67. The antibody-drug conjugate of any one of claims 64 to 66, wherein the antibody or antigen-binding fragment comprises a heavy chain comprising an amino acid sequence of SEQ ID NO: 17, and a light chain comprising an amino acid sequence of SEQ ID NO: 18.
68. The antibody-drug conjugate of any one of claims 57 to 67, wherein p is from 1 to 6.
69. The antibody-drug conjugate of any one of claims 57 to 68, wherein p is 6.
70. The antibody-drug conjugate of any one of claims 57 to 68, wherein p is 2.
71. A pharmaceutical composition comprising the antibody or antigen-binding fragment of any one of claims 1 to 12, or the antibody-drug conjugate of any one of claims 13 to 70, and a pharmaceutically acceptable carrier.
72. The pharmaceutical composition of claim 71, wherein the pharmaceutical composition comprises multiple copies of the antibody, antigen-binding fragment, or antibody-drug conjugate.
73. The pharmaceutical composition of claim 71 or claim 72, wherein the pharmaceutical composition comprises multiple copies of the antibody-drug conjugate, wherein the average p of the antibody-drug conjugates in the composition is about 1 to about 6. Optionally, the average p of the antibody-drug conjugates in the composition is about 1.3, about 1.4, about 1.5, about 1.6, about 1.7, about 1.8, about 1.9, about 2.0, about 2.1, about 2.2, or about 2.3.
74. The pharmaceutical composition of claim 73, wherein the average p of the antibody-drug conjugates in the composition is about 6.
75. The pharmaceutical composition of claim 73, wherein the average p of the antibody-drug conjugates in the composition is about 1.9 or about 2.0.

76. A method of treating a subject having or suspected of having a cancer, comprising administering to the subject a therapeutically effective amount of the antibody or antigen-binding fragment of any one of claims 1 to 12, the antibody-drug conjugate of any one of claims 13 to 70, or the pharmaceutical composition of any one of claims 71 to 75.
77. The method of claim 76, wherein the cancer expresses mesothelin.
78. The method of claim 76 or claim 77, wherein the cancer is a mesothelioma, breast cancer, cervical cancer, colorectal cancer, endometrial cancer, head and neck cancer, liver cancer, lung cancer, ovarian cancer, pancreatic cancer, prostate cancer, renal cancer, gastric cancer, thyroid cancer, urothelial cancer, uterine cancer, bile duct cancer, or leukemia.
79. The method of any one of claims 76 to 78, wherein the cancer is a mesothelioma, lung cancer, ovarian cancer, or gastric cancer.
80. A method of reducing or slowing the growth of a cancer cell population in a subject, comprising administering to the subject a therapeutically effective amount of the antibody or antigen-binding fragment of any one of claims 1 to 12, the antibody-drug conjugate of any one of claims 13 to 70, or the pharmaceutical composition of any one of claims 71 to 75.
81. The method of claim 80, wherein the cancer cell population expresses mesothelin.
82. The method of claim 80 or claim 81, wherein the cancer cell population is a solid tumor or a hematological malignancy.
83. The method of any one of claims 80 to 82, wherein the cancer cell population is a mesothelioma, breast cancer, cervical cancer, colorectal cancer, endometrial cancer, head and neck cancer, liver cancer, lung cancer, ovarian cancer, pancreatic cancer, prostate cancer, renal cancer, gastric cancer, thyroid cancer, urothelial cancer, uterine cancer, bile duct cancer, or leukemia.
84. The method of any one of claims 80 to 83, wherein the cancer cell population is a mesothelioma, lung cancer, ovarian cancer, or gastric cancer.
85. The method of any one of claims 80 to 84, wherein administration of the antibody, antigen-binding fragment, antibody-drug conjugate, or pharmaceutical composition reduces the

cancer cell population by at least about 10%, at least about 20%, at least about 50%, at least about 70%, at least about 80%, at least about 90%, at least about 95%, or at least about 99%.

86. The method of any one of claims 80 to 85, wherein administration of the antibody, antigen-binding fragment, antibody-drug conjugate, or pharmaceutical composition slows the growth of the cancer cell population by at least about 10%, at least about 20%, at least about 50%, at least about 70%, at least about 80%, at least about 90%, at least about 95%, or at least about 99%.

87. A method of determining whether a subject having or suspected of having a cancer will be responsive to treatment with the antibody or antigen-binding fragment of any one of claims 1 to 12, the antibody-drug conjugate of any one of claims 13 to 70, or the pharmaceutical composition of any one of claims 71 to 75, comprising providing a biological sample from the subject; contacting the sample with the antibody or antigen-binding fragment; and detecting binding of the antibody or antigen-binding fragment to one or more cancer cells in the sample.

88. The method of claim 87, wherein the one or more cancer cells express mesothelin.

89. The method of claim 87 or claim 88, wherein the cancer expresses mesothelin.

90. The method of any one of claims 87 to 89, wherein the cancer is a mesothelioma, breast cancer, cervical cancer, colorectal cancer, endometrial cancer, head and neck cancer, liver cancer, lung cancer, ovarian cancer, pancreatic cancer, prostate cancer, renal cancer, gastric cancer, thyroid cancer, urothelial cancer, uterine cancer, bile duct cancer, or leukemia.

91. The method of any one of claims 87 to 90, wherein the cancer is a mesothelioma, lung cancer, ovarian cancer, or gastric cancer.

92. The method of any one of claims 87 to 91, wherein the sample is a tissue biopsy sample, a blood sample, a lymph sample, a bone marrow sample, a skin sample, or a cerebral spinal fluid (CSF) sample.

93. An antibody or antigen-binding fragment of any one of claims 1 to 12, an antibody-drug conjugate of any one of claims 13 to 70, or a pharmaceutical composition of any one of claims 71 to 75 for use in treating a subject having or suspected of having a cancer.

94. The antibody, antigen-binding fragment, antibody-drug conjugate, or pharmaceutical composition of claim 93, wherein the cancer expresses mesothelin.
95. The antibody, antigen-binding fragment, antibody-drug conjugate, or pharmaceutical composition of claim 93 or claim 94, wherein the cancer is a mesothelioma, breast cancer, cervical cancer, colorectal cancer, endometrial cancer, head and neck cancer, liver cancer, lung cancer, ovarian cancer, pancreatic cancer, prostate cancer, renal cancer, gastric cancer, thyroid cancer, urothelial cancer, uterine cancer, bile duct cancer, or leukemia.
96. The antibody, antigen-binding fragment, antibody-drug conjugate, or pharmaceutical composition of any one of claims 93 to 95, wherein the cancer is a mesothelioma, lung cancer, ovarian cancer, or gastric cancer.
97. Use of the antibody or antigen-binding fragment of any one of claims 1 to 12, the antibody-drug conjugate of any one of claims 13 to 70, or the pharmaceutical composition of any one of claims 71 to 75 in treating a subject having or suspected of having a cancer.
98. The use of claim 97, wherein the cancer expresses mesothelin.
99. The use of claim 97 or claim 98, wherein the cancer is a mesothelioma, breast cancer, cervical cancer, colorectal cancer, endometrial cancer, head and neck cancer, liver cancer, lung cancer, ovarian cancer, pancreatic cancer, prostate cancer, renal cancer, gastric cancer, thyroid cancer, urothelial cancer, uterine cancer, bile duct cancer, or leukemia.
100. The use of any one of claims 97 to 99, wherein the cancer is a mesothelioma, lung cancer, ovarian cancer, or gastric cancer.
101. Use of the antibody or antigen-binding fragment of any one of claims 1 to 12, the antibody-drug conjugate of any one of claims 13 to 70, or the pharmaceutical composition of any one of claims 71 to 75 in a method of manufacturing a medicament for treating a subject having or suspected of having a cancer.
102. The use of claim 101, wherein the cancer expresses mesothelin.
103. The use of claim 101 or claim 102, wherein the cancer is a mesothelioma, breast cancer, cervical cancer, colorectal cancer, endometrial cancer, head and neck cancer, liver cancer, lung

cancer, ovarian cancer, pancreatic cancer, prostate cancer, renal cancer, gastric cancer, thyroid cancer, urothelial cancer, uterine cancer, bile duct cancer, or leukemia.

104. The use of any one of claims 101 to 103, wherein the cancer is a mesothelioma, lung cancer, ovarian cancer, or gastric cancer.

105. An isolated nucleic acid encoding the antibody or antigen-binding fragment of any one of claims 1 to 12.

106. An isolated vector comprising the nucleic acid of claim 105.

107. An isolated cell or cell population comprising the nucleic acid of claim 105 or the vector of claim 106.

108. A method of producing the antibody or antigen-binding fragment of any one of claims 1 to 12, comprising culturing the cell or cell population of claim 107 under conditions suitable to produce the antibody or antigen-binding fragment.

109. A method of producing the antibody-drug conjugate of any one of claims 13 to 70, comprising reacting an antibody or antigen-binding fragment with a cleavable linker attached to eribulin under conditions that allow conjugation.

110. The method of claim 109, wherein the cleavable linker attached to eribulin reacts with a cysteine residue on the light chain of the antibody or antigen-binding fragment.