

Claims:

1. A virus-specific immune cell comprising a chimeric antigen receptor (CAR) or nucleic acid encoding a CAR for use in a method of treating or preventing a disease or condition characterised by an alloreactive immune response, 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).
2. Use of a virus-specific immune cell comprising a chimeric antigen receptor (CAR) or nucleic acid encoding a CAR in the manufacture of a medicament for use in treating or preventing a disease or condition characterised by an alloreactive immune response, 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).
3. A method of treating or preventing a disease or condition characterised by an alloreactive immune response, comprising administering to a subject a therapeutically or prophylactically effective quantity of virus-specific immune cells 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, 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).
4. The virus-specific immune cell for use according to claim 1, the use according to claim 2, or the method according to claim 3, wherein the disease or condition characterised by an alloreactive immune response is a disease or condition associated with allotransplantation.
5. The virus-specific immune cell for use, the use, or the method according to any one of claims 1 to 4, wherein the disease or condition is graft versus host disease (GVHD).
6. The virus-specific immune cell for use, the use, or the method according to any one of claims 1 to 4, wherein the disease or condition is graft rejection.
7. The virus-specific immune cell for use, the use, or the method according to any one of claims 1 to 6, wherein the method comprises administering a therapeutically or prophylactically effective quantity of the virus-specific immune cells to a donor subject for an allotransplant prior to harvesting the allotransplant.

8. The virus-specific immune cell for use, the use, or the method according to any one of claims 1 to 7, wherein the method comprises administering a therapeutically or prophylactically effective quantity of the virus-specific immune cells to a recipient subject for an allotransplant.
- 5 9. The virus-specific immune cell for use, the use, or the method according to any one of claims 1 to 8, wherein the method comprises contacting an allotransplant with a therapeutically or prophylactically effective quantity of the virus-specific immune cells.
- 10 10. A virus-specific immune cell comprising a chimeric antigen receptor (CAR) or nucleic acid encoding a CAR for use in a method of treating or preventing a disease or condition by allotransplantation, 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).
- 15 11. Use of a virus-specific immune cell comprising a chimeric antigen receptor (CAR) or nucleic acid encoding a CAR in the manufacture of a medicament for use in treating or preventing a disease or condition by allotransplantation, 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).
- 20 12. A method of treating or preventing a disease or condition by allotransplantation, comprising administering to a subject a therapeutically or prophylactically effective quantity of virus-specific immune cells 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, 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).
- 25 30 13. The virus-specific immune cell for use according to claim 10, the use according to claim 11, or the method according to claim 12, wherein the method comprises administering a therapeutically or prophylactically effective quantity of the virus-specific immune cells to a donor subject for an allotransplant prior to harvesting the allotransplant.
- 35 14. The virus-specific immune cell for use, the use, or the method according to any one of claims 10 to 13, wherein the method comprises administering a therapeutically or prophylactically effective quantity of the virus-specific immune cells to a recipient subject for an allotransplant.

15. The virus-specific immune cell for use, the use, or the method according to any one of claims 10 to 14, wherein the method comprises contacting an allotransplant with a therapeutically or prophylactically effective quantity of the virus-specific immune cells.
- 5 16. The virus-specific immune cell for use, the use, or the method according to any one of claims 10 to 15, wherein the allotransplantation comprises adoptive transfer of allogeneic immune cells.
17. The virus-specific immune cell for use, the use, or the method according to any one of claims 10 to 16, wherein the disease or condition is a T cell dysfunctional disorder, a cancer or an infectious disease.
- 10 18. A method of killing alloreactive immune cells, comprising contacting alloreactive immune cells with a virus-specific immune cell comprising a chimeric antigen receptor (CAR) or nucleic acid encoding a CAR for use in a method of treating or preventing a disease or condition characterised by an alloreactive immune response, wherein the CAR comprises: (i) an antigen-binding domain which binds specifically to
- 15 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).
19. The virus-specific immune cell for use, the use, or the method according to any one of claims 1 to 18,
- 20 wherein the signalling domain comprises an amino acid sequence having at least 80% amino acid sequence identity to SEQ ID NO:26.
20. The virus-specific immune cell for use, the use, or the method according to any one of claims 1 to 19,
- 25 wherein the transmembrane domain is derived from the transmembrane domain of CD28.
21. The virus-specific immune cell for use, the use, or the method according to any one of claims 1 to 20,
- wherein the transmembrane domain comprises an amino acid sequence having at least 80% amino acid sequence identity to SEQ ID NO:20.
- 30 22. The virus-specific immune cell for use, the use, or the method according to any one of claims 1 to 21,
- 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.
- 35 23. The virus-specific immune cell for use, the use, or the method according to any one of claims 1 to 22,
- wherein the antigen-binding domain comprises an amino acid sequence having at least 80% amino acid sequence identity to SEQ ID NO:18.
24. The virus-specific immune cell for use, the use, or the method according to any one of claims 1 to 23,
- 40 wherein the signalling domain comprises: (a) an amino acid sequence derived from the intracellular domain of CD3 ζ .

25. The virus-specific immune cell for use, the use, or the method according to any one of claims 1 to 24, wherein the signalling domain comprises an amino acid sequence having at least 80% amino acid sequence identity to SEQ ID NO:25.
- 5
26. The virus-specific immune cell for use, the use, or the method according to any one of claims 1 to 25, wherein the CAR additionally comprises a hinge region provided between the antigen-binding domain and the transmembrane domain.
- 10
27. The virus-specific immune cell for use, the use, or the method according to claim 26, wherein the hinge region comprises an amino acid sequence having at least 80% amino acid sequence identity to SEQ ID NO:33.
- 15
28. The virus-specific immune cell for use, the use, or the method according to any one of claims 1 to 27, wherein the CAR comprises an amino acid sequence having at least 80% amino acid sequence identity to SEQ ID NO:35 or 36.
- 20
29. The virus-specific immune cell for use, the use, or the method according to any one of claims 1 to 28, 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.
- 25
30. The virus-specific immune cell for use, the use, or the method according to any one of claims 1 to 29, 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); and
- 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.
- 30
31. The virus-specific immune cell for use, the use, or the method according to claim 29 or claim 30, wherein the virus-specific immune cell comprises more than one non-identical CAR, or nucleic acid encoding more than one non-identical CAR.
- 35
32. The virus-specific immune cell for use, the use, or the method according to any one of claims 29 to 31, wherein the target antigen other than CD30 is a cancer cell antigen.
33. The virus-specific immune cell for use, the use, or the method according to any one of claims 29 to 32, 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.
- 40

34. The virus-specific immune cell for use, the use, or the method according to any one of claims 29 to 33, wherein the target antigen other than CD30 is CD19.

5 35. The virus-specific immune cell for use, the use, or the method according to any one of claims 1 to 34, wherein the virus-specific immune cell is a virus-specific T cell.

36. The virus-specific immune cell for use, the use, or the method according to any one of claims 1 to 35, wherein the virus-specific immune cell is specific for Epstein-Barr virus (EBV).

10