

WHAT IS CLAIMED IS

1. An antibody that binds to B-Cell Maturation Antigen (BCMA), or a BCMA-binding fragment thereof, comprising heavy chain CDR1, CDR2 or CDR3 sequences of:
 - a. SEQ ID NO:7, SEQ ID NO:8, and SEQ ID NO:9, respectively;
 - b. SEQ ID NO:10, SEQ ID NO:11 and SEQ ID NO:12, respectively;
 - c. SEQ ID NO:13, SEQ ID NO:14 and SEQ ID NO:15, respectively;
 - d. SEQ ID NO:18, SEQ ID NO:19 and SEQ ID NO:20, respectively;
 - e. SEQ ID NO:21, SEQ ID NO:22 and SEQ ID NO:23, respectively;
 - f. SEQ ID NO:24, SEQ ID NO:25 and SEQ ID NO:26, respectively;
 - g. SEQ ID NO:29, SEQ ID NO:30 and SEQ ID NO:31, respectively;
 - h. SEQ ID NO:32, SEQ ID NO:33 and SEQ ID NO:34, respectively;
 - i. SEQ ID NO:35, SEQ ID NO:36 and SEQ ID NO:37, respectively;
 - j. SEQ ID NO:40, SEQ ID NO:41 and SEQ ID NO:42, respectively;
 - k. SEQ ID NO:43, SEQ ID NO:44 and SEQ ID NO:45, respectively;
 - l. SEQ ID NO:46, SEQ ID NO:47 and SEQ ID NO:48, respectively;
 - m. SEQ ID NO:51, SEQ ID NO:52 and SEQ ID NO:53, respectively;
 - n. SEQ ID NO:54, SEQ ID NO:55 and SEQ ID NO:56, respectively; or
 - o. SEQ ID NO:57, SEQ ID NO:58 and SEQ ID NO:59, respectively.
2. The antibody or BCMA-binding fragment thereof, of claim 1, wherein said antibody additionally comprises light chain CDR1, CDR2 or CDR3 sequences of SEQ ID NO:2, SEQ ID NO:3 or SEQ ID NO:4, respectively.
3. The antibody or BCMA-binding fragment thereof, of claim 1, wherein said antibody additionally comprises light chain CDR1, CDR2 and CDR3 sequences of SEQ ID NO:2, SEQ ID NO:3 and SEQ ID NO:4, respectively.
4. An antibody that binds to BCMA, or a BCMA-binding fragment thereof, comprising a light chain comprising CDR1, CDR2 or CDR3 sequences of SEQ ID NO:2, SEQ ID NO:3 and SEQ ID NO:4, respectively, and heavy chain CDR1, CDR2 and CDR3 sequences of:
 - a. SEQ ID NO:7, SEQ ID NO:8, and SEQ ID NO:9, respectively;
 - b. SEQ ID NO:10, SEQ ID NO:11, and SEQ ID NO:12, respectively; or
 - c. SEQ ID NO:13, SEQ ID NO:14 and SEQ ID NO:15, respectively.

5. An antibody that binds to BCMA, or a BCMA-binding fragment thereof, comprising a light chain comprising CDR1, CDR2 or CDR3 sequences of SEQ ID NO:2, SEQ ID NO:3 and SEQ ID NO:4, respectively, and heavy chain CDR1, CDR2 and CDR3 sequences of:

- a. SEQ ID NO:18, SEQ ID NO:19 and SEQ ID NO:20, respectively;
- b. SEQ ID NO:21, SEQ ID NO:22 and SEQ ID NO:23, respectively; or
- c. SEQ ID NO:24, SEQ ID NO:25 and SEQ ID NO:26, respectively.

6. An antibody that binds to BCMA, or a BCMA-binding fragment thereof, comprising a light chain comprising CDR1, CDR2 or CDR3 sequences of SEQ ID NO:2, SEQ ID NO:3 and SEQ ID NO:4, respectively, and heavy chain CDR1, CDR2 and CDR3 sequences of:

- a. SEQ ID NO:29, SEQ ID NO:30 and SEQ ID NO:31, respectively;
- b. SEQ ID NO:32, SEQ ID NO:33 and SEQ ID NO:34, respectively; or
- c. SEQ ID NO:35, SEQ ID NO:36 and SEQ ID NO:37, respectively.

7. An antibody that binds to BCMA, or a BCMA-binding fragment thereof, comprising a light chain comprising CDR1, CDR2 or CDR3 sequences of SEQ ID NO:2, SEQ ID NO:3 and SEQ ID NO:4, respectively, and heavy chain CDR1, CDR2 and CDR3 sequences of:

- a. SEQ ID NO:40, SEQ ID NO:41 and SEQ ID NO:42, respectively;
- b. SEQ ID NO:43, SEQ ID NO:44 and SEQ ID NO:45, respectively; or
- c. SEQ ID NO:46, SEQ ID NO:47 and SEQ ID NO:48, respectively.

8. An antibody that binds to BCMA, or a BCMA-binding fragment thereof, comprising a light chain comprising CDR1, CDR2 or CDR3 sequences of SEQ ID NO:2, SEQ ID NO:3 and SEQ ID NO:4, respectively, and heavy chain CDR1, CDR2 and CDR3 sequences of:

- a. SEQ ID NO:51, SEQ ID NO:52 and SEQ ID NO:53, respectively;
- b. SEQ ID NO:54, SEQ ID NO:55 and SEQ ID NO:56, respectively; or
- c. SEQ ID NO:57, SEQ ID NO:58 and SEQ ID NO:59, respectively.

9. The antibody or binding fragment thereof of any of claims 1-6, which comprises the light chain variable sequence of SEQ ID NO:1.

10. The antibody or binding fragment thereof of any of claims 1-6, which comprises the heavy chain variable sequence of SEQ ID NO:6, SEQ ID NO:17, SEQ ID NO:28, SEQ ID NO:39, or SEQ ID NO:50.

11. The antibody of any of claims 1-8, wherein said antibody is a monoclonal antibody, a chimeric antibody, a diabody, a bispecific antibody, a bispecific Fab₂, a bispecific (mab)₂, a humanized antibody, an artificially-generated human antibody, bispecific T-cell engager, bispecific NK cell engager, or a single chain antibody.

12. The antibody of any of claims 1-8, wherein said antibody is a triomab, knob-in-hole (kih) IgG with common light chain, crossmab, ortho-Fab IgG, DVD-Ig, 2 in 1-IgG, IgG-scFv, sdFv₂-Fc, bi-nanobody, tandAb, DART, DART-Fc, scFv-HAS-scFv, or DNL-Fab3.

13. The antibody of any of claims 1-10, wherein said antibody is an antibody-drug conjugate.

14. The binding fragment of any of claims 1-8, which is a single-chain variable fragment (scFv), Fab fragment, or F(ab')₂ fragment.

15. A polypeptide that comprises the heavy chain CDR1, CDR2 or CDR3 sequences of:

- a. SEQ ID NO:7, SEQ ID NO:8, and SEQ ID NO:9, respectively;
- b. SEQ ID NO:10, SEQ ID NO:11 and SEQ ID NO:12, respectively;
- c. SEQ ID NO:13, SEQ ID NO:14 and SEQ ID NO:15, respectively;
- d. SEQ ID NO:18, SEQ ID NO:19 and SEQ ID NO:20, respectively;
- e. SEQ ID NO:21, SEQ ID NO:22 and SEQ ID NO:23, respectively;
- f. SEQ ID NO:24, SEQ ID NO:25 and SEQ ID NO:26, respectively;
- g. SEQ ID NO:29, SEQ ID NO:30 and SEQ ID NO:31, respectively;
- h. SEQ ID NO:32, SEQ ID NO:33 and SEQ ID NO:34, respectively;
- i. SEQ ID NO:35, SEQ ID NO:36 and SEQ ID NO:37, respectively;
- j. SEQ ID NO:40, SEQ ID NO:41 and SEQ ID NO:42, respectively;
- k. SEQ ID NO:43, SEQ ID NO:44 and SEQ ID NO:45, respectively;
- l. SEQ ID NO:46, SEQ ID NO:47 and SEQ ID NO:48, respectively;
- m. SEQ ID NO:51, SEQ ID NO:52 and SEQ ID NO:53, respectively;
- n. SEQ ID NO:54, SEQ ID NO:55 and SEQ ID NO:56, respectively; or
- o. SEQ ID NO:57, SEQ ID NO:58 and SEQ ID NO:59, respectively.

16. The polypeptide of claim 1, wherein said polypeptide additionally comprises light chain CDR1, CDR2 or CDR3 sequences of SEQ ID NO:2, SEQ ID NO:3 and SEQ ID NO:4, respectively.

17. The polypeptide of claim 1, wherein said polypeptide additionally comprises light chain CDR1, CDR2 and CDR3 sequences of SEQ ID NO:2, SEQ ID NO:3 and SEQ ID NO:4, respectively.

18. A polypeptide that comprises the light chain CDR1, CDR2 and CDR3 sequences of SEQ ID NO:2, SEQ ID NO:3 and SEQ ID NO:4, respectively.

19. A polypeptide that comprises the light chain variable sequence of SEQ ID NO:1.

20. A polypeptide that comprises the heavy chain variable sequence of SEQ ID NO:6, SEQ ID NO:17, SEQ ID NO:28, SEQ ID NO:39, or SEQ ID NO:50.

21. A composition comprising the antibody, binding fragment thereof, or polypeptide of any of claims 1-20.

22. The composition of claim 21, wherein said composition is a pharmaceutical composition.

23. The composition of claim 22, wherein said composition is formulated for intravenous, intraarterial, intramuscular, subcutaneous, intradural, intrathecal, or intraperitoneal delivery.

24. A polynucleotide encoding the antibody, antibody fragment, or polypeptide of any of claims 1-20.

25. A polynucleotide encoding a polypeptide comprising heavy chain CDR1, CDR2 or CDR3 sequences of:

- a. SEQ ID NO:7, SEQ ID NO:8, and SEQ ID NO:9, respectively;
- b. SEQ ID NO:10, SEQ ID NO:11 and SEQ ID NO:12, respectively;
- c. SEQ ID NO:13, SEQ ID NO:14 and SEQ ID NO:15, respectively;
- d. SEQ ID NO:18, SEQ ID NO:19 and SEQ ID NO:20, respectively;
- e. SEQ ID NO:21, SEQ ID NO:22 and SEQ ID NO:23, respectively;
- f. SEQ ID NO:24, SEQ ID NO:25 and SEQ ID NO:26, respectively;
- g. SEQ ID NO:29, SEQ ID NO:30 and SEQ ID NO:31, respectively;
- h. SEQ ID NO:32, SEQ ID NO:33 and SEQ ID NO:34, respectively;
- i. SEQ ID NO:35, SEQ ID NO:36 and SEQ ID NO:37, respectively;

- j. SEQ ID NO:40, SEQ ID NO:41 and SEQ ID NO:42, respectively;
 - k. SEQ ID NO:43, SEQ ID NO:44 and SEQ ID NO:45, respectively;
 - l. SEQ ID NO:46, SEQ ID NO:47 and SEQ ID NO:48, respectively;
 - m. SEQ ID NO:51, SEQ ID NO:52 and SEQ ID NO:53, respectively;
 - n. SEQ ID NO:54, SEQ ID NO:55 and SEQ ID NO:56, respectively; or
 - o. SEQ ID NO:57, SEQ ID NO:58 and SEQ ID NO:59, respectively.
26. A polynucleotide encoding a polypeptide comprising light chain CDR1, CDR2 or CDR3 sequences of SEQ ID NO:2, SEQ ID NO:3 and SEQ ID NO:4, respectively.
27. The polynucleotide of claim 25, wherein said polynucleotide comprises the nucleotide sequence of SEQ ID NO:5, SEQ ID NO:16, SEQ ID NO:27, SEQ ID NO:38, SEQ ID NO:49 or SEQ ID NO:60.
28. A polynucleotide that encodes a polypeptide that comprises the light chain variable sequence of SEQ ID NO:1.
29. A polynucleotide that encodes a polypeptide that comprises the heavy chain variable sequence of SEQ ID NO:6, SEQ ID NO:17, SEQ ID NO:28, SEQ ID NO:39, or SEQ ID NO:50.
30. A polynucleotide vector comprising the polynucleotide of any of claims 24-28.
31. The vector of claim 30, wherein said vector is an expression vector.
32. The vector of claim 30, wherein said vector is a retroviral vector or a lentiviral vector.
33. A cell comprising the polynucleotide of any of claims 24-28.
34. A cell comprising the vector of claim 31 or claim 32.
35. The cell of claim 33 or claim 34, wherein said cell expresses said antibody, binding fragment thereof, or polypeptide.
36. A method of producing a polypeptide, comprising causing the cell of claim 35 to express said polynucleotide and thereby produce said polypeptide; and isolating said polypeptide.
37. A method of producing an antibody that binds to BCMA, or BCMA binding fragment thereof, comprising causing the cell of claim 35 to express said polynucleotide and thereby produce said antibody; and isolating said antibody.

38. A method of depleting BCMA-expressing cells in a patient in need thereof, comprising administering to the patient a therapeutically effective amount of the antibody, or BCMA binding fragment thereof, or polypeptide, of any of claims 1-20.

39. A method of depleting BCMA-expressing plasma cells in a patient in need thereof, comprising administering to the patient a therapeutically effective amount of the antibody, or BCMA binding fragment thereof, or polypeptide, of any of claims 1-20.

40. A method of treating a disorder caused by BCMA-expressing cells in a patient in need thereof, comprising administering to the patient a therapeutically effective amount of the antibody, or BCMA binding fragment thereof, or polypeptide of any of claims 1-20.

41. A method of treating a disorder caused by BCMA-expressing plasma cells in a patient in need thereof, comprising administering to the patient a therapeutically effective amount of the antibody, or BCMA binding fragment thereof, or polypeptide, of any of claims 1-20.

42. A method of treating a B cell-related disorder associated with BCMA expression in a patient in need thereof, comprising administering to the patient a therapeutically effective amount of the antibody, or BCMA binding fragment thereof, or polypeptide, of any of claims 1-20.

43. The method of any of claims 38-42, wherein said B cell-related disorder is plasmacytoma, Hodgkins lymphoma, follicular lymphomas, small non-cleaved cell lymphomas, endemic Burkitt's lymphoma, sporadic Burkitt's lymphoma, marginal zone lymphoma, extranodal mucosa-associated lymphoid tissue lymphoma, nodal monocytoid B cell lymphoma, splenic lymphoma, mantle cell lymphoma, large cell lymphoma, diffuse mixed cell lymphoma, immunoblastic lymphoma, primary mediastinal B cell lymphoma, pulmonary B cell angiocentric lymphoma, small lymphocytic lymphoma, B cell proliferations of uncertain malignant potential, lymphomatoid granulomatosis, post-transplant lymphoproliferative disorder, an immunoregulatory disorder, rheumatoid arthritis, myasthenia gravis, idiopathic thrombocytopenia purpura, anti-phospholipid syndrome, Chagas' disease, Grave's disease, Wegener's granulomatosis, poly-arteritis nodosa, Sjogren's syndrome, pemphigus vulgaris, scleroderma, multiple sclerosis, anti-phospholipid syndrome, ANCA associated vasculitis, Goodpasture's disease, Kawasaki disease, autoimmune hemolytic anemia, and rapidly

progressive glomerulonephritis, heavy-chain disease, primary or immunocyte-associated amyloidosis, or monoclonal gammopathy of undetermined significance.

44. The polypeptide of any of claims 15-18, wherein said polypeptide is a chimeric antigen receptor (CAR).

45. The polypeptide of any of claims 15-18, wherein said CAR comprises said heavy chain CDR1, CDR2 and CDR3 sequences, and/or said light chain CDR1, CDR2 and CDR3 sequences in an extracellular BCMA-binding domain.

46. The polypeptide of claim 19 or claim 20, wherein said CAR comprises said light chain sequence and/or said heavy chain sequence in an extracellular BCMA-binding domain.

47. The polypeptide of claim 44, wherein said CAR comprises one or more of a transmembrane domain, a primary signaling domain, or a costimulatory domain.

48. The polypeptide of claim 44, wherein said CAR comprises a transmembrane domain, a primary signaling domain, or a costimulatory domain.

49. A cell that expresses the polypeptide of any of claims 44-48.

50. The cell of claim 49, wherein said cell is an immune cell.

51. The cell of claim 50, wherein said immune cell is a T cell, natural killer cell (NK cell), or natural killer T cell (NK T cell).

52. A method of depleting BCMA-expressing cells in a patient in need thereof, comprising administering to the patient a therapeutically effective amount of the cell of any of claims 49-52.

53. A method of depleting BCMA-expressing plasma cells in a patient in need thereof, comprising administering to the patient a therapeutically effective amount of the cell of any of claims 49-52.

54. A method of treating a disorder caused by BCMA-expressing cells in a patient in need thereof, comprising administering to the patient a therapeutically effective amount of the cell of any of claims 49-52.

55. A method of treating a disorder caused by BCMA-expressing plasma cells in a patient in need thereof, comprising administering to the patient a therapeutically effective amount of the cell of any of claims 49-52.

56. A method of treating a B cell-related disorder associated with BCMA expression in a patient in need thereof, comprising administering to the patient a therapeutically effective amount of the cell of any of claims 49-52.

57. The method of any of claims 52-56, wherein said B cell-related disorder is plasmacytoma, Hodgkins lymphoma, follicular lymphomas, small non-cleaved cell lymphomas, endemic Burkitt's lymphoma, sporadic Burkitt's lymphoma, marginal zone lymphoma, extranodal mucosa-associated lymphoid tissue lymphoma, nodal monocytoid B cell lymphoma, splenic lymphoma, mantle cell lymphoma, large cell lymphoma, diffuse mixed cell lymphoma, immunoblastic lymphoma, primary mediastinal B cell lymphoma, pulmonary B cell angiocentric lymphoma, small lymphocytic lymphoma, B cell proliferations of uncertain malignant potential, lymphomatoid granulomatosis, post-transplant lymphoproliferative disorder, an immunoregulatory disorder, rheumatoid arthritis, myasthenia gravis, idiopathic thrombocytopenia purpura, anti-phospholipid syndrome, Chagas disease, Grave's disease, Wegener's granulomatosis, poly-arteritis nodosa, Sjogren's syndrome, pemphigus vulgaris, scleroderma, multiple sclerosis, anti-phospholipid syndrome, ANCA associated vasculitis, Goodpasture's disease, Kawasaki disease, autoimmune hemolytic anemia, and rapidly progressive glomerulonephritis, heavy-chain disease, primary or immunocyte-associated amyloidosis, or monoclonal gammopathy of undetermined significance.