

## Claims

1. An isolated antibody or antigen-binding fragment thereof, which binds human bone morphogenetic protein 9 (BMP9) and comprises:
  - (a) heavy chain complementarity determining region 1 (HCDR1), heavy chain complementarity determining region 2 (HCDR2), and heavy chain complementarity determining region 3 (HCDR3) sequences of SEQ ID NOs: 1, 2 and 3, respectively, and light chain complementarity determining region 1 (LCDR1), light chain complementarity determining region 2 (LCDR2), and light chain complementarity determining region 3 (LCDR3) sequences of SEQ ID NOs: 11, 12 and 13, respectively; or
  - (b) HCDR1, HCDR2, and HCDR3 sequences of SEQ ID NOs: 4, 5 and 6, respectively, and LCDR1, LCDR2, and LCDR3 sequences of SEQ ID NOs: 14, 15 and 16, respectively.
2. The isolated antibody or antigen-binding fragment thereof of claim 1, comprising a heavy chain variable region (VH) sequence of SEQ ID NO: 7.
3. The isolated antibody or antigen-binding fragment thereof of claim 1, comprising a light chain variable region (VL) sequence of SEQ ID NO: 17.
4. The isolated antibody or antigen-binding fragment thereof of claim 1, comprising a VH sequence of SEQ ID NO: 7 and a VL sequence of SEQ ID NO: 17.
5. The isolated antibody or antigen-binding fragment thereof of claim 1, comprising:
  - (a) a VH sequence having 95%-99% sequence identity to SEQ ID NO: 7; or
  - (b) a VH sequence having one, two, three, four or five amino acid mutations relative to SEQ ID NO: 7.
6. The isolated antibody or antigen-binding fragment thereof of claim 1, comprising:
  - (a) a VL sequence having 95%-99% sequence identity to SEQ ID NO: 17; or
  - (b) a VL sequence having one, two, three, four or five amino acid mutations relative to SEQ ID NO: 17.
7. The isolated antibody or antigen-binding fragment thereof of claim 1, comprising a heavy chain sequence of SEQ ID NO: 9.
8. The isolated antibody or antigen-binding fragment thereof of claim 1, comprising a light chain sequence of SEQ ID NO: 19.
9. The isolated antibody or antigen-binding fragment thereof of claim 1, comprising a heavy chain sequence of SEQ ID NO: 9; and a light chain sequence of SEQ ID NO: 19.
10. The isolated antibody or antigen-binding fragment thereof of claim 1, comprising:
  - (a) a heavy chain amino acid sequence having 95%-99% sequence identity to SEQ ID NO: 9;
  - (b) a light chain amino acid sequence having 95%-99% sequence identity to SEQ ID NO: 19; or
  - (c) a heavy chain amino acid sequence having 95%-99% sequence identity to SEQ ID NO: 9 and a light chain amino acid sequence having 95%-99% sequence identity to SEQ ID NO: 19.
11. The isolated antibody or antigen-binding fragment thereof of claim 1, wherein the isolated antibody or antigen-binding fragment is an IgG.
12. The isolated antibody or antigen-binding fragment thereof of claim 11, wherein the IgG is selected from the group consisting of an IgG1, an IgG2, an IgG3 and an IgG4.
13. The isolated antibody or antigen-binding fragment thereof of claim 1, which has altered effector function through mutation of amino acids within a Fc region.

14. The isolated antibody or antigen-binding fragment thereof of claim 1, wherein the isolated antibody or antigen-binding fragment is selected from the group consisting of: a monoclonal antibody, a chimeric antibody, a single chain antibody, a Fab and a scFv.
15. The isolated antibody or antigen-binding fragment thereof of claim 1, wherein the antibody is a chimeric, humanized or fully human antibody.
16. The isolated antibody or antigen-binding fragment thereof of claim 1, which binds to human BMP9 and inhibits the binding of human BMP9 to a BMP Type II receptor.
17. The isolated antibody or antigen-binding fragment thereof of claim 16, wherein the inhibition of the binding of human BMP9 to said BMP Type II receptor is at an IC<sub>50</sub> of less than or equal to about 1 nM.
18. The isolated antibody or antigen-binding fragment thereof of claim 1, wherein the isolated antibody or antigen-binding fragment thereof is a component of an immunoconjugate.
19. A composition comprising the isolated antibody or antigen-binding fragment thereof of claim 1, and a pharmaceutically acceptable carrier.
20. A composition comprising the isolated antibody or antigen-binding fragment thereof of claim 1, and an additional therapeutic agent.
21. An isolated polynucleotide comprising a nucleic acid sequence encoding the antibody or antigen-binding fragment thereof of claim 1.
22. An isolated polynucleotide comprising a nucleic acid sequence encoding a VH or a VL sequence of the antibody or antigen-binding fragment thereof of claim 1, which binds human BMP9.
23. The isolated polynucleotide of claim 22, wherein the nucleic acid sequence encodes a VH sequence comprising SEQ ID NO: 7.
24. The isolated polynucleotide of claim 22, wherein the nucleic acid sequence encodes a VL sequence comprising SEQ ID NO: 17.
25. The isolated polynucleotide of claim 22, comprising a nucleic acid sequence encoding a VH sequence and a nucleic acid sequence encoding a VL sequence, wherein the VH sequence comprising SEQ ID NO: 7 and the VL sequence comprising SEQ ID NO: 17.
26. The isolated polynucleotide of claim 22, wherein the antibody or antigen-binding fragment thereof comprises a heavy chain sequence of SEQ ID NO: 9.
27. The isolated polynucleotide of claim 22, wherein the antibody or antigen-binding fragment thereof comprises a light chain sequence of SEQ ID NO: 19.
28. The isolated polynucleotide of claim 22, wherein the antibody or antigen-binding fragment thereof comprises a heavy chain sequence of SEQ ID NO: 9; and a light chain sequence of SEQ ID NO: 19.
29. The isolated polynucleotide of claim 22, comprising a nucleic acid sequence encoding a heavy chain or a light chain of the antibody or antigen-binding fragment thereof which binds human BMP9, the polynucleotide comprising:
  - (a) a VH sequence of SEQ ID NO: 8;
  - (b) a heavy chain sequence of SEQ ID NO: 10;
  - (c) a VL sequence of SEQ ID NO: 18; or
  - (d) a light chain sequence of SEQ ID NO: 20.

30. The isolated polynucleotide of claim 22, comprising a nucleic acid sequence encoding a VH sequence and a VL sequence of the antibody or antigen-binding fragment thereof which binds human BMP9, the polynucleotide comprising a VH sequence of SEQ ID NO: 8 and a VL sequence of SEQ ID NO: 18.
31. The isolated polynucleotide of claim 25, disposed on a single continuous nucleic acid sequence.
32. The isolated polynucleotide of claim 25, disposed on two nucleic acid sequences.
33. A vector comprising the polynucleotide of claim 22.
34. An isolated host cell comprising the vector of claim 33.