CLAIMS

1. An isolated antibody that specifically binds to membrane bound IgM of a B-cell Receptor Complex, in which the isolated antibody is a monoclonal antibody designated mAb4-2b produced by a hybridoma cell line from fusion 119 (ATCC deposit number PTA-121716) and clones thereof, a monoclonal antibody designated mAb1-1 produced by a hybridoma cell line from fusion 117 (ATCC deposit number PTA-121719) and clones thereof, a monoclonal antibody designated mAb2-2b produced by a hybridoma cell line from fusion 118 (ATCC deposit number PTA-121717) and clones thereof, or a monoclonal antibody designated mAb3-2b produced by a hybridoma cell line from fusion 118 (ATCC deposit number PTA-121718) and clones thereof.

2. An isolated antibody or antigen binding fragment thereof that specifically binds membrane bound IgM of a B-cell Receptor Complex comprising a heavy chain variable region and a light chain variable region, in which:

(a) the heavy chain variable region (VH) is encoded by the nucleic acid sequence of SEQ ID NO: 1; and

(b) the light chain variable region (VL) is encoded by the nucleic acid sequence of SEQ ID NO: 3.

3. An isolated antibody or antigen binding fragment thereof that specifically binds membrane bound IgM of a B-cell Receptor Complex comprising a heavy chain variable region and a light chain variable region according to Claim 2, in which:

(a) the heavy chain variable region comprises the amino acid sequence of SEQ ID NO: 2 (heavy chain); and

(b) the light chain variable region comprises the amino acid sequence of SEQ ID NO: 4 (light chain).

4. An isolated antibody or antigen binding fragment thereof according to Claim 3, comprising:

(a) a heavy chain variable region CDR1 comprising the amino acid sequence of SEQ ID NO: 5;

(b) a heavy chain variable region CDR2 comprising the amino acid sequence of SEQ ID NO: 6;

(c) a heavy chain variable region CDR3 comprising the amino acid sequence of SEQ ID NO: 7;

(d) a light chain variable region CDR1 comprising the amino acid sequence of SEQ ID NO: 8;

(e) a light chain variable region CDR2 comprising the amino acid sequence of SEQ ID NO: 9; and

(f) a light chain variable region CDR3 comprising the amino acid sequence of SEQ ID NO: 10;

in which the antibody or antigen binding fragment thereof specifically binds to membrane bound IgM of a B-cell Receptor Complex.

5. An isolated antibody or antigen binding fragment according to Claim 2, 3 or 4, in which the antibody is a Fab, Fab', $F(ab')_2$, Fd, single-chain Fv, single-chain antibody, disulfide-linked Fv, single domain antibody, antigen binding fragment, diabody, triabody, or minibody.

6. An isolated nucleic acid encoding an antibody comprising the nucleic acid sequences of SEQ ID NO: 1 and SEQ ID NO: 3, in which the nucleic acid sequence of SEQ ID NO: 1 encodes a heavy chain variable region (VH) and the nucleic acid sequence of SEQ ID NO: 3 encodes a light chain variable region (VL).

7. An isolated nucleic acid encoding a heavy chain variable region (VH) comprising the amino acid sequence of SEQ ID NO: 2 and encoding a light chain variable region (VL) comprising the amino acid sequence of SEQ ID NO: 4.

8. An isolated polypeptide comprising the amino acid sequences of SEQ ID NO: 2 and SEQ ID NO: 4.

9. A hybridoma cell line for producing an isolated antibody according to Claim 1, in which the hybridoma cell line is a hybridoma cell line designated ATCC PTA-121719, a hybridoma cell line designated ATCC PTA-121717, a hybridoma cell line designated ATCC PTA-121718, or a hybridoma cell line designated ATCC PTA-121716.

10. An antibody according to any of Claims 1 to 5 further comprising a label, cytotoxin, radioisotope or immunotoxin.

11. A composition comprising an antibody according to any of Claims 1 to 5 and at least one of a physiologically acceptable carrier, diluent, excipient, or stabilizer.

12. A method of producing an antibody comprising culturing a hybridoma cell line according to Claim 9 under conditions suitable for the production of the antibody, and isolation of the antibody.

13. An expression vector comprising an isolated nucleic acid according to Claim 6 or 7.

14. A host cell comprising an expression vector, in which the expression vector comprises an isolated nucleic acid according to Claim 6 or 7.

15. A method of producing an antibody or antigen binding fragment thereof, comprising:

(a) culturing a host cell comprising an expression vector, in which the expression vector comprises a nucleic acid according to Claim 6 or 7 in culture medium under conditions in which the nucleic acid sequence is expressed, thereby producing a polypeptide comprising the light and heavy chain variable regions; and

(b) recovering the polypeptides from the host cell or culture medium.

16. A method for purifying membrane bound IgM (mIgM) of a B-cell Receptor Complex in a sample comprising (a) attaching monoclonal antibodies designated mAb1-1 produced by a hybridoma cell line designated fusion 117 (ATCC deposit number PTA-121719) alone or in combination with monoclonal antibodies designated mAb2-2b produced by a hybridoma cell line designated fusion 118 (ATCC deposit number PTA-121717) and monoclonal antibodies designated mAb3-2b produced by a hybridoma cell line designated fusion 118 (ATCC deposit number PTA-121718) to a solid support; (b) contacting the immobilized antibodies with the

sample; (c) washing the solid support with a first solvent to remove all the material in the sample except the mIgM of the B-cell Receptor Complex that is bound to the immobilized antibodies; and (d) washing the solid support with a second solvent to release the mIgM of the B-cell Receptor Complex from the immobilized antibodies.

17. A monoclonal antibody or antigen binding fragment thereof that specifically binds to membrane bound IgM of a B-cell Receptor Complex for use in a method of killing or inhibiting the growth of B cells in a subject, in which the heavy chain variable region of the monoclonal antibody comprises the amino acid sequence of SEQ ID NO: 2 and the light chain variable region of the monoclonal antibody comprises the amino acid sequence of SEQ ID NO: 4, in which an effective amount of the monoclonal antibody or antigen binding fragment thereof is to be administered to a subject in need thereof, thereby killing or inhibiting the growth of the B cells in the subject.

18. A monoclonal antibody or antigen binding fragment thereof that specifically binds to membrane bound IgM of a B-cell Receptor Complex for use in a method of killing or inhibiting the growth of B cells in a subject, in which the heavy chain variable region (VH) of the monoclonal antibody comprises:

(a) a heavy chain variable region CDR1 comprising the amino acid sequence of SEQ ID NO: 5;

(b) a heavy chain variable region CDR2 comprising the amino acid sequence of SEQ ID NO: 6;

(c) a heavy chain variable region CDR3 comprising the amino acid sequence of SEQ ID NO: 7; and

in which the light chain variable region (LH) of the monoclonal antibody comprises:

(d) a light chain variable region CDR1 comprising the amino acid sequence of SEQ ID NO: 8;

(e) a light chain variable region CDR2 comprising the amino acid sequence of SEQ ID NO: 9; and

(f) a light chain variable region CDR3 comprising the amino acid sequence of SEQ ID NO: 10

in which an effective amount of the monoclonal antibody or antigen binding fragment thereof is to be administered to a subject in need thereof, thereby killing or inhibiting the growth of the B cells in the subject.

19. A monoclonal antibody or antigen binding fragment thereof for use according to Claim 17, in which the monoclonal antibody is conjugated to a cytotoxin, radioisotope or immunotoxin.

20. A monoclonal antibody or antigen binding fragment thereof for use according to Claim 17, in which the effective amount of the monoclonal antibody is to be administered to a subject in need thereof in combination with one or more anti-B-cell antibodies, a cytotoxin, and/or a radioisotope, thereby killing or inhibiting the growth of the B cells in a subject.