CLAIMS:

1. An isolated antibody that specifically binds to B7-H1, wherein the antibody exhibits one or more of the following properties, selected from the group consisting of:

binds human B7-H1 with a K_D of less than 2 nM, as determined by BIAcore;

cross-reacts with cynomologus monkey B7-H1;

binds cynomologus B7-H1 with a K_D of less than 2 nM, as determined by BIAcore;

exhibits activation of CD4+ T cells in dendritic cell-T-cell mixed lymphocyte assay;

inhibits binding of human B7-H1 to PD-1 expressed on ES-2 cells with an IC50 of less than 0.2 nM;

inhibits binding of human B7-H1 to B7-1 using a homogenous TR-FRET assay with an IC50 of less than 0.1 nM; and

inhibits tumor growth of a cancer cell line in a xenograft model as compared to an isotype control antibody.

2. The antibody according to claim 1, wherein said antibody inhibits tumor growth of a human pancreatic cancer (HPAC) cell line in a xenograft model by day 30 by greater than 40% compared to the isotype control, as determined by measuring tumor volumes.

3. The antibody according to claim 1, wherein said antibody inhibits tumor growth of A375 (melanoma) cell line in a xenograft model by day 30 by greater than 50% compared to the isotype control, as determined by measuring tumor volumes.

4. The antibody according to any one of the preceding claims, wherein the antibody binds to the same epitope on the extracellular domain of human B7-H1 as any one of antibodies 2.7A4, 2.14H9 or 2.9D10, 2.7A4OPT or 2.14H9OPT.

5. The antibody of claim 4, wherein the antibody binds an epitope on the extracellular domain of human B7-H1 comprising at least two of the following three amino acid residues of Asp at position 122, Arg at position 125 or Arg at position 113.

6. The antibody of claim 5, wherein the antibody exhibits no binding to an epitope comprising Ile at position 54, Ser at position 117, and Ala at position 121 on human B7-H1, as determined by a competition assay.

7. The antibody of claim 5, wherein the antibody loses its ability to bind to human B7-H1 if the Arg at position 113 on said human B7-H1 is mutated to an Ala, or to a Tyr, or to a Leu, as determined by a competition assay as compared to binding to wild-type B7-H1.

8. The antibody of claim 5, wherein said antibody loses its ability to bind to human B7-H1 if the Arg at position 125 on said human B7-H1 is mutated to an Ala, or to a Gln, or to a Ser, as determined by a competition assay as compared to binding to wild-type B7-H1.

9. The antibody of claim 5, wherein said antibody retains its ability to bind to human B7-H1 if the Arg at position 123 on said human B7-H1 is mutated to an Ala, or to a Phe, or to a Thr, as determined by a competition assay as compared to binding to wild-type B7-H1.

10. The antibody of claim 4, wherein the antibody binds at least two of the following three amino acid residues of Phe at position 19, Thr at position 20 or Asp at position 122 on human B7-H1.

11. The antibody of claim 10, wherein the antibody exhibits no binding to an epitope comprising Ile at position 54, Met at position 115, Ser at position 117, and Ala at position 121 on human B7-H1, as determined by a competition assay as compared to binding to wild-type B7-H1.

12. The antibody of claim 10, wherein said antibody loses its ability to bind to human B7-H1 if the Phe at position 19 on said human B7-H1 is mutated to an Ala, or to a Gly, or to a Ser, as determined by a competition assay as compared to binding to wild-type B7-H1.

13. The antibody of claim 10, wherein said antibody loses its ability to bind to human B7-H1 if the Thr at position 20 on said human B7-H1 is mutated to an Ala, or to a Val, or to a Asp, as determined by a competition assay as compared to binding to wild-type B7-H1.

14. The antibody of claim 10, wherein said antibody loses its ability to bind to human B7-H1 if the Asp at position 122 on said human B7-H1 is mutated to an Asn, or to a Glu, as determined by a competition assay as compared to binding to wild-type B7-H1.

15. The antibody of claim 10, wherein said antibody retains its ability to bind to human B7-H1 if the Arg at position 123 on said human B7-H1 is mutated to an Ala, or to a Phe, or to a Thr, as determined by a competition assay as compared to binding to wild-type B7-H1.

16. The antibody of claim 1, wherein said antibody binds human B7-H1 with a Kd of less than 1.0 nM, as determined by BIAcore.

17. The antibody of claim 16, wherein said antibody binds human B7-H1 with a Kd of less than 200 pM, as determined by BIAcore.

18. The antibody of claim 1, wherein said antibody is a monoclonal antibody.

19. The antibody of claim 18, wherein said antibody is a fully human monoclonal antibody.

20. The antibody according to any one of the preceding claims, wherein said antibody is any one of 2.9D10, 2.7A4, 2.14H9, 2.7A4OPT, or 2.14H9OPT.

21. The antibody of claim 20, wherein said antibody is a binding fragment selected from the group consisting of a Fab, Fab', $F(ab')_2$, Fv and dAb fragment.

22. The antibody of claim 20 having an amino acid sequence comprising:

a heavy chain variable domain amino acid sequence encoded by a polynucleotide in a plasmid designated 2.7A4_G which was deposited at the NCIMB under deposit number 41598 and a light chain variable domain amino acid sequence encoded by the

polynucleotide in a plasmid designated 2.7A4_G which was deposited at the NCIMB under deposit number 41598; or

a heavy chain variable domain amino acid sequence encoded by a polynucleotide in a plasmid designated 2.14H9_G which was deposited at the NCIMB under deposit number 41597 and a light chain variable domain amino acid sequence encoded by the polynucleotide in a plasmid designated 2.14H9_G which was deposited at the NCIMB under deposit number 41597; or

a heavy chain variable domain amino acid sequence encoded by a polynucleotide in a plasmid designated 2.9D10_NG which was deposited at the NCIMB under deposit number 41599 and a light chain variable domain amino acid sequence encoded by the polynucleotide in a plasmid designated 2.9D10_NG which was deposited at the NCIMB under deposit number 41599.

23. The antibody of claim 20 having an amino acid sequence comprising:

a VH CDR1 having the amino acid sequence of SEQ ID NO: 3; and
a VH CDR2 having the amino acid sequence of SEQ ID NO: 4; and
a VH CDR3 having the amino acid sequence of SEQ ID NO: 5; and
a VL CDR1 having the amino acid sequence of SEQ ID NO: 8; and
a VL CDR2 having the amino acid sequence of SEQ ID NO: 9; and
a VL CDR3 having the amino acid sequence of SEQ ID NO: 10; or

a VH CDR1 having the amino acid sequence of SEQ ID NO: 23; and
a VH CDR2 having the amino acid sequence of SEQ ID NO: 24; and
a VH CDR3 having the amino acid sequence of SEQ ID NO: 25; and
a VL CDR1 having the amino acid sequence of SEQ ID NO: 28; and
a VL CDR2 having the amino acid sequence of SEQ ID NO: 29; and
a VL CDR3 having the amino acid sequence of SEQ ID NO: 30; or

a VH CDR1 having the amino acid sequence of SEQ ID NO: 13; and
a VH CDR2 having the amino acid sequence of SEQ ID NO: 14; and
a VH CDR3 having the amino acid sequence of SEQ ID NO: 15; and

a VL CDR1 having the amino acid sequence of SEQ ID NO: 18; and
a VL CDR2 having the amino acid sequence of SEQ ID NO: 19; and
a VL CDR3 having the amino acid sequence of SEQ ID NO: 20; or

a VH CDR1 having the amino acid sequence of SEQ ID NO: 63; and
a VH CDR2 having the amino acid sequence of SEQ ID NO: 64; and
a VH CDR3 having the amino acid sequence of SEQ ID NO: 65; and
a VL CDR1 having the amino acid sequence of SEQ ID NO: 68; and
a VL CDR2 having the amino acid sequence of SEQ ID NO: 69; and
a VL CDR3 having the amino acid sequence of SEQ ID NO: 70; or

a VH CDR1 having the amino acid sequence of SEQ ID NO: 73; and
a VH CDR2 having the amino acid sequence of SEQ ID NO: 74; and
a VH CDR3 having the amino acid sequence of SEQ ID NO: 75; and
a VL CDR1 having the amino acid sequence of SEQ ID NO: 78; and
a VL CDR2 having the amino acid sequence of SEQ ID NO: 79; and
a VL CDR3 having the amino acid sequence of SEQ ID NO: 80.

24. The antibody of claims 22 or 23, wherein said antibody further comprises an Fc variant, wherein the Fc region comprises at least one non naturally occurring amino acid selected from the group consisting of 234F, 235F, and 331S, as numbered by the EU index as set forth in Kabat.

25. A nucleic acid molecule encoding the antibody of claim 24.

26. A host cell transfected with a vector comprising the nucleic acid molecule of claim 25.

27. An antibody produced by a method comprising, culturing said host cell of claim 26, expressing an antibody encoded by said nucleic acid molecule of claim 25, and isolating said antibody from said culture.

28. A composition comprising the antibody of claim 22 or 23 or 24.

29. A pharmaceutical composition comprising the antibody of claim 22 or 23 or 24 and a pharmaceutically acceptable carrier.

30. A method of repressing B7-H1-mediated T cell inhibition in an animal comprising, administering to an animal in need thereof an effective amount of the composition of claim 28.

31. A method of treating a malignant tumor in an animal, comprising: selecting an animal in need of treatment for a malignant tumor; and administering to said animal a therapeutically effective amount of the composition of claim 29.

32. The method of claim 31, wherein said malignant tumor is selected from the group consisting of: melanoma, non-small cell lung cancer, hepatocellular carcinoma, gastric cancer, bladder cancer, lung cancer, renal cell carcinoma, cervical cancer, colon cancer, colorectal cancer, and pancreatic cancer.

33. The method of claim 30-32, wherein said animal is human.

34. The antibody of claim 20, wherein said antibody is monoclonal antibody 2.14H9OPT.

35. A purified antibody or antibody fragment, wherein the antibody or the fragment immunospecifically binds B7-H1 and comprises a heavy chain variable domain having at least 90% identity to the amino acid of SEQ ID NO:72 and comprises a light chain variable domain having at least 90% identity to the amino acid sequence of SEQ ID NO:77, wherein said antibody has the activity of binding to B7-H1.

36. A composition comprising the antibody of claim 35.

37. A pharmaceutical composition comprising the antibody of claim 35 and a pharmaceutically acceptable carrier.

38. A method of repressing B7-H1-mediated T cell inhibition in an animal comprising, administering to an animal in need thereof an effective amount of the composition of claim 36.

39. A method of treating a malignant tumor in an animal, comprising: selecting an animal in need of treatment for a malignant tumor; and administering to said animal a therapeutically effective amount of the composition of claim 37.

40. The method of claim 39, wherein said malignant tumor is selected from the group consisting of: melanoma, non-small cell lung cancer, hepatocellular carcinoma, gastric cancer, bladder cancer, lung cancer, renal cell carcinoma, cervical cancer, colon cancer, colorectal cancer, and pancreatic cancer.

CLAIMS:

1. An antibody or fragment thereof wherein the antibody binds to the same epitope on the extracellular domain of human B7-H1 as any one of an antibody comprising:

(a) a heavy chain variable domain amino acid sequence encoded by a polynucleotide in a plasmid designated 2.7A4_G which was deposited at the National Collections of Industrial and Marine Bacteria (NCIMB) under deposit number 41598 and a light chain variable domain amino acid sequence encoded by the polynucleotide in a plasmid designated 2.7A4_G which was deposited at the NCIMB under deposit number 41598; or

(b) a heavy chain variable domain amino acid sequence encoded by a polynucleotide in a plasmid designated 2.14H9_G which was deposited at the NCIMB under deposit number 41597 and a light chain variable domain amino acid sequence encoded by the polynucleotide in a plasmid designated 2.14H9_G which was deposited at the NCIMB under deposit number 41597; or

(c) a heavy chain variable domain amino acid sequence encoded by a polynucleotide in a plasmid designated 2.9D10_NG which was deposited at the NCIMB under deposit number 41599 and a light chain variable domain amino acid sequence encoded by the polynucleotide in a plasmid designated 2.9D10_NG which was deposited at the NCIMB under deposit number 41599.

2. The antibody or fragment thereof of claim 1, wherein the antibody binds an epitope on the extracellular domain of human B7-H1 comprising at least two of the following three amino acid residues of Asp at position 122, Arg at position 125 or Arg at position 113.

3. The antibody or fragment thereof of claim 2, wherein the antibody exhibits no binding to an epitope comprising Ile at position 54, Ser at position 117, and Ala at position 121 on human B7-H1, as determined by a competition assay.

4. The antibody or fragment thereof of claim 2, wherein the antibody loses its ability to bind to human B7-H1 if the Arg at position 113 on said human B7-H1 is mutated to an Ala, or to a Tyr, or to a Leu, as determined by a competition assay as compared to binding to wild-type B7-H1.

5. The antibody or fragment thereof of claim 2, wherein said antibody loses its ability to bind to human B7-H1 if the Arg at position 125 on said human B7-H1 is mutated to an Ala, or to a Gln, or to a Ser, as determined by a competition assay as compared to binding to wild-type B7-H1.

6. The antibody or fragment thereof of claim 2, wherein said antibody retains its ability to bind to human B7-H1 if the Arg at position 123 on said human B7-H1 is mutated to an Ala, or to a Phe, or to a Thr, as determined by a competition assay as compared to binding to wild-type B7-H1.

7. The antibody or fragment thereof of claim 1, wherein the antibody binds at least two of the following three amino acid residues of Phe at position 19, Thr at position 20 or Asp at position 122 on human B7-H1.

8. The antibody or fragment thereof of claim 7, wherein the antibody exhibits no binding to an epitope comprising Ile at position 54, Met at position 115, Ser at position 117, and Ala at position 121 on human B7-H1, as determined by a competition assay as compared to binding to wild-type B7-H1.

9. The antibody or fragment thereof of claim 7, wherein said antibody loses its ability to bind to human B7-H1 if the Phe at position 19 on said human B7-H1 is mutated to an Ala, or to a Gly, or to a Ser, as determined by a competition assay as compared to binding to wild-type B7-H1.

10. The antibody or fragment thereof claim 7, wherein said antibody loses its ability to bind to human B7-H1 if the Thr at position 20 on said human B7-H1 is mutated to an Ala, or to a Val, or to a Asp, as determined by a competition assay as compared to binding to wild-type B7-H1.

11. The antibody or fragment thereof claim 7, wherein said antibody loses its ability to bind to human B7-H1 if the Asp at position 122 on said human B7-H1 is mutated to an Asn, or to a Glu, as determined by a competition assay as compared to binding to wild-type B7-H1.

12. The antibody or fragment thereof of claim 7, wherein said antibody retains its ability to bind to human B7-H1 if the Arg at position 123 on said human B7-H1 is mutated to an Ala, or to a Phe, or to a Thr, as determined by a competition assay as compared to binding to wild-type B7-H1.

13. The antibody or fragment thereof of claim 1, wherein said antibody binds human B7-H1 with a Kd of less than 1.0 nM, as determined by BIAcore.

14. The antibody or fragment thereof of claim 13, wherein said antibody binds human B7-H1 with a Kd of less than 200 pM, as determined by BIAcore.

15. The antibody or fragment thereof of claim 1, wherein said antibody is a monoclonal antibody.

16. The antibody or fragment thereof of claim 15, wherein said antibody is a fully human monoclonal antibody.

17. The antibody of claim 1, wherein said antibody is a binding fragment selected from the group consisting of a Fab, Fab', $F(ab')_2$, Fv and dAb fragment.

18. An antibody or fragment thereof having an amino acid sequence comprising:

a heavy chain variable domain amino acid sequence encoded by a polynucleotide in a plasmid designated 2.7A4_G which was deposited at the National Collections of Industrial and Marine Bacteria (NCIMB) under deposit number 41598 and a light chain variable domain amino acid sequence encoded by the polynucleotide in a plasmid designated 2.7A4_G which was deposited at the NCIMB under deposit number 41598; or

a heavy chain variable domain amino acid sequence encoded by a polynucleotide in a plasmid designated 2.14H9_G which was deposited at the NCIMB under deposit number 41597 and a light chain variable domain amino acid sequence encoded by the polynucleotide in a plasmid designated 2.14H9_G which was deposited at the NCIMB under deposit number 41597; or

a heavy chain variable domain amino acid sequence encoded by a polynucleotide in a plasmid designated 2.9D10_NG which was deposited at the NCIMB under deposit number 41599 and a light chain variable domain amino acid sequence encoded by the polynucleotide in a plasmid designated 2.9D10_NG which was deposited at the NCIMB under deposit number 41599.

19. The antibody or fragment thereof of claim 1 having an amino acid sequence comprising:

a VH CDR1 having the amino acid sequence of SEQ ID NO: 3; and

a VH CDR2 having the amino acid sequence of SEQ ID NO: 4; and

a VH CDR3 having the amino acid sequence of SEQ ID NO: 5; and

a VL CDR1 having the amino acid sequence of SEQ ID NO: 8; and

a VL CDR2 having the amino acid sequence of SEQ ID NO: 9; and

a VL CDR3 having the amino acid sequence of SEQ ID NO: 10; or

a VH CDR1 having the amino acid sequence of SEQ ID NO: 23; and

a VH CDR2 having the amino acid sequence of SEQ ID NO: 24; and

a VH CDR3 having the amino acid sequence of SEQ ID NO: 25; and

a VL CDR1 having the amino acid sequence of SEQ ID NO: 28; and

a VL CDR2 having the amino acid sequence of SEQ ID NO: 29; and

a VL CDR3 having the amino acid sequence of SEQ ID NO: 30; or

a VH CDR1 having the amino acid sequence of SEQ ID NO: 13; and

a VH CDR2 having the amino acid sequence of SEQ ID NO: 14; and

a VH CDR3 having the amino acid sequence of SEQ ID NO: 15; and

a VL CDR1 having the amino acid sequence of SEQ ID NO: 18; and

a VL CDR2 having the amino acid sequence of SEQ ID NO: 19; and

a VL CDR3 having the amino acid sequence of SEQ ID NO: 20; or

a VH CDR1 having the amino acid sequence of SEQ ID NO: 63; and

a VH CDR2 having the amino acid sequence of SEQ ID NO: 64; and

a VH CDR3 having the amino acid sequence of SEQ ID NO: 65; and

a VL CDR1 having the amino acid sequence of SEQ ID NO: 68; and

a VL CDR2 having the amino acid sequence of SEQ ID NO: 69; and

a VL CDR3 having the amino acid sequence of SEQ ID NO: 70; or

a VH CDR1 having the amino acid sequence of SEQ ID NO: 73; and

a VH CDR2 having the amino acid sequence of SEQ ID NO: 74; and

a VH CDR3 having the amino acid sequence of SEQ ID NO: 75; and

a VL CDR1 having the amino acid sequence of SEQ ID NO: 78; and

a VL CDR2 having the amino acid sequence of SEQ ID NO: 79; and

a VL CDR3 having the amino acid sequence of SEQ ID NO: 80.

20. The antibody or fragment thereof of claim 18, wherein said antibody further comprises an Fc variant, wherein the Fc region comprises at least one amino acid selected from the group consisting of 234F, 235F, and 331S, as numbered by the EU index as set forth in Kabat.

21. A nucleic acid molecule encoding the antibody of claim 20.

22. A cultured host cell transfected with a vector comprising the nucleic acid molecule of claim 21.

23. An antibody produced by a method comprising, culturing said host cell of claim 22, wherein said host cell expresses the antibody.

24. A composition comprising the antibody of claim 1.

25. A pharmaceutical composition comprising the antibody of claim 1 and a pharmaceutically acceptable carrier.

26. A method of repressing B7-H1-mediated T cell inhibition in an animal comprising, administering to an animal in need thereof an effective amount of the composition of claim 24.

27. The method of claim 26, wherein said animal is human.

28. A purified antibody or antibody fragment, wherein the antibody or the fragment immunospecifically binds B7-H1 and comprises a heavy chain variable domain having at least 90% identity to the amino acid of SEQ ID NO:72 and comprises a light chain variable domain having at least 90% identity to the amino acid sequence of SEQ ID NO:77, wherein said antibody has the activity of binding to B7-H1.

29. A composition comprising the antibody of claim 28.

30. A pharmaceutical composition comprising the antibody of claim 28 and a pharmaceutically acceptable carrier.

31. A method of repressing B7-H1-mediated T cell inhibition in an animal comprising, administering to an animal in need thereof an effective amount of the composition of claim 29.