Claims

1. An anti-OX40L antibody or an antigen-binding fragment thereof, specifically binding to OX40L (OX40 ligand) and inhibiting an interaction between OX40L and an OX40 receptor, wherein the anti-OX40L antibody or the antigen-binding fragment thereof binds to at least one epitope represented by an amino acid sequence selected from the group consisting of SEQ ID NOs: 3 and 4.

2. The anti-OX40L antibody or the antigen-binding fragment thereof according to claim 1, wherein the anti-OX40L antibody or the antigen-binding fragment thereof binds to human OX40L with a K_D of 1×10^{-9} M or less, and wherein the K_D is measured by surface plasmon resonance (Biacore) analysis.

3. An anti-OX40L antibody or an antigen-binding fragment thereof, specifically binding to OX40L (OX40 ligand) and inhibiting an interaction between OX40L and an OX40 receptor, wherein the anti-OX40L antibody or the antigen-binding fragment thereof comprises:

a heavy chain variable region comprising heavy chain CDR1 represented by one amino acid sequence selected from the group consisting of SEQ ID NOs: 12, 13 and 14; heavy chain CDR2 represented by one amino acid sequence selected from the group consisting of SEQ ID NOs: 15, 16, 17 and 18; and heavy chain CDR3 represented by one amino acid sequence selected from the group consisting of SEQ ID NOs: 19, 20, 21 and 22; and

a light chain variable region comprising light chain CDR1 represented by one amino acid sequence selected from the group consisting of SEQ ID NOs: 23 and 24; light chain CDR2 represented by one amino acid sequence selected from the group consisting of SEQ ID NOs: 25 and 26; and light chain CDR3 represented by one amino

acid sequence selected from the group consisting of SEQ ID NOs: 27, 28, 29 and 30.

4. The anti-OX40L antibody or the antigen-binding fragment thereof according to claim 1 or 3, wherein the anti-OX40L antibody or the antigen-binding fragment thereof comprises:

(i) an antibody or an antigen-binding fragment thereof comprising: a heavy chain variable region comprising heavy chain CDR1 represented by SEQ ID NO: 12; heavy chain CDR2 represented by SEQ ID NO: 15; and heavy chain CDR3 represented by SEQ ID NO: 19, and a light chain variable region comprising light chain CDR1 represented by SEQ ID NO: 23; light chain CDR2 represented by SEQ ID NO: 25; and light chain CDR3 represented by SEQ ID NO: 27;

(ii) an antibody or an antigen-binding fragment thereof comprising: a heavy chain variable region comprising heavy chain CDR1 represented by SEQ ID NO: 13; heavy chain CDR2 represented by SEQ ID NO: 16; and heavy chain CDR3 represented by SEQ ID NO: 20, and a light chain variable region comprising light chain CDR1 represented by SEQ ID NO: 24; light chain CDR2 represented by SEQ ID NO: 26; and light chain CDR3 represented by SEQ ID NO: 28;

(iii) an antibody or an antigen-binding fragment thereof comprising: a heavy chain variable region comprising heavy chain CDR1 represented by SEQ ID NO: 13; heavy chain CDR2 represented by SEQ ID NO: 17; and heavy chain CDR3 represented by SEQ ID NO: 21, and a light chain variable region comprising light chain CDR1 represented by SEQ ID NO: 24; light chain CDR2 represented by SEQ ID NO: 26; and light chain CDR3 represented by SEQ ID NO: 29; or

(iv) an antibody or an antigen-binding fragment thereof comprising: a heavy chain variable region comprising heavy chain CDR1 represented by SEQ ID NO: 14; heavy chain CDR2 represented by SEQ ID NO: 18; and heavy chain CDR3 represented

by SEQ ID NO: 22, and a light chain variable region comprising light chain CDR1 represented by SEQ ID NO: 24; light chain CDR2 represented by SEQ ID NO: 26; and light chain CDR3 represented by SEQ ID NO: 30.

5. The anti-OX40L antibody or the antigen-binding fragment thereof according to claim 1 or 3, wherein the anti-OX40L antibody or the antigen-binding fragment thereof comprises:

a heavy chain variable region represented by one amino acid sequence selected from the group consisting of SEQ ID NOs: 37, 41, 45, 49 and 53; and

a light chain variable region represented by one amino acid sequence selected from the group consisting of SEQ ID NOs: 38, 42, 46, 50 and 54.

6. The anti-OX40L antibody or the antigen-binding fragment thereof according to claim 1 or 3, wherein the anti-OX40L antibody or the antigen-binding fragment thereof comprises:

(a) a heavy chain variable region represented by SEQ ID NO: 37 and a light chain variable region represented by SEQ ID NO: 38;

(b) a heavy chain variable region represented by SEQ ID NO: 41 and a light chain variable region represented by SEQ ID NO: 42;

(c) a heavy chain variable region represented by SEQ ID NO: 45 and a light chain variable region represented by SEQ ID NO: 46;

(d) a heavy chain variable region represented by SEQ ID NO: 49 and a light chain variable region represented by SEQ ID NO: 50; or

(e) a heavy chain variable region represented by SEQ ID NO: 53 and a light chain variable region represented by SEQ ID NO: 54.

7. The anti-OX40L antibody or the antigen-binding fragment thereof according to claim 6, wherein the anti-OX40L antibody or the antigen-binding fragment thereof

comprises:

a heavy chain constant region represented by one amino acid sequence selected from the group consisting of SEQ ID NOs: 5, 6, 7, and 8; and

a light chain constant region represented by an amino acid sequence of SEQ ID NO: 10.

8. A bispecific antibody, comprising: an anti-OX40L antibody or an antigen-binding fragment thereof specifically binding to OX40L; and an anti-TNFα antibody or an antigen-binding fragment thereof specifically binding to TNFα, wherein the anti-OX40L antibody or the antigen-binding fragment thereof binds to at least one epitope represented by an amino acid sequence selected from the group consisting of SEQ ID NOs: 3 and 4.

9. A bispecific antibody, comprising: an anti-OX40L antibody or an antigen-binding fragment thereof specifically binding to OX40L; and an anti-TNFα antibody or an antigen-binding fragment thereof specifically binding to TNFα, wherein the anti-OX40L antibody or the antigen-binding fragment thereof comprises:

a heavy chain variable region comprising heavy chain CDR1 represented by one amino acid sequence selected from the group consisting of SEQ ID NOs: 12, 13 and 14; heavy chain CDR2 represented by one amino acid sequence selected from the group consisting of SEQ ID NOs: 15, 16, 17 and 18; and heavy chain CDR3 represented by one amino acid sequence selected from the group consisting of SEQ ID NOs: 19, 20, 21 and 22; and

a light chain variable region comprising light chain CDR1 represented by one amino acid sequence selected from the group consisting of SEQ ID NOs: 23 and 24; light chain CDR2 represented by one amino acid sequence selected from the group consisting of SEQ ID NOs: 25 and 26; and light chain CDR3 represented by one amino

acid sequence selected from the group consisting of SEQ ID NOs: 27, 28, 29 and 30.

10. The bispecific antibody according to claim 8 or 9, wherein the bispecific antibody is a bispecific antibody in which the anti-OX40L antibody or the antigen-binding fragment thereof and the anti-TNFα antibody or the antigen-binding fragment thereof are linked to each other.

11. The bispecific antibody according to claims 8 or 9, wherein the anti-OX40L antibody or the antigen-binding fragment thereof comprises:

(i) an antibody or an antigen-binding fragment thereof comprising: a heavy chain variable region comprising heavy chain CDR1 represented by SEQ ID NO: 12; heavy chain CDR2 represented by SEQ ID NO: 15; and heavy chain CDR3 represented by SEQ ID NO: 19, and a light chain variable region comprising light chain CDR1 represented by SEQ ID NO: 23; light chain CDR2 represented by SEQ ID NO: 25; and light chain CDR3 represented by SEQ ID NO: 27;

(ii) an antibody or an antigen-binding fragment thereof comprising: a heavy chain variable region comprising heavy chain CDR1 represented by SEQ ID NO: 13; heavy chain CDR2 represented by SEQ ID NO: 16; and heavy chain CDR3 represented by SEQ ID NO: 20, and a light chain variable region comprising light chain CDR1 represented by SEQ ID NO: 24; light chain CDR2 represented by SEQ ID NO: 26; and light chain CDR3 represented by SEQ ID NO: 28;

(iii) an antibody or an antigen-binding fragment thereof comprising: a heavy chain variable region comprising heavy chain CDR1 represented by SEQ ID NO: 13; heavy chain CDR2 represented by SEQ ID NO: 17; and heavy chain CDR3 represented by SEQ ID NO: 21, and a light chain variable region comprising light chain CDR1 represented by SEQ ID NO: 24; light chain CDR2 represented by SEQ ID NO: 26; and light chain CDR3 represented by SEQ ID NO: 29; or

(iv) an antibody or an antigen-binding fragment thereof comprising: a heavy chain variable region comprising heavy chain CDR1 represented by SEQ ID NO: 14; heavy chain CDR2 represented by SEQ ID NO: 18; and heavy chain CDR3 represented by SEQ ID NO: 22, and a light chain variable region comprising light chain CDR1 represented by SEQ ID NO: 24; light chain CDR2 represented by SEQ ID NO: 26; and light chain CDR3 represented by SEQ ID NO: 30.

12. The bispecific antibody according to claim 8 or 9, wherein the anti-OX40L antibody or the antigen-binding fragment thereof comprises:

a heavy chain variable region represented by one amino acid sequence selected from the group consisting of SEQ ID NOs: 37, 41, 45, 49 and 53; and

a light chain variable region represented by one amino acid sequence selected from the group consisting of SEQ ID NOs: 38, 42, 46, 50 and 54.

13. The bispecific antibody according to claim 8 or 9, wherein the anti-OX40L antibody or the antigen-binding fragment thereof comprises:

(a) a heavy chain variable region represented by SEQ ID NO: 37 and a light chain variable region represented by SEQ ID NO: 38;

(b) a heavy chain variable region represented by SEQ ID NO: 41 and a light chain variable region represented by SEQ ID NO: 42;

(c) a heavy chain variable region represented by SEQ ID NO: 45 and a light chain variable region represented by SEQ ID NO: 46;

(d) a heavy chain variable region represented by SEQ ID NO: 49 and a light chain variable region represented by SEQ ID NO: 50;

(e) a heavy chain variable region represented by SEQ ID NO: 53 and a light chain variable region represented by SEQ ID NO: 54; or

(f) a heavy chain variable region having an amino acid sequence represented

by SEQ ID NO: 33 and a light chain variable region having an amino acid sequence represented by SEQ ID NO: 34.

14. The bispecific antibody according to any one of claims 8 to 13, wherein the anti-TNFα antibody or the antigen-binding fragment thereof comprises:

a heavy chain variable region comprising heavy chain CDR1 represented by SEQ ID NO: 89; heavy chain CDR2 represented by SEQ ID NO: 90; and heavy chain CDR3 represented by SEQ ID NO: 91; and

a light chain variable region comprising light chain CDR1 represented by SEQ ID NO: 92; light chain CDR2 represented by SEQ ID NO: 93; and light chain CDR3 represented by SEQ ID NO: 94.

15. The bispecific antibody according to claim 14, wherein the anti-TNFα antibody or the antigen-binding fragment thereof comprises a heavy chain variable region represented by SEQ ID NO: 35 and a light chain variable region represented by SEQ ID NO: 36.

16. The bispecific antibody according to claim 14, wherein the bispecific antibody binds to human OX40L with a K_D of 1.5 X 10^{-9} M or less, and binds to human TNFα with a K_D of 1 X 10^{-9} M or less, and wherein the K_D is measured by surface plasmon resonance (Biacore) analysis.

17. The bispecific antibody according to claim 14, wherein the bispecific antibody is a bispecific antibody, in which an anti-TNFα antibody or an antigen-binding fragment thereof specifically binding to TNFα is linked to at least one terminus of the light and heavy chains of the anti-OX40L antibody.

18. The bispecific antibody according to claim 17, wherein the bispecific antibody is a bispecific antibody, in which the anti-TNFα antibody or the antigen-binding fragment thereof is linked to at least one C terminus of the light and heavy chains of

the anti-OX40L antibody.

19. The bispecific antibody according to claim 14, wherein the bispecific antibody is a bispecific antibody, in which an anti-OX40L antibody or an antigen-binding fragment thereof specifically binding to OX40L is linked to at least one terminus of the light and heavy chains of the anti-TNFα antibody.

20. The bispecific antibody according to claim 19, wherein the anti-OX40L antibody or the antigen-binding fragment thereof is linked to at least one C terminus of the light and heavy chains of the anti-TNFα antibody.

21. The bispecific antibody according to claim 14, wherein the anti-OX40L antibody or the antigen-binding fragment thereof and the anti-TNFα antibody or the antigen-binding fragment thereof are linked by a linker.

22. The bispecific antibody according to claim 21, wherein the linker is represented by SEQ ID NO: 31 or SEQ ID NO: 32.

23. A nucleic acid encoding an antibody or an antigen-binding fragment thereof according to any one of claims 1 to 7 or a bispecific antibody according to any one of claims 8 to 22.

24. An expression vector comprising nucleic acid according to claim 23.

25. A transformant comprising the expression vector according to claim 24 introduced thereinto.

26. A method for producing an antibody or an antigen fragment thereof, or a bispecific antibody by using the transformant of claim 25.

27. A pharmaceutical composition for preventing or treating autoimmune diseases or inflammatory diseases, comprising an antibody or an antigen-binding fragment thereof according to any one of claims 1 to 7 or a bispecific antibody according to any one of claims 8 to 22.

28. The pharmaceutical composition according to claim 27, wherein the pharmaceutical composition prevents or treats rheumatoid arthritis.

29. A method for providing information on diagnosis of autoimmune diseases or inflammatory diseases by using an antibody or an antigen-binding fragment thereof according to any one of claims 1 to 7 or a bispecific antibody according to any one of claims 8 to 22.

30. A kit for providing information on diagnosis of autoimmune diseases or inflammatory diseases, comprising an antibody or an antigen-binding fragment thereof according to any one of claims 1 to 7 or a bispecific antibody according to any one of claims 8 to 22.

31. Use of an antibody or an antigen-binding fragment thereof according to any one of claims 1 to 7 or a bispecific antibody according to any one of claims 8 to 22 in the manufacture of a medicament for preventing or treating autoimmune diseases or inflammatory diseases.