Claims

1. A human antibody or antibody fragment capable of binding to phosphorylcholine and/or a phosphorylcholine conjugate, wherein the antibody or antibody fragment comprises a variable heavy chain (VH) domain and a variable light chain (VL) domain, and wherein -

(a) the VH domain comprises an amino acid sequence that includes:

i) a CDR1 sequence comprising an amino acid sequence having the sequence of SEQ ID NO: 17;

a CDR2 sequence comprising an amino acid sequence having the sequence of SEQ ID NO: 18; and

a CDR3 sequence comprising an amino acid sequence having the sequence of SEQ ID NO: 19;

or

ii) a CDR1 sequence comprising an amino acid sequence having the sequence of SEQ ID NO: 17;

a CDR2 sequence comprising an amino acid sequence having the sequence of SEQ ID NO: 18; and

a CDR3 sequence comprising an amino acid sequence having the sequence of SEQ ID NO: 20;

or

iii) a CDR1 sequence comprising an amino acid sequence having the sequence of SEQ ID NO: 17;

a CDR2 sequence comprising an amino acid sequence having the sequence of SEQ ID NO: 18; and

a CDR3 sequence comprising an amino acid sequence having the sequence of SEQ ID NO: 21; or

or

iv) a CDR1 sequence comprising an amino acid sequence having the sequence of SEQ ID NO: 17;

a CDR2 sequence comprising an amino acid sequence having the sequence of SEQ ID NO: 18; and

a CDR3 sequence comprising an amino acid sequence having the sequence of SEQ ID NO: 22; and

(b) the VL domain comprises an amino acid sequence that includes:

i) a CDR4 sequence comprising an amino acid sequence having the sequence of SEQ ID NO: 23;

a CDR5 sequence comprising an amino acid sequence having the sequence of SEQ ID NO: 25; and

a CDR6 sequence comprising an amino acid sequence having the sequence of SEQ ID NO: 26;

or

ii) a CDR4 sequence comprising an amino acid sequence having the sequence of SEQ ID NO: 24;

a CDR5 sequence comprising an amino acid sequence having the sequence of SEQ ID NO: 25; and

a CDR6 sequence comprising an amino acid sequence having the sequence of SEQ ID NO: 26,

wherein the antibody or antibody fragment binds to aminophenyl-phosphorylcholine immobilized through coupling to the free amine group, with a Kd of no greater than 500nM, when tested using a surface plasmon resonance sensor.

2. The antibody or antibody fragment of Claim 1 wherein –

the VH domain comprises an amino acid sequence that includes the CDR1, CDR2 and CDR3 sequences present in an amino acid sequence selected from the group consisting of SEQ ID NOs: 1, 3, 5, 7, 9, 11, 13, or 15;

and/or

the VL domain comprises an amino acid sequence that includes the CDR4, CDR5 and CDR6 sequences present in an amino acid sequence selected from the group consisting of SEQ ID NOs: 2, 4, 6, 8, 10, 12, 14, or 16.

3. An antibody or antibody fragment according to any preceding claim, wherein -

the VH domain comprises an amino acid sequence selected from the group consisting of SEQ ID NOs: 1, 3, 5, 7, 9, 11, 13, or 15; and

the VL domain comprises an amino acid sequence selected from the group consisting of SEQ ID NOs: 2, 4, 6, 8, 10, 12, 14, or 16.

4. The antibody or antibody fragment according to any of the preceding claims, wherein -

the VH domain comprises an amino acid sequence having at least 80%, 85%, 90%, 95% or 100% sequence identity SEQ ID NO:1; and

the VL domain comprises an amino acid sequence having at least 80%, 85%, 90%, 95% or 100% sequence identity SEQ ID NO: 2.

5. The antibody or antibody fragment according to any of Claims 1 to 3, wherein -

the VH domain comprises an amino acid sequence having at least 80%, 85%, 90%, 95% or 100% sequence identity SEQ ID NO:3; and

the VL domain comprises an amino acid sequence having at least 80%, 85%, 90%, 95% or 100% sequence identity SEQ ID NO: 4.

6. The antibody or antibody fragment according to any of Claims 1 to 3, wherein -

the VH domain comprises an amino acid sequence having at least 80%, 85%, 90%, 95% or 100% sequence identity SEQ ID NO:5; and

the VL domain comprises an amino acid sequence having at least 80%, 85%, 90%, 95% or 100% sequence identity SEQ ID NO: 6.

7. The antibody or antibody fragment according to any of Claims 1 to 3, wherein -

the VH domain comprises an amino acid sequence having at least 80%, 85%, 90%, 95% or 100% sequence identity SEQ ID NO:7; and

the VL domain comprises an amino acid sequence having at least 80%, 85%, 90%, 95% or 100% sequence identity SEQ ID NO: 8.

8. The antibody or antibody fragment according to any of Claims 1 to 3, wherein -

the VH domain comprises an amino acid sequence having at least 80%, 85%, 90%, 95% or 100% sequence identity SEQ ID NO:9; and

the VL domain comprises an amino acid sequence having at least 80%, 85%, 90%, 95% or 100% sequence identity SEQ ID NO: 10.

9. The antibody or antibody fragment according to any one of Claims 1 to 3, wherein -

the VH domain comprises an amino acid sequence having at least 80%, 85%, 90%, 95% or 100% sequence identity SEQ ID NO:11; and

the VL domain comprises an amino acid sequence having at least 80%, 85%, 90%, 95% or 100% sequence identity SEQ ID NO: 12.

10. The antibody or antibody fragment according to any one of Claims 1 to 3, wherein -

the VH domain comprises an amino acid sequence having at least 80%, 85%, 90%, 95% or 100% sequence identity SEQ ID NO:13; and

the VL domain comprises an amino acid sequence having at least 80%, 85%, 90%, 95% or 100% sequence identity SEQ ID NO: 14.

11. The antibody or antibody fragment according to any one of Claims 1 to 3, wherein -

the VH domain comprises an amino acid sequence having at least 80%, 85%, 90%, 95% or 100% sequence identity SEQ ID NO:15; and

the VL domain comprises an amino acid sequence having at least 80%, 85%, 90%, 95% or 100% sequence identity SEQ ID NO: 16.

12. The antibody or antibody fragment according to any of claims 4 to 11,

wherein the VH domain, the VL domain, or preferably both of the VH and VL domains, comprise an amino acid sequence having 100% sequence identity to the, or one or more of each, stated SEQ ID NO.

13. The antibody or antibody fragment according to any of claims 4 to 11,

wherein the VH domain, the VL domain, or both of the VH and VL domains, comprise an amino acid sequence having less than 100%, but at least 80%, 85%, 90%, 95%, sequence identity to the, or one or more of each, stated SEQ ID NO.

14. The antibody or antibody fragment according to any of claims 4 to 11,

wherein the VH domain, the VL domain, or both of the VH and VL domains, comprise an amino acid sequence having less than 100%, but at least 90%, 95%, sequence identity to the, or one or more of each, stated SEQ ID NO, and wherein

the ability of the antibody or antibody fragment to bind to phosphorylcholine and/or a phosphorylcholine conjugate is equivalent to (that is, at least 90% or 95%, of), or greater than, the ability of a corresponding antibody or antibody fragment, wherein the VH domain and the VL domain of the corresponding antibody or antibody fragment each comprise an antigen-binding sequence comprising an amino acid sequence having 100% sequence identity to the, or each, stated SEQ ID NO.

15. The antibody or antibody fragment according to any preceding claim wherein the VH domain and the VL domain are present in a linear polypeptide sequence.

16. The antibody or antibody fragment according to any preceding claim wherein the VH domain and the VL domain are each present in a separate polypeptide sequence, and preferably wherein the separate polypeptide sequence are directly or indirectly bound together (such as by one or more disulphide bonds between the separate polypeptide sequence).

17. The antibody according to any of Claims 1-14 or 16 wherein the antibody is a monoclonal antibody.

18. The antibody fragment according to any of Claims 1 to 14 wherein the antibody fragment is a single chain antibody, Fv, scFv, Fab, $F(ab')_2$, Fab', Fd, dAb, CDR, or scFv-Fc fragment, a nanobody, and diabody, or any fragment that has been stabilized, optionally stabilized by PEGylation.

19. The antibody or antibody fragment according to any preceding claim which is capable of binding to a phosphorylcholine conjugate.

20. The antibody or antibody fragment according to Claim 19 wherein the phosphorylcholine conjugate is a phosphorylcholine moiety linked to a carrier, optionally via a spacer, and preferably the antibody or antibody fragment binds specifically to the phosphorylcholine moiety in the phosphorylcholine conjugate.

21. A pharmaceutical composition comprising or consisting essentially of an antibody or an antibody fragment according to any of the preceding claims and a pharmaceutically acceptable carrier or excipient, optionally wherein the only antibodies or antibody fragments present in the composition are those defined by any of the preceding claims.

22. An antibody or antibody fragment according to any of Claims 1 to 20, or a pharmaceutical composition according to Claim 21 for use in medicine.

23. An antibody or antibody fragment according to any of Claims 1 to 20, or a pharmaceutical composition according to Claim 21 for use in the prevention,

prophylaxis and/or treatment of mammals, including humans, against atherosclerosis, an atherosclerotic related disease or cardiovascular disease.

24. The antibody or antibody fragment according to claim 23 wherein the cardiovascular disease is selected from the group consisting of atherosclerosis, acute coronary syndrome, acute myocardial infarction, myocardial infarction (heart attack), stable and unstable angina pectoris, aneurysms, coronary artery disease (CAD), ischemic heart disease, ischemic myocardium, cardiac and sudden cardiac death, cardiomyopathy, congestive heart failure, heart failure, stenosis, peripheral arterial disease (PAD), intermittent claudication, critical limb ischemia, and stroke.

25. A nucleic acid sequences encoding an antibody or an antibody fragment according to any of Claims 1 to 20.

26. A vector or plasmid comprising the nucleic acid sequence of Claim 25.

27. A host cell comprising the nucleic acid sequence of Claim 25 and/or a vector or plasmid according to Claim 26.

28. The host cell of Claim 27 wherein the cell is a prokaryotic cell, such as an *Escherichia coli* cell, or a eukaryotic cell, such as animal, plant, or fungal cell.

29. The host cell of Claims 27 or 28 which expresses the nucleic acid sequence of Claim 25 and thereby produces an antibody or an antibody fragment according to any of Claims 1 to 20.

30. A method of producing an antibody or an antibody fragment according to any of Claims 1 to 20 comprising culturing a host cell according to Claim 29, and recovering therefrom an antibody or an antibody fragment according to any of Claims 1 to 20.

31. A method of preparing a variant of the antibody or antibody fragments of according to any of Claims 1 to 20, which variant retains the ability to bind to phosphorylcholine and/or a phosphorylcholine conjugate with a Kd of no greater than 500nM, when tested using a surface plasmon resonance sensor, the method comprising –

(i) providing a nucleic acid according to Claim 25 encoding a parent antibody or antibody fragment;

(ii) introducing one or more nucleotide mutations into the amino acid coding regions of the nucleic acid sequence, optionally within the regions encoding the VH and/or VL domain(s), such that the mutated nucleic acid encodes a variant antibody or antibody fragment having a different amino acid sequence compared to the parent antibody or antibody fragment;

(iii) expressing the variant antibody or antibody fragment that is encoded by the mutated nucleic acid sequence; and

(iv) comparing the ability of the variant antibody or antibody fragment and the parent antibody or antibody fragment to bind to phosphorylcholine and/or a phosphorylcholine conjugate,

wherein the step of assessing the ability of the variant antibody or antibody fragment to bind to phosphorylcholine and/or a phosphorylcholine conjugate further comprises selecting those variants that have substantially equal or enhanced ability to bind to phosphorylcholine and/or a phosphorylcholine conjugate compared to the parent.

32. The method of Claim 31 further comprising recovering a nucleic acid molecule that comprises the mutated nucleic acid sequence that encodes the variant antibody or antibody fragment, and optionally transforming a host cell with a composition comprising the recovered nucleic acid molecule and further optionally expressing the variant antibody or antibody fragment from the host cell, and yet further optionally recovering the thus-expressed variant antibody or antibody fragment from the host cell.

33. The method of Claim 32 that comprises the step of recovering the thus-expressed variant antibody or antibody fragment from the host cell, and further comprises the step of formulating the recovered variant antibody or antibody fragment into a pharmaceutically acceptable composition.