

Claims:

1. A virus-specific immune cell, comprising a chimeric antigen receptor (CAR) or nucleic acid encoding a CAR, wherein the CAR comprises: (i) an antigen-binding domain which binds specifically to CD30, (ii) a
5 transmembrane domain, and (iii) a signalling domain, wherein the signalling domain comprises: (a) an amino acid sequence derived from the intracellular domain of CD28, and (b) an amino acid sequence comprising an immunoreceptor tyrosine-based activation motif (ITAM).
2. The virus-specific immune cell according to claim 1 or claim 2, wherein the signalling domain
10 comprises an amino acid sequence having at least 80% amino acid sequence identity to SEQ ID NO:26.
3. The virus-specific immune cell according to claim 1 or claim 2, wherein the transmembrane domain is derived from the transmembrane domain of CD28.
- 15 4. The virus-specific immune cell according to any one of claims 1 to 3, wherein the transmembrane domain comprises an amino acid sequence having at least 80% amino acid sequence identity to SEQ ID NO:20.
5. The virus-specific immune cell according to any one of claims 1 to 4, wherein the antigen-binding
20 domain comprises an amino acid sequence having at least 80% amino acid sequence identity to SEQ ID NO:14, and an amino acid sequence having at least 80% amino acid sequence identity to SEQ ID NO:15.
6. The virus-specific immune cell according to any one of claims 1 to 5, wherein the antigen-binding
25 domain comprises an amino acid sequence having at least 80% amino acid sequence identity to SEQ ID NO:18.
7. The virus-specific immune cell according to any one of claims 1 to 6, wherein the signalling domain comprises: (a) an amino acid sequence derived from the intracellular domain of CD3 ζ .
- 30 8. The virus-specific immune cell according to any one of claims 1 to 7, wherein the signalling domain comprises an amino acid sequence having at least 80% amino acid sequence identity to SEQ ID NO:25.
9. The virus-specific immune cell according to any one of claims 1 to 8, wherein the CAR additionally comprises a hinge region provided between the antigen-binding domain and the transmembrane domain.
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10. The virus-specific immune cell according to claim 9, wherein the hinge region comprises an amino acid sequence having at least 80% amino acid sequence identity to SEQ ID NO:33.
11. The virus-specific immune cell according to any one of claims 1 to 10, wherein the CAR comprises an
40 amino acid sequence having at least 80% amino acid sequence identity to SEQ ID NO:35 or 36.

12. The virus-specific immune cell according to any one of claims 1 to 11, wherein the virus-specific immune cell comprises a CAR comprising an antigen-binding domain which binds specifically to a target antigen other than CD30, or nucleic acid encoding a CAR comprising an antigen-binding domain which binds specifically to a target antigen other than CD30.
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13. A virus-specific immune cell, comprising: a chimeric antigen receptor (CAR) or nucleic acid encoding a CAR, wherein the CAR comprises: (i) an antigen-binding domain which binds specifically to CD30, (ii) a transmembrane domain, and (iii) a signalling domain comprising an immunoreceptor tyrosine-based activation motif (ITAM);
- 10 wherein the virus-specific immune cell comprises a CAR comprising an antigen-binding domain which binds specifically to a target antigen other than CD30, or nucleic acid encoding a CAR comprising an antigen-binding domain which binds specifically to a target antigen other than CD30.
14. The virus-specific immune cell according to claim 12 or claim 13, wherein the virus-specific immune cell comprises more than one non-identical CAR, or nucleic acid encoding more than one non-identical CAR.
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15. The virus-specific immune cell according to any one of claims 12 to 14, wherein the target antigen other than CD30 is a cancer cell antigen.
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16. The virus-specific immune cell according to any one of claims 12 to 15, wherein the target antigen other than CD30 is selected from CD19, CD20, CD22, ROR1R, CD4, CD7, CD38, BCMA, Mesothelin, EGFR, GPC3, MUC1, HER2, GD2, CEA, EpCAM, LeY and PSCA.
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17. The virus-specific immune cell according to any one of claims 12 to 16, wherein the target antigen other than CD30 is CD19.
18. The virus-specific immune cell according to any one of claims 1 to 17, wherein the virus-specific immune cell is a virus-specific T cell.
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19. The virus-specific immune cell according to any one of claims 1 to 18, wherein the virus-specific immune cell is specific for Epstein-Barr virus (EBV).
20. A method for producing a virus-specific immune cell, comprising:
- 35 modifying a virus-specific immune cell to comprise a chimeric antigen receptor (CAR) or nucleic acid encoding a CAR, wherein the CAR comprises: (i) an antigen-binding domain which binds specifically to CD30, (ii) a transmembrane domain, and (iii) a signalling domain, wherein the signalling domain comprises: (a) an amino acid sequence derived from the intracellular domain of CD28, and (b) an amino acid sequence comprising an immunoreceptor tyrosine-based activation motif (ITAM).
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21. The method according to claim 20, wherein the signalling domain comprises an amino acid sequence having at least 80% amino acid sequence identity to SEQ ID NO:26.
22. The method according to claims 20 or claim 21, wherein the transmembrane domain is derived from the transmembrane domain of CD28.
23. The method according to any one of claims 20 to 22, wherein the transmembrane domain comprises an amino acid sequence having at least 80% amino acid sequence identity to SEQ ID NO:20.
24. The method according to any one of claims 20 to 23, wherein the antigen-binding domain comprises an amino acid sequence having at least 80% amino acid sequence identity to SEQ ID NO:14, and an amino acid sequence having at least 80% amino acid sequence identity to SEQ ID NO:15.
25. The method according to any one of claims 20 to 24, wherein the antigen-binding domain comprises an amino acid sequence having at least 80% amino acid sequence identity to SEQ ID NO:18.
26. The method according to any one of claims 20 to 25, wherein the signalling domain comprises: (a) an amino acid sequence derived from the intracellular domain of CD3 ζ .
27. The method according to any one of claims 20 to 26, wherein the signalling domain comprises an amino acid sequence having at least 80% amino acid sequence identity to SEQ ID NO:25.
28. The method according to any one of claims 20 to 27, wherein the CAR additionally comprises a hinge region provided between the antigen-binding domain and the transmembrane domain.
29. The method according to any one of claims 20 to 28, wherein the hinge region comprises an amino acid sequence having at least 80% amino acid sequence identity to SEQ ID NO:33.
30. The method according to any one of claims 20 to 29, wherein the CAR comprises an amino acid sequence having at least 80% amino acid sequence identity to SEQ ID NO:35 or 36.
31. The method according to any one of claims 20 to 30, wherein the virus-specific immune cell comprises a CAR comprising an antigen-binding domain which binds specifically to a target antigen other than CD30, or nucleic acid encoding a CAR comprising an antigen-binding domain which binds specifically to a target antigen other than CD30.
32. A method for producing a virus-specific immune cell, comprising:
modifying a virus-specific immune cell to comprise a chimeric antigen receptor (CAR) or nucleic acid encoding a CAR, wherein the CAR comprises: (i) an antigen-binding domain which binds specifically to CD30, (ii) a transmembrane domain, and (iii) a signalling domain comprising an immunoreceptor tyrosine-based activation motif (ITAM);

wherein the virus-specific immune cell comprises a CAR comprising an antigen-binding domain which binds specifically to a target antigen other than CD30, or nucleic acid encoding a CAR comprising an antigen-binding domain which binds specifically to a target antigen other than CD30.

- 5 33. The method according to any one of claims 20 to 32, wherein the method comprises:
 modifying a virus-specific immune cell to comprise a chimeric antigen receptor (CAR) or nucleic acid encoding a CAR, wherein the CAR comprises an antigen-binding domain which binds specifically to a target antigen other than CD30.
- 10 34. The method according to any one of claims 31 to 33, wherein the virus-specific immune cell comprises more than one non-identical CAR, or nucleic acid encoding more than one non-identical CAR.
35. The method according to any one of claims 31 to 34, wherein the target antigen other than CD30 is a cancer cell antigen.
- 15 36. The method according to any one of claims 31 to 35, wherein the target antigen other than CD30 is selected from CD19, CD20, CD22, ROR1R, CD4, CD7, CD38, BCMA, Mesothelin, EGFR, GPC3, MUC1, HER2, GD2, CEA, EpCAM, LeY and PSCA.
- 20 37. The method according to any one of claims 31 to 36, wherein the target antigen other than CD30 is CD19.
38. The method according to any one of claims 20 to 38, wherein the virus-specific immune cell is a virus-specific T cell.
- 25 39. The method according to any one of claims 20 to 39, wherein the virus-specific immune cell is specific for Epstein-Barr virus (EBV).
40. A virus-specific immune cell obtained or obtainable by the method according to any one of claims 20 to 39.
- 30 41. A pharmaceutical composition comprising a virus-specific immune cell according to any one of claims 1 to 19 or claim 40 and a pharmaceutically acceptable carrier, adjuvant, excipient or diluent.
42. A virus-specific immune cell according to any one of claims 1 to 19 or claim 40, or a pharmaceutical composition according to claim 41, for use in a method of medical treatment or prophylaxis.
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