

CLAIMS:

1. An antibody or antigen-binding fragment, wherein the antibody or antigen-binding fragment comprises:
 - a) an immunoglobulin heavy chain variable region comprising an amino acid sequence having at least about 70% identity to SEQ ID NOs: 1, 2, 3, 7, 10, 13, 14, 40, 42 or 44;
 - b) an immunoglobulin light chain variable region comprising an amino acid sequence having at least about 70% identity to any one of SEQ ID NOs: 4, 5, 6, 8, 9, 11, 12, 15, 16, 41, 43, and 45; or
 - c) a combination thereof.
2. The antibody or antigen-binding fragment of claim 1, wherein the antibody or antigen-binding fragment comprises:
 - (a) an immunoglobulin heavy chain variable region comprising a CDR_{H1} having an amino acid sequence comprising SEQ ID NO: 1 or 13, a CDR_{H2} having an amino acid sequence comprising SEQ ID NO: 2 or 7, a CDR_{H3} having an amino acid sequence comprising SEQ ID NO: 3, 10 or 14, or a combination of any thereof;
 - (b) an immunoglobulin light chain variable region comprising a CDR_{L1} having an amino acid sequence comprising SEQ ID NO: 4, 8, 11 or 15, a CDR_{L2} having an amino acid sequence comprising SEQ ID NO: 5 or 9, a CDR_{L3} having an amino acid sequence comprising SEQ ID NO: 6, 12 or 16, or a combination of any thereof; or
 - (c) a combination thereof.
3. The antibody or antigen-binding fragment of claim 1 or 2, wherein the immunoglobulin heavy chain variable region comprises a CDR_{H1} having an amino acid sequence comprising SEQ ID NO: 1 or 13, a CDR_{H2} having an amino acid sequence comprising SEQ ID NO: 2 or 7, or a CDR_{H3} having an amino acid sequence comprising SEQ ID NO: 3, 10 or 14.

4. The antibody or antigen-binding fragment of any one of claims 1 to 3 wherein the immunoglobulin heavy chain variable region comprises a CDR_{H1} having an amino acid sequence comprising SEQ ID NO: 1 or 13.
5. The antibody or antigen-binding fragment of claim 4 wherein the immunoglobulin heavy chain variable region comprises a CDR_{H1} having an amino acid sequence comprising SEQ ID NO: 1.
6. The antibody or antigen-binding fragment of claim 4 wherein the immunoglobulin heavy chain variable region comprises a CDR_{H1} having an amino acid sequence comprising SEQ ID NO: 13.
7. The antibody or antigen binding fragment of any one of claims 1 to 6, wherein the immunoglobulin heavy chain variable region comprises a CDR_{H2} having an amino acid sequence comprising SEQ ID NO: 2 or 7.
8. The antibody or antigen binding fragment of claim 7, wherein the immunoglobulin heavy chain variable region comprises a CDR_{H2} having an amino acid sequence comprising SEQ ID NO: 2.
9. The antibody or antigen-binding fragment of claim 7, wherein the immunoglobulin heavy chain variable region comprises a CDR_{H2} having an amino acid sequence comprising SEQ ID NO: 7.
10. The antibody or antigen-binding fragment of any one of claims 1 to 9, wherein the immunoglobulin heavy chain variable region comprises a CDR_{H3} having an amino acid sequence comprising SEQ ID NO: 3, 10 or 14.
11. The antibody or antigen-binding fragment of claim 10, wherein the immunoglobulin heavy chain variable region comprises a CDR_{H3} having an amino acid sequence comprising SEQ ID NO: 3.
12. The antibody or antigen-binding fragment of claim 10, wherein the immunoglobulin heavy chain variable region comprises a CDR_{H3} having an amino acid sequence comprising SEQ ID NO: 10.

13. The antibody or antigen-binding fragment of claim 10, wherein the immunoglobulin heavy chain variable region comprises a CDR_{H3} having an amino acid sequence comprising SEQ ID NO: 14.

14. The antibody or antigen-binding fragment of any one of claims 1 to 13, wherein the immunoglobulin heavy chain variable region comprises a CDR_{H1} having an amino acid sequence comprising SEQ ID NO: 1 or 13, a CDR_{H2} having an amino acid sequence comprising SEQ ID NO: 2 or 7, and a CDR_{H3} having an amino acid sequence comprising SEQ ID NO: 3, 10 or 14.

15. The antibody or antigen-binding fragment of any one of claims 1 to 14, wherein the immunoglobulin heavy chain variable region comprises:

a) a CDR_{H1} having an amino acid sequence comprising SEQ ID NO: 1, a CDR_{H2} having an amino acid sequence comprising SEQ ID NO: 7, and a CDR_{H3} having an amino acid sequence comprising SEQ ID NO: 3;

b) a CDR_{H1} having an amino acid sequence comprising SEQ ID NO: 1, a CDR_{H2} having an amino acid sequence comprising SEQ ID NO: 7, and a CDR_{H3} having an amino acid sequence or SEQ ID NO: 10; or

c) a CDR_{H1} having an amino acid sequence comprising SEQ ID NO: 13, a CDR_{H2} having an amino acid sequence comprising SEQ ID NO: 7, and a CDR_{H3} having an amino acid sequence comprising SEQ ID NO: 14.

16. The antibody or antigen-binding fragment of any one of claims 1 to 15, wherein the immunoglobulin light chain variable region comprises a CDR_{L1} having an amino acid sequence comprising SEQ ID NO: 4, 8, 11 or 15, a CDR_{L2} having an amino acid sequence comprising SEQ ID NO: 5 or 9, or a CDR_{L3} having an amino acid sequence comprising SEQ ID NO: 6, 12 or 16.

17. The antibody or antigen-binding fragment of any one of claims 1 to 16 wherein the immunoglobulin light chain variable region comprises a CDR_{L1} having an amino acid sequence comprising any one of SEQ ID NOs: 4, 8, 11 or 15.

18. The antibody or antigen-binding fragment of claim 17, wherein the immunoglobulin light chain variable region comprises a CDR_{L1} having an amino acid sequence comprising SEQ ID NO: 4.
19. The antibody or antigen-binding fragment of claim 17, wherein the immunoglobulin light chain variable region comprises a CDR_{L1} having an amino acid sequence comprising SEQ ID NO: 8.
20. The antibody or antigen-binding fragment of claim 17, wherein the immunoglobulin light chain variable region comprises a CDR_{L1} having an amino acid sequence comprising SEQ ID NO: 11.
21. The antibody or antigen-binding fragment of claim 17, wherein the immunoglobulin light chain variable region comprises a CDR_{L1} having an amino acid sequence comprising SEQ ID NO: 15.
22. The antibody or antigen-binding fragment of any one of claims 1 to 21, wherein the immunoglobulin light chain variable region comprises a CDR_{L2} having an amino acid sequence comprising SEQ ID NO: 5 or 9.
23. The antibody or antigen-binding fragment of claim 22, wherein the immunoglobulin light chain variable region comprises a CDR_{L2} having an amino acid sequence comprising SEQ ID NO: 5.
24. The antibody or antigen-binding fragment of claim 22, wherein the immunoglobulin light chain variable region comprises a CDR_{L2} having an amino acid sequence comprising SEQ ID NO: 9.
25. The antibody or antigen-binding fragment of any one of claims 1 to 24 wherein the immunoglobulin light chain variable region comprises a CDR_{L3} having an amino acid sequence comprising SEQ ID NO: 6, 12 or 16.
26. The antibody or antigen-binding fragment of claim 25, wherein the immunoglobulin light chain variable region comprises a CDR_{L3} having an amino acid sequence comprising SEQ ID NO: 6.

27. The antibody or antigen-binding fragment of claim 25, wherein the immunoglobulin light chain variable region comprises a CDR_{L3} having an amino acid sequence comprising SEQ ID NO: 12.

28. The antibody or antigen-binding fragment of claim 25, wherein the immunoglobulin light chain variable region comprises a CDR_{L3} having an amino acid sequence comprising SEQ ID NO: 16.

29. The antibody or antigen-binding fragment of any one of claims 1 to 28 wherein the immunoglobulin light chain variable region comprises a CDR_{L1} having an amino acid sequence comprising SEQ ID NO: 4, 8, 11 or 15, a CDR_{L2} having an amino acid sequence comprising SEQ ID NO: 5 or 9, and a CDR_{L3} having an amino acid sequence comprising SEQ ID NO: 6, 12 or 16.

30. The antibody or antigen-binding fragment of any one of claims 1 to 29, wherein the immunoglobulin light chain variable region comprises:

a) a CDR_{L1} having an amino acid sequence comprising SEQ ID NO: 8, a CDR_{L2} having an amino acid sequence comprising SEQ ID NO: 9, and a CDR_{L3} having an amino acid sequence comprising SEQ ID NO: 6; or

b) a CDR_{L1} having an amino acid sequence comprising SEQ ID NO: 11, a CDR_{L2} having an amino acid sequence comprising SEQ ID NO: 9, and a CDR_{L3} having an amino acid sequence comprising SEQ ID NO: 12; or

c) a CDR_{L1} having an amino acid sequence comprising SEQ ID NO: 15, a CDR_{L2} having an amino acid sequence comprising SEQ ID NO: 9, and a CDR_{L3} having an amino acid sequence comprising SEQ ID NO: 16.

31. The antibody or antigen-binding fragment of any one of claims 1 to 30, wherein the antibody or antigen-binding fragment comprises:

(a) an immunoglobulin heavy chain variable region comprising a CDR_{H1} having an amino acid sequence comprising SEQ ID NO: 1 or 13, a CDR_{H2} having an amino acid sequence comprising SEQ ID NO: 2 or 7, and a CDR_{H3} having an amino acid sequence comprising SEQ ID NO: 3, 10 or 14; and

(b) an immunoglobulin light chain variable region comprising a CDR_{L1} having an amino acid sequence comprising SEQ ID NO: 4, 8, 11 or 15, a CDR_{L2} having an amino acid sequence comprising SEQ ID NO: 5 or 9, and a CDR_{L3} having an amino acid sequence comprising SEQ ID NO: 6, 12 or 16.

32. The antibody or antigen-binding fragment of claim 31, wherein the antibody or antigen-binding fragment comprises:

a) an immunoglobulin heavy chain variable region comprising a CDR_{H1} having an amino acid sequence comprising SEQ ID NO: 1, a CDR_{H2} having an amino acid sequence comprising SEQ ID NO: 7, and a CDR_{H3} having an amino acid sequence comprising SEQ ID NO: 3; and

b) an immunoglobulin light chain variable region comprising a CDR_{L1} having an amino acid sequence comprising SEQ ID NO: 8, a CDR_{L2} having an amino acid sequence comprising SEQ ID NO: 9, and a CDR_{L3} having an amino acid sequence comprising SEQ ID NO: 6.

33. The antibody or antigen-binding fragment of claim 31, wherein the antibody or antigen-binding fragment comprises:

a) an immunoglobulin heavy chain variable region comprising a CDR_{H1} having an amino acid sequence comprising SEQ ID NO: 1, a CDR_{H2} having an amino acid sequence comprising SEQ ID NO: 7, and a CDR_{H3} having an amino acid sequence comprising SEQ ID NO: 10; and

b) an immunoglobulin light chain variable region comprising a CDR_{L1} having an amino acid sequence comprising SEQ ID NO: 11, a CDR_{L2} having an amino acid sequence comprising SEQ ID NO: 9, and a CDR_{L3} having an amino acid sequence comprising SEQ ID NO: 12.

34. The antibody or antigen-binding fragment of claim 31, wherein the antibody or antigen-binding fragment comprises:

a) an immunoglobulin heavy chain variable region comprising a CDR_{H1} having an amino acid sequence comprising SEQ ID NO: 13, a CDR_{H2} having an amino acid sequence comprising SEQ ID NO: 7, and a CDR_{H3} having an amino acid sequence comprising SEQ ID NO: 14; and

b) an immunoglobulin light chain variable region comprising a CDR_{L1} having an amino acid sequence comprising SEQ ID NO: 15, a CDR_{L2} having an amino acid sequence comprising SEQ ID NO: 9, and a CDR_{L3} having an amino acid sequence comprising SEQ ID NO: 16.

35. The antibody or antigen-binding fragment of any one of claims 1 to 34, wherein the antibody or antigen-binding fragment comprises an immunoglobulin heavy chain variable region comprising an amino acid sequence having at least about 70% identity to any one of SEQ ID NOs: 40, 42 and 44.

36. The antibody or antigen-binding fragment of any one of claims 1 to 35, wherein the antibody or antigen-binding fragment comprises an immunoglobulin heavy chain variable region comprising an amino acid sequence having at least about 75% identity to any one of SEQ ID NOs: 40, 42, and 44.

37. The antibody or antigen-binding fragment of any one of claims 1 or 36, wherein the antibody or antigen-binding fragment comprises an immunoglobulin heavy chain variable region comprising an amino acid sequence having at least about 80% identity to any one of SEQ ID NOs: 40, 42, and 44.

38. The antibody or antigen-binding fragment of any one of claims 1 to 37, wherein the antibody or antigen-binding fragment comprises an immunoglobulin heavy chain variable region comprising an amino acid sequence having at least about 85% identity to any one of SEQ ID NOs: 40, 42, and 44.

39. The antibody or antigen-binding fragment of any one of claims 1 to 38, wherein the antibody or antigen-binding fragment comprises an immunoglobulin heavy chain variable region comprising an amino acid sequence having at least about 90% identity to any one of SEQ ID NOs: 40, 42, and 44.

40. The antibody or antigen-binding fragment of any one of claims 1 to 39, wherein the antibody or antigen-binding fragment comprises an immunoglobulin heavy chain variable region comprising an amino acid sequence having at least about 95% identity to any one of SEQ ID NOs: 40, 42, and 44.

41. The antibody or antigen-binding fragment of any one of claims 1 to 40, wherein the antibody or antigen-binding fragment comprises an immunoglobulin heavy chain variable region

comprising an amino acid sequence having at least about 96% identity to any one of SEQ ID NOs: 40, 42, and 44.

42. The antibody or antigen-binding fragment of any one of claims 1 to 41, wherein the antibody or antigen-binding fragment comprises an immunoglobulin heavy chain variable region comprising an amino acid sequence having at least about 97% identity to any one of SEQ ID NOs: 40, 42, and 44.

43. The antibody or antigen-binding fragment of any one of claims 1 to 42, wherein the antibody or antigen-binding fragment comprises an immunoglobulin heavy chain variable region comprising an amino acid sequence having at least about 98% identity to any one of SEQ ID NOs: 40, 42, and 44.

44. The antibody or antigen-binding fragment of any one of claims 1 to 43, wherein the antibody or antigen-binding fragment comprises an immunoglobulin heavy chain variable region comprising an amino acid sequence having at least about 99% identity to any one of SEQ ID NOs: 40, 42, and 44.

45. The antibody or antigen-binding fragment of any one of claims 1 to 44, wherein the antibody or antigen-binding fragment comprises an immunoglobulin heavy chain variable region comprising an amino acid sequence having at least about 99.5% identity to any one of SEQ ID NOs: 40, 42, and 44.

46. The antibody or antigen-binding fragment of any one of claims 1 to 45, wherein the antibody or antigen-binding fragment comprises an immunoglobulin heavy chain variable region comprising an amino acid sequence having at least about 99.9% identity to any one of SEQ ID NOs: 40, 42, and 44.

47. The antibody or antigen-binding fragment of any one of claims 1 to 46, wherein the antibody or antigen-binding fragment comprises an immunoglobulin light chain variable region comprising at least about 70% identity to any one of SEQ ID NOs: 41, 43, and 45.

48. The antibody or antigen-binding fragment of any one of claims 1 to 47, wherein the antibody or antigen-binding fragment comprises an immunoglobulin light chain variable region comprising at least about 75% identity to any one of SEQ ID NOs: 41, 43, and 45.

49. The antibody or antigen-binding fragment of any one of claims 1 to 48, wherein the antibody or antigen-binding fragment comprises an immunoglobulin light chain variable region comprising at least about 80% identity to any one of SEQ ID NOs: 41, 43, and 45.
50. The antibody or antigen-binding fragment of any one of claims 1 to 49, wherein the antibody or antigen-binding fragment comprises an immunoglobulin light chain variable region comprising at least about 85% identity to any one of SEQ ID NOs: 41, 43, and 45.
51. The antibody or antigen-binding fragment of any one of claims 1 to 50, wherein the antibody or antigen-binding fragment comprises an immunoglobulin light chain variable region comprising at least about 90% identity to any one of SEQ ID NOs: 41, 43, and 45.
52. The antibody or antigen-binding fragment of any one of claims 1 to 51, wherein the antibody or antigen-binding fragment comprises an immunoglobulin light chain variable region comprising at least about 95% identity to any one of SEQ ID NOs: 41, 43, and 45.
53. The antibody or antigen-binding fragment of any one of claims 1 to 52, wherein the antibody or antigen-binding fragment comprises an immunoglobulin light chain variable region comprising at least about 96% identity to any one of SEQ ID NOs: 41, 43, and 45.
54. The antibody or antigen-binding fragment of any one of claims 1 to 53, wherein the antibody or antigen-binding fragment comprises an immunoglobulin light chain variable region comprising at least about 97% identity to any one of SEQ ID NOs: 41, 43, and 45.
55. The antibody or antigen-binding fragment of any one of claims 1 to 54, wherein the antibody or antigen-binding fragment comprises an immunoglobulin light chain variable region comprising at least about 98% identity to any one of SEQ ID NOs: 41, 43, and 45.
56. The antibody or antigen-binding fragment of any one of claims 1 to 55, wherein the antibody or antigen-binding fragment comprises an immunoglobulin light chain variable region comprising at least about 99% identity to any one of SEQ ID NOs: 41, 43, and 45.
57. The antibody or antigen-binding fragment of any one of claims 1 to 56, wherein the antibody or antigen-binding fragment comprises an immunoglobulin light chain variable region comprising at least about 99.5% identity to any one of SEQ ID NOs: 41, 43, and 45.

58. The antibody or antigen-binding fragment of any one of claims 1 to 57, wherein the antibody or antigen-binding fragment comprises an immunoglobulin light chain variable region comprising at least about 99.9% identity to any one of SEQ ID NOs: 41, 43, and 45.

59. The antibody or antigen-binding fragment of any one of claims 1 to 58, wherein the antibody or antigen-binding fragment comprises an immunoglobulin heavy chain variable region comprising an amino acid sequence having at least about 70%, at least about 75%, at least about 80%, at least about 85%, at least about 90%, at least about 95%, at least about 96%, at least about 97%, at least about 98%, at least about 99%, at least about 99.5% sequence, or at least about 99.9% identity to any one of SEQ ID NOs: 40, 42 and 44 and an immunoglobulin light chain variable region comprising an amino acid sequence having at least about 70%, at least about 75%, at least about 80%, at least about 85%, at least about 90%, at least about 95%, at least about 96%, at least about 97%, at least about 98%, at least about 99%, at least about 99.5%, or at least about 99.9% identity to any one of SEQ ID NOs: 41, 43, and 45.

60. The antibody or antigen-binding fragment of claim 59, wherein the antibody or antigen-binding fragment comprises an immunoglobulin heavy chain variable region comprising any one of SEQ ID NOs: 40, 42 and 44 and an immunoglobulin light chain variable region comprising any one of SEQ ID NOs: 41, 43 and 45.

61. The antibody or antigen-binding fragment of claim 60, wherein the antibody or antigen-binding fragment comprises an immunoglobulin heavy chain variable region comprising SEQ ID NO: 40.

62. The antibody or antigen-binding fragment of claim 60, wherein antibody or antigen-binding fragment comprises an immunoglobulin heavy chain variable region comprising SEQ ID NO: 42.

63. The antibody or antigen-binding fragment of claim 60, wherein antibody or antigen-binding fragment comprises an immunoglobulin heavy chain variable region comprising SEQ ID NO: 44.

64. The antibody or antigen-binding fragment of claim 60, wherein the antibody or antigen-binding fragment comprises an immunoglobulin light chain variable region comprising SEQ ID NO: 41.

65. The antibody or antigen-binding fragment of claim 60, wherein the antibody or antigen-binding fragment comprises an immunoglobulin light chain variable region comprising SEQ ID NO: 43.
66. The antibody or antigen-binding fragment of claim 60, wherein the antibody or antigen-binding fragment comprises an immunoglobulin light chain variable region comprising SEQ ID NO: 45.
67. The antibody or antigen-binding fragment of claim 60, wherein the antibody or antigen-binding fragment comprises: an immunoglobulin heavy chain variable region comprising SEQ ID NO: 40 and an immunoglobulin light chain variable region comprising SEQ ID NO: 41.
68. The antibody or antigen-binding fragment of claim 60, wherein the antibody or antigen-binding fragment comprises an immunoglobulin heavy chain variable region comprising SEQ ID NO: 42 and an immunoglobulin light chain variable region comprising SEQ ID NO: 43.
69. The antibody or antigen-binding fragment of claim 60, wherein the antibody or antigen-binding fragment comprises an immunoglobulin heavy chain variable region comprising SEQ ID NO: 44 and an immunoglobulin light chain variable region comprising SEQ ID NO: 45.
70. An antibody or antigen-binding fragment thereof that comprises a polypeptide that has a tertiary structure that is structurally similar to a polypeptide having an amino acid sequence of any one of SEQ ID NOs: 1 to 46.
71. The antibody or antigen-binding fragment of claim 70, wherein the polypeptide has a tertiary structure that is structurally similar to a single CDRH3 loop comprising any one of SEQ ID NOs: 3, 10, and 14.
72. The antibody or antigen-binding fragment of any one of claims 1 to 71, wherein the antibody or antigen-binding fragment binds an influenza virus.
73. The antibody or antigen-binding fragment of claim 72, wherein the antibody or antigen-binding fragment specifically binds to a neuraminidase.

74. The antibody or antigen-binding fragment of claim 73, wherein the antibody or antigen-binding fragment inhibits the neuraminidase with an IC_{50} of about 0.0001 $\mu\text{g/ml}$ to about 30 $\mu\text{g/ml}$.

75. The antibody or antigen-binding fragment of 73 or 74, wherein the CDR_{H3} region of the antibody or antigen-binding fragment interacts with at least one active site residue of the neuraminidase.

76. The antibody or antigen-binding fragment of claim 75, wherein the neuraminidase is an N1 neuraminidase, the CDR_{H3} region comprises SEQ ID NO: 3 and the active site residue of the N1 neuraminidase comprises at least one of: R118, E119, D151, R152, I222, R224, E276, E277, R371, and Y406, wherein the amino acid numbering is according to SEQ ID NO: 46.

77. The antibody or antigen-binding fragment of claim 75, wherein the neuraminidase is an N1 neuraminidase, CDR_{H3} comprises SEQ ID NO: 10 and the active site residue comprises at least one of R118, E119, D151, R152, I222, R224, E277, R371, and Y406, wherein the amino acid numbering is according to SEQ ID NO: 46.

78. The antibody or antigen-binding fragment of claim 75, wherein neuraminidase is an N1 neuraminidase, the CDR_{H3} comprises SEQ ID NO: 14 and the active site residue comprises at least one of R118, E119, L134, D151, R152, R156, W178, I222, R224, E276, E277, R371, and Y406, wherein the amino acid numbering is according to SEQ ID NO: 46.

79. The antibody or antigen-binding fragment of any one of claims 73 to 78, wherein the neuraminidase comprises an influenza Type A neuraminidase.

80. The antibody or antigen-binding fragment of claim 79, wherein the neuraminidase comprises any one of N1 to N9.

81. The antibody or antigen-binding fragment of any one of claims 73 to 78, wherein the neuraminidase comprises an influenza Type B neuraminidase.

82. The antibody or antigen-binding fragment of any one of claims 73 to 81, wherein the neuraminidase is expressed on a surface of the influenza virus.

83. The antibody or antigen-binding fragment of any one of claims 1 to 82, wherein the antibody or antigen-binding fragment is humanized.
84. The antibody or antigen binding fragment of any one of claims 1 to 83, wherein the antibody or antigen binding fragment is a monoclonal antibody and/or is an IgG antibody.
85. An antibody or antigen binding fragment having specific affinity for an N1 neuraminidase of an influenza virus, and wherein the antibody or antigen binding fragment binds to an active site residue of the N1 neuraminidase comprising at least about 70% of SEQ ID NO: 46 and containing at least one residue selected from R118, E119, L134, D151, R152, R156, W178, I222, R224, E276, E277, R371, and Y406 according to the amino acid numbering of SEQ ID NO: 46.
86. The antibody or antigen bind fragment of any one of claims 1 to 85, wherein the antibody or antigen bind fragment comprises a hinge region or Fc region that contains at least one amino acid substitution, deletion, or insertion relative to the sequence of a wild-type hinge region or a wild-type Fc region.
87. The antibody or antigen bind fragment of any one of claims 1 to 86, wherein the antibody or antigen bind fragment comprises an Fc region that contains at least one amino acid substitution, deletion, or insertion relative to the sequence of a wild-type Fc region.
88. The antibody or antigen bind fragment of claim 87, wherein the substitution, deletion, or insertion prevents or reduces recycling of the antibody or antigen-binding fragment.
89. The antibody or antigen-binding fragment of any one of claims 1 to 88 wherein the antibody or antigen-binding fragment comprises a heavy chain variable region and/or a light chain variable region having an amino acid sequence comprising at least one amino acid substitution, insertion, or deletion as compared to any of SEQ ID NOs: 40 – 46.
90. The antibody of any one of claims 1 to 89.
91. The antigen-binding fragment of any one of claims 1 to 89.

92. A nucleic acid comprising a nucleotide sequence encoding the immunoglobulin heavy chain variable region of the antibody or antigen-binding fragment of any one of claims 1 to 91.
93. The nucleic acid of claim 92, wherein the nucleic acid comprises any one of SEQ ID NOs: 47 – 49.
94. A nucleic acid comprising a nucleotide sequence encoding an immunoglobulin light chain variable region of the antibody or antigen-binding fragment of any one of claims 1 to 91.
95. The nucleic acid of claim 94, wherein the nucleic acid comprises SEQ ID NOs: 50 – 52.
96. An expression vector comprising the nucleic acid of claim 92 or 93 and/or the nucleic acid of any one of claims 94 or 95.
97. A host cell comprising the expression vector of claim 96.
98. A method of producing an antibody or antigen-binding fragment that binds a neuraminidase of an influenza virus, the method comprising growing the host cell of claim 97 under conditions so that the host cell expresses a polypeptide or polypeptides comprising the immunoglobulin heavy chain variable region and the immunoglobulin light chain variable region, thereby producing the antibody or antigen-binding fragment and purifying the antibody or antigen-binding fragment.
99. A vaccine comprising an antibody or antigen-binding fragment of any one of claims 1 to 91.
100. A vaccine comprising a polypeptide or a nucleic acid encoding the polypeptide, wherein the polypeptide comprises an amino acid sequence comprising at least about 70% identity to an epitope targeted by an antibody or antigen binding fragment of any one of claims 1 to 91.
101. The vaccine of claim 100, wherein the polypeptide comprises an amino acid residue selected from R118, E119, D151, R152, W178, R156, I222, R224, E276, E277, R371, and Y406 according to a reference sequence comprising SEQ ID NO: 46.
102. The vaccine of claim 100 or 101 wherein the nucleic acid comprises DNA or RNA.
103. The vaccine of any one of claims 99 to 102, wherein the vaccine provides an effective immunological response to an influenza virus when administered to a subject.

104. A pharmaceutical composition, the composition comprising an antibody or antigen-binding fragment of any one of claims 1 to 91 and a pharmaceutically acceptable carrier or excipient.
105. The pharmaceutical composition of claim 104, wherein the composition further comprises a monoclonal antibody selective for a hemagglutinin of the influenza virus.
106. The pharmaceutical composition of claim 104 or 105, wherein the composition further comprises an antiviral drug.
107. The pharmaceutical composition of claim 106, where the antiviral drug comprises baloxavir, oseltamivir, zanamivir, peramivir or any combination thereof.
108. The pharmaceutical composition of any one of claims 104 to 107, wherein the pharmaceutically acceptable carrier or excipient comprises at least one of a filler, a diluent, a surface active, a wetting or emulsifying agent, a preservative, an agent for adjusting pH, a buffering agent, a thickener, a colorant, a dye, a flow aid, a non-volatile silicone, an adhesive, a bulking agent, a flavoring, a sweetener, an adsorbent, a binder, a disintegrating agent, a lubricant, a coating agent, or an antioxidant.
109. The pharmaceutical composition of any one of claims 104 to 108, wherein the composition is formulated without blood, plasma or a major component of blood or plasma.
110. The pharmaceutical composition of any one of claims 104 to 109, wherein the composition is free of or substantially free of blood, plasma or a major component of blood or plasma.
111. A method of preventing or treating influenza in a subject in need thereof, the method comprising administering the antibody or antigen-binding fragment of any one of claims 1 to 91, the nucleic acid of any one of claims 92 to 95, the expression vector of claim 96, the vaccine of any one of claims 99 to 103, or the composition of any one of claims 104 to 110 to the subject.
112. The method of claim 111, wherein the influenza infection is caused by an influenza A virus or an influenza B virus.

113. The method of claim 112, wherein the serotype of the influenza A virus is selected from the group consisting of: HXN1, HXN2, H2N3, HXN4, HXN5, HXN6, HXN7, HXN8, HXN9 or any combination thereof, wherein X is an integer between 1 and 18.

114. The method of any one of claims 111 to 113, wherein the antibody or antigen-binding fragment, nucleic acid, expression vector, vaccine or composition is parenterally administered.

115. The method of claim 114, wherein the antibody or antigen-binding fragment, nucleic acid, expression vector, vaccine or composition is administered via intramuscular, intravenous, or intradermal delivery or is administered intranasally via an aerosol.

116. The method of any one of claims 111 to 115, wherein the antibody or antigen-binding fragment, nucleic acid, expression vector, vaccine or composition is administered therapeutically to treat an active influenza infection.

117. The method of any one of claims 111 to 116, wherein the antibody or antigen-binding fragment, nucleic acid, expression vector, vaccine or composition is administered prophylactically to prevent an influenza infection.

118. The method of any one of claims 111 to 117, wherein antibody or antigen-binding fragment, nucleic acid, expression vector, vaccine or composition is administered at a dose of about 1 to 70 mg/kg.