Claims

1. A monoclonal antibody specifically binding to human B cell maturation antigen (BCMA), wherein the antibody comprises a CDR3H region of SEQ ID NO:17 and a CDR3L region of SEQ ID NO:20 and a CDR1H, CDR2H, CDR1L, and CDR2L region combination selected from the group of:

a) CDR1H region of SEQ ID NO:21 and CDR2H region of SEQ ID NO:22, CDR1L region of SEQ ID NO:25, and CDR2L region of SEQ ID NO:26, and

b) CDR1H region of SEQ ID NO:21 and CDR2H region of SEQ ID NO:22, CDR1L region of SEQ ID NO:27, and CDR2L region of SEQ ID NO:28.

2. The antibody according to claim 1, wherein the antibody comprises as VH region a VH region of SEQ ID NO:10 and as VL region a VL region selected from the group consisting of VL regions of SEQ ID NO: 13 and 14.

3. A bispecific antibody specifically binding to BCMA and human CD3ε (further named also as "CD3"), wherein the bispecific antibody comprises a CDR3H region of SEQ ID NO:17 and a CDR3L region of SEQ ID NO:20 and a CDR1H, CDR2H, CDR1L, and CDR2L region combination selected from the group of:

a) CDR1H region of SEQ ID NO:21 and CDR2H region of SEQ ID NO:22, CDR1L region of SEQ ID NO:25, and CDR2L region of SEQ ID NO:26, and

b) CDR1H region of SEQ ID NO:21 and CDR2H region of SEQ ID NO:22, CDR1L region of SEQ ID NO:27, and CDR2L region of SEQ ID NO:28.

4. The bispecific antibody according to claim 3, wherein the bispecific antibody comprises as BCMA VH a VH region of SEQ ID NO:10 and as VL region a VL region of SEQ ID NO:13, or as BCMA VH a VH region of SEQ ID NO:10 and as VL region a VL region of SEQ ID NO:14.

5. The bispecific antibody according to claim 3 or 4, wherein the bispecific antibody comprises a light chain and a heavy chain of an antibody specifically binding to CD3, wherein the variable domains VL and VH or the constant domains CL and CH1 are replaced by each other, optionally wherein the variable domain VH of the anti-CD3 antibody portion (further named as "CD3 VH") comprises the heavy chain CDRs of SEQ ID NO: 1, 2 and 3 as respectively heavy

chain CDR1, CDR2 and CDR3 and the variable domain VL of the anti-CD3 antibody portion (further named as "CD3 VL") comprises the light chain CDRs of SEQ ID NO: 4, 5 and 6 as respectively light chain CDR1, CDR2 and CDR3.

6. A bispecific antibody specifically binding to BCMA and CD3, characterized in comprising:

a) the first light chain and the first heavy chain of a first antibody according to any one of claims 1 to 2; and

b) the second light chain and the second heavy chain of a second antibody which specifically binds to CD3, and wherein the variable domains VL and VH in the second light chain and second heavy chain of the second antibody are replaced by each other; and

c) wherein in the constant domain CL of the first light chain under a) the amino acid at position 124 is substituted independently by lysine (K), arginine (R) or histidine (H) (numbering according to Kabat), and wherein in the constant domain CH1 of the first heavy chain under a) the amino acid at position 147 and the amino acid at position 213 is substituted independently by glutamic acid (E), or aspartic acid (D), optionally wherein the bispecific antibody comprises in addition a Fab fragment of said first antibody (further named also as "BCMA-Fab") and in the constant domain CL said BCMA-Fab the amino acid at position 124 is substituted independently by lysine (K), arginine (R) or histidine (H) (numbering according to Kabat), and wherein in the constant domain CH1 of said BCMA-Fab the amino acid at positions 147 and the amino acid at position 213 is substituted independently by glutamic acid (E), or aspartic acid (D) (numbering according to EU index of Kabat) (see e.g. Figures 2A, 2C).

7. A bispecific antibody specifically binding to BCMA and CD3, characterized in comprising

a) the first light chain and the first heavy chain of a first antibody according to any one of claims 1 to 2; and

b) the second light chain and the second heavy chain of a second antibody which specifically binds to CD3, and wherein the variable domains VL and VH in the second light chain and second heavy chain of the second antibody are replaced by each other; and wherein

c) in the constant domain CL of the second light chain under b) the amino acid at position 124 is substituted independently by lysine (K), arginine (R) or histidine (H) (numbering according to Kabat), and wherein in the constant domain CH1 of the second heavy chain under b) the amino acid at positions 147 and the amino acid at position 213 is substituted independently by glutamic acid (E), or aspartic acid (D) (numbering according to EU index of Kabat).

8. The bispecific antibody according to any one of claims 3 to 7, wherein the bispecific antibody comprises:

a) not more than one Fab fragment of an anti-CD3 antibody portion, not more than two Fab fragments of an anti-BCMA antibody portion and not more than one Fc part;

b) an Fc part linked with its N-terminus to the C-terminus of said CD3 antibody Fab fragment and to the C-terminus of one of said BCMA antibody Fab fragments; and/or

c) a second Fab fragment of said anti-BCMA antibody portion linked with its C-terminus to the N-terminus of the CD3 antibody portion of said bispecific antibody, optionally wherein the VL domain of said anti-CD3 antibody Fab fragment is linked to the CH1 domain of said second anti-BCMA antibody Fab fragment.

9. The bispecific antibody according to claim 3, wherein the bispecific antibody comprises a heavy and light chain set selected from the group consisting of polypeptides:

i) SEQ ID NO:48, SEQ ID NO:52, SEQ ID NO:53, and SEQ ID NO:54 (2x), and

ii) SEQ ID NO:48, SEQ ID NO:55, SEQ ID NO:56, and SEQ ID NO:57 (2x).

10. A method for the preparation of an antibody according to any one of claims 1 to 9 comprising the steps of:

a) transforming a host cell with

b) vectors comprising nucleic acid molecules encoding the light chain and heavy chain of an antibody according to any one of claims 1 to 9;

c) culturing the host cell under conditions that allow synthesis of said antibody molecule; and

d) recovering said antibody molecule from said culture.

11. A pharmaceutical composition comprising an antibody according to any one of claims 1 to 9 and a pharmaceutically acceptable excipient.

12. Use of an antibody in the manufacture of a medicament for treating multiple myeloma or plasma cell leukemia, wherein said antibody is as described in any one of claims 3 to 9.

13. A chimeric antigen receptor (CAR), wherein the CAR comprises an antigen recognition moiety directed against BCMA and a T-cell activation moiety, wherein the antigen recognition moiety is a monoclonal antibody or antibody fragment according to claim 1 or 2.

14. A host cell comprising vectors comprising nucleic acid molecules encoding an antibody according to any one of claims 1 to 9.